The Russian Academy of Sciences, 2006 Update

With an historical introduction by the President of the Academy Iuri S. Osipov

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The creation of the Academy of Sciences is directly connected with Peter the Great's reformer activities aimed at strengthening the state, its economic and political independence. Peter the Great understood the importance of scientific thought, education and culture for the prosperity of the country. And he started acting "from above". Under his project, the Academy was substantially different from all related foreign organizations. It was a state institution; while on a payroll, its members had to provide for the scientific and technical services of thee state. The Academy combined the functions of scientific research and training, having its own university and a high school. On December 27, 1725, the Academy celebrated its creation with a large public meeting. This was a solemn act of appearance of a new attribute of Russian state life. Academic Conference has become a body of collective discussion and estimation of research results. The scientists were not tied up by any dominating dogma, were free in their scientific research, and took an active part in the scientific opposition between the Cartesians and Newtonians.

Possibilities to publish scientific works were practically unlimited. Physician Lavrentii Blumentrost was appointed first President of the Academy. Taking care of bringing the Academy's activities to the world level, Peter the Great invited leading foreign scientists. Among the first were mathematicians Nikolas and Daniil Bornoulli, Christian Goldbach, physicist Georg Bulfinger, astronomer and geographer J.Delille, historian G.F.Miller.

In 1727, Leonard Eiler joined the Academy. In the first three decades, the Academy's research work was done in the three directions (of "classes"): mathematical, physical (natural sciences) and the humanities. Actually, the Academy at once joined in multiplying the scientific and cultural riches of the country. It got a splendid collection of the Cabinet of Curiosities. An anatomical theater, a department of geography, and astronomical observatory, a physical cabinet, and a mineralogical cabinet were set up. The Academy had a botanical garden and instrumental shops. Here, prominent botanists I.G.Gmelin and I.G.Kelreiter, the founder of embrylolgy K.F.Volf, the famous naturalist and traveler P.S.Pallas were working. Work on electricity and magnetism theory was done by G.V.Rikgman and F.U.Eoubys. Thanks to the academic scientists' research, foundations for development of mining, metallurgy, and other branches of Russian industry were laid. Work on geodesy and cartography was going on. In 1745, the first general map of the country, the Atlas of Russia, was created. From the start, the activities of the Academy let it take an honorable place among the greatest scientific institutions of Europe. This was prompted by the fame of such giants as L. Eiler and M.Lomonosov. The fruitful, really titanic scientific activities of the great scientist Leonard Eiler started in St.Petersburg Academy of Sciences. The mathematical research of L.Eiler heralded the most important stage in the

development of calculus after Newton and Leibliz. L.Eiler obtained deep results in number theory, set foundations for complex analysis, variational calculus, analytical mechanics, and, together with Daniil Bernoulli, hydrodynamics. His mathematical research was closely related to practical problems in mechanics, ballistics, cartography, shipbuilding, and navigation. L.Eiler brought up first Russian mathematicians later becoming Academy members.

The scientific, educational and organizing activities of the great scientist and a person of encyclopaedic learning. Mikhail Lomonosov made as much as a whole era in the Academy's history. He enriched the Academy with fundamental discoveries in chemistry, physics, astronomy, geology, geography, and made a large contribution to the development of history, linguistics and poetry. He set up Russia's first chemical laboratory in 1748. In 1755, he took an active part in founding Moscow University now rightfully bearing his name. On the Academy's initiative and with its participation, complex expedition were carried out, making an enormous contribution to the discovery of Russia's natural resources, and ethnographic research of the country's territories from the White to the Caspian Seas, from the western regions to Kamchatka.

The Great Northern Expedition of 1733-1742 and the academic expeditions of 1760-1770, the fundamental works of their participants I.G.Gmelin, S.G.Gelin, A.P.Gorlanov Sea, S.P.Kracheninnikov, S.P.Pallas and other played an outstanding role in the development of geography, biology, ethnography, history and culture of the peoples of Russia, and were highly praised in Europe, discovering territories little known to European researchers. They solved the problem of a bay between Asia and America, and the northeastern borders of Russia. The regions' maps were made, fauna and flora studied, mineral resources discovered, history, ethnography, economic activities of the people lining there descried, and their languages studied. G.V.Steller, who sailed together with V.Bering, started pioneer studies of the nature and everyday life of the peoples of Alaska and the Aleutian Islands.

The academy started publishing Russian history sources, and participants in its expeditions collected artifacts of the numerous peoples living in the suburbs of the Empire. The works of V.N.Tatishchev, M.V.Lomonosov, G.F.Miller, M.M.Scervatov, I.N.Boltin, publishing The Oldest Russian Bibliotheca, setting up departments of archives and manuscripts in museums crowned the making of history as a science in Russia. In the early forties, several volumes of the catalog of collections of the Cabinet of Curiosities were Published. The Academy becomes a keeper of the monuments of home and world science. In 1773, 18 volumes of Kepler's manuscripts were acquired, even now a pride of the academic archives and used by the Bavarian Academy of Sciences in publishing his complete works. A very rich collection of scientific correspondence of the 18th century was being amassed, the most valuable monument not only of Russian but also of Pan-European culture.

The Academy was constantly in touch with European scientific journals publishing abstracts of its publications. Since 1728, a journal in Latin, or, more precisely, an annual collection of scientific papers. Commentarii Peterburgskoi akademii nauk (Commentaries of St.Petersburg Academy of Sciences) was launched, which enjoyed wide popularity with the scientific

community as one of the leading scientific journals in Europe. The Academy set up its own printing press, quickly winning an excellent reputation. The press was assigned to publish all kinds (except for ecclesiastical) of the literature in the country. This marked immediately the leading role of the Academy in the general development of Russian culture. As early as 1736, the well-known French physicist D. de Merand wrote that "St.Petersburg Academy since its inception rose to an outstanding scientific height, which the Paris and London Academies reached only after 60 years of hard work". In 1748, first Russian President of the Academy (Count K.G.Razumovsky) was appointed. Native scientists started being elected to the Academy. The first Russian academicans became S.P. Krasheninnikov, author of the first natural science book Description of the Land of Kamchatka written in Russian, M.V.Lomonosov, poet V.k.Tredyakovsky, and later astronomers N.I.Popov, S.Ya.Rumovsky, P.B.Inokhodtsev, naturalists I.I.Lepekhin, N.Ya.Ozeretskovsky, V.F.Zuev, and others.

The Academy publications actively contributed to the spreading of scientific knowledge. In Notes to the Records, papers on natural phenomena and minerals, machines and devices, travels, remote lands and peoples, diseases and their treatment, poetic and dramatic arts, opera and many other things appeared. Callendars published by the Academy in two languages reached a wide audience. They regularly published papers on historical and natural sciences. And though by the end of the century, private book publishing and journalism gained ground, it is the academic publications that maintained the leadership in the propaganda of science (we are still leaders in the field). The variety of themes covered by the Russian language journal Monthly Compositions for Use and Entertainment (1755-1764) was ample. Later, Academic News appeared, as well as other popular publications authored by academicians or placing translations o foreign popular science literature. A bright spot in the cultural life of St.Petersburg was public lectures given in 1785-1802 for all those interested in science. Almost all Russian academicians and adjuncts used to give lectures on mathematics, physics, mineralogy and natural history. The readings, which were held in Russian, gathered large audiences.

University was an inseparable part of the Academy. In had to train scientific cadres University sis work quite regularly in the fifties and early sixties when under and active care of M.V.Lomonosov. After his death, Academic University was on the decline, and dissolved in 1767. Its role in training firs native academicians was very important. The Academy assisted in setting up Moscow University in 1755, completed the education of geodesists from the Naval Academy in its Observatory, took part in the affairs of the Cadet Corps, taught physiology to physicians at the Army ad Naval hospitals. In a word, the Academy's role in uplifting the educational level of the first native specialists was undoubtedly great. The Academy played an enormous role in drawing up and executing the school reform of the eighties and nineties o the 18th century. The Academy members worked out its main provisions, took part in training first professional teachers. Wrote and published about 30 textbooks and manuals. As defined by S.I.Vavilov, "in the 18th and early 19th centuries, the Russian Academy was a synonym for Russian science". In the 18th century, the titles of honorary members and corresponding members of the Academy were granted tomore than 160 foreign scientists (F.Voltaire, D.Diderot, J.D'Alembert, C.Linnaeus, B.Franklin, and others). In turn, L.Eiler, M.V.Lomonosov,

I.I.Lepekhin, S.Ya.Rumovsky, and P.S.Pallas became honorary members of foreign academies. In 1783, in parallel with the St.Petersburg Academy of Sciences, the Russian Academy was founded, whose main goal was to compile a dictionary of the Russian language. Its members were the famous Russian writers and poets D.I.Fonvizin, G.R.Derzhavin, and, since 1833, the genius of Russian poetry A.S.Pushkin, as well as scientists S.K.Kotelnokov, A.P.Protasov, S.Ya.Rumovsky, and others. One of the initiators of inception and the first chairperson of this Academy was Countess Ye.R.Dachkova. In 1841, the Russian Academy was dissolved, and some of its members joined the Academy of Sciences' Department of the Russian Language and Literature.

Completing the survey of the first 75 years of the work of the Academy and passing on to the next historic stage of its life, I cannot help quoting the Academy's Statute of 1803, approved by Alexander I and, together with that of 1836, becoming a base for the academic life in the next hundred odd years. It vividly depicts the history of the Academy's creation, the role assigned, and the place in the life of the Russian state at the time: "All the enlightened persons at various times felt how much the joint effort of many scientists inspired by the same striving for perfecting sciences adds to the success of the latter. Founded in their bosom and under the patronage of their Sovereigns, both the Academies and the scientific societies, directing the activities of their members to a unique goal, undertook and made important deeds, and enriched sciences with discoveries, which without that happy combination of striving and knowledge, might perish irreparable for the human race. "Thus, Russia,, too, shares with them the glory of spreading the sciences' limits. During his travels, God bless his memory, sovereign Peter the Great was an obvious witness to the use of these educational establishments, and conceiving desire to erect a temple of sciences, whose been factory affect would also spread onto the remote countries of the Empire, in his new capital, intended to bound and Academy, no sooner had drawn up its Statute than death suddenly cut his glorious life. Empress Catherine I completed what was started by her consort; she arranged for this Academy of Sciences, which, under the partronage of successors to the Russian throne and having been granted regulations by, God bless her memory, Empress Elisabeth, spreading the sphere of its, activities, repeatedly proved, especially during the glorious reign of Empress Catherine II, the use which similar institutions sensible governed and strongly supported by the government can bring to the state, which is confirmed by many deeds undertaken by her; above all, glorious and successfully completed journeys for studying and describing the natural works of Russia, and the expedition for astronomical observations. "Having made sure that spreading of sciences and perfecting useful knowledge is most beneficial for the well-being of peoples, we turned our special attention to the Academy of Sciences, and, having found that its previous regulations did not correspond to the present time, that the amount appointed to it was quite insufficient, and that various obstacles proceeding from this had subsequently weakened its activities, we judged it right to publish new regulations for it, and a new list corresponding to the present circumstances and cooperative with the goal designed to it…

"The primary objective of the Academy" comes from the very goal of its establishment common with that of all the Academies and scientific communities: to extend the range of human

knowledge, perfect the sciences, enrich them with new discoveries, promote education, as much as possible, to direct knowledge to common benefit, adapting theories and useful consequences of the experiments and observations to practical use; this is, in short, a book of the Academy's duties. "To the duties common with other Academies, the duty to address its work directly to the use of Russia, promoting knowledge of natural works of the Empire, discovering means of multiplying such that make up the subject of popular industry and trade, of improving the state of factories, manufactures, trades and arts – these sources of the wealth and power of states."

Russia on the rise

In the twenties of the 19th century, a special building was constructed for the Academy in St.Petersburg. In the thirties, the Botanical, Zoological, Ethnographic, Mineralogical, Asian, Egyptian, and Numismatic Museums were set up, using the exhibits of the Cabinet of Curiosities. Some have subsequently become corresponding departments of the Hermitage and other world-famous museums. On January 1, 1839, the Pulkovo Astronomical Observatory was unveiled, which at once occupied a leading place in the world astronomical science.

Its first director was V.Ya.Struve, and the second his son O.V.Struve. In 1804, the academy of Sciences started issuing a new publication, Technological Journal, or a Collection of Works and News Related to Technology, and Applications of Discoveries Made in Science. The journal reflected the striving to strengthen the ties of science with practice. The periodic scientific publications Theoretical Studies, Works of the Academy of Sciences were published in Russian. The number of its corresponding members and hnonrary members was growing, including N.I.Gnedich, V.M.Golovnin, N.I.Grech, V.I.Dal, N.M.Karamzin, K.Kh.F.Ledebur, N.I.Pirogov, N.F.Polevoi, O.I.Senkovsky, Kh.Kh.Steven,, A.S.Shishkov, and many other men of culture, famous travelers and naturalists.

The fact, that among its foreign members we see the names of brilliant writers and scientists of the 19th century such as A.-M.Ampere, J.L.Gay-Lussac, T.H.Huxley, W.Herschel, J.W.Goethe, A. von Humboldt, Ch.R.Darwin, Ch.Layel, T.R.Malthus, O.L.Cauchy and J.Fourier, proves a high authority of the Academy. The early 19th century became a new bright stage in the history of Russian geographical studies. In 1803-1806, I.F.Kruzenshtern and Yu.f.Lisyansky made the first round-the-world trip, in which Academy embers W.`Tilesius bor Tilenau and G.I.Langsdorf took part. In the first half of the 19th century, the Russian government organized about 50 major sea trips, in which, as a rule, the Academy's naturalists took part, An outstanding event in the development of geographical studies became the discovery of Antarctica by the expedition of F.F.Bellinsgausen and M.P.Lazarev in 1820.

The expeditions brought glory to Russia, and turned St.Petersburg into a center of world geography. The value of zoological collections and botanical herbaria of those years increased hundredfold today. It is only from them that we can learn of some species disappeared in the last two centuries. Problems of calculus, mathematical physics and mechanics were given development in the studies of the outstanding mathematicians M.V.Ostrogradsky and V.Ya.Bunyakovsky. To demonstrate successes of university science, one can take the discovery

of non-Euclidean geometry by the great Russian mathematician N.I.Lobachevsky, as an example, the theory was ahead of its time.

Among the greatest mathematicians of the 19th century is Pafnuty Lvovich Chebyshev. He created new directions in calculus, function theory, probability theory and number theory, solved most difficult problems of long standing, not yielding to the efforts of his predecessors. P.L.Chebyshev's greatest achievement is the creation of the famous St.Petersburg school of mathematicians. A.N.Korkin, Ye.I.Zolotarev, A.A.Markov, A.M.Lyapunov and V.A.steklov make up a far from complete list o brilliant representatives of his school.

The famous disciple of P.L.Chebyshev founder of mathematical theory of stability, A.M.Lyapunov wrote:

"P.L.Cheyshev and his followers constantly remain of the real ground, being guided by the view that only such studies are valuable that are caused by applications (scientific of practical), and only such theories are really useful that follow from considering particular cases. A detailed study of the problems, particulary important from the standpoint of applications, and at the same time, presenting particular theoretical difficulties, which should be overcome by the invention of new methods and retracing one's steps to the principles of science, and then generalization of a more or less general theory were the directions of the majority of works of P.L.Chebyshev and the scientists sharing his views". This quotation is very characteristic of methodological views of the St. Petersburg mathematical school. Since that time and until now, Russia has remained one of the world leaders in mathematics.

Of greatest importance for the development of fundamental problems in aerodynamics were the works of N.Ye.Zhukovsky and S.A.Chaplygin; in astronomy, of V.Ya.Struve, F.A.Bredikhin and A.A.Boloplsky. The following discoveries made history: of the electric arc. By V.V.Petrov; the studies of E.Kh.Lenz, who formulated the law of the thermal effect of the current, and also a fundamental rule determining the direction of induced currents; B.S.Yakobi invented electroplating and the ships' electric motor. A.G.Stoletov and P.N.Lebedev performed a fundamental study on electromagnetic processes. An outstanding achievement was invention of radio by A.S.Popov in 1895.

The second half of the 19th century is characterized by the flourishing of chemistry in Russia. The contributions by D.I.Mendeleev, creator of the periodic table of the chemical elements, N.N.Zinin, founder of a school o organic chemists, and A.M.Butlerov, creator of the theory of chemical construction, are invaluable. Biological sciences in the Academy of the 19th century were represented by K.M.Baire, founder of the comparative embryology of animals, A.O.Kovalevsky, founder of evolutional embryology, A.S.Famintrsyn, creator of evolutional physiology of plants and author of the symbiogenesis hypothesis.

On the verge of the 20th century Russia gave the world such names as D.I.Ivanovsky, discoverer of viruses, I.I.Mechnikov, one of the first Nobel laureates, who discovered cell mechanisms of

immunity, I.P.Pavlov, a Noble laureate, who discovered conditioned reflexes base o consciousness, and whose 150th anniversary we mark this year.

V.M.Severgin was the first of work out systematization of minerals, created a fundamental work on the topomineralogy of Russia. The first geological map of the European part of the country was made by G.G.Gelemersen. Ye.S.Fyodorov laid foundations for structural crystallography, a systematic geological mapping of Russia was performed under the leadership of A.P.Karpinsky. B.B.Golitsyn created foundations of seismometry.

The works of genius by V.I.Vernadsky laid foundations for new sciences: geochemistry, and then radiochemistry and radiogeology. His teaching o biosphere and noosphere plays an outstanding role in solving ecological problems. Establishing new system of the Paleozoic, called the Perm system, became the greatest discovery related to the Earth's history. It was then that considerable resources of platinum in the Urals, uranium in Fergana, oil in the Baku region, and gold and coals in Siberia were discovered.

One of the Academy of Sciences most important goals was perfecting the Russian language. Together with prominent linguists, the brilliant Russian writers P.A.Vyazemsky, V.A.Zhukovsky, I.A.Krylov, I.A.Goncharov, F.M.Dostoevsky, A.N.Mainkov, I.S.Turgenev, A.N.Ostrovsky, A.K.Tolstoy, F.I.Tyutchev, A.A.Fet, A.S.Khomyakov and others joined the Department of the Russian Language and Literature. Acad. Ya.K.Grot set norms of Russian orthography, maintained until the reform of 1918, and compiled a dictionary, which has not lost its importance even now. Acad. A.Kh.Vostokov, researcher of monuments of Old Slavonic literature, published Ostromirovo Gospel in 1843.

In the 19th century, historians drew society's attention to the riches of native history. In 1818, publication of The History of the Russian State by N.M.Karamzin started. N.M.kramzin was elected Honorary Member of the Academy that same year. As A.S.Pushkin put it figuratively, "the history of Russia was discovered by Columbus". Its tortuous history Russia learned also thanksto the efforts of academic historians S.M.Solovyev, V.O.Klyuchevsky, T.N.Granovsky, nd others. In the first quarter of the 19th century, statesman N.P.Rumyantsev succeeded in uniting scientists K.F.Kalaidovich, I.I.Grigorovich, A.Kh.Vostokov, P.M.Stroev and others, who made it their vocation to collect, study, and publish documents of Russian history.

An archeographic expedition was organized in 1828-1834. The Lavrentyevskaya, Troitskaya and Ipatyevskaya Chronicles, and the Code of Laws of 1497 became accessible to general public. N.P.Rumyantsev amassed a collection of manuscrips and books making up a base for the Rumyantsev museum. Fundamental studies of philologists I.I.Sreznevsky, V.I.Dal and A.A.Shakhmatov wre made widely known. The works of V.R.Rozen, V.V.Radlov, U.U.Bartold, F.I.Shcherbaatsky, S.F.Oldenburg and others laid foundations for the now world-known schools of oriental studies.

The high scientific and social status of Academy members was to a considerable degree also due

to the fact that many of them were professors at higher educational establishments. It was the Academy that used to award the most prestigious prizes in the field of science. The Demidov, Uvarov and Upshkin Award funds were active. The F.F.Brandt, V/Ya.Bunyakovsky, K.M.Baire, G.P.Gelmersen, Metropolitan Macarius and Count D.A.Tolstoy Awards were instituted.

In 1865, the 100th anniversary of the death of M.V.Lomonosov was marked by a new annual M.V.Lomonosov Award. By the way, the Academy member Metropolitan Macarius Award was reinstituted by the Moscow Patriarch, Government of Moscow and our Academy three years ago. In December 1899, when the 100th anniversary of the birth of A.S.Pushkin was marked, a Section of Belles Lettres was set up under the Department of the Russian Language and Literature, with the goal of compiling a Dictionary of the Russian Language and publishing an annotated edition of the works of Russian writers.

The Section of Belles Lettres also united Honorary Academicians among writers, artists and literary critics. During the first elections in Jonuary 1900, the first generally recognized “masters of thought” of Russia L.N.Tolstoy, A.F.Koni, A.M.Zhemchuzhnikov, V.G.Korolenko, A.P.Chekhov, V.S.Slolvyev and V.V.Stasov were elected. In the following years, K.S.Alekseev (Stanislavsky), I.A.Bunin, A.N.Veselovsky and lethers became Honorary Members.

And though sometimes stormy disputes and even scandals accompanied the elections, as in electing A.M.Gorky, men of literature and arts highly evaluated their election as Honorary Members of the Academy, and regarded the fact as not only a manifestation of the Academy’s interest in the country’s culture, but also as an act of recognition by the whole of Russia.

In 1889, the Academy was headed by a highly-educated member of the Emperor’s family, a well-known poet Grand Duke Konstantin Konstantinovich Romanv. He led the Academy without losses through the hard times of the early 20th century. 1917, a year of great upheavals came. The Russian Empire collapsed. Most scientists did not accept the October Revolution On November 21, 1917, the General Assembly of the academy addressed the scientists of the country with a message expressing their negative attitude toward the revolution. Meanwhile, however, the Academy did not reject professional cooperation with the new power. In December 1917, S.F.Oldenburg noted that “Russia was on the verge of ruin”, and stressed at an annual meeting that “men of science cannot help being fully aware that without their work public education and culture are unthinkable, as any worthy human existence without the latter”.

A new, almost 70-year, period of unprecedented development of science and education in the country began. But a period dramatic, maiming the fates of many thousands of scientists, a period of inadmissible intrusions of power and ideology in science. It is just in this period that attempts to dissolve the Academy were made.

Since February 1918, at a decision of the General Assembly, the Emperor’s St.Petersburg Academy changed its name for the Russian Academy of Sciences. For the first time, the principle of elected leadership was introduced. The outstanding geologist A.P.Karpinsky was elected

President. The Academy actively joined in the resolution of socio-economic and cultural problems of the country. A Commission on the Study of natural Productive Forces and Natural Resources set up under the aegis of the Academy in 1915 on the initiative of V.I.Vernadsky was involved in the process. Research into the Kursk magnetic anomaly and the mineral resources of the Kola Peninsula was launched. Under the leadership of G.M.Krzhizhanovsky, subsequently and Academician and Academy's Vice-President, a State Plan for the country's Electrification (GOELRO) was worked out, for many years becoming an extensive program for construction of hydroelectric power stations and high-voltage lines, and serving as a basis for industrialization of the entire country.

Modeled on the RAS, the Academy of Sciences of Ukraine was set up in 1918, with V.I.Vernadsky as President, and the Academy of Sciences of Belorussia in 1929. From 1918, within the Academy system, research institutes were set up; in particular, the Engineering Physics Institute headed by A.F.Loffe, Institute of Physics and Mathematics headed by V.A.Steklov. The number of scientific workers of the Academy increased fourfold, as compared with 1917.

The government's decision of 1925 to proclaim the Academy the "highest all-Union scientific institution" become a recognition of the Academy's role in the life of society. It was named the USSR Academy of Sciences. Scientists working outside of the Academy in higher educational establishments, branch institutes and other organizations started being elected to the Academy, which enabled to unite most outstanding men of science, without bureaucratic obstacles. With the goal of improving the Academy's interaction with the central state institutions, at a decision of the government of 1934, the Academy's Presidium and a number of academic scientific institutions were transferred from Leningrad to Moscow.

In 1935, a Department of Technical Sciences was set up. In 1938, the Academy already had 8 departments: Physics and Mathematics, Technical, chemical, Biological, Geological and Geographical sciences, Economics and Law, History and Philosophy, Literature and Language. In the national republics and major regions of the Russian Federation the Academy started setting up its branches and bases subsequently turned into the Academies of Sciences of the union republics, scientific centers, and regional divisions.

Dear colleagues, taking into account the shortage of time, let me further on, with the exception of but a few, not to name the members and workers of the Academy, now living. You will know them easily from the context. Otherwise, I would have to name most on those present.

In 1957, a Siberian Branch was set up and, later on, specialized scientific centers in Pushchino, Troitsk and Chernogolovka. In the late sixties, the Ural and Far-Eastern Branches were transformed into scientific centers, and then, in the eighties, into regional divisions. An outstanding role in the organization of regional divisions, branches, scientific centers was played by V.L.Komarov (subsequently, President of the Academy of Sciences), M.A.Lavrentyev, S.L.Sobolev, A.A.Troimuk, S.A.Khristianovich, S.V.Vonsovsky, N.N.Krasovsky and our other

scientists.

First Chairman of the Siberian Branch M.A.Lavrentyev has actually created a system for managing science in the regions, which was subsequently developed by G.O.Marchuk and V.A.Koptyug, and used in the Ural and Far East. In the early sixties, the creation of the Academy of Sciences in all the union republics was completed. The academy of Sciences was assigned coordination of the activities of the republican Academies. As the Academy grows, its contribution to world science grows too, as well as to the solution of problems facing the country. I will mention just a few of the outstanding achievements.

A major contribution to the development of modern mathematics and its applications was made. I.M.Vinogradov and his disciples obtained outstanding results in the theory of numbers. Most difficult problems were solved. Fundamental results in constructive function theory. Differential equations and probability theory were obtained by S.N.Bernshtein.

The remarkable results of N.N.Luzin laid foundations for a further development of the theory of functions of a real variable in this country. In the twenties, N.N.Luzin set up the well-known Moscow school of function theory, where many outstanding mathematicians, organizers and leaders of native scientific schools of various branches of mathematics had grown.

The remarkably diverse works of A.N.Kolmogorov had an enormous impact on the development of modern mathematics. In his work on function theory and functional analysis, classical mechanics, information theory, and, first of all, probability theory, mathematical statistics and turbulence theory, fundamental problems were solved, basic results obtained and new problems posed, bringing to life a great many of new research works.

L.S.Pontryagin and his school obtained outstanding results in the fields of algebraic topology and theory of optimal control. Let me mention the famous Pontryagin principle. The theory of differential equations, methods of mathematical physics and functional analysis were developed by the works of I.G.Petrovsky, S.L.Sobolev, A.N.Tihonov and their disciples. In the mathematical works of M.V.Keldysh and M.A.Lavrentyev, outstanding results in the field of complex analysis, potential theory, functional analysis and approximation theory were obtained.

Most difficult problems of mathematical logic, algebra, geometry ad topology were studied in the fundamental works of P.S.Novikov, A.I.Maltsev, P.S.Aleksandrov and many other prominent mathematicians. Major results were obtained in the field of calculus and mathematical modeling by A.N.Tikhonov, A.A.Dorodnitsyn, and others. Effective numerical methods for solution of problems in mechanics, physics, geophysics and technology, enabling to solve many difficult applied problems, were worked out. The works of L.V.Kantotovich on mathematical economics were awarded a Nobel prize. Under the leadership of S.A.Lebedev, studies leading to creation of first domestic fast-operating computers, uncluding the BESM-1 (1952), at the time the most efficient computer in Europe, were launched. I will specially note the basic contribution to mathematics, mechanics and theoretical physics, made by N.N.Bogolyubov, who for more than

25 years headed the Mathematics Department of our Academy.

The most important results were obtained in the field of mechanics. The theory o nonlinear oscillations is due to N.M.Krylov, N.N.Bogolyubov, L.I.Mandelshtam, A.A.Andronov, and others. A major contribution to the development of aerodynamics was made by M.V.Keldysh, V.V.Struminsky, A.A.Dorodnitsyn; elasticity theory, by N.I.Muskhelishvili; filtration theory, by P.Ya.Kochina, whose centenary was marked in May this year (I think we now have a good occasion to pass Pelageya Yakovlevna our best wishes with our applause); the mechanics of machines and mechanisms, by A.A.Blagonravov and I.I.Artobolevsky. The theory of small-scale turbulence structure was created in the works of A.N.Kolmogorov and A.M.Obukhof. Major achievements were obtained in the mechanics of solids, liquids and gases, mechanics of porous media, mechanics of navigational systems, motion stability theory, control theory and their applications. The Academy's achievements in the field of astronomy and astrophysics, including the studies of the distribution of diffused matter in world space, received a wide recognition.

Astronomers' observational base was extended substantially. The world's biggest Crimean and Special astronomical observatories were constructed. The latter possesses one of the world's largest optical and radio telescopes. Outstanding results in the study of evolution of the Galaxy were obtained by V.A.Ambartsumyan, solar physics by A.B.Severny, and relativist astrophysics by Ya.B.Zeldovich. Important results were obtained in radioastronomical observations. Planets radiolocation, and X-ray astronomy. It is difficult to overestimate the contribution to the development of physical sciences by the world-famous school of physics, headed by A.F.Ioffe and Leningrad Physical Engineering Institute, engendering a number of new institutes and scientific trends.

Physics in the Academy has always been on a high level. Here is a far from complete list of outstanding achievements in the field. D.V.Skobeltsyn discovered showers in cosmic rays, G.N.Flerov and K.A.Petrzhak spontaneous nuclear division. V.I.Veksler laid foundation for the principles of operation of high-energy particle accelerators, G.I.Budker was first to propose and apply his colliding beams method, which became basic in studies on high-energy physics. At the Serpukhov accelerator, new elementary particles and important laws in the physics of elementary particles were discovered. At underground observatories, neutrino physics and astrophysics were developed. Studies on superhigh-energy particles coming from outer space were performed. Relativist nuclear physics develops successfully, and synthesis of the heaviest trans-Uranium elements is carried out.

The works of physical theorists deepened the understanding of nuclear structure and elementary particles, made a large contribution of the creation of the theory of strong interactions, i.e. quantum chromodynamics. Synchrotron radiation was predicted.

Fundamental results in the theory of high-temperature plasma and problems of controlled thermonuclear synthesis were obtained. I.E.Tamm and A.D.Sakharov offered a basic idea of holding plasma in a magnetic field; in particular, in a Tokamak-type plants and in the

development of the problem of inertial thermonuclear synthesis. Fundamental research of luminescence was performed by S.I.Vavilov and his disciples. P.A.Cherenkov discovered, and I.E.Tamm and I.M.Frank supplied a theoretical explanation to the phenomenon of light radiation by a charged particle moving with a speed exceeding the phase speed of light in a medium. G.S.Landsberg and L.I.Mandelshtam discovered combination diffusion of light in crystals. N.G.Basov and A.M.Prokhorov laid foundations for quantum electronics, created a number of types of lasers, and determined areas of application of laser technology. Important results were obtained in nonlinear optics, nonlinear laser spectroscopy.

Foundations for color holography were laid. Wide-scale research into spreading radio waves of different bandwidths was performed. Major results were obtained in statistical radiophysics and in the theory of potential noisestability of radio communications. Science owes E.K.Zavoisky his discovery of electronic paramagnetic resonance, and P.L.Kapitsa the discovery of liquid helium super-fluidity. Theoretical explanation of this phenomenon and development of the theory of superconductivity is due to L.D.Landau, N.N.Bogolyubor, and others.

The contribution to solid-state physics is very important, including the development of the quantum theory of the condensed state of matter, and of semiconductor physics. Principles of creation of power semiconductors of current transformers, semiconductor heterostructures and lasers on their basis, and principles of acoustoelectronics were worked out. Exitons in semiconductors were discovered and studied.

The works of L.F.Vereshchagin on the technology of producing artificial diamonds led to the creation of an industry of synthetic supersolid materials. Among the Nobel laureates are N.N.Sepmyonov (1956), P.A.Cherenkov, I.M.Frank, and I.E.Tamm (1958), L.D.Landau (1962), N.G.Basov and A.M.Prokhorov (1964), and P.L.Kapitsa (1978). Greatest achievements in chemical sciences are obtained by the schools of L.A.Chugaev, I.I.Chernyaev, A.A.Grivberg on the chemistry of complex compounds; N.D.Zelinsky, S.S.Namyotkin, on the chemistry of hydrocarbons and petrochemistry; N.S.Kurnakov in the field of physicochemical analysis.

Foundations of modern organic synthesis were laid by the works of A.E.Favorsky, I.N.Nazarov and N.N.Vorozhtsov. A major contribution to the development of catalysis theory was made by A.A.Balandin and G.K.Boreskov, electrochemisty by A.N.Frumkin, and physicochemical mechanics by P.A.Rebinder. Nobel laureate N.N.Semyonov experimentally discovered and created a theory of branched chain reactions.

Chemical kinetics, combustion and detonation theory were given a brilliant development in the works of Ya.B.Zeldovich, V.N.Kondratyev and N.M.Emanuel. New physical methods for stimulating chemical transformations by radiation, laser radiation and shock waves were developed.

A new direction in chemistry, the chemistry of element-organic compounds, which A.N.Nesmeyanov called a “third continent of Chemistry”, was created by A.N.Nesmeyanov,

G.A.Razuvaev, I.L.Knunyants, M.I.Kavachnik, and father and son Arbuzovs. Many other directions in modern chemistry and its applications developed considerably. Chemical scientists made an invaluable contribution to the development of home in the 20th century. S.V.Levedev created the world's first technology for producing synthetic rubber.

The works of V.A.Kargin, S.S.Medvedev, N.S.Enikolopov, V.N. Tsvetkov on the chemistry and physics of polymers enabled to start production of synthetic materials. The works of I.P.Bardin and A.A.Baikov found wide application in metallurgy.

An outstanding role in the development of electrical welding and special electrometallurgy belonged to the studies of B.E.Paton and his colleagues. Among the achievements determining progress in biology, one cannot help marking the discovery by N.I.Vavilov of the law of homologous series in hereditary changes, the works of N.K.Koltsov on the gene structure, the pioneer studies of A.N.Belozersky on nucleic acids, gene systematization and the original theory of the origins of life by F.I.Oparin.

The works of I.P.Pavlov and his school led to major developments in the physiology of the central nervous system. P.K.Anokhin, M.N.Livanov had major successes in the study of the brain function; L.A.Orbeli, Kh.S.Koshtoyants and E.M.Kreps, in the development of evolutional physiology; A.A.Ukhtomsky, in the physiology of labour. A.M.Ugolev discovered membrane digestion.

The development of space physiology in the works of V.N.Chernigoncky and V.V.Parin prompted launching man into space. An informational theory of emotions was developed. Important results in psychophysiological micromapping and physicochemical mechanisms of the nervous system were obtained.

The results of fundamental studies by A.N.Severtsov and I.I.Shmalgauzen in the field of evolutional morphology of animals, Ye.N.Pavlovsky and K.I.Skryabin in the files of parasitology and helminthology, M.S.Gilyarov in the field of biogeocenology are widely known.

In the fifties, sixties and seventies, our scientists successfully took part in the solution of problems of global importance. Among them are the creation of a vaccine against poliomyelitis enabling to practically eliminate this terrible children's disease. Foundations for radiobiology were developed. Radiation disease and methods for its treatment were developed. With the most active participation of our country, the Earth's population was vaccinated against smallpox.

Successes in the field of space physiology are well-known. Since the sixties, studies in the field of physicochemical biology and biotechnology are being developed intensely. V.A.Engelgardt, A.A.Baev and others did much to learn the structure and functions of biologically active compounds; Yu.A.Ovchinnikiv, in studies on mechanics of functioning of biological membranes; A.L.Kursanov, in studies on substance transport in plants.

In this period, research into a theoretical basis for prospecting new sources of mineral resources and their exploration were given large-scale development. In all the regions of the country, new institutes were created with in the Academy framework, the world's largest scientific fleet set up, wide-scale expeditions embracing not only the USSR territory, but also the World Ocean were carried out. A new system in the history of the Earth was discovered, outstanding results in studying the depths structure were obtained. Geological cartography became the most important direction of work. The created geological and special maps became a scientific basis for new most important geological discoveries. The works of I.M.Gubkin, A.A.Trofimuk and their disciples supplied theoretical foundations for the discovery of major oil and natural gas provinces.

V.I.Vernadsky, D.I.Shcherbakov and their disciples did much to create the world's largest resource basis for nuclear industry. A.N.Zavaritsky discovered giant natural resources of iron ores in the Urals and in region of the Kursk magnetic anomaly; A.E.Fersman, the unique resources of apatites in the Kola Peninsula; V.S.Sobolev, diamonds in Siberia; V.A.Obruchev and Yu.A.Bilibin, gold in the northeast of the country; S.S.Smirnov, non-ferrous metals and rare earths.

All this became a weighty contribution to the power of our homeland, In the field of earth sciences, well-known scientific schools were formed: in tectonics (N.S.Shatsky, A.V.peyve, V.V.Belousov); in paleontology and stratigraphy (V.V.Menner, B.S.Sokolov); in lithology and geochemistry of sediment accumulation (N.M.Strakhov, V.B.Ronov); in geochemistry of isotopes and geochronology (v>I>Vernadsky, A.P.Vinogradov, A.I.Tugarinov); in physiochemical petrology (D.S.Korzhinsky); in crystallography and mineralogy (N.V.Belov, A.G.Betekhtin, F.V.Chukhrov); in geophysics (G.A.Gambutsev, M.A.Sadovsky).

In the postwar period, a powerful experimental base was set up in the Academy, the world's largest scientific fleet created, wide-scale experimental studies of the World Ocean were performed. Results obtained with the help of space facilities were used more and more in the earth sciences. In solving theoretical problems, the Moon, Venus and data on other solar system planets' were taken into account. The role of the Academy is particularly important in the field of outer space research and exploration. The world's first Earth satellite launched in 1957 and the flight of Juri Gagarin became possible thanks to the work of scientists headed by S.P.Korolyov, M.V.Keldysh, V.P.Barmin, A.F.Bogomolov, V.P.Glushko, V.I.Kuznetsov, N.A.Pilyugin, and others. The Academy's scientific achievements in deepening our ideas about the terrestrial space, atudying the effect of the processes in space on the ionosphere and Earth atmosphere, as well as in the development of space became well-known. With the help of space exploration vehichles and equipment, pioneer studies of the Moon and the nearest planets of the Solar system, Venus above all, were carried out. In economics studies, it is necessary first of al to note the creation of methods for drawing up a balance sheet as a basis for national economy planning by K.V.Ostronityanov, N.A.Voznesensky and V.S.Nemchinov.

In studies on the problems of philosophy, of special interest is the development of natural history in the works of B.M.Fedrov, M.E.Omelyanovsky, and their school. Among the works on

theoretical problems of the state and law, of special importance was the development o a scientific basis for the country's legislation and legal reform. In the field of sociological and politological studies, an accent was made on the development of methods to study social processes. Fundamental studies on the history of Russia were performed by N.M.Druzhinin, B.D.Grekov,Ye.V.Tarle, L.V.Cgerepnin, and others. Ye.M.Zhukv and other scientists carried out basic studies on the history of foreign countries. The works of native orientologistts I.Yu.Krachkovsky, I.A.Orbeli, V.M.Alekseev, N.I.Konrad and their colleagues, works of Slavonic scholars and ethnographers are well-known. The discovey by A.V.Artsikhovsky and V.L.Yanin of birchs bark letters in Novgorod and other towns, investigations by B.B.Piotrovsky of the ancient settlements in Transcaucasia, by S.P.Tolsov in Khoresm, by A.P.Okladnikov in the south of Siberia received a world recognition. The academic scientists discovered many new pages in the history of World War II. Significant studies in the field of literature were performed by philologists. A lot of work on the studies of the languages of the peoples f Russia and the rest of the world was done by V.V.Vinogradov, L.V.Shcherva, and others.

Soviet times

As before, in the Soviet times the Academy of Sciences played a determining role in the making of education in the country, actively prompting the creation of a system of universities and higher educational establishments, in the making and development of a state system for training and certification of scientists and teaching personnel. Great attention was paid by the Academy to school education. Many good textbooks and manuals were created by our staff members or with their participation. Our Academy paid great importance to the dissemination of scientific knowledge, and played a key role in the work of the well-known (Znaniye – Knowledge) society.

A major contribution was made by the Academy to the creation of a system of continuous education. It suffices to remember the note of Academicians A.M.Laypunov, A.A.Markov and V.A.Steklov on the university mathematics program; on the organization, as proposed by Academicians P.L.Kapitsa and S.A.Khristianovich, of the Moscow Physical Engineering Institute, whose basic departments were located in the Academy's research institutes since the day of its inception; on establishing Novosibirsk University in the Academgorodok of the Siberian Department of the Academy; on the organization, on the initiative of Academicians A.D.Aleksandrov, M.A.Lavrentyev and A.N.Kholmogorov, of specialized physics, mathematics, chemistry and biology boarding schools under the aegis of major universities in Moscow, Leningrad, Novosibirsk and Kiev.

Unfortunately, I cannot go on speaking here on the role of academic science in education and enlightenment of people in the Soviet times. I will only say that the creation of one of the world's best systems of school and higher education played an outstanding role in the achievements of our people. This system has the Academy o Sciences it self. Let me inform the participants in the meeting that organized in cooperation with Moscow University, a meeting will be held on June 8 to discuss problems of interaction of the Academy with universities, higher educational establishments, and with the system o school education. ***

It seems also important today to remember that in the years of calamities, world and civil wars, the academic scientists applied tremendous effort to preserve monuments of science and culture under the threat of destruction. Let me give you some examples. In October 1927, due to a war threat to Petrograd, the Academy of Sciences moved its manuscript collection, early-printed books, almost all the editions of the 18th century kept in its Library, collections of the Asian Museum and the Archives to Saratov. In the years of the civil war, the collections of the museums were not only preserved but substantially replenished. For example, the collection of V.G.Druzhinin's manuscripts, A.S.Pushkin's authentic manuscripts, and autographs o any writers from the Dashkova manuscripts collection were acquired. The activities of the Academy of Sciences museums and manuscripts collection workers, who preserved and enlarged the funds in the conditions of the blockade of Leningrad became an immortal deed. ***

The role of the Academy of Sciences in strengthening the defense potential of the Country is great. As early as the last century, corresponding member of the Academy, Artillery General N.V.Maievsky, founder of the Russian scientific school of ballistics, designed a cannon with record characteristics. Acad. N.D.Zelinsky created a gas mask saving tens of thousands of soldiers in the years of World War I. Acad. V.N.Ipatyev set up production of explosives and powders in 1916-1920. The name of Acad. A.N.Krylov is prominent both in the history of Russian Navy and the history of science. He was the first to perform the most complete study on the rolling and vibrations of ships, compiled the well-known "tables of unsinkability", whose application strengthened the fighting capacity of the Navy. Under his supervision, the destroyer Novik, the world's best at the time, was built.

The role of scientists was especially prominent in World War II. The studies of academic scientists in the prewar and war years enabled to design first-class airplanes and tanks, artillery and infantry weaponry, volley fire jet systems, and organize their mass production. Under the leadership of A.P.Aoeksandrow, protection of war ships against magnetic mines was provided. The works of M.V.Keldysh and others substantially improved the flight characteristics of war planes. The disciples and followers of N.E.Zhukovsky and S.A.Chaplygin form the S.V.Ilyushin, A.V.Yakovlev and A.N.Tupolev bureaus designed airplanes ensuring the superiority of our aviation in the air during the war, and then served as a basis for creating modern Air Forces of Russia. With the most active participation of the academic scientists, the industry was converted shortly into producing military equipment. Oil reserves in Povolzhye and Presuralye, most powerful gold and platinum reserves in Siberia were prospected and exploited.

The works of N.N.Burdenko, A.D.Speransky and other medical scientists provided for successful treatment of the wounded in field conditions. The role of the Academy of Sciences in guaranteeing national security in the post war period is enormous. Creation of a nuclear missile shield, attainment of military and strategic parity and its successful maintenance for almost 50 years is due to native science Academicians I.V.Zeldovich, A.D.Sarharov, K.I.Shchelkin. Ye.Zababakhin, A.P.Aleksandrov and others provided for creation of nuclear arms. S.P.Korolyov, M.V.Keldysh, A.N.Tupolev, S.V.Ilyshin, A.S.Yakovlev, V.P.lushko, M.K.Yangel, V.N.Chelomei, V.P.Makeev, N.A.Semikhatov, V.P.Barmin, V.I.Kuznetsov,

N.D.Kuznetsov, N.A.Pilyugin, A.D.Nadiradze, V.F.Utkin and others provided for the creation of jet aviation and missile technology. In the early fifties, in response to the creation of nuclear-powered submarines abroad, a program for the construction of nuclear-powered submarines in the USSR was completed. The names of A.P.Aleksandrov, V.N.peregudov, N.A.Dollezhal, N.N.Isanin, V.V.Novozhilov, S.N.Kovalyov, I.D.Spassky and our other colleagues will forever remaining the history of creation of our submarine fleet. Simultaneously with creation of nuclear arms, work on peaceful use of nuclear energy started. D.I.Blokhintsev, N.A.Dollezhal and A.I.Leipunsky became creartors of the first nuclear power station in 1954. Thanks to the works of A.I.Berg and A.A.Raspletin, sophisticated radio electronic complexes and communications facilities were designed. Appearance of lasers developed by the works of complexes and samples of various purpose weapons. Lasers became irreplaceable in detection, location and targeting of missiles.

Much earlier than in the U.S.A., an oxidizer for missile heavy fuels with record power characteristics was synthesized by academic scientists, and its industrial production organized. Many of our defense complexes and technologies are no worse than their foreign analogs, while exceeding them in a number of characteristics. The Academy of Sciences has done a great service to the country in this. Many of our colleagues, who played an outstanding role in their creation, are in this hall now. Academic scientists initiated major international agreements; the Treaty banning nuclear weapon tests in the atmosphere, in outer space and under water and the international program for peaceful use of nuclear energy. Development of these ideas served as a basis for the wide international Purgwash movement of scientists for security and disarmament playing the most important role in the period of cold war. In many respects due to scientists uniting in their striving for stability and lasting peace in the period of the two systems' confrontation, no nuclear conflict started. At the source of this movement were A.V.Topchiev, L.A.Artsimvich, M.D.Millionshchikov, M.A.Markov, and others. We have to recall with gratitude the names of Presidents of the Academy of Sciences of the Soviet times; A.P.Karpinsky (1917-1936), V.L.Komarov (1936-1945), S.I.Vavilov (1945-1951), A.N.Nesmeyanov (1951-1961), M.V.Keldysh (1961-1975), A.P.Aleksansrov (1975-1986) and G.I.Marchuk (1986-1991).

Russian Academy

A new stage in the life of the Academy of Sciences began since the early nineties. It was a difficult, complicated and dramatic period. The collapse of the USSR and the habitual state and social institutions, a deep economic crisis, a legal vacuum are far from all the problems facing the Academy of Sciences. In 1991, the situation grew worse with a wide scale campaign of discreditation of the Academy of Sciences in the eyes of society, attempts to separate the Academic community from institutes, and set up a faceless association of institutes, to dissolve the Academy of Sciences by analogy with liquidation of all-Union structures under a pretext of fighting totalitarianism. This was frequently based on an understanding of democracy as all-out permissiveness with no serious responsibility. But the Academy has withstood. A decisive role was played by the decree of President of the RF of November 21, 1991. On the Reconstruction of the Russian Academy of Sciences.

Despite the hardest political, economic, social and psychological problems in the country, the Academy of Sciences has preserved its unity. It remains the main scientific center of Russia, and one of the leading scientific centers of world science. The major scientific achievements of the nineties are an obirous proof of it. Let me mention some of them. ***

The fundamental results were obtained by mathematicians in classical and new branches arising lately. A number of problems posed many decades ago in the number theory, algebra, geometry, topology, probability theory, mathematical physics, differential equations, and other fields have been solved. Studies on mathematical modeling and image recognition led to creation of effective methods of solution of important theoretical and applied problems. Multiprocessor computer systems of the domestic supercomputer line have been created. A number of complicated applied problems have been solved. Major discoveries extending our ideas of the Universe and, in particular, understanding of the processes of the galaxy formation at the early stages of the Universe evolution were made in astrophysics. Thus, by means of a 6-meter optical telescope at the Academy Special Astrophysical Laboratory, images of the remotest galaxies with red shifts up to 7 were received.

At the radio telescope of the Physical Institute of the Academy of Sciences at Pushchino, radiation of a pulsar known as the brightest source of X-ray radiation was discovered, and at the 6-meter optical telescope, optical pulsations of this object. Russian scientists continue to occupy leading positions in a number of branches of modern physics. This is the physics of quantum liquids and crystals, semiconductor heterostructures, laser physics, the physics of extreme conditions, high-precision relativist electronics, the physics of colliding beams, and a number of other directions. Major scientific plants have been launched for the last years. Russia's unique impulse neutron complex on the proton beam of a high-precision accelerator has been started. The world's only deep-water neutrino telescope on Lake Baikal was created. Literally the other day, the Globus tokamak plant was started. Rare processes of decay of short-living k-mesons were studied on our plants. The world's best limit for the neutrino mass in the state of rest was obtained. Major achievements marked the studies in the field of solid-state physics, plasma physics, optics and radiophysics. Research into the physics of solid-state low-temperature nanostructures developed successfully.

Methods for receiving two-dimensional, one-dimensional (points) semicinductor heterostructures were worked out, and absolutely new devices such as injection lasers, transistors, etc., were created. They will become a basis for the elementary base of electronics in the 21th century. Major achievements were made in relativist high-precision electronics. Important research and developments with applications to industry, medicine, ecology and other fields have been carried out. A laser femtosecond microscope with record space resolution close to the fundamental theoretical limit has been created. A method of coherent optical tomography to construct object images hidden in strongly diffusing media has been worked out; optical tomographs for nondamaging diagnostics of biotissues to a depth of 2 mm have been created. Unique plasmotrons have been designed. Major achievements were made in mechanics, solution of problems in machine-building, control, informatics and solution of physical engineering problems. An

effective method for opening the oil-bearing stratum and exploitation of oil wells with a substantial increase in their debit was offered. A new generationof walking robots capable of moving across surfaces with an arbitrary orientation in space was created. A method for synthesis of control of manipulation robots in case the information about the state is of qualitative character (of the “faster-slower” type) was designed.

A system was created, providing for automatic extraction of significant information from textual messages. A number of important studies on the durability, resource and endurance of powerful turbines, and other power equipment were performed. A system of plasma destruction and neutralization of complex chloro-fluorocarbons causing destruction of stratospheric ozone was worked out for the first time. The phenomenon of partial gas collapse in two-dimensional nonstationary nonautomodel compression of gas prisms was discovered. Construction of the general theory of wave solid-state gyroscope was completed.

A number of difficult problems of control of complex systems were solved. Works on ballistico-navigational support of flights on the MIR long-life orbital station and the international ALFA station were performed, including those necessary to provide for the transport ships PROGRESS M-37, 38,39, 40 and the manned SOYUZ TM 27,28 ships. Parameters of maneuvering necessary for approaching and docking the transport ships with the MIR station, the undocking and descent of the ships to a prescribed region were determined.

A new-generation mesoscale stochastic trajectory model for atmospheric displacement used as a basis for a Nostradamus computer system capable of predicting the radiation situation in emergencies at nuclear power stations was devised. A promising method for measuring the adhesion stability of the coating of gas turbine blades was created. Major achievements were obtained in chemistry.

A catalytic fixation of molecular nitrogen in soft conditions was discovered. An impact of weak magnetic fields on chemical reactions was discovered, and a new branch, so-called spin chemistry, was created. Important results were obtained on catalytic transformations of hydrocarbons, photocatalysis, directed synthesis of physiologically active substances and high-molecular compounds, tunnel effects in chemical processes, kinetics of superfast reactions in nano- and femtosecond bandwidths, production and research of giant palladium clusters.

A family of chemical sensors of different use was created, new methods for monitoring the environment worked out, scientific foundations for ecologically safe chemical technologies were worked out. Unique constructional and functional materials for new technologies were designed. Totally new methods for self-extending high-temperature synthesis of various substances were created.

A new superstrong steel was developed, having no worlds analogs. Products are made from it by rolling and other methods for processing under pressure, and not by moulding.

Life sciences are one of the priorities of the nearest decades, and, possibly, of the whole 21st century. Our scientists determined the spatial structure of a number of proteins and peptides. Molecular mechanics of ion transport through biological membranes was studied.

Informosomes playing an important role in transferring genetic information in the processes of biosynthesis are discovered. The structure and mechanisms of the ribosome functions playing a special role in protein synthesis were studied. The technique of noncellular proteing synthesis on ribosomes has been worked out. Problems of biochemistry and biotechnology, cellular biology, biophysics and bioenergetics are solved successfully. Original research into the genetic engineering of protein molecules with prescribed properties is performerd. Work on the studies of the human genome is in progress.

Together with colleagues from the Argonne National Laboratory, biochips were created, serving as express diagnosticums for identification of individual DNA molecules enabling with high precision to exhibit genetic defects in their structures. Unknown regulator molecules called mielopeptides were discovered, and their structure decoded. Together with the Immunology Institute under the Russian Health Ministry, new-generation vaccines were worked out; in particular, against flu and hepatitis. Original cancer- and TB-fighting medicines were created.

New promising biologically active substances and medicines were produced from sea and ground plants, and animals. New methods for ecological norming, based on analysis of the reaction of natural ecosystems against a toxic load, were worked out. In spite of dramatic cuts on expedition research, new and previously formed directions in the earth sciences advances substantially. New outstanding geodetic and seismological data on geodynamical processes were obtained. An effective system for monitoring seismic events and control of nuclear tests, incorporated into the global system, was created. A new map of possible seismic threat on the CIS territory, which is part of the World Map worked out under the aegis of UNESCO, was published.

We retained a leading position in the field of geochemistry of isotopes, ore-formation theory and dynamics of climatic processes. Prompted by the academic scientists' prognosis, the world's oldest, Precambrian, oil was discovered in Eastern Siberia. A high estimate of oil content of the shelf of Arctic seas was confirmed, and unique reserves of hydrocarbons in the Far North and Western Siberia discovered. Discoveries of the most important industrially feasible reserves were predicted scientifically.

Models for redionuclides migration in the atmosphere, ocean, continental landscapes and underground hydrosphere were worked out. Unique atlases of the Nature and Resources of the Earth, Snow and Ice Resources of the World, and Radioactive Pollution Resulted from Chernobyl Accident were created. Of fundamental importance are the discoveries related to the dynamics of the World Ocean waters, serving as a basis for mathematical models of the general circulation of waters, and interaction of the ocean with the atmosphere. Space studies on the color of the surface layer of the ocean for the first time enabled to estimate the global biological productivity of the ocean waters.

Progress in the field of social sciences is substantial. In the past decade Russian historians introduced qualitative changes in the methods of historical research and substantially extended its sources. A great number of documents became available, enabling to look at the known events and processes from a new angle, advancing totally different ideas and appraisals in the understanding of social transformations and modernization of social processes, in the analysis of international relations, and in the systems of social and state management.

A new treatment of the role of man and spiritual origins in history should be regarded as one of the most important achievements. The theory and comparative history of different types of civilizations, revealing the role and place of Russia in the world history was worked out intensely. Publishing fundamental generalizing works on the history of Russia and other countries, a series of documental publications of qualitatively new type, and monograph studies crowned tremendous research work. Important results in the studies of World Wars I and II were obtained.

A number of discoveries of the world level were made by native archeologists in this country and abroad. Historical education was renewed qualitatively on the basis of the newest achievements of historians, and new basic textbooks for schools and higher educational establishments were written. Remarkable encyclopedias were published. In the field of philosophy, global social and scientific and technological processes of modern times were comprehended. Outstanding works were published.

The sociologists received impressive all-Russia data on the state and mechanism of functioning of pubic opinion during perestroika. Lawers determined basic tendencies in the development of modern law and the state in Russia and abroad. Dominating tendencies in the sphere of relations between the national minorities and the making of public self-government in Russia were revealed. Our scientists studied problems in the psychic development and psychodiagnostics of man in a changing world. Stidies in the sphere of economics enabled to work out a conception and strategy o financial and monetary-credit policy for the purpose of recovery of the Russian economy. Modern decision-making technologies were offered, providing for a progressive structural transformation and economic growth. A concept for the state strategy in the social sphere in Russia was offered.

The Academy of Sciences worked out a concept of the modern stage in international relations as a forming multipole global system of correlations, reflecting the variety and integrity of the interests of a citizen, society, state and world community. With the account of confrontation and conflicts going on in the world, problems of national security in Russia were considered.

Theoretical and practical problems of the economic security of Russia, its geoeconomic interests and relation with the “far” and “near” abroad were studied. A long-term prognosis for development of the world economy and policies up to 2015 enabled to find the most probable variants of the making of new systems of international political and economic relations between

the main countries, including Russia. Among practical results we must point out the elaboration of an expert classification of the priority interests of Russia, goals of the national and state policy, mechanisms and methods for their attainment.

The traditions of native philology developed successfully in recent years. Literary critics paid special attention to Pushkin studies. The Pushkin House completed an 8-volume edition of A.S.Pushkin. Work Notebooks. Studies on Old Russian literature continue. The publication of the multivolume series Monuments of Literature of Old Rus has been completed. A significant event in literary studies was the completion of the fundamental History of World Literature in 8 volumes. Continuing the traditions of Acad. N/I/Tolstoy, folklore specialists actively work on collecting, studying and publishing works of spoken folk art. In recent years, a number of dictionaries and grammar books were prepared.

The Russian Language Federal Program was worked out, whose realization will prompt strengthening the state support for the Russian language. The history of Russian emigrationis studied actively. An important place is occupied by a complex interdisciplinary program for studying Russian culture in the world context. ***

In the nineties, the Academy of Sciences preserved and developed the traditional directions of activities, which, of course, started acquiring new forms and shads, in accordance with new realities. With an incredible effort, we preserved the system of academic book publishing.

We publish about 200 scientific and 7 popular science journals, 150 of which are translated into English. We publish all major remarkable traditional series. Our staff members have written wonderful books, many of which are of great cultural value. International ties are being developed.

Today, the Academy of Sciences has about 100 bilateral cooperation agreements, takes part in realization of more than 40 intergovernmental egreements, and is a member of 236 international organizations, representing Russia in them. We are developing and strengthening cooperation with the Academies of Sciences of the CIS countries, including that within the framework of the International Association of Academies.

We actively cooperate with the National Academies of Sciences and scientific centers of France, the UK, Germany, U.S.A., India, Italy, Poland, Finland, Sweden, Israel, China, Japan, and other countries.

The Academy of Sciences actively works on a mutually beneficial cooperation with foreign companies interested in joint applied studies. Dozens of international scientific conferences were held in Russian for the last few years. Our workers also took an active part in other international conferences. Following the tradition, the Academy of Sciences attaches a great importance to a cardinal rapprochement between science and education.

Dozens of lyceums and colleges were set up. Scientific educational centers, academic universities and faculties were created.

About 700 members of the Academy of Sciences and thousands of its workers are involved in education. The academic scientists wrote textbooks and manuals for schools and higher educational establishments. The closest interaction between our institutes and the country's higher educational establishments is a strategic line of the academic activities.

I have already said that they will be discussed in detail in June 8. In recent years, the Academy of Sciences substantially extended its interaction with state structures on a professional basis. I could mention just a few of the key directions of the academic activities in recent years. It is not customary to talk about troubles and problems on such occasions as today. We have a lot of them, and they are well-known.

Today, in the 275th year of the Academy, we can say that, with common efforts, we have preserved the Academy of Sciences, the invaluable asset of Russia. It is alive and developing. Its strength has been tested by time, due to the deep historical traditions cementing the Academy, and thanks to the selfless work of many generations of our workers. ***

In 275 years, Russia has managed to cultivate a unique tree of academic science bearing remarkable fruit for its people and works civilization, changing the image of this country. Powerful branches of the whole of Russian science and education, and many impressive achievements of our people have started out from this tree. Not every state is capable of doing this! Storms and hurricanes striking our home-land sometimes break the branches of the tree of science, and inflict deep wounds. But the Academy and academic science will support Russia in all its basic deeds.

Organizational structure of Russian academy of sciences

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Joint SuperComputer Center (JSCC) was founded in 1996 by joint decision of Russian Academy of Sciences (RAS), Russian Federation Ministry of Science and Technologies, Russian Federation Ministry of Education and Russian Foundation for Basic Research (RFBR) as state scientific institution.

Main goals of JSCC are:

to provide researchers (employees of scientific institutions of RAS, participants for science programs of Russian Ministry of Education and Science, grant-holders of RFBR and federal science centers) with modern computational resources locally and remotely via national telecommunicational network for science and high school;

to help researches maximize utilization efficiency of HPC-systems and to use modern information processing techniques, included Internet;

to provide access to modern databases;

to conduct researches for developing of system and applied mathematical software and solving problems of high complexity.

JSCC staff consists of high qualified scientists, programmers and engineers. At present JSCC employ 84 person.

To solve complex problems in various areas of science and technology JSCC form temporary creative groups from prominent mathematicians and experienced programmers.

Director of JSCC is academician, professor Savin Gennady Ivanovich, leading scientist in information technologies and mathematical modeling.

First deputy director - Shabanov Boris Mikhailovich, specialist in designing of hardware and software solutions for supercomputers.

JSCC acts as sub-faculties for the following universities: Moscow Institute of Physics and Technology (MIPT), Moscow Institute for Electronically Technics (MIET), Moscow State Institute for Radiotechnics, Electronics and Automation (MIREA) and teaches more then 70 students.

Strategic partnership was established with Moscow State University, where, by join efforts, educational computational complex was founded.

JSCC has formed consultation council to aid users. Users may listen to lectures on schedule and apply to course required by them. Three level system for raising skills and propagation of modern techniques exists in JSCC. It is oriented on specialist with different grades of experiences. JSCC is the most powerful and largest supercomputer center in Russia, with its performance ten times greater then performance of any other supercomputer centers of Russia in science and education.

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GENERAL INFORMATION

The Library for Natural Sciences (LNS) of the Russian Academy of Sciences (RAS) was established in 1973. Now it is a leading center of one of the largest and the most developed centralized library system **(CLS)** of the Russia comprising more than 200 libraries of the RAS research institutes. About one hundred LNS RAS branch libraries are located in Moscow institutes and in Moscow region research centers, the other ones are set in several different regions of Russia. The Central Library is in the center of Moscow at the following address: ***Znamenka str., 11.***

LNS RAS is a structural unit of the **RAS** Presidium and has a status of a research institute. Its activities are being coordinated by the Information and Library Council of the **RAS**.
As a whole the **CLS LNS RAS** renders services to more than 76 thousand readers. Its library collections on natural sciences are the most large and comprehensive in Russia. They include about 15 million library items.

Along with the traditional functions of a big library, the Central Library is solving several specific problems among which are the following ones:

centralized acquisition of library material to develop the collections of the **CLS** branch libraries including the analysis of the world book market, the subscription to scholar periodicals, the purchase of books and serials, international exchange of publications, the receipt of the literature

and its distribution among the libraries of the **CLS**;
centralized cataloguing of all coming in literature and supplying the **CLS** branch libraries with the library materials along with bibliographic descriptions made on traditional cards or in electronic format;
management of the traditional and electronic summary catalogues of the CLS's collections; providing an access to the electronic catalogues via the Internet;
playing the role of the Inter-Library Loan Center in the field of natural science;
purchase of the databases and the rights for an access to electronic publications and databases via the Internet to the CLS's readers;
creating the electronic information resources on the results of the **RAS** research activity and making them available to the users of the Internet;
information provision of the researches conducted in the RAS on the bases of the own and acquired resources;
working out, introducing and supporting the up-to-date automation technologies in the **CLS** libraries;
conducting research among others in the fields of computerization of the information and library processes; optimizing the **CLS** management; elaboration of the literature classification schemes.
The staff of the Central Library numbers about 300 persons among whom there are qualified librarians and specialists in the fields of computer technologies and natural sciences.

Library collections of the LNS RAS

The LNS RAS possesses the collection of library material that is one of the most comprehensive collections of scholar literature published after 1973 (the year when the Library was established). It has about 1,5 million library items. The collection of LNS RAS includes literature on natural sciences as well as on theoretical problems of technical, medical and agricultural sciences. As to the types of publications there are monographs, reference books, periodicals, conference proceedings, preprints, foreign dissertations and published reports.
The **LNS RAS** does not acquire educational and popular scientific literature. The **LNS RAS** has agreements for the book exchange with more than 400 partners all over the world.

Cataloques of the LNS RAS.

LNS RAS has a Card Union Catalogue of all library collections that are being developed in **CLS** branch libraries of the RAS institutes. It covers the time period with effect from 1930. Since 1990 the Library has been managing an electronic union catalogue of periodicals, since 1995 - a union electronic catalogue of books and serials. On the **LNS RAS** Website you can find the current acquisitions coming in weekly.

Reader services.

An employee of any **RAS** institution is eligible to become a regular reader of the **LNS** after showing his identification card. Other persons are served on a contractual basis. The readers may request documents to use them in the Library's reading room, look through newly acquired library material on the Exhibition of new comings, order photocopies, may use the Internet room.

National and International Interlibrary Loan and Document Delivery Services.
The **LNS RAS** provides interlibrary loan and document delivery services to Russian and foreign libraries. It loans original library material and supplies articles in paper and electronic formats. The **LNS RAS** accepts orders by mail, fax, by email and online via the Internet. You can find detailed information about the International Interlibrary Loan and Document Delivery Services here or use contact email: ***mmba@benran.ru***

Information Services. Along with rendering current information services to its patrons, the **LNS** complies with separate requests for several types of work received from different organizations. Among these types of work are the following ones:
compiling subject bibliographies in different science areas;
making the problem-oriented databases on different aspects in natural sciences;
working out/adaptation of software for libraries;
making paper copies, microfiche and microfilm copies of the library material collected by the LNS centralized library system.
For detailed information about the different kind of services offered by the **LNS RAS**, please, use the following contact e-mail: ***osiat@benran.ru***

Research work.
As the **LNS RAS** has the status of a research institute of the Russian Academy of Sciences, much attention is given to research aimed at updating of the processes leading to the improvement of science research provision with library and information services. All technological processes in the Central library and branch libraries of the **CLS** are maintained by the two-level complex automated system (**AS NAUKA**). The system was worked out and now is being supported by the **LNS** specialists. The scientific work is devoted to the problems of improvement of library resources management methods and to the problems of developing of scholar publications classification systems. The **LNS RAS** implements several science projects supported by the Russian Foundation for Basic Research (**RFBR**) and Russian Foundation for the Humanities. These projects are aimed at creating information resources, typical means of the resources processing as well as at making the acquisition process optimal in order to improve the development of library collections. The Library participates in several Russian interdepartmental projects such as “Creation of the Russian Union Catalogues System”, “Setting up of a corporate Moscow libraries system” (the project is supported by the Soros Foundation), in academic project “Creation of an Integrated Information System (**IIS**) **RAS** and others. The **LNS** cooperates with many foreign organizations.

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Main Research and Application Areas

Computing Centre RAS (established in 1955) is a leading research institute of the Russian Academy of Sciences engaged in developing computational methods, software, mathematical models and applying them to various fields of science and technology.

The main research and application areas of the Computing Centre are as follows:
- Computational Fluid Dynamics.

- Mathematical Physics.
- Mathematical Modeling of Climatic Ecological Processes and other Nonlinear Phenomena.
- Mechanics of Solid Bodies. Elastic-Plastic Problems.
- Pattern Recognition and Image Analysis.
- Computer Aided Design.
- Optimization Methods. Linear and Nonlinear Programming.
- Analitical Mechanics and Lyapunov's Stability of Motion.
- Dynamics of Rigid Bodies. Space Dynamics.
- Interactive Optimization and Decision Support Systems.
- Parallel Computing.
- Artificial Intelligence. Expert Systems. Applied Intelligent Systems.

(in Russian)

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Department of Continuum Mechanics (Head: Prof. A. Charakhch'yan)
Department of Computational Physics (Head: Prof. L. Turchak)
Department of Applied Mathematical Physics (Head: Prof. A. Tolstykh)
Center of Supercomputer and Massively Parallel Applications (Head: Dr.V.Konshin)
Department of Mechanics (Head: Prof. S. Stepanov)consists of 2 subdepartments:
Subdepartment of Theory of Stability and Mechanics of Control Systems (Head: Prof. A. Karapetyan)
Subdepartment of Kinetic Theory of Gases (Head: Prof. F. Tcheremissine)
Department of Nonlinear Methods (Head: Prof. V. Bereznov)

2. Informatics and Mathematical Cybernetics

Department of Mathematical Pattern Recognition and Methods of Combinatorial Analysis (Head: Academician Yu.Zhuravlev) consists of 4 subdepartments. The one of them is:
Subdepartment of Digital Signal Processing and Speech Recognition (Head: Dr. V. Chuchupal).
Department of Computational Forecasting Methods (Head: Corresponding Member of RAS K.Rudakov)consists of 2 subdepartments. The one of them is:
Subdepartment of Mathematical Modelling in Ecology and Medicine (Head: Dr. V. Shakin).
Department of Applied Intelligent Systems (Head: Prof.S.Dulin) (in Russian; in English)
Department of Applied Optimization Problems (Head: Prof.V.Zhadan)
Department of CAD Methods for Developing Systems (Head: Prof. V.Khachaturov
Department of Mathematical Modeling of Conflict Situations (Head: Prof. A.Kononenko)
Department of Modeling Systems (Head: Dr.A.Abramov)
Department of Operations Research (Head: Prof.Yu.Malashenko)
Department of Reliability and Stability Problems (in Russian) (Head: Prof.N.Severtsev, in Russian)

3. Divisions of Mathematical Modeling of Systems and Decisions (Head: Academician P.Krasnoshekov)

Department of Mathematical Modeling of CAD Systems (Head: Prof.Yu.Flerov, in Russian)
Subdepartment of Real-Time CAD Systems (Dr.M.G.Furugyan)
Department of Imitation Systems (Head: Corresponding Member of RAS Yu. Pavlovsky)
Department of Mathematical Modeling of Technical Systems (Head: Prof. A. Belolipetsky)
Department of Mathematical Modeling of Economic Systems (Head: Academician A.Petrov)
Department of Computational and Information Systems (Head: Dr. F. Ereshko)

4. Mathematical and Programming Software

Department of Software Engineering (Head: Prof. V. Serebryakov)
Department of Complex Systems (Head: Prof. V. Tsurkov)
Department of Scientific Information (Head: Dr. S. Gusev)

5. Computational Technique

Department of Computational Systems and Nets (Head: M. Kopytov)

- Mathematical Modeling of Economic Processes.

Department of Mathematical Modelling of Economic Systems
at the Dorodnicyn Computing Centre of the Russian Academy of Sciences
Head: Prof. Alexander A. Petrov, Full Member of the Russian Academy of Sciences

The Department consists of three divisions:
Mathematical methods for simulation of economic systems (A.Petrov)
Mathematical Modelling of Economic Structures (I.Pospelov)
Mathematical Methods for Economic Decision Analysis (N. Kukushkin)

New books were published:

Economic Dynamics Models Based on Equilibrium of Economic Agents' Forecasting (DOWNLOADABLE!!!) by Igor G. Pospelov. **Dorodnicyn Computing Centre of the Russian Academy of Sciences (2003). 200 pp.** *In Russian*

FEASIBLE GOALS METHOD. SEARCH FOR SMART DECISIONS (DOWNLOADABLE!!!) by A. Lotov, V. Bushenkov, and G. Kamenev. ***Dorodnicyn Computing Centre of the Russian Academy of Sciences, Moscow, Russia (2001) 240 pp.*** *In English*

FEASIBLE GOALS METHOD: Mathematical foundations and environmental applications by A. Lotov, V. Bushenkov, and G. Kamenev. ***The Edwin Mellen Press, NY, USA (1999) 400 pp.*** *In Russian*

FROM GOSPLAN TO MARKET ECONOMY: Mathematical Analysis of the Evolution of the Russian Economic Structures by A.A. Petrov, I.G. Pospelov, and A.A. Shananin. ***The Edwin Mellen Press (1999) 408pp.*** *In Russian*

A Mathematical Model of the Transition Economy (DOWNLOADABLE!!!) by E.V. Avtukhovich, S.M. Guriev, N.N. Olenev, A.A. Petrov, I.G. Pospelov, A.A. Shananin, S.V. Chukanov ***Dorodnicyn Computing Centre of the Russian Academy of Sciences (1999) 144pp.*** *In Russian*

COMPUTER SEARCH FOR BALANCED DECISIONS: Feasible Goals Method (DOWNLOADABLE!!!) by A.V.Lotov, V.A.Bushenkov, G.K.Kamenev, and O.L.Chernykh

Nauka (1997) In Russian
Essayes on the Mathematical Modelling of Economics by A.A. Petrov, I.G. Pospelov, and A.A. Shananin. ***Energoatomizdat (1996) 544pp.*** *In Russian*

- Development of Software.

The Computing Centre issues scientific proceedings on the above subjects. Starting from 1960 one of the most prestigious journals,"Journal of Computational Mathematics and Mathematical Physics", has been published by the Computing Centre. This journal is translated into English and is well known in the world. Our researchers publish their results in many other Russian and international scientific journals as well.

Additional information about the Computing Centre RAS may be obtained from Dr. L.V.Shurshalov - phone:(095) 135-02-28, E-mail: wcan@ccas.ru

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Computational Fluid Dynamics
Computational Hydrodynamics
Mathematical modelling and computer experiment
Mathematical physics
Numerical methods
Parallel computing

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ORGANIZATIONS

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Keldysh Institute of Applied Mathematics (Russian Academy of Sciences) was founded in 1953 to solve complex mathematical problems involved in national projects of space exploration, atomic and thermonuclear energy application, etc. This goal was meant to be achieved by developing and using appropriate computer hardware and software facilities. The Institute founder and first director (1953-1978) was President of the USSR Academy of Sciences *Mstislav Keldysh*.

Since its first years the Institute activity oriented to solving large scale applied problems is based on the results of fundamental scientific research in mathematics, mechanics, cybernetics, informatics, etc. which is carried out by the Institute scientists. Among them are four academicians, five corresponding members of the Russian Academy of Sciences, 74 doctors of sciences and 224 candidates of sciences, including 14 laureates of Lenin prize, 30 laureates of State prize, 5 laureates of the USSR Soviet of Ministers prize.

Since the launch of the first satellite the Ballistic Center of the Institute has been engaged in navigational support of unmanned and manned space missions including those of long-term orbital stations "Salyut" and "Mir", Soviet space shuttle "Buran", spacecraft "Luna", "Venera", "Mars", etc. It also takes part in some international space projects.

The studies carried out at the Institute on algorithmic and software support of locomotive machines (walking robots), automation of manual operations for assembling machine parts by adaptable robots have been widely recognized throughout the world.

The Institute is one of the first scientific organizations in this country where a new technique to carry out theoretical studies has been developed and widely recognized.This is a computational experiment based on using perfect mathematical models, efficient computational codes and high performance computers.

The Institute has been an initiator in utilizing computer facilities in the USSR. The first mass-production computer was installed at the Institute and the first team of soviet engineers was formed to perform pioneer work in the development of computer software. In 1963 the Algol-60 translator (one of the first from the complete language version) and the IS-2 (the first mini-OS) were developed and implemented by the Institute specialists. This trend in the software development was further continued in the full scale operational systems DISPAK and OS IPM, an optimizing compiler from FORTRAN, the program package GRAFOR for graphic data representation, in the studies on supercomputer architecture and software, manymachine complexes and networks. An important role in the Institute activity is given to the system studies of applied problems such as: programming and debugging systems for the Buran space

shuttle, the real-time control system, the information retrieval systems for different applications, CAD/ CAM systems, software tools for constructing applied packages.
Much attention is attached to educational and training issues. The Institute acts as a basis for Moscow State University, Moscow Engineer and Physical Institute and Moscow Aviation Institute. The Faculty of Applied Mathematics of the Moscow Physical and Technical Institute is set up at the Institute.
The Keldysh Institute is a head investigator in a number of leading studies in applied mathematics. The results obtained by the Institute scientists have been recognized in Russia and abroad. At different times several research organisations such as the Computing Center, the Institute of Space Research, the Institute of Mathematical Modelling had sprung from the Keldysh Institute and become leading scientific centers of the Russian Academy of Sciences.

Some statistics

300 specialists are engaged in applied problems, some of them in applied programming, and 300 specialists - in system studies.
Computer facilities include Convex SPP, Silicon Graphics workstations, Sun microsystems workstations, Hewlett-Packard C180-XP workstation, Hewlett-Packard D and K servers, Intel-based PCs.
Operational systems Unix, Microsoft Windows NT.
Programming languages are: Fortran, PL/I, C, C++, Prolog, Pascal, LISP.
Databases used are: Adabase, Foxbase, Oracle, DBASE-X, Paradox, SQL.
Now Institute is directed by Corresponding Member **Yurii P. Popov**

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About the Institute

Steklov Mathematical Institute of the Russian Academy of Sciences was created according to the decision of the General Assembly of the Academy of Sciences of the USSR (April 28, 1934) on the division of *the Institute of Physics and Mathematics* into two establishments: *the Institute of Mathematics* and *the Institute of Physics*.

Steklov Mathematical Institute is a structural unit of the Russian Academy of Sciences (RAS) and belongs to the *Division of Mathematics of RAS.* The Institute is working under scientific, methodological and organizational guidance of the Division of Mathematics of RAS.

Scientific investigations are being done according to 6 programs of the Division of Mathematics of RAS that include 32 topics. Basic problems of scientific investigations in the Steklov Mathematical Institute of RAS have to be approved by the Division of Mathematics of RAS Steklov Mathematical Institute is participating in the scientific program *"Non-linear dynamics and solitons"* of the Russian Academy of Sciences.

Steklov Mathematical Institute is regularly publishing "Proceedings of the Steklov Mathematical Institute". The Chief Editor of these is Academician E. F. Mishchenko.

In the Steklov Mathematical Institute there is an All-Institute seminar working under the guidance of Academicians V. S. Vladimirov and Yu. S. Osipov. *The sessions of this seminar take place on the third Thursday of every month at 16 o'clock in the conference hall of the Institute situated on the 9th floor.* Reports are delivered and the most interesting results, mostly those obtained by research fellows of the Mathematical Institute, are discussed. *Every person interested may attend these sessions, since the access is free.*

Administration

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01.01.03 – Mathematical physics
01.04.02 – Theoretical physics

Members of the Dissertation Council D 002.022.02

Dissertation Council D 002.022.03
Chairman – Corresponding Member of the RAS A. N. Parshin,
Academic Secretary – Doctor Phys.-Math. Sci. N. P. Dolbilin
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01.01.04 – Geometry and topology
01.01.06 – Mathematical logic, algebra and number theory

Members of the Dissertation Council D 002.022.03

Departments

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Department of Mathematical Logic
Department of Number Theory
Department of Geometry and Topology
Department of Function Theory
Department of Complex Analysis
Department of Differential Equations
Department of Mathematical Physics
Department of Theoretical Physics
Department of Mechanics
Department of Probability Theory and Mathematical Statistics
Department of Discrete Mathematics

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Since 1987 during 15 years the Integrated Long-Term Program of Scientific and Technical Cooperation of two countries, Russia and India is realized. The mutual benefit which brings cooperation in frameworks of ILTP is marked and appreciable.
The tendency of global development of science and high technologies, goes on a uniform cycle: idea ? its scientific embodiment - creation of a ready product - promotion of the product in the international market - utilization of the product by the end user.

This process demands continuous support by experts of various directions: scientists - researchers, programmers, managers, economists, lawyers etc. In this aspect a problem of ILTP projects became absence of an organizational - administrative component at presence of high level scientists teams.
Time has demanded usage of new forms for the organization of scientific projects, since purely research collectives have no opportunity to carry out all necessary organizational functions. ILTP leaders have fully realized this problem and as the answer to requirements of time the decision on creation of the Russian - Indian Centre for Advanced computing researches was accepted.

The Autonomous noncommercial organization **"Russian-Indian Centre for Advanced computing research" (RICCR)** is created according to the documents signed at an intergovernmental level in July, 2000. The Centre was registered as the juridical unit on December 7, 2000.

According to the basic idea of founders of Centre RICCR should become multilevel Russian-Indian ?bridge? for assistance in cooperation between the two states in scientific, technological, economic and humanitarian spheres.

The Centre is to solve the following tasks:
Realization of scientific researches in the following basic scientific fields:
- Fundamental and applied problems of algorithmic support of high-efficiency computers with parallel architecture
- Seismic data processing
- Weather forecast and modelling of climate
- Economy, computer satellite systems
- Numerical modelling and researches in the field of mechanics of continuous environments, physics of plasma, physics of powerful shock and detonation waves
- Ecology
- Geology and geophysics
- Medicine
- Forest fires
- and also a number of others

Development of information technologies with integration of scientific forces of Institutes of Russian Academy of Sciences, branch scientific research institutes and educational Institutes of the Russian Federation and scientific - technological resources of Republic of India.
? Promotion of the Russian and Indian scientific products and high technologies on the markets of our two countries and the markets of the third countries of the world.
? In view of needs of the Russian side to promote purchase of computer facilities at our Indian partners on favorable terms and - or creation of computer complexes by joint team of the Russian and Indian experts.

Founders and management of the Centre:

Russian Academy of Sciences (RAS, Moscow, Russia)
The Centre for Development of Advanced Computing, Ministry of communication and information technologies, Government of India (C-DAC, Pune, India)
Institute for Computer Aided Design, Russian Academy of Sciences (ICAD RAS, Moscow, Russia)
Academician of Russian Academy of Sciences, Lenin Prize Winner Belotserkovskii Oleg Mihajlovich is elected The President of the Centre.

In frameworks of ILTP within the area "Computer sciences" there were executed more than 20 projects, organized 5 Russian - Indian exhibitions in Moscow at ICAD RAS, several groups of scientists and engineers participated in a scientific exchange.
As the result of almost 15 years of cooperation both sides have come to agreement about creation of the Russian-Indian Centre for Advanced Computing Research which enable to use Supercomputer PARAM for joint development of software.

In 1998 The secretary of Ministry of science and technologies, Government of India, Mr. V.S. Ramamurthy and the President of Russian Academy of Science academician Yu.S. Osipov signed Program of cooperation? in the field of computer researches between the Ministry of Science and Technologies, Government of India and Russian Academy of Science. This program has designated the basic stages the further cooperation in the frameworks of ILTP.

Russian Academy of Sciences has made extremely important step for realization of specified Program, having accepted the Resolution 251 Creation of the Russian - Indian Centre for Advanced Computing Research? followed by Resolution ?293 of 16.11.99.

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Euler International Mathematical Institute
of the Russian Academy of Sciences

Director: Prof. Ildar A. Ibragimov, Academician

St. Petersburg Department of V.A. Steklov Mathematical Institute (PDMI RAS) was established in 1940 after the Institute had moved to Moscow. At present, despite the word "department" in its name kept due to historical traditions, PDMI RAS is an independent institute within the Russian Academy of Sciences. From 1976 till 2000 the Institute was headed by a prominent Russian scientist, mathematician and physicist, Academician Ludwig D.Faddeev. He established in St.Petersburg a new institute of Russian Academy of Sciences, Euler International Mathematical Institute (EIMI). Since January 1996 Euler International Mathematical Institute is contained in PDMI as a department.

Basic research areas

Fundamental research in pure mathematics and mathematical models of theoretical physics: mathematical logic and the theory of algorithms, algebra, number theory, geometry and topology, mathematical analysis, probability theory and mathematical statistics, mathematical problems of continuum mechanics, quantum physics, geophysics, and seismology.

Main scientific achievements

Creation and development of new methods for studying metric properties of geometric figures which led to the solution of classic problems of geometry of surfaces (A.D.Alexandrov and his pupils). Application of functional analysis methods to the problems of numerical mathematics, development of a general theory of approximative methods, new effective methods of solution operator equations (L.V.Kantorovich). Creation of the theory and methods for solving extremal problems with restraints (linear programming methods, in particular) and their application to the problems of economics (L.V. Kantorovich). The solution of the 19th and 20th Hilbert problems and the construction of the attractor theory of nonlinear evolutionary semigroups (O.A.Ladyzhenskaya). New methods in analytic number theory (large sieve, dispersion method) and solutions of a series of classic number theoretic problems (Yu.V.Linnik). The theory of summation of random variables (Yu.V.Linnik, I.A.Ibragimov). New methods and results in algorithm theory and constructive mathematics (proof of unsolvability of problem of homeomorphism, the notion of normal algorithm) (A.A.Markov). The solution of 10th Hilbert problem (Yu.V.Matiyasevich). Homologies in group theory, numerical methods in linear algebra (D.K.Faddeev). The complete solution of the quantum problem of three and more particles and the multidimensional inverse problem of scattering theory (L.D.Faddeev).The quantum inverse scattering method (L.D.Faddeev and his pupils). Correct rules of quantization of Yang-Mills fields (V.N.Popov, L.D.Faddeev). Theory of zeta-functions of multidimensional modular forms (A.N.Andrianov). Creation and development of ray method of implementation of wave fields (V.M.Babich). Investigation of integral representations of functions specified for regions and imbedding theorems (V.P.Il'in).

Many scientists of the Institute were granted high prestige scientific awards of the USSR and Russia: Lenin and State Prizes, special awards instituted in commemoration of the great Russian scholars. Academician L.V. Kantorovich was awarded the Nobel Prize in Economics in 1975.

Recent scientific achievements

The computation of motivic cohomology of weight 2 is completed, and the Quillen-Lichtenbaum conjecture on K-theory with finite coefficients for complex varieties of dimension no greater than 2 is proved (A.A.Suslin). The theory of cubic metaplectic forms on linear algebraic groups of

range 1 and 2 is developed (N.N.Proskurin). New profound results are obtained in the classical problem of number theory concerning the asymptotics of the number of points of a lattice in an expanding domain and it is proved that in any dimension there are domains and lattices with logarithmically small remainders in the asymptotic formula for the number of points of a lattice in a domain (M.M.Skriganov). New investigation methods of sums of dependent random variables are developed (M.I.Gordin). The infrared parameterisation of Yang-Mills field is proposed (L.D.Faddeev). The methods of calculation of correlation functions in the integrable models of quantum field theory and statistical mechanics are developed (A.G.Izergin, N.M.Bogoliubov). New methods of asymptotic study of nonparametric estimation problems in mathematical statistics have been developed (I.A.Ibragimov).

International scientific cooperation

Organizing international scientific cooperation and creating conditions for joint research of Russian and foreign scientists, in the first place, mathematicians, are the main problems of Euler International Mathematical Institute that became a department of PDMI in 1996. EIMI is located in a separate building at 10 Pesochnaya naberezhnaya, appropriately equipped for conferences numbering up to a hundred persons and for individual work of mathematicians coming to St.Petersburg. EIMI has a network of computers with Internet connection. Every year EIMI organizes about 10 international working meetings and conferences. It also conducts a long-term program of scientific cooperation "Tete-a-tete in Russia", whose aim is to organize meetings of Russian and foreign scientists for joint work in St. Petersburg. Moreover, for many years PDMI has been collaborating with Max Plank Institute (Germany), the University Paris-7, Lund University (Sweden), the University of Florence (Italy) and some other scientific centres.

Awards

Yu.V. Matiyasevich has been awarded by the Alexander von Humboldt Foundation Award. A.Yu.Zaitsev, A.Kitaev, A.Bytsko are the Alexander von Humboldt Foundation fellows. K.Zainullin have been awarded an EPDI two-year grant. I.A.Ibragimov, A.N.Borodin, A.Yu.Zaitsev, M.I.Gordin have RFBR-DFG Grant 99-01--04027 and INTAS grant 99-01317; Maksim Skriganov has INTAS Grant 00-429; I.A.Panin, S.A.Yagunov i K.V.Zainullin have an INTAS grant; V.Kamotskii: INTAS Young Scientists Fellowship, YSF 01-198; E.A.Hirsch: INTAS Young Scientists Fellowship YSF 99-4044; Laboratory of mathematical logics: INTAS 447 "Weak Arithmetics". K.Dyakonov have been awarded a prize from Academia Europaea for young scientists from the CIS republics.

Scientific issues

PDMI is the founder and publisher of the notes of scientific seminars "Zapiski Nauchnykh Seminarov POMI RAN" (English version - "Journal of Mathematical Sciences") and the preprints of PDMI RAS. In addition, the editorial staff of the journal "Algebra i Analiz" (English version - "St. Petersburg Mathematical Journal") is located in the building of PDMI. English translations of these two journals are published abroad. Electronic versions of PDMI preprints are available in Internet at the www-server of the Institute.

Library

The library of PDMI is the leading mathematical library in St. Petersburg. All best mathematicians of St. Petersburg have a possibility to use the books and journals of the library of PDMI. Unfortunately, due to the financial situation in Russia, the library has no possibility to

buy new books and journals which are extremely necessary for mathematical work. At this moment the library has 176396 books and journals. Among them 109764 are published in foreign languages (English, French, German...). The library is a part of the library of the Academy of Sciences and has no own budget. The books and journal are arriving from the central library and as donations of different organizations and persons. In the last years the amount of donations is about 50% of the whole amount of new books and journals. The new monographs in English are all donations.

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Founded in 1964, the Computing Centre (now ICMMG) of SB RAS has been engaged in research on computational and applied mathematics in such areas as the modelling of processes in the atmosphere and ocean, environmental protection problems, methods of mathematical modelling in geophysics, geophysical informatics, simulation of informatics systems, telecommunication systems, software for supercomputers.

ICMMG consists of 11 departments which are subdivided into 23 laboratories. The personnel of

the Institute is 395 workers including 195 scientists. There are 41 Professors and 110 PhD among them.

Since 1994 the investigations of the ICMMG are supported by the Russian Foundation of Basic Research (RFBR) and RFBR-INTAS.
Research is supported by the state scientific programs "Perspective Information Technologies", "Informatization of Russia", "Global Changes of Environment and Climate" and "World Ocean".

ICMMG is the base institution for the Chair on Numerical Mathematics, the Chair on Mathematical Methods of Geophysics, the Chair on Computing Systems at the Novosibirsk State University; the Chair on Parallel Computing Technologies, the Chair on Networks Information Technology at the Novosibirsk State Technical University, the Chair on Image Processing at the Siberian State Academy of Geodesy.

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This is the official World-Wide Web server of the Institute of Mathematics and Mechanics (IMM), Ural Branch of the Russian Academy of Sciences. This server was founded under EuroMath "EmNet/NIS" and Russian Academy of Sciences "Mathematica" Projects, and contains information about our Institute, personalities and bibliography on mathematical literature.

The Institute of Mathematics and Mechanics of the Ural Branch of Russian Academy of Sciences (RAS) is a theoretical successor of the Sverdlovsk Branch of the V.A.Steklov Mathematical Institute of the USSR Academy of Sciences (the Russian abbreviation is SOMI) which was organized according to the decision of the USSR Council of Ministers dated of August 6, 1956, and the decision of the Presidium of the USSR Academy of Sciences dated of September 17, 1956.

In 1957, the construction of the building of SOMI started at the address S.Kovalevskaya Str. 16, and the first SOMI part was put into operation in April, 1961.

Professor S.B.Stechkin was nominated the first Vice-Director of the V.A.Steklov Mathematical Institute of the USSR Academy of Sciences in charge of the Sverdlovsk Branch. The first order on SOMI was issued on February 24, 1961.

Since March 1967, according to the decision of the Presidium of the USSR Academy of Sciences, Doctor of Sciences, Professor S.D.Volkov was nominated the acting Vice-Director in charge of SOMI. Since June, 1968, DSc., Professor A.I.Starostin was nominated the Vice-Director in charge of SOMI.

SOMI was reorganized as the Institute of Mathematics and Mechanics of the USSR Academy of Sciemces according to the plan of development of scientific institutions in the Urals in keeping with the decision of the USSR Council of Ministers of August 38, 1969 and the decision of the Presidium of the USSR Academy of Sciences of May 28, 1970.

The Institute was placed under the scientific supervision of the Branch of Mathematics of the USSR Academy of Sciences together with the Branch of Mechanics and Control Processes of the USSR Academy of Sciences.

The main directions of scientific investigations of the Institute were specified:

development of the mathematical theory of control processes;
theoretical investigation in the field of algebra, differential equations and the theory of functions;
elaboration of metons for solving problems with the help of computers, including economic

problems, technological ones, problems of mathematical physics;
development of calculation means of high productivity
development of methods of nonlinear mechanics with applications to problems of stability of oscillations and control
development of mathematical methods of continuum mechanics

According to the 1970's decision the Institute of Mathematics and Mechanics (IMM) of the USSR Academy of Sciences was headed by Academician N.N.Krasovsky.
Since March 1971, IMM was incorporated into the Urals Scientific Center of the USSR Academy of Sciences.

Since February 1977, DSc., Professor A.B.Kurzhanskii became the Director of the Institute, and, since Desember 1983, DSc., Professor V.D.Batukhtin became the acting Director of the Institute. Since October 1986, IMM was headed by Academician Yu.S.Osipov. In Desember 1991, Yu.S.Osipov was elected as President of the Russian Academy of Sciences (RAS). Since December 1993 and till March 1999, Academician A.F.Sidorov became the Director of the Institute.

Due to the reorganization of the Urals Scientific Center in February 1987, IMM was included into the Ural Branch of the USSR Academy of Sciences. In Desember 1991, because of the organization of the Russian Academy of Sciences, the Institute was incorporated in the Ural Branch of the RAS.

Within 30 years at the Institute of Mathematics and Mechanics, acknowledged scientific schools have been formed on many important directions of modern and classic mathematics: mathematical theory of control processes, analytical and numerical methods of continuum mechanics, the theory of ill-posed problems and generalized functions, the theory of approximation of functions and operators, methods of convex optimization and pattern recognition, in the field of modern algebra and topology.

The traditions established in the sphere of mathematical resarch resulted in awarding Lenin Prizes in 1966, to Correspoding Member V.K.Ivanov together with Academician A.N.Tikhonov for the elaboration of the theory and methods of solution of ill-posed problems; in 1976, to Academicians N.N.Krasovskii, A.B.Kurzhanskii, Yu.S. Osipov, Corresponding Member A.I.Subbotin for a cycle of investigations in the mathematical theory of control problems. In 1996, Academitian N.N.Krasovskii won the Demidov Prize, and, in 1997, he was awarded by the M.V.Lomonosov Gold Medal of RAS.

On staff at the Institute there are 145 research associates, including 4 Academicians of RAS, 4 Corresponding Members of RAS, 34 DSc's, 63 PhD's (date of January 1, 1997). The Institute incorporates the following departments and laboraties:

Algebra and Topology Department

Function Approximation Theory Department
Approximation and Applications Department
Mathematical Programming Department
Dynamical Systems Department
Differential Equations Department
Optimal Control Department
Control Systems Department
The Department of ill-posed problems of analysis and applications
The Department of Equations of Mathematical Physics
Applied Problems Department
System Software Department

Department of Computer Networks

Computer Sciences Department
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Sobolev Institute of Mathematics of the Siberian Branch of the Russian Academy of Sciences is located in Novosibirsk Akademgorodok.

The list of personnel of the Institute contains about 500 research workers. Data Base of IM SB RAS staff can be seen here.

The Institute was foundered in 1957 by Academician Sergei Sobolev.

At present the Institute is directed by Academician Yurii L. Ershov.

Main fields of research

The members of the Institute carry on fundamental investigations in mathematics, mathematical physics, and informatics in the following main directions:

- algebra, theory of numbers, and mathematical logic;
- geometry, topology, and functional analysis;
- differential equations and mathematical physics;
- probability and mathematical statistics;
- numerical mathematics;
- mathematical modeling and methods of applied mathematics.

The investigations carried on at the Institute are supported by various domestic and interactive funds. In 2004, the Institute had 54 grants of the Russia Foundation for Basic Research, 8 grants of the Russia Humanitarian Scientific Foundation, 4 grants of the Federal Pilot Program "Integration", etc. In the frames of the state program for support of leading scientific schools, the grants were allotted to 7 scientific schools headed by A. A. Borovkov, Yu. L. Ershov, M. M. Lavrent'ev, Yu. G. Reshetnyak, S. S. Goncharov, V. L. Beresnev and V. A. Vasil'ev. State scholarships for prominent scientists are awarded to 20 members of the Institute, and 9 men received state scholarships for young scientists.

The Institute participates actively in training of highly qualified scientific cadres in cooperation with the Department of Mechanics and Mathematics of Novosibirsk State University.

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The Computing Center FEB RAS is a scientific institution engaged in research in physics and mathematics. It was founded on the basis of a department of Khabarovsk Complex Research Institute, an Institute of the USSR Academy of Sciences. Academician Yevgeny Zolotov was the first director of the Computing Center and made a considerable contribution into formation of its scientific potential.

Now the CC FEB RAS is carrying out research in three directions:
Mathematical modeling of physical fields and processes;
Development and studies of numerical methods for solution of direct and inverse problems in mathematical physics;
Studies of integral and differential operators.

Applied research is focused on problems concerned with geodynamics (e.g. mechanical stress computations in the earth's crust and lithosphere of the Asia-Pacific active zone), hydrodynamics (e.g. numerical modeling of diffusion of multicomponent non-conservative admixtures in rivers and lakes), electric elasticity (e.g. numerical modeling of electroelastic processes in piezotransmitters).

The Institute has the following base research laboratories:
1. Laboratory for numerical methods in mathematical physics (Dr. Sergei Smagin, Prof.)
Areas of research: Mathematical modeling of physical fields in inhomogeneous media.
Achievements: Theory and algorithms for approximate solution were developed; on this basis, numerical modeling of three-dimentional problems of wave diffraction and propagation (for waves of different physical nature) was carried out. A unifity of relaxing viscoelastic media and media with different modules (including loose media) was created.
2. Laboratory for mathematical modeling in geology and geophysics (Dr. Leo Maslov, Prof.)
Areas of research: Mathematical modeling of geodynamics processes in active tectonic structures. Evaluating of mechanical stresses in the tectonosphere of the Pacific active belt. Region environment control.
Achievements: A number of mathematical methods for mechanical stress evaluation was developed. A program set for mechanical stress computations in the earth's crust and tectonosphere according to the gravity field anomalies and to the area de del(?) was worked out. Methods and models for decision-making in the active complex "nature-society" systems control

were developed.

3. Laboratory for mathematical modeling methods in mechanics (Dr. Sergei Smagin, Prof.)
Areas of research: Mathematical modeling of physico-chemical processes in fluid media.
Achievements: Maximum efficiency values for fluid MHD-generators and pumps of conductive type were found. A computation program for the non-conserative admixture diffusion process in a river with tributaries was created.

4. Laboratory for mathematical modeling methods in phisics and technology (Dr.Viktor Rukavishnikov)
Areas of research: Numerical analysis methods for boundary and initial-value boundary problems with solution singularity und their applications.
Achievements: A solution concept for boundary problems with singularity was defined; two classes of problems with concordant and non-concordant degeneration of initial data were derived, differential properties of their R-generalized solution were investigated, numerical methods for this solution were developed. A differential method for numerical modeling and analysis of electroelastic processes in piezotransmitters in a radiation mode was proposed and studied.

5. Laboratory for medical information science (Dr. Sergei Savin)
Areas of research: Information models for biological objects condition diagnostics and control, for human and animal adaptation in the Far East. Achievements: A new theoric line - topographic physiology of acupoints system and an acupoints atlas with more precise prescriptions for patients suffering from infantile cerebral paralysis were developed in co-operation with the Academy of onal Chinese Medicine. A computier cancer-register of the Russian Far East and Bis-technology were compiled.

6. Laboratory for approximate methods and functional analysis (Dr. Vladimir Stepanov)
Areas of research: Studies of integral and differentional operators,limit theorems for the random variables with values in functional spaces and variational inequalities
Achievements: The boundness and compactness of Volterra operators in Lorenz spaces were studied. Evaluations of approximate numbers were obtained. New proofs and applications for Hardy inequalities in Lebeg spaces with critical indices were found, boundness criteria for operators of classical type in Lorenz spaces were derived. Error estimates of normal approximation in Hilbert space for arbitrary balls were obtained provided that the fourth moment exists. It was shown that the Bergstrom's expansion can be much more precise than the Edgeworth's one. Convergence of the unsmooth functionals minimization method based on the prox-regularization algorithm was researched. An equivalent, metrical, geometrical, analytical description of (p,q), i.e. quasi-conform representations of Carno groups, was obtained. A lower bound of the extention operator norm for Sobolev space functions was derived.
10 monographs,17 preprints, 329 papers were published by the scholars of the Institute in Russia and abroad. The Computing Center was an initiator and organizer of the Russian-Japanese Joint Seminar "Integral Equations in Mathematical Physics" held in 1993, 1994, and of the International Scientific Symposium "Regularities in Structure and Evolution of Geospheres" held in 1992, 1994, 1996, 1998, 2000, 2003 in Khabarovsk and Vladivostok.

International scientific co-operation

The Institute develops its co-operation with several scientific institutions and reseachers in the

USA, Canada, Great Britain, Germany, Bulgaria, Japan, China, Korea and some other countries. Its scholars are invited abroad for taking part in tional scientific conferences, carrying out joint research in foreing scientific centers and delivering lectures in universities. The CC FEB RAS, in its turn, invites and receives foreign scientists thus mantaining an effective international scienti ic exchange.
The above Russian-Japanese Joint Seminar and International Scientific Simposium are illustrative examples of this co-operation. Many results of the joint research work were represented in a number of scientific publications in Russia and in other countries of the world.

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History
The Institute of Tectonics and Geophysics was founded on August, 1, 1971, based on the Far Eastern Research Centre, the USSR Academy of Sciences. Academician Yu. A Kosygin, the Hero of the Socialist Labor, the Lenin prize laureate, was its founder and Director during 17 years (from 1971 through 1988). He invaluably contributed his intellectual potential and managerial abilities to the foundation and development of the Institute as the academic institution. The Academician Yu. A. Kosygin, whose name the institute bears since 2000, created the research staff of associates who were the best graduates from the higher educational schools of the USSR. From the very outset the climate of mutual understanding, democracy and collectivism has arisen in the research work, which was developed further by the Corresponding member of the USSR Academy of Sciences, Ch. B. Borukaev, who was the Director of the Institute from 1989 through 1992, and Professor N. P. Romanovsky, who headed the Institute from 1992 to 2003. This climate is still maintained.

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The Institute of Numerical Mathematics of the Russian Academy of Sciences (INM RAS) was established according to the USSR Academy of Sciences Order No. 452 On Foundation of the Department of Numerical Mathematics of the USSR Academy of Sciences issued on May 29, 1980. This Department was then transformed into the he Instiute of Numerical Mathematics of the USSR Academy of Sciences according to the USSR Academy of Sciences Order No. 215 On Transformation of the Department of Numerical Mathematics into the Institute of Numerical Mathematics of the USSR Academy of Sciences issued on October 1, 1991. According to the Decree of the President of Russian Federation No. 228 On the Structure of the Russian Academy of Sciences issued on November 21, 1991 the Institute is a member of the Russian Academy of Sciences (RAS). The INM RAS acts in line with the current edition of the General Principles of the Structure and Scientific Research of RAS Institutes. At present, the INM RAS is a unique scientific institution engaged in solving both fundamental and applied problems of interdisciplinary character. Joining the efforts of leading scientists in the areas of computational mathematics, atmospheric and oceanic physics, and mathematical immunology is a top priority. The research staff of the INM RAS involves a total of 27 Dr.Sci. (including 4 Academicians and 1 Correspoding Member) and more than 30 Cand.Sci. Enhanced collaborative research (projects and programs) with Russian and international organizations are conducted. Full-scale training programs are actively carried out through postgraduate and doctorate courses.
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History of the Institute
The history of Institute began since 1971 when the Department of Physics and Mathematics (DPM) was founded in the Bashkir Branch of the USSR Academy Of Sciences. At the same time prominent mathematicians specializing in function theory, differential equation and mathematical physics were invited to Ufa.

The first sector in new Department was Sector of Function Theory, established by Corresponding Member of USSR AS A.F. Leont'ev. In 1974 A.M. Il'in (today the RAS academician) organized the Sector of Differential Equations. In 1980 the Sector of Mathematical Physics was organized. In 1980-1984 the head of this sector was Doctor of Science N.Kh. Ibragimov, in 1984-1988 the head of this one was A.B. Shabat. A Sector of Complex analysis was established in 1985. The first head of the sector was V.V. Napalkov (today Corresponding Member of RAS, director of Institute).

A decision on founding of Institute of Mathematics with Computing Centre on the basis of mathematical subdivision of DPM was taken in 1988.

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The Department of Complex Analysis was founded in 1985. At first it was established as the Sector in the Department of Physics and Mathematics, the Bashkir Branch of the USSR Academy Of Sciences. When the Institute of Mathematics with Computing Center was organized the Sector was renamed to the Department of Complex Analysis. First head of Department was Valentin Vasilievich Napalkov (now Corresponding Member of Russian Academy of Sciences, the director of the Institute). At present the head of the Department is Professor Aleksandr Sergeevich Krivosheev.

Research
Complex analysis, Bergman spaces, description of Bergman spaces in terms of the Caushy and Fourier transforms
Mathematical analysis, algebra
Asymptotic methods of mathematical statistics
Quantization theory, approximation theory, cubature formulas

Seminars
Seminar on function theory and complex analysis under the supervision of Professor, Corresponding Member of RAS V.V. Napalkov.

Department of Computational Mathematics
The Department of Computational Mathematics was founded in 1988. First head of Department was Corresponding Member of ASRB Valentin Timofeevich Ivanov. Since 1992 the head of the Department is Professor Marat Davidovich Ramazanov.
Research

Seminars
Permanent Seminar on computational mathematics under the supervision of Professors M.D. Ramazanov and N.D. Morozkin.
Conferences
Since 1990 the Department of Computational Mathematics (in collaboration with Sobolev Mathematical Institute of SB RAS, KSTU (Krasnoyarsk), RCC MSU, Kurchatov Institute, UUSPU (Ulan-Ude), IM UzbAS) organizes regular international conferences "Cubature formulas

and applications"

Conference "Cubature formulas and applications - VII", Krasnoyarsk, 2003

Teaching

Collaboration
Research group for Programme 17 of RAS Presidium:
Asadullin Ramil' Midkhatovich, Doctor of Science
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Voitishek Anton Vazlavovich, Doctor of Science
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Mukminov Farit Khamzaevich, Doctor of Science
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Osipov Nikolai Nikolaevich, Doctor of Science
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Also students and postgraduate students.

Department of Differential Equations
The Department was founded by Arlen Mikhailovich Il'in (today the RAS academician) in 1974. At first it was established as the Sector of Differential Equations in the Department of Physics and Mathematics, the Bashkir Branch of the USSR Academy Of Sciences. When the Institute of Mathematics with Computing Center was organized the Sector was renamed to the Department of Differential Equations. Since 1990 the head of the Department is Professor Leonid Anatolievich Kalyakin.

The main lines of investigation in the Department are the asymptotic methods for studying the solutions of partial and ordinary differential equations, differential equations with a small parameter, singular perturbations of boundary-value and initial problems.

Research
Autoresonance
Soliton generation
Catastrophes and kink generation
Separatrices and chaos in the solutions of ordinary differential equations

Seminars
In the Department functions permanently the Seminar of abstracts on differential equations. For a long time runs another Seminar on differential equations of mathematical physics under the

supervision of Professors L.A. Kalyakin and V.Yu. Novokshenov.

Conferences

In 2005 researchers of the Department participated in the following international and all-russian conferences:

International Conference "Physics and Control 2005", St.Peterburg, Russia, August, 24-26, 2005 (L.A. Kalyakin)

International Conference on Mathematical Modeling of Wave Phenomena 2005, Sweden, 2005 (O.M. Kiselev)

International Conference on Control and synchronization of dynamical systems, Leon, Mexico, October 3-7, 2005 (L.A. Kalyakin)

36 Regional Conf. "Problems of theoretical and applied mathematics", Ekaterinburg, Russia, 31 January – 4 February, 2005 (Yu.Yu. Bagderina)

In 2004 researchers of the Department participated in the following international and all-russian conferences:

5-9 December, Int. Conf. on Complex analysis, equations of mathematical physics, computational Mathematics, Yaktykul', Russia

24 June - 3 July Int. conference "Nonlinear Physics: Theory and Experiment III", Gallipoli, Lecce, Italy (L.A. Kalyakin)

June, Int. Conf. on Symmetry and Perturbation Theory, Cala-Gonone, Italy (R.N. Garifullin)

10-14 May Conference "New mathematical models in mechanics of continua: constructing and studying", Novosibirsk, Russia (Yu.Yu. Bagderina)

May, Int. Conf. "Differential Equations and Related Topics", Moscow, Russia (R.N. Garifullin, L.A. Kalyakin)

In 2003 researchers of the Department participated in the following international and all-russian conferences:

July 1-4, Int. Conf. on Day on Diffraction, Saint-Petersburg, Russia (S.G. Glebov)

In 2002 researchers of the Department participated in the following international and all-russian conferences:

International Conference on Asymptotics in Differential Equations, Ufa, Russia, May 26-30, 2002

Teaching

The Department maintains close contacts with the principal Ufa universities:

Bashkir State University,

Ufa State Aviation Technical University,

Ufa State Petroleum Technical University.

In these universities for a long time we give the lecture courses on the principal mathematical topics:

Ordinary differential equations;

Partial differential equations;

Discrete mathematics

and such special courses as:

Hamilton mechanics;
Nonlinear oscillations;
Special functions;
Theory and planning of the experiment;
Numerical-analytic methods.
Also we perform a research with the students and post-graduate students of the above mentioned universities.

Collaboration
The new research trends and obtained results are discussed with the colleagues from
Institute of Mathematics and Mechanics, Ural Branch of RAS, Ekaterinburg;
Institute for Problems in Mechanics of RAS, Moscow;
Saint-Petersburg Division of V.A. Steklov Mathematical Institute of RAS, Saint-Petersburg;
Moscow State University, Moscow;
Landau Institute for Theoretical Physics of RAS, Moscow;
B.Verkin Institute for Low Temperature Physics and Engineering, Kharkov, Ukraine;
Dept. of Mathematics, South Methodist University, Dallas, USA;
Dept. of Mathematics, McMaster University, Canada
Dept. of Mathematics , University of Cape Town, South Africa
and other research organizations.
People of this department work in collaration with teams from
Laboratory of Nonlinear Mechanics, Institute of Metal Physics, Ekaterinburg;
Department of Theoretical Physics, P.N. Lebedev Physical Institute, Moscow;
Institute of Terrestrial Magnetism, Ionosphere and Radio Wave Propagation, Troitsk;
Department of Nonlinear waves Institute of Applied Physics, Nizhnii Novgorod;
Department of Optics and Fluid Mechanics, RISOE National Laboratory, and Institute of Mathematical Modeling, The Technical University of Denmark
Racah Institute of Physics, Hebrew University, Jerusalem, Israel
University of Bayreuth, Bayreuth, Germany

Department of Function Theory
The Sector of Function Theory, established by Corresponding Member of USSR AS A.F. Leont'ev in 1971, was first sector in Division of Physics and Mathematics, Bashkir Branch of the Academy of Sciences. When the Institute of Mathematics with Computing Center was organized the Sector was renamed to the Department of Function Theory. At present the head of the Department is Corresponding Member of RAS, professor Valentin Vasilievich Napalkov .

Research
Spectral syntezis of analitical functions
Analitical extentions of functions from invariant subspaces
Function theory, complex analysis, harmonic analysis
Approxymation of analytic functions in complex domain by system of exponents.
Representation of funtions by exponential series. Asymptotic behaviour of functions given by

exponential series
Spectral synthesi's of invariant subspaces, analytical extension of functions from invariant subspaces

Seminars
Seminar on function theory (A.F. Leont'ev Seminar) under the supervision of Professor, Corresponding Member of RAS V.V. Napalkov and Professor I.F. Krasichkov-Ternovsky

Seminar on function theory and complex analysis under the supervision of Professor, Corresponding Member of RAS V.V. Napalkov

Napalkov Valentin Vasil'evich
Head of Department of Function Theory,
Director of the Institute,
Corresponding Member of RAS, Professor, Doctor of Science
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Scientific interests:
Analisys, convolution equation, Laplace transformations, entire functions, holomorphic functions.

Gaisin Ahtyar Magazovich
Leading Researcher,
Doctor of Science
Scientific interests:
Approxymation of analytic functions in complex domain by system of exponents. Representation of funtions by exponential series. Asymptotic behaviour of functions given by exponential series.
Golichev Iosif Iosifovich
Leading Researcher,
Doctor of Science

Ishmitova Janna Gennad'evna
Mathematician

Kim Vitaly Eduardovich
Junior Researcher,
PhD

Krasichkov-Ternovsky Igor Fedorovich
master researcher,
Doctor of Science
Scientific interests:
Spectral syntezis of analitical functions. Analitical extentions of functions from invariant

subspaces.

Latypov Ilyas Damirovich
Junior Researcher,
PhD

Musin Il'dar Khamitovich
Leading Researcher,
Doctor of Science
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Scientific interests:
Function theory, complex analysis, harmonic analysis.

Odinokov Oleg Viktorovich
Reseacher,
PhD

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Tarov Vladimir Andreevich
Reseacher,
PhD

Department of Mathematical Physics

The Department of Mathematical Physics was founded in 1981 by Alexey Borisovich Shabat. At present the head of the Department is Professor Viktor Yurievich Novokshenov.

Research
Higher symmetries theory
Classification of integrable equations
Construction of asymptotic solutions of soliton equations
Discrete integrable models
Orthogonal polynomials

Seminars
Permanent Seminar on differential equations of mathematical physics under the supervision of Professors L.A. Kalyakin and V.Yu. Novokshenov.

Staff
Novokshenov Viktor Yurievich
(Head of the Department)
Khabibullin Ismagil Talgatovich
Kordyukov Yury Arkadievich
Startsev Sergey Yakovlevich
Vereschagin Vadim Leont'evich
Yamilov Ramil Islamovich
Zhiber Anatoly Vasilievich
Computer Research and Education Centre
Staff
Akulinin Oleg Borisovich
Head of the Centre,
PhD
Scientific interests:
Information technologies, computational mathematics, documents processing.

Denisova Elena Leonidovna
Software engineer

Administration
Director of the Institute
Napalkov Valentin Vasilievich
Director of the Institute,
Head of Department of Function Theory,
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Scientific Secretary
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Administration
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Vsesviatskaia Evgenia Mikhailovna
Lavrent'ev Valeriy Fedorovich
Osipenko Ekaterina Vladimirovna
Koloskova Yulia Anatol'evna
Razbezhkin Nikolay Maksimovich
Sabirova Lilia Fauzel'kabirovna

Seminar on differential equations of mathematical physics
Seminar of abstracts on differential equations
Seminar on computational mathematics

Director
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cpms **Shaigardanov** Yurii Zakirovich
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Institute for Mathematical Modelling of the Russian Academy of Sciences

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Keldysh Institute of Applied Mathematics (Russian Academy of Sciences) was founded in 1953 to solve complex mathematical problems involved in national projects of space exploration, atomic and thermonuclear energy application, etc. This goal was meant to be achieved by developing and using appropriate computer hardware and software facilities. The Institute founder and first director (1953-1978) was President of the USSR Academy of Sciences *Mstislav Keldysh*.

Since its first years the Institute activity oriented to solving large scale applied problems is based on the results of fundamental scientific research in mathematics, mechanics, cybernetics, informatics, etc. which is carried out by the Institute scientists. Among them are four academicians, five corresponding members of the Russian Academy of Sciences, 74 doctors of sciences and 224 candidates of sciences, including 14 laureates of Lenin prize, 30 laureates of State prize, 5 laureates of the USSR Soviet of Ministers prize.

Since the launch of the first satellite the Ballistic Center of the Institute has been engaged in navigational support of unmanned and manned space missions including those of long-term orbital stations "Salyut" and "Mir", Soviet space shuttle "Buran", spacecraft "Luna", "Venera", "Mars", etc. It also takes part in some international space projects.

The studies carried out at the Institute on algorithmic and software support of locomotive machines (walking robots), automation of manual operations for assembling machine parts by adaptable robots have been widely recognized throughout the world.

The Institute is one of the first scientific organizations in this country where a new technique to carry out theoretical studies has been developed and widely recognized.This is a computational experiment based on using perfect mathematical models, efficient computational codes and high performance computers.

The Institute has been an initiator in utilizing computer facilities in the USSR. The first mass-production computer was installed at the Institute and the first team of soviet engineers was formed to perform pioneer work in the development of computer software. In 1963 the Algol-60 translator (one of the first from the complete language version) and the IS-2 (the first mini-OS) were developed and implemented by the Institute specialists. This trend in the software development was further continued in the full scale operational systems DISPAK and OS IPM, an optimizing compiler from FORTRAN, the program package GRAFOR for graphic data representation, in the studies on supercomputer architecture and software, manymachine complexes and networks. An important role in the Institute activity is given to the system studies of applied problems such as: programming and debugging systems for the Buran space shuttle, the real-time control system, the information retrieval systems for different applications, CAD/ CAM systems, software tools for constructing applied packages.

Much attention is attached to educational and training issues. The Institute acts as a basis for Moscow State University, Moscow Engineer and Physical Institute and Moscow Aviation Institute. The Faculty of Applied Mathematics of the Moscow Physical and Technical Institute is set up at the Institute.

The Keldysh Institute is a head investigator in a number of leading studies in applied mathematics. The results obtained by the Institute scientists have been recognized in Russia and abroad. At different times several research organisations such as the Computing Center, the Institute of Space Research, the Institute of Mathematical Modelling had sprung from the Keldysh Institute and become leading scientific centers of the Russian Academy of Sciences.

Some statistics
300 specialists are engaged in applied problems, some of them in applied programming, and 300 specialists - in system studies.

Computer facilities include Convex SPP, Silicon Graphics workstations, Sun microsystems workstations, Hewlett-Packard C180-XP workstation, Hewlett-Packard D and K servers, Intel-based PCs.

Operational systems Unix, Microsoft Windows NT.

Programming languages are: Fortran, PL/I, C, C++, Prolog, Pascal, LISP.

Databases used are: Adabase, Foxbase, Oracle, DBASE-X, Paradox, SQL.

Now Institute is directed by Corresponding Member **Yurii P. Popov**

General directions of research

Mathematical modeling of sophisticated phenomena and structures including
applications in the fields.
mechanics,
control processes,
continuum mechanics and mass- and heat transfer,
aerodynamics and gasdynamics,
electrodynamics and quantum mechanics,
hydrodynamics,
computational plasma physics and controlled thermonuclear fusion,
biocybernetics,
neural network,
physics of reactors and shielding against penetrating radiation,
astrophysics and planetary physics,
physical processes and technology of semiconductor production,
computer diagnostics and tomography,
laser and optical systems,
ecology,
Theory of numerical methods.
theory of difference schemes,
systems of ordinary differential equations and nonlinear partial differential equations,
inverse and ill-posed problems.

Theoretical and applied celestial mechanics.
-calculations of dynamics and construction of high-accuracy theory for artificial and natural
celestial body motions,
ballistic and navigational support of spacecraft missions,
improvement of astronomical constants.
attitude dynamics of artificial satellites,
classical problems of celestial mechanics

Nonlinear analysis
System software.
architecture of the up-to-date supercomputers,
modern programming technologies,

parallel programming languages,
extensible programs,
architecture and software of computer networks,
representative and interactive computer graphics,
distributed real-time control systems,
user interface facilities.
Applied system software.

architecture of transputer networks for computer simulation of mathematical and engineering problems,
representation of knowledge in artificial intelligence systems,
robotic complexes with artificial intelligence elements,
assembly processes automation,
CAE/CAD/CAM,
flexible CAM systems,
expert systems and software tools for their development,
data management systems for organisations,
integrated software systems based on hypertext technology,
computer education systems including those with MULTIMEDIA technology.

Pattern recognition.
medical diagnostics,
estimation of geological safety in regions.

The main scientific projects
Space robot
Internet Robotics
Robot teleoperation via the Internet
Bank of tests of radiation guard problems
This project is supported by RSSI grant N 95-01-01194?
Object-oriented programming language - Markiz
tool for producing various language processors (including compilers, interpreters, converters from one language to another).
DVM-system
toolkit to develop parallel programs for different architecture computers and networks

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Institute for System Programming of the Russian Academy of Sciences
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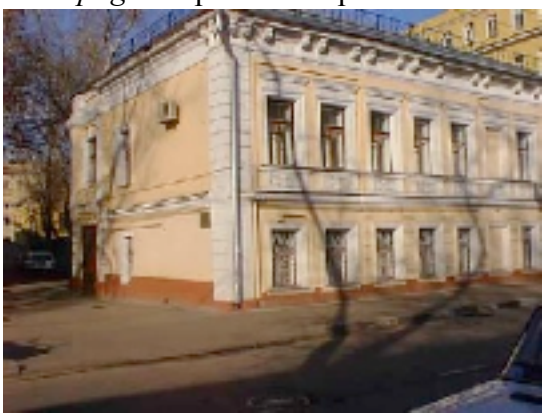

The Institute for System Programming (ISP) of the Russian Academy of Sciences (RAS) was founded on January 25, 1994, from the departments of System Programming and Numerical Software, formerly of the Institute for Cybernetics Problems of the RAS.

ISP RAS is embodied in the Division of Mathematical Sciences of the RAS under the guidance of the Presidium of the RAS.

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dts **Shnitman** Victor Zinovievich
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About the Institute

Steklov Mathematical Institute of the Russian Academy of Sciences was created according to the decision of the General Assembly of the Academy of Sciences of the USSR (April 28, 1934) on the division of *the Institute of Physics and Mathematics* into two establishments: *the Institute of Mathematics* and *the Institute of Physics*.

Steklov Mathematical Institute is a structural unit of the Russian Academy of Sciences (RAS) and belongs to the *Division of Mathematics of RAS.* The Institute is working under scientific, methodological and organizational guidance of the Division of Mathematics of RAS. Scientific investigations are being done according to 6 programs of the Division of Mathematics of RAS that include 32 topics. Basic problems of scientific investigations in the Steklov Mathematical Institute of RAS have to be approved by the Division of Mathematics of RAS Steklov Mathematical Institute is participating in the scientific program *"Non-linear dynamics and solitons"* of the Russian Academy of Sciences.

Steklov Mathematical Institute is regularly publishing "Proceedings of the Steklov Mathematical Institute". The Chief Editor of these is Academician E. F. Mishchenko.

In the Steklov Mathematical Institute there is an All-Institute seminar working under the guidance of Academicians V. S. Vladimirov and Yu. S. Osipov. *The sessions of this seminar take place on the third Thursday of every month at 16 o'clock in the conference hall of the Institute situated on the 9th floor.* Reports are delivered and the most interesting results, mostly those obtained by research fellows of the Mathematical Institute, are discussed. *Every person interested may attend these sessions, since the access is free.*

Director

Academician **Kozlov** Valery Vasil'evich

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Last modification 14.04.2006

Russian-Indian Centre for Advanced Computing Research
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The autonomous non-commercial organization Russian-Indian Centre for Advanced Computer Research (RICCR) was founded in accordance with documents undersigned in December 2000 on the intergovernmental level.

The Centre was created with the aim of development of scientific and technological collaboration, as well as activity in scientific research and scientific practice in the following principal fields:
- fundamental and applied problems of development of software for high-speed computers with parallel architecture;
- development of the program codes;
- processing of seismic data;
- weather forecasting and climate?s modeling;
-economics, computer satellite systems, and some others
Elected as the President of RICCR is
Academician of Russian Academy of Sciences, Lenin Prize winner,
rector MIPT 1962 - 1987,
Director of ICAD RAS
Belotserkovskii Oleg Mikhailovich

CENTRE FOR DEVELOPMENT OF ADVANCED COMPUTING (C-DAC)
National PARAM Supercomputing Facility (Centre for Development of Advanced Computing, Pune, India)
Established in March 1988, as a Scientific Society of the Ministry of Information Technology (formerly Department of Electronics), Government of India, the **Centre For Development of Advanced Computing (C-DAC),** is primarily an R& D institution involved in the design,

development and deployment of Advanced Information Technology (IT) products and solutions. C-DAC's operations are mission oriented and driven by its mission objectives.

The interaction between Russian scientists and their Indian counterparts has now considerably grown to tackle much more complex real life situations like simulation of forest fire, design of artificial heart valve, bio-engineeringand basic aerodynamic design of re-entry vehicles. In the meantime, C-DAC has completed designing and commissioning of many variants of PARAM supercomputers using faster processing nodes and including state-of-the-art technology in high performance computing. National PARAM Supercomputing Facility (Centre for Development of Advanced Computing, Pune, India)

The interaction between Russian scientists and their Indian counterparts has now considerably grown to tackle much more complex real life situations like simulation of forest fire, design of artificial heart

valve, bio-engineeringand basic aerodynamic design of re-entry vehicles. In the meantime, C-DAC has completed designing and commissioning of many variants of PARAM supercomputers using faster processing nodes and including state-of-the-art technology in high performance computing. In order to re-enforce the scientific activities utilizing high performance computing through PARAM, it was decided to set up the Russian Indian Centre for Supercomputer at ICAD, Moscow. This Centre will install PARAM 10000 (UltraSPARC-ll as the processing node and the latest network switch) developed by C-DAC. To start with, C-DAC will install a scaled down version of the system having 128 Gflops with peak performance capabilities. This will help demonstrate the parallelization of scientific and engineering applications which will be subsequently optimized by new system software tools. The computing system will be further upgraded to, first 36 Gflops and then to 72 Gflops. The computing resources will be utilized by researchers for three-dimensional flow simulation and analysis of turbulence characteristics along with fluid structure interactive study. C-DAC will be very closely collaborating with ICAD and other Russian scientists for the relevant algorithmic development support. It is envisaged that this-supercomputing centre will help analyze many multi-disciplinary applications.

In a little over a decade since inception, C-DAC has developed a range of high performance parallel computers, known as the PARAM series of supercomputers. The latest in the series is the PARAM Anant, which is a low-cost supercomputing solution based on C-DAC's unique OpenFrame architecture for scalable and high-performance computing that incorporates the well-known Cluster of Workstations (COW) and Massively Parallel Processing (MPP) concepts. PARAM Anant is based on, off the shelf, low-cost, commodity processors and networks but provides a similar environment and features available with the more comprehensive and powerful PARAM 10000.

Presently, more than 50 installations of various PARAM systems exist in India & abroad. Recognising the fact that it would not be possible for all academic, research facilities and other users in the country to have full-scaled PARAM systems, C-DAC has set up a National

PARAM Supercomputing Facility (NPSF) at Pune. The facility houses the most powerful supercomputer built in the country, PARAM 10000 and facilitates researchers and other supercomputer users to use the same for their work. In addition to utilizing the system in-house, the PARAM may be accessed over wide area network.

C-DAC's expertise also extends to other related areas of Information Technology and includes pioneering work undertaken in the field of multilingual and multimedia technologies, education and training and developing IT based solutions in areas like Financial Modelling, Network and Internet Security, Real Time Systems, e-Governance, Geomatics, Digital Library and Artificial Intelligence.

C-DAC, evolved the Graphics and Intelligence Based Script Technology (GIST), with a view to extend the benefits of Information Technology to the vast and diversified multilingual population of India. Use of the GIST range of products has lead to the proliferation of the use of computers and their application in all major Indian languages Countrywide.

Some of the multilingual software products include LEAP office, GIST shell toolkit, GIST SDK, GIST Mail, iPlugin, ISM2000 Language learning software LI LA and Machine aided translation MANTRA tools are other products based on Artificial Intelligence.

C-DAC has undertaken a number of development projects in the area of Electronics and Information Technology, which have been assigned and sponsored by the Ministry of Information Technology, Department of Official Language (DOL), Department of Science and Technology (DST) and the Department of Scientific and Industrial Research (DSIR).

As part of its business activities, C-DAC has executed projects, which are broadly categorized in the areas of:
High Performance Computing Internet and Networking
e-Governance
Geomatics
Banking and Finance Power
Telecom
Health
Real Time System

C-DAC's Advanced Computing Training School (ACTS) is dedicated to creating high quality manpower for C-DAC in particular, and the IT industry in general by way of designing and delivering various courses. The courses are offered through a network of 85 Authorised Training Centres (ATC's) in India, besides the C-DAC's own centers in Pune, Delhi, Hyderabad & Bangalore.

The courses currently offered by ACTS are:
Diploma in Advanced Computing (DAC)

Diploma in Business Computing (DBC)
Advanced Diploma in Information Technology (ADIT)
Diploma in Information Technology (DIT)
Co curricular Diploma in Advanced Computing (CoDAC)
Diploma in VLSI Design (DVLSI)
Diploma in Advanced Computing Arts (DACA)
Low Cost Multimedia Certificate (LCMC)

The National Multimedia Resource Centre (NMRC) of C-DAC is engaged in the development of tools and templates for fast and convenient designing of multimedia sites and web content design. As part of its initiative on Digital Libraries, C-DAC is developing the architecture and tools, standards and templates that will form the basis for archiving, querying, presenting and disseminating multimedia-based information.

C-DAC's website at www.cdacindia.com provides a window into the developments and activities at C-DAC. It also includes free downloadable versions of multilingual and multimedia software.
Director
Academician **Belotserkovsky** Oleg Mikhailovich

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St. Petersburg Department of V.A. Steklov Mathematical Institute and
Euler International Mathematical Institute
of the Russian Academy of Sciences
Director: Prof. Ildar A. Ibragimov, Academician

St. Petersburg Department of V.A. Steklov Mathematical Institute (PDMI RAS) was established in 1940 after the Institute had moved to Moscow. At present, despite the word "department" in its name kept due to historical traditions, PDMI RAS is an independent institute within the Russian Academy of Sciences. From 1976 till 2000 the Institute was headed by a prominent Russian scientist, mathematician and physicist, Academician Ludwig D.Faddeev. He established in St.Petersburg a new institute of Russian Academy of Sciences, Euler International Mathematical Institute (EIMI). Since January 1996 Euler International Mathematical Institute is contained in PDMI as a department.

Basic research areas

Fundamental research in pure mathematics and mathematical models of theoretical physics: mathematical logic and the theory of algorithms, algebra, number theory, geometry and topology, mathematical analysis, probability theory and mathematical statistics, mathematical problems of continuum mechanics, quantum physics, geophysics, and seismology.

Main scientific achievements

Creation and development of new methods for studying metric properties of geometric figures which led to the solution of classic problems of geometry of surfaces (A.D.Alexandrov and his pupils). Application of functional analysis methods to the problems of numerical mathematics, development of a general theory of approximative methods, new effective methods of solution operator equations (L.V.Kantorovich). Creation of the theory and methods for solving extremal problems with restraints (linear programming methods, in particular) and their application to the problems of economics (L.V. Kantorovich). The solution of the 19th and 20th Hilbert problems and the construction of the attractor theory of nonlinear evolutionary semigroups (O.A.Ladyzhenskaya). New methods in analytic number theory (large sieve, dispersion method) and solutions of a series of classic number theoretic problems (Yu.V.Linnik). The theory of summation of random variables (Yu.V.Linnik, I.A.Ibragimov). New methods and results in algorithm theory and constructive mathematics (proof of unsolvability of problem of homeomorphism, the notion of normal algorithm) (A.A.Markov). The solution of 10th Hilbert problem (Yu.V.Matiyasevich). Homologies in group theory, numerical methods in linear algebra (D.K.Faddeev). The complete solution of the quantum problem of three and more particles and the multidimensional inverse problem of scattering theory (L.D.Faddeev).The quantum inverse scattering method (L.D.Faddeev and his pupils). Correct rules of quantization of Yang-Mills fields (V.N.Popov, L.D.Faddeev). Theory of zeta-functions of multidimensional modular forms (A.N.Andrianov). Creation and development of ray method of implementation of wave fields (V.M.Babich). Investigation of integral representations of functions specified for regions and imbedding theorems (V.P.Il'in).

Many scientists of the Institute were granted high prestige scientific awards of the USSR and Russia: Lenin and State Prizes, special awards instituted in commemoration of the great Russian scholars. Academician L.V. Kantorovich was awarded the Nobel Prize in Economics in 1975.

Recent scientific achievements

The computation of motivic cohomology of weight 2 is completed, and the Quillen-Lichtenbaum conjecture on K-theory with finite coefficients for complex varieties of dimension no greater than 2 is proved (A.A.Suslin). The theory of cubic metaplectic forms on linear algebraic groups of range 1 and 2 is developed (N.N.Proskurin). New profound results are obtained in the classical problem of number theory concerning the asymptotics of the number of points of a lattice in an expanding domain and it is proved that in any dimension there are domains and lattices with logarithmically small remainders in the asymptotic formula for the number of points of a lattice in a domain (M.M.Skriganov). New investigation methods of sums of dependent random variables are developed (M.I.Gordin). The infrared parameterisation of Yang-Mills field is proposed (L.D.Faddeev). The methods of calculation of correlation functions in the integrable models of quantum field theory and statistical mechanics are developed (A.G.Izergin, N.M.Bogoliubov). New methods of asymptotic study of nonparametric estimation problems in mathematical statistics have been developed (I.A.Ibragimov).

International scientific cooperation

Organizing international scientific cooperation and creating conditions for joint research of Russian and foreign scientists, in the first place, mathematicians, are the main problems of Euler International Mathematical Institute that became a department of PDMI in 1996. EIMI is located in a separate building at 10 Pesochnaya naberezhnaya, appropriately equipped for conferences numbering up to a hundred persons and for individual work of mathematicians coming to St.Petersburg. EIMI has a network of computers with Internet connection. Every year EIMI organizes about 10 international working meetings and conferences. It also conducts a long-term program of scientific cooperation "Tete-a-tete in Russia", whose aim is to organize meetings of Russian and foreign scientists for joint work in St. Petersburg. Moreover, for many years PDMI has been collaborating with Max Plank Institute (Germany), the University Paris-7, Lund University (Sweden), the University of Florence (Italy) and some other scientific centres.

Awards

Yu.V. Matiyasevich has been awarded by the Alexander von Humboldt Foundation Award. A.Yu.Zaitsev, A.Kitaev, A.Bytsko are the Alexander von Humboldt Foundation fellows. K.Zainullin have been awarded an EPDI two-year grant. I.A.Ibragimov, A.N.Borodin, A.Yu.Zaitsev, M.I.Gordin have RFBR-DFG Grant 99-01--04027 and INTAS grant 99-01317; Maksim Skriganov has INTAS Grant 00-429; I.A.Panin, S.A.Yagunov i K.V.Zainullin have an INTAS grant; V.Kamotskii: INTAS Young Scientists Fellowship, YSF 01-198; E.A.Hirsch: INTAS Young Scientists Fellowship YSF 99-4044; Laboratory of mathematical logics: INTAS 447 "Weak Arithmetics". K.Dyakonov have been awarded a prize from Academia Europaea for young scientists from the CIS republics.

Scientific issues

PDMI is the founder and publisher of the notes of scientific seminars "Zapiski Nauchnykh Seminarov POMI RAN" (English version - "Journal of Mathematical Sciences") and the preprints of PDMI RAS. In addition, the editorial staff of the journal "Algebra i Analiz" (English

version - "St. Petersburg Mathematical Journal") is located in the building of PDMI. English translations of these two journals are published abroad. Electronic versions of PDMI preprints are available in Internet at the www-server of the Institute.

Library
The library of PDMI is the leading mathematical library in St. Petersburg. All best mathematicians of St. Petersburg have a possibility to use the books and journals of the library of PDMI. Unfortunately, due to the financial situation in Russia, the library has no possibility to buy new books and journals which are extremely necessary for mathematical work. At this moment the library has 176396 books and journals. Among them 109764 are published in foreign languages (English, French, German...). The library is a part of the library of the Academy of Sciences and has no own budget. The books and journal are arriving from the central library and as donations of different organizations and persons. In the last years the amount of donations is about 50% of the whole amount of new books and journals. The new monographs in English are all donations.

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Founded in 1964, the Computing Centre (now ICMMG) of SB RAS has been engaged in research on computational and applied mathematics in such areas as the modelling of processes in the atmosphere and ocean, environmental protection problems, methods of mathematical modelling in geophysics, geophysical informatics, simulation of informatics systems, telecommunication systems, software for supercomputers.

ICMMG consists of 11 departments which are subdivided into 23 laboratories. The personnel of the Institute is 395 workers including 195 scientists. There are 41 Professors and 110 PhD among them.

Since 1994 the investigations of the ICMMG are supported by the Russian Foundation of Basic Research (RFBR) and RFBR-INTAS.
Research is supported by the state scientific programs "Perspective Information Technologies", "Informatization of Russia", "Global Changes of Environment and Climate" and "World Ocean".

ICMMG is the base institution for the Chair on Numerical Mathematics, the Chair on Mathematical Methods of Geophysics, the Chair on Computing Systems at the Novosibirsk State University; the Chair on Parallel Computing Technologies, the Chair on Networks Information Technology at the Novosibirsk State Technical University, the Chair on Image Processing at the Siberian State Academy of Geodesy.

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INSTITUTE OF MATHEMATICS AND MECHANICS, URAL BRANCH OF THE RUSSIAN ACADEMY OF SCIENCES

The Institute of Mathematics and Mechanics of the Ural Branch of Russian Academy of Sciences (RAS) is a theoretical successor of the Sverdlovsk Branch of the V.A.Steklov Mathematical Institute of the USSR Academy of Sciences (the Russian abbreviation is SOMI) which was organized according to the decision of the USSR Council of Ministers dated of August 6, 1956, and the decision of the Presidium of the USSR Academy of Sciences dated of September 17, 1956.

In 1957, the construction of the building of SOMI started at the address S.Kovalevskaya Str. 16, and the first SOMI part was put into operation in April, 1961.

Professor S.B.Stechkin was nominated the first Vice-Director of the V.A.Steklov Mathematical Institute of the USSR Academy of Sciences in charge of the Sverdlovsk Branch. The first order on SOMI was issued on February 24, 1961.

Since March 1967, according to the decision of the Presidium of the USSR Academy of Sciences, Doctor of Sciences, Professor S.D.Volkov was nominated the acting Vice-Director in charge of SOMI. Since June, 1968, DSc., Professor A.I.Starostin was nominated the Vice-Director in charge of SOMI.

SOMI was reorganized as the Institute of Mathematics and Mechanics of the USSR Academy of Sciemces according to the plan of development of scientific institutions in the Urals in keeping with the decision of the USSR Council of Ministers of August 38, 1969 and the decision of the Presidium of the USSR Academy of Sciences of May 28, 1970.

The Institute was placed under the scientific supervision of the Branch of Mathematics of the USSR Academy of Sciences together with the Branch of Mechanics and Control Processes of the USSR Academy of Sciences.

The main directions of scientific investigations of the Institute were specified:

development of the mathematical theory of control processes;
theoretical investigation in the field of algebra, differential equations and the theory of functions;
elaboration of metons for solving problems with the help of computers, including economic problems, technological ones, problems of mathematical physics;

development of calculation means of high productivity
development of methods of nonlinear mechanics with applications to problems of stability of oscillations and control
development of mathematical methods of continuum mechanics

According to the 1970's decision the Institute of Mathematics and Mechanics (IMM) of the USSR Academy of Sciences was headed by Academician N.N.Krasovsky.

Since March 1971, IMM was incorporated into the Urals Scientific Center of the USSR Academy of Sciences.

Since February 1977, DSc., Professor A.B.Kurzhanskii became the Director of the Institute, and, since Desember 1983, DSc., Professor V.D.Batukhtin became the acting Director of the Institute. Since October 1986, IMM was headed by Academician Yu.S.Osipov. In Desember 1991, Yu.S.Osipov was elected as President of the Russian Academy of Sciences (RAS). Since December 1993 and till March 1999, Academician A.F.Sidorov became the Director of the Institute.

Due to the reorganization of the Urals Scientific Center in February 1987, IMM was included into the Ural Branch of the USSR Academy of Sciences. In Desember 1991, because of the organization of the Russian Academy of Sciences, the Institute was incorporated in the Ural Branch of the RAS.

Within 30 years at the Institute of Mathematics and Mechanics, acknowledged scientific schools have been formed on many important directions of modern and classic mathematics: mathematical theory of control processes, analytical and numerical methods of continuum mechanics, the theory of ill-posed problems and generalized functions, the theory of approximation of functions and operators, methods of convex optimization and pattern recognition, in the field of modern algebra and topology.

The traditions established in the sphere of mathematical resarch resulted in awarding Lenin Prizes in 1966, to Correspoding Member V.K.Ivanov together with Academician A.N.Tikhonov for the elaboration of the theory and methods of solution of ill-posed problems; in 1976, to Academicians N.N.Krasovskii, A.B.Kurzhanskii, Yu.S. Osipov, Corresponding Member A.I.Subbotin for a cycle of investigations in the mathematical theory of control problems. In 1996, Academitian N.N.Krasovskii won the Demidov Prize, and, in 1997, he was awarded by the M.V.Lomonosov Gold Medal of RAS.

On staff at the Institute there are 145 research associates, including 4 Academicians of RAS, 4 Corresponding Members of RAS, 34 DSc's, 63 PhD's (date of January 1, 1997). The Institute incorporates the following departments and laboraties:

Algebra and Topology Department

Function Approximation Theory Department
Approximation and Applications Department
Mathematical Programming Department
Dynamical Systems Department
Differential Equations Department
Optimal Control Department
Control Systems Department
The Department of ill-posed problems of analysis and applications
The Department of Equations of Mathematical Physics
Applied Problems Department
System Software Department
Department of Computer Networks
Computer Sciences Department
Visual System Laboratory
Scientific Library

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Sobolev Institute of Mathematics of the Siberian Branch of the Russian Academy of Sciences is located in Novosibirsk Akademgorodok.

The list of personnel of the Institute contains about 500 research workers. Data Base of IM SB RAS staff can be seen here.

The Institute was foundered in 1957 by Academician Sergei Sobolev.

At present the Institute is directed by Academician Yurii L. Ershov.

Main fields of research

The members of the Institute carry on fundamental investigations in mathematics, mathematical physics, and informatics in the following main directions:

algebra, theory of numbers, and mathematical logic;
geometry, topology, and functional analysis;
differential equations and mathematical physics;
probability and mathematical statistics;
numerical mathematics;
mathematical modeling and methods of applied mathematics.

The investigations carried on at the Institute are supported by various domestic and interactive funds. In 2004, the Institute had 54 grants of the Russia Foundation for Basic Research, 8 grants of the Russia Humanitarian Scientific Foundation, 4 grants of the Federal Pilot Program "Integration", etc. In the frames of the state program for support of leading scientific schools, the grants were allotted to 7 scientific schools headed by A. A. Borovkov, Yu. L. Ershov, M. M. Lavrent'ev, Yu. G. Reshetnyak, S. S. Goncharov, V. L. Beresnev and V. A. Vasil'ev. State scholarships for prominent scientists are awarded to 20 members of the Institute, and 9 men received state scholarships for young scientists.

The Institute participates actively in training of highly qualified scientific cadres in cooperation with the Department of Mechanics and Mathematics of Novosibirsk State University.

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Historical background

1975 - Department of mathematical methods of scientific research and design automation.
Basic research trends:
scientific research automation in divisions of the Karelian branch of the Academy of Sciences of the USSR;
computer-aided design of transport communications and land-reclamation systems.

1992 - Department of mathematics and data analysis.
Basic research trends:
systematic investigation into natural, social and production complexes in Karelia, development of mathematical and informational models for solving scientific, technical and ecological problems of the optimum management in these complexes;
study of the problems of fuel-energy complex development in Karelia.

1999 - Institute of Applied Mathematical Research.

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Khabarovsk department
ABOUT THE DIVISION
The Structure of the Division
The Khabarovsk Department of the Institute of Applied Mathematics DVO RAN [RUSSIAN ACADEMY OF SCIENCE] was created in 1989 on the foundation of the mathematics subdivisions of the Computing Center DVO RAN [RUSSIAN ACADEMY OF SCIENCE].

Presently the staff of the division consists of 42 collaborators, including 30 research officers (Ph.D.ís ñ 4, Candidates ñ 15, Post-Graduate Students, the 2 being in-residence training). Khabarovsk Division consists of 2 departments:
• Department of theoretical and applied mathematics;
• Department of informational-computer technologies.

The most important achievements of the Division, mentioned in the summary report of Russian Academy of Science:
• The EuhlerñShimurañManin theory for modular groups of any dimension was constructed and dual Steinberg modulus in Bohrel-Serre duality theorem was written down. This result generalizes investigations of Y.I. Manin, K. Sule, A. Ash and M. Ridder for dimensions 2, 3, 4. [year 2003];

• The unimprovable by the number of arithmetical operations algorithm for calculation of elements of many-dimensional continued fractions, extending integers expansion into a continued fraction classical algorithm, was constructed. [year 2004].

RFBR grants:
• ìArithmetical and analytical properties of Gekke series automorphic formsî, director - Ph.D., V.A. Bykovskii, π96-01-00439-‡, 1996-1998.

• ìTrace formulas and their applicationî, director ñ RAS corresponding member, N.V. Kuznetsov, π99-01-00768-‡, 1999-2001.

• ìQuasiconformal deformations of rational mappingsî, director ñ Candidate, P.M. Makienko, 1999-2001.

• ìNumber-theoretic methods of data protection and processingî, director - Ph.D., V.A. Bykovskii, π01-01-96301-r2001Khabarovsk, 2001-2003.

• ìTheory of latticesí local minima and its applicationî, director - Ph.D., V.A. Bykovskii, π04-01-97000-r2004priamurje_‡, 2004-2005.
International grants:
• National Science Foundation of USA, Grant DMS-9022140 (P.M. Makienko)

• ´Analytical and Combinatorial Methods in Number Theory and Geometry[a], Grant INTAS π03-51-5070, 2004-2006 (Team Leader ñ V.A. Bykovskii)

Russian Academy of Science, Far Eastern Branch grants:
• Number-theoretic methods of data protection and processing. (V.A. Bykovskii, 2002)

• Theory of local minima of lattices and its application. (V.A. Bykovskii, 2003-2005)

• Investigation of intercommunication of two Lindeloef hypotheses for Riemann zeta function and Gekke series. (N.V. Kuznetsov, 2003)

• Reduction of linear operators to the integral form with analytic kernels. (I.M. Novitsky, 2003-2005)

• Properties of local minima of integer lattices. (Y.A. Smirnov, 2003

• Euhler ñ Shimura ñ Manin theory. (V.A. Bykovskii, 2004)

• Euhler ñ Shimura moduli. (V.A. Bykovskii, 2005)

Khabarovsk Divisionís elaborations, introduced into public establishments and financial structures of the Russian Far Eastern region:
The library of object modules ìElectronic Digital Signatureî allows quickly and simply to build functions of cryptographic data protection into programs: electronic digital signature and encoding.
Performing module ìClearingî is intended for mutual offsets of interbank payments with or without usage of bank reserves. The module uses optimization of flows in networks fast-acting algorithms. Processing of ten thousands payments takes less then one minute. Data (payments and reserves) can be stored in main memory and in files (including local network) as well. The module can be also used for mutual offsets of debts of enterprises, including by goods.
Automatized working place [AWP] ìDocExpertî is constructed for mastic seals authentication. The merits of AWP are a high level of automation, simplicity in usage and reliability of seals authentication. AWP ìDocExpertî differs from analogous complexes by fast-acting tunable original database with instantaneous search by any criterion, direct support of any scanners, unprecedented set of service functions.

Country science assistance fundís laureates:
• V.A. Bykovskii ñ in nomination ìYoung doctor of scienceî [2001-2002]
• A.V. Rukavishnikov ñ in nomination ìThe best post-graduate students of RASî [2005]
Laureates of regional competition of young scientists and post-graduate students:
In section ìMathematics, Physics and Informational Technologiesî:
year 2002:
• M.O. Avdeeva ñ the 1st place
• V.V. Krishtop ñ the 2nd place;
year 2003:
• V.V. Krishtop ñ the 1st place;
• Y.A. Smirnov ñ the 2nd place;
year 2004:
• A.V. Rukavishnikov ñ the 1st place.
In section ìTechnical Sciencesî:
year 2004:

• V.V. Krishtop ñ the 1st place.

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The Astronomical Council of the USSR Academy of Sciences was founded in December 20, 1936, by a decree of the Presidium of the USSR Academy of Sciences. Its main task was to coordinate studies in the field of ground-based optical astronomy that were carried out in the USSR by astronomical institutions, belonging to the Academy of Sciences and to other organizations.

Chairmen of the Astronomical Council were the well-known Russian scientists academician V.G. Fessenkov, academician A.A.Mikhailov, corresponding member of the Academy E.V.Mustel. The present director of the Institute of Astronomy is academician A.A.Boyarchuk. Professor A.G.Massevitch, who was vice-chairman of the Astronomical Council for 35 years, has performed great services to the evolution of the Astronomical Council to a recognized research center.

Scientific investigations in the Astronomical Council started after the war. On the commission from the International Astronomical Union, the Astronomical Council began creation of the "General Catalogue of Variable Stars" (GCVS), and in 1948 the first edition was published. At present the fourth edition of the catalogue in 5 volumes is published. In 1959, by a decree of the Presidium of the Academy of Sciences, several scientific departments were organized in the Astronomical Council and an intensive development of studies in the fields of physics and evolution of stars, solar activity, physics of the Moon, and, later on, stellar spectroscopy proceeded.

With the beginning of space research in late fifties, a very intensive work in organization and carrying out observations of artificial satellites and use of these observations for studies in the field of space geodesy, geodynamics and geophysics started.

In 1958, near Zvenigorod (Moscow region), by a decree of the Presidium of the Academy of Sciences, the Zvenigorod Experimental Station of the Astronomical Council (now the Zvenigorod Observatory of the Institute of Astronomy of RAS) was founded. The Astronomical Council organized a net of tracking stations over the country and abroad (in several countries of Asia, Africa, and South America). Large amount of visual, photographic and, later on, laser observations of artificial satellites were performed on these stations. These observations were aimed for geodesy, geophysics, ephemeris service, and space monitoring problems. By the middle eighties most of these stations having fulfilled their tasks, were closed, with their equipment

given to the universities and other educational institutes.

In 1975, at the Simeiz branch of the Crimean Astrophysical Observatory of the USSR Academy of Sciences, that was assigned to the Astronomical Council, a laser ranging station was built. Later the 1-meter Zeiss telescope was installed there. At present, observations with this telescope, that belongs to the Institute of Astronomy, are carried out according to the program of the Institute, though the Simeiz Observatory has been again transferred to the Crimean Observatory.

In 1971, the Department of Applied Mathematics and Computer Technics was organized in the Astronomical Council. In 1980, on its technical basis the Astronomical Data Center was founded as a Soviet branch of the Strasbourg Centre de Donnees Stellaire (CDS). Since 1986 a new research field --- the dynamics of stellar and planetery systems --- is developed.

In December 1990, the Astronomical Council, being in fact a scientific institution for many years, was reorganized, by a decree of the Presidium of the USSR Academy of Sciences, into the Institute of Astronomy of the USSR Academy of Sciences, and in 1991 into the Institute of Astronomy of the Russian Academy of Sciences (INASAN).

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Fields of Research
Modelling of the dynamic interaction between stars and interstellar medium (B.M.Shustov, V.I.Shematovich, D.Z.Wiebe)
Numerical modelling of the gas flow in binary systems (A.A.Boyarchuk, D.V.Bisikalo, O.A.Kuznecov)
Nonlinear pulsations and mass loss in giants (Yu.A.Fadeyev, A.A.Pamyatnykh, A.B.Fokin)
Numerical modelling of the evolution of Galaxy binaries ensemble (A.V.Tutukov, L.R.Yungelson, A.V.Fedorova)
Study of nonequilibrium processes in diluted gas media: geophysical, aeronomical and astrophysical (V.I.Shematovich, D.V.Bisikalo)
Best results, 2001
The detailed chemical model for the starless cores of strongly magnetized molecular clouds, with

the ambipolar diffusion-driven dynamic evolution of the clouds coupled to the chemistry through ion abundances is developed. We concentrate on two representative model clouds in this initial study, one with magnetic fields and the other without. The model predictions on the peak values and spatial distributions of the column densities of CO, CCS, N2H+ and HCO+ are compared with those observationally inferred for the well-studied starless core L1544, which is thought to be on the verge of star formation. We find that the magnetic model, in which the cloud is magnetically supported for several million years before collapsing dynamically, provides a reasonable overall fit to the available data on L1544; the fit is significantly worse for the non-magnetic model, in which the cloud collapses promptly. The observed large peak column density for N2H+ and clear central depression for CCS favor the magnetically-retarded collapse over the free-fall collapse. A relatively high abundance of CCS is found in the magnetic model, resulting most likely from an interplay of depletion and late-time hydrocarbon chemistry enhanced by CO depletion. Our results, although still preliminary, lend some support to the standard picture of dense core formation in strongly magnetized clouds through ambipolar diffusion. They are at variance with those of Aikawa et al. (2001) who considered a set of models somewhat different from ours and prefered one in which the cloud collapses more or less freely for L1544. (B.M.Shustov, V.I.Shematovich, D.Z.Wiebe)

Head: Chugai N.N.
Staff

Stellar spectroscopy, stellar atmospheres
GCVS Group
Chugai Nikolai N. (head of department)
Samus Nikolaj N.
Antipova Ludmila I.
Karitskaya Evgenija A.
Boyarchuk Margarita E.
Ipatov Alexander P.
Khokhlova Vera L.
Kazarovec Elena V.
Ryabchikova Tatiana A.
Gorynya Natalia A.
Davydova Elena S.
Kireeva Natalia N.
Pavlova Vera M.
Medvedeva Galina I.
Pastukhova Elena N.
Tsvetkova Tatiana M.
Novikova Margarita F.

Fields of Research

Study of the atmospheres of red giants (A.A.Boyarchuk, L.I.Antipova.)
Study of the magnetic and chemical structure of the surfaces of magnetic chemically peculiar stars and spot forming activity of the solar-type stars by means of the inverse problem method (T.A.Ryabchikova)
Mechanisms of the supernovae outbursts and structure of their envelopes (N.N.Chugai)
Catalogs of variable stars: lists of designations, coordinates, electronic versions and databases (N.N.Samus, E.V.Kazarovec)
The complex investigation of variable stars (N.N.Samus**,** N.A.Gorynya**,** E.A.Karitskaya**,** E.N.Pastukhova)
The complex investigation of stars in globular clusters using observations on Russian and Chilean telescopes and estimation of the physical parameters of globular clusters (N.N.Samus, A.P.Ipatov)
The best result, 2001

The new model of phenomena observed in type IIn supernovae is proposed. According to this model during initial period of couple of weeks up to two months some SNIIn expand inside a circumstellar envelope, which is essentially opaque to Thomson scattering. The proposed picture is based upon an analysis of emission line profiles and the light curve of SN1998S, one of these supernovae. The model radically changes the view on the nature of wide emission lines in spectra of these supernovae. Previously a combination of narrow and wide lines seen in these objects was thought as a superposition of a narrow line from circumstellar envelope and a wide line from the supernova envelope. In the new model both components is essentially single line, which arises in the circumstellar envelope. The wide component is attributed to the narrow line broadening due to multiple scattering of photons on thermal electrons of the optically thick circumstellar envelope with the temperature of 20000-25000 K. Modelling of Halpha line profile in SN1998S using Monte Carlo technique permits to measure both the Thomson optical depth of the envelope, which is found to be 3.5 on day 9 after the explosion, and the characteristic radius of the circumstellar enevelope, which is estimated as 1015 cm.

The radius combined with an upper limit of the velocity of the circumstellar gas implies that the circumstellar material with a mass 0.1 Msun was ejected by the presupernova less than 30 yr before the explosion. Interestingly, a cool dense shell formed in the interaction of the expanding supernova with this circumstellar gas turns out opaque in the optical during first 45 days. This provides a natural explanation for another interesting feature of SN1998S: the lack of strong lines from supernova itself during for about one and a half months after the explosion. The proposed model provides an important diagnostic tool for probing robust mass loss experienced by presupernova prior to the SNIIn explosion and through this permits to get an insight in the origin of presupernovae responsible for SNIIn events.(N.N.Chugai)

Head: academician Fridman A.M.
Staff
Fridman Alexei M.
Khoruzhij Oleg V.

Terentjeva Alexandra K.
Polyachenko Valerij L.
Polyachenko Evgenij V.

Main Topics
Dynamics of galaxies and interplanetary matter (Fridman A.M., Khoruzhij O.V., Polyachenko V.L., Terentjeva A.K.**)**

Department of Physics of Stellar and Planetary Systems
The Physics of Stellar and Planetary Systems (**PSPS**) is a department of the Institute of Astronomy of the Russia Academy of Sciences.

Personnel
Chair: Prof. Alexei M. Fridman
Secretary: Dr. Alexandra K. Terent'eva

Dr. Valerii L. Polyachenko
Dr. Oleg V. Khoruzhii

Some important scientific results which were obtained during the last decade
Prediction and discovery of new structures in spiral galaxies: giant anticyclones.
Physics of planetary rings: celestial mechanics of continuous medium.
Physics of gravitating systems: collective processes and structures.
Determination of the 3D distribution function in stellar clusters and relaxation mechanisms of stellar population in the solar neighbourhood.

Major-priority programs of the department
Spiral-Vortex structures of galaxies
Mini-Bars
Galactic Center Dynamics

Research activities:
Formation and dynamics of spiral-vortex structures
Formation and dynamics of bars
Galactic gaseous disks
Planetary disks
Accretion disks
Asteroids

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Bagrov Alexander V. (*senior researcher*)
Bakanas Elena S. (*unior researcher.*)

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Kolesnik Yurij B. (*junior researcher*)
Leonov Vladislav A. (*junior researcher.*)
Mikisha Anatolij M. (*senior researcher*)
Podgornyj Igor M. (*leading researcher*)
Rykhlova Lidiya V. (*head of department*)
Smirnov Mikhail A. (*leading researcher*)
Suleiman Mokammed O. (*senior researcher*)

Main Topics
Theoretical and applied problems of geodynamics (e.g. Earth's rotation)
Methods of observation of natural and artificial celestial bodies in the circumterrestrial space (geostationary artificial satellites, space debris etc.).

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Milyaeva Lyubov V.
Sorokin Nikolaj A.
Kuzin Sergei P.
Oraevskaya Svetlana P.
Zvenigorod group
Iourov Evgenij A.

Main Topics
Astrodynamics methods, use of observations of artificial satellites for time-coordinate support and solving of fundamental problems of geodynamics (e.g. movement of lithispheric plates)
The best result, 2001
Conference Proceedings
Proceedings of the International Seminar "On the Use of Space Techniques for Asia-Pacific Regional Crustal Movements Studies", APSG-IRKUTSK 2002, Irkutsk, Russia, 5-10, August, 2002, Edited by Suriya Tatevian, Nicolai Sorokin, Svetlana Oraevskaya
Participation in international projects on space geodynamics
WEGENER (**W**orking Group of **E**uropean **G**eoscientists for the **E**stablishment of **N**etworks for

Earth-science **R**esearch)
ASPG (**A**sian-**P**asific **S**pace **G**eodynamics)
DORIS (**D**oppler **O**rbitography and **R**adiopositioning **I**ntegrated by **S**atellites)
GPS Service

Reports of CDDIS GPS
Global map of igscb.jpl.nasa.gov
Graphic presentation of Zwenigorod data by igscb.jpl.nasa.gov
Station Report for the IGS Central Bureau by JPL's Satellite Geodesy

Laser Service
The following is a Joint CSTG/IERS Call for Participation in the establishment of an International Laser Ranging Service (ILRS) modelled in part after the successful International GPS Service (IGS). Full details regarding the new organization can be found at the CSTG SLR/LLR Subcommission Web Site.
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The Centre for Astronomical Data (CAD) of the Institute of Astronomy (INASAN) of the Russian Academy of Sciences was established in 1980 as a branch regional center of the Centre de Donnes Stellaire (CDS) with the purpose of astronomical data dissemination among Soviet and Eastern Europe astronomers and for providing the CDS with Soviet machine readable astronomical catalogues.

The CAD archive is based on astronomical catalogues received from Strasbourg since 1980. Several well known astronomical archives and databases are also stored at INASAN (e.g. VizieR, ADS, INES).
At present CAD coordinates work on the Russian Virtual Observatory (RVO) project.
Please send your questions and comments to *www.inasan.rssi.ru*

Scientific and applied problems dealing with observations of artificial sattelites
Ground based observing station of the space control network
Being the observing station of the Russian ground-based space control network, Zvenigorod observatory of the Institute of Astronomy carries out observations of geostationary objects. The detection of high-orbit satellites in the search regime as well as identification and catalogisation of a registered objects are rather effective.

Observatons of near-earth satellites
At present, in order to solve some of fundamental and applied problems the positional observations of near-earth satellites are reopened. The corresponding software is developed. The photometric observations of near-earth satellites using state-of-the-art detectors are started. The location of the Zvenigorod observatory is favourable for observations of sun-synchronous satellites.

Development of optical methods of artificial and natural celestial bodies observations
The theory and method for identification of objects, as well as for determination of shape and orientation of a satellite are worked out.

Educational activities
Space control specialists training
Work with students, school childs and amateurs

Work with mass media

Head: Oleg Malkov
Alexander Kilpio (system administrator)
Sergey Kruchkov (hardware & network engineer)
Oleg Smirnov (UNIX guru)
Pavel Kaigorodov (system operator & tech.support)
Valery Myakutin (PC software specialist)
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Last modification 28.12.2005
GEOELECTROMAGNETIC RESEARCH CENTER
(GEMRC IPE RAS)

The Geoelectromagnetic Research Center was founded in 1993 and is presently one of the Centers of Institute of the Physics of the Earth (IPE RAS). The GEMRC RAS employs now 47 staff, of whom 31 are R&D employes (including 7 Professors and 12 Doctors).

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Dr. Youry P. Sizov

SCIENTIFIC PROFILE
theory of natural EM fields in anisotropic and frequency dispersed conductivity medium;
physical and mathematical foundations of interrelation of seismic and electromagnetic phenomena in porous and watersaturated rocks;
algorithms and software packages for numerical modeling of EM fields induced in 3D anisotropic earth by natural and controlled sources;
methods for 3D EM data interpretation;
high resolution subsurface electromagnetics;
EM tomography of volcanoes and faults;
marine electromagnetics;
regional MT studies aimed at construction of 3D conductivity models;
application of EM methods to environmental investigations;
EM monitoring of geodynamic processes.

DEPARTMENTS
LABORATORIES:
Marine EM study
Head: Prof. S.M. Korotaev
EM fields and geological medium interactions
Head: Dr. V.V. Ageev
MT study
Head: Dr. I.M. Varentsov
EM data interpretation methodology
Head: Prof. V.V. Spichak
EM methods and technologies
for environment studies

Head: Prof. E.B. Fainberg
CIENTIFIC PERSONAL

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Barsukov, Pavel Olegovich
Leading researcher
Bezruk, Igor Andreevich
Leading researcher
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Fonarev, Gennady Aleksandrovich
Principal investigator
Korotaev, Sergey Maratovich
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Spichak, Viacheslav Valentinovich
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Svetov, Boris Sergeevich
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2. DOCTORS

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Ageeva, Olga Anatolievna
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Borisova, Valery Petrovna
Senior researcher
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Kevorkyans, Suren Sergeevich
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Sizov, Youry Pavlovich
Senior researcher
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Sokolova, Elena Yurievna
Senior researcher
Trofimov, Igor Leontyevich
Senior researcher
Varentsov, Ivan Mikhailovich

Head of Laboratory
Zakharova, Olga Konstantinovna
Senior researcher

INTERNATIONAL PROECTS
INTAS project: **"3D Electromagnetic and thermal tomography of the active crustal zones".**

Project coordinators:
Dr. V.Spichak (GEMRC IPE RAS)
Dr. H. Eysteinsson (Íslenskar Orkurannsóknir, Reykjavik, Iceland)

PROJECT: **"Electromagnetic Studies of Seismically and Geothermally Active Regions, and Mineralized Zones"**

Project coordinators:
Dr. V.Spichak (GEMRC IPE RAS)
Dr. Saurabh K. Verma (National Geophysical Research Institute, Heiderabad, India)

PROJECT: **"Electromagnetic study of the crust and upper mantle resistivity structure aimed at generation of Indian lithosphere conductance map".**

Project coordinators:
Dr. V.Spichak (GEMRC IPE RAS)
Dr. B. Arora (WIHG, Mumbai, India)

PROJECT: **"Development of new magnetotelluric data processing and 2D/3D inversion techniques with applications to the deep conducrivity studies in the different geological surroundings".**

Project coordinators:
Dr. V.Spichak (GEMRC IPE RAS)
Prof. E.Jankowski (Institute of Geophysics, Warsaw, Poland)

FPG project: **"Ehnanced Geothermal Innovative Network for Europe (ENGINE)".**

RECENT PUBLICATIONS
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Meloni A., **Spichak V.** and Uyeda S. (Eds.). 2004. Magnetic, Electric and Electromagnetic Methods in Seismology and Volcanology. *INGV, Italy*. 245pp.

Papers

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Avdeev D.B., Kuvshinov A.V., Pankratov O.V.,, Newman O.G. 2002. Three-dimensional induction logging problems , Part I: An integral eqution solution and model comparisons. *Geophysics*. **67**. 2. 413-426.
Avdeev D.B., Kuvshinov A.V., Pankratov O.V. Golyshev S.A. Olsen N. 2002. Modelling electromagnetic fields in a 3D spherical earth using a fast integral equation approach// *Three-dimensional electromagnetics.* Elsevier: P. 43-54.
Avdeev D.B., Kuvshinov A.V., Pankratov O.V., Newman G.A., Rudyak B.V. 2002. Modelling induction log responses in 3D geometries using a fast integral equation approach// *Three-dimensional electromagnetics.* Elsevier: P. 55-63.
Barsukov P.O. and Fainberg E.B.. 2001. Superparamagnetic effect over gold and nickel deposits. *Environmental and Engineering Geophysics*. **6**. 61-72.
Barsukov P. O. and E. B. Fainberg. 2002. Study of the Environment by the Transient electromagnetic Method Using the Induced Polarization and Superparamagnetic Effects. *Izvestia, Physics of the Solid Earth. MA1K "Nauka/Interperiodka" (Russia)*, Vol. **38**. No. 11. P. 981-984
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Fainberg E.B., Andrieux, P., Astapenko, V.N., Gueren, R., Zhdanov, M.S., Singer, B.Sh., Ingerov, A.I., Lapitsky, A.I., **Vasilieva, T.A.** 1998. Deep Electromagnetic Studies in Belarus: Crustal Sounding within the framework of the Europrobe Project, *Physics of Solid Earth*. 6. 53-63
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Korja T., Engels M., Zhamaletdinov A.A. et al., BEAR WG*. 2002. Crustal conductivity in Fennoscandia - a compilation of a database on crustal conductance in the Fennoscandian Shield // *Earth Planets Space*. V. **54**. P. 535-558.
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Spichak V.V., Yamaya Y. and Mogi T. 2004. ANN modeling of 3D conductivity structure of the Komagatake volcano (Hokkaido, Japan) by MT data. *In: Proc. IV Int. Symp. MEEMSV-2004. La Londe Les Maures. France*. 121-124.
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Svetov B.S. 2001. On the Statement of the Stationary Electric Field Problem. *Izvestiya. Physics of the Solid Earth*, **37.**, 10, 791-795.
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Vanyan L.L., **Varentsov Iv.M., Golubev N.G., Sokolova E.Yu.,** 1997. Construction of MT induction curves from a profile of geomagnetic data to resolve electrical conductivity of the continental asthenosphere in the EMSLAB experiment. *Izvestiya, Physics of the Solid Earth*, **33**, 10, 807-819.
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Earth. **34**. 9. 779-786.
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In 1968 (November 29) the Presidium of the USSR Academy of Sciences resolved in its decree No.863: “In accordance with the decision No.15, item 4 (March 26, 1968) of the USSR Government State Committee on Science and Technology the **Institute of Spectroscopy of the USSR Academy of Sciences should be organized** on the basis of the Laboratory of the Commission for Spectroscopy. The Institute is an institution of the USSR Academy of Sciences Department of General Physics and Astronomy”.

Main scientific trends of the research work of the Institute were defined by that decision but

their content changed in time, and nowadays they may be formulated in the following way:
1. Spectroscopy of atoms, ions, molecules, clusters, bulk and surface states of condensed media and development of new methods of spectroscopy optics of near field, nanooptics .
2. Laser spectroscopy with accent on specific influence of the light on a substance and its application for isotope separation, cooling of atoms, modification of molecules surrounding in matrices, and also in photochemistry, photobiology, analytical chemistry, etc.
3. Analytical spectroscopy and its application in technology control, in environmental monitoring, in life-support systems, in studies of natural and technologic disasters, etc.
4. Development and design of unique spectral instrumentation, analytical devices, lasers, registration systems, methods of measurements necessary for research work and applications.
5. Training of researchers of highest qualification.

The qualification and abilities of the Institute are generally recognized both in Russia and abroad. The founder of the Institute and its director during the first 20 years, the USSR Acad. Sci. Corresponding Member Professor Sergey L. Mandelstam did a great deal for choosing trends of research work and gathering the scientific stuff representing various scientific traditions and schools. It was he who laid the principles covering all the main trends in spectroscopy, interaction of theoretical and experimental research works both in fundamental and in applied researches, close relations with universities and industry in the USSR and with advanced world research centers as well.

The Institute carries out spectral investigations of atoms, multicharged ions, plasma, molecules (both the simplest molecules in gas phase and complex organic ones in solid matrices), liquids, crystals and films, multilayer thin structures, superlattices, quantum wells, other nanostructures, high temperature superconductors, solid state surfaces, biological objects.

The important scientific trend of the Institute from the very moment of its foundation is provision with methods and apparatus for fundamental researches based on the use of new methods of investigation for designing the spectral instruments, and also the use of lasers, computers and other means for substantial increase in sensitivity, spectral, temporal and spatial resolution, precision and high speed of spectroscopic and analytical measurements. Many methods and devices were based on inventions and were designed in the Institute, and they are very promising as for their applications in national economy, defense, medicine and ecology.
The studied spectra cover a wide spectral range from X-rays to microwaves. The Institute has a series of unique spectral instruments and setups:
- instruments having high spectral resolution up to 10-6cm-1, time resolution up to 3x10-14s, and local resolution up to 5 nm.
- methods and instruments for ultrasensitive detection of atom traces (isotopes) and molecules in gaseous, liquid and solid samples with detection limit up to several femtograms (10-15gram) in a sample;
- methods and instruments for investigation of ultra thin films (down to monolayers) on the surface of metals and dielectrics and for new surface physics data;

Over whelming majority of researches corresponds to the very high world scientific levels. During 35 years of existence of the Institute more than 100 researches were qualified as Candidate of sciences (PhD equivalent) and 40 researches as Doctor of phys.-math. sciences. The list of Doctor dissertation titles is in Appendix 1 as they do reflect the main trends of research works of the Institute.

During this period our researches published more than 4800 articles in scientific journals (about 2000 in leading international journals). 41 monographs are published, majority of them was translated in English. The list of them is in Appendix 2.

The next parts of the booklet is a brief survey of scientific activity of the Institute in the basic research field.

Nowadays scientific structure of Institute of Spectroscopy includes:
Atomic Spectroscopy Department - 18 researches, chief of department - Prof. A.N.Ryabtsev, includes Atomic Spectroscopy Laboratory (Prof. A.N.Ryabtsev) and Laboratory of Plasma Spectroscopy (Dr. K.N.Koshelev);
Molecular Spectroscopy Department - 32 researches, chief of department - Dr. V.G.Koloshnikov, includes Laboratory of Molecular Spectroscopy of High Resolution and Analytical Spectroscopy (Dr. V.G.Koloshnikov), Section of microwave spectroscopy (Prof. B.S.Dumesh) and Section of Electronic Spectra of Molecules (Dr. Yu.G.Vainer),);
Department of Condensed Media Spectroscopy - 27 researches, chief of department - Prof. E.A.Vinogradov, includes Laboratory of Spectroscopy of Condensed Media (Prof. B.N.Mavrin), Laboratory of Spectroscopy of Semiconductor Structures (Prof. E.A.Vinogradov) and Section of fourier-spectroscopy of the Center of collective using "Optical-spectral measurement ISAN" (Prof. M.N.Popova);
Laser Spectroscopy Department - 31 researches, chief of department - Prof. V.S.Letokhov), includes Laser Spectroscopy Laboratory (Prof. V.S.Letokhov), Laboratory of Excited Molecular States Spectroscopy (Prof. E.A.Ryabov), Laboratory of Spectroscopy of Ultrafast Processes (Prof. S.V.Chekalin) and Section of femtosecond spectroscopy of the Center of collective using "Optical-spectral measurement ISAN" (Dr. Yu.A.Matveets);
Department of Laser-Spectral Instrumentation - 18 researches, chief of department - Prof. O.N.Kompanets;
Theoretical Department - 11 researches, chief of department - Prof. V.M.Agranovich, includes Section of Spectroscopy of Phase Transitions (Prof. A.G.Malshukov) and Section of Nonlinear Spectroscopy (Prof. S.A.Darmanyan);
Laboratory of Spectroscopy of Nanostructures - 10 researches, chief of laboratory - Dr. Yu.E.Lozovik;
Laboratory of Experimental Methods of Spectroscopy - 2 researches, chief of laboratory - Dr.E.B.Perminov.
The Institute is responsible for the **Rus.Ac.Sci. Scientific Council** on the Problem "Spectroscopy of Atoms and Molecules" – one of the oldest Council in the Department of Phisics Sciences RAS. During the long time the chief of department was The founder of the

Institute the USSR Acad. Sci. Corresponding Member Professor Sergey L. Mandelstam . Actually the head of Council is Russian Acad.Sci. Corresponding Member Professor I.I.Sobel'man, the Deputy Chairman is Prof. E.A.Vinogradov and Scientific Secretary is Dr. L.A.Bureyeva. Scientific Council on the Problem "Spectroscopy of Atoms and Molecules" leads big scientific-organizing work under the help of ISAN. In 2001 XXII Congress on spectroscopy was held. In December 2003 was held XVII Conference "Fondamental Atomic Spectroscopy". At present 256 persons work in the Institute, 160 researches are working in the scientific laboratories and scientific-technical divisions together with physics engineers and post-graduate students, including 30 Professors, 53 Doctors, 40 employees of Experimental Production Department, about 40 - in auxiliary services. Administrative and Management staff is 16 employees.

The founder of the Institute Professor S.L.Mandelstam was at the head of the Institute till 1989.

The present Director of the Institute is Prof. E.A.Vinogradov, his Deputies are Prof. O.N.Kompanets (Scientific work), A.Yu.Plodukhin (Deputy Financial Director) and E.I.Yulkin (General problems), the Scientific Secretary is Dr. E.B.Perminov.

The Scientific Council considers all principal problems of the Institute scientific activity and consists of E.A.Vinogradov (Council Chairman), O.N.Kompanets (Deputy Chairman), E.B.Perminov (Scientific Secretary) and leading scientists: V.M.Agranovich, D.P.Antonyuk, V.I.Balykin, M.A.Bolshov, L.A.Bureeva, Yu.G.Vainer, B.S.Dumesh, A.M.Kamchatnov, V.G.Koloshnikov, K.N.Koshelev, V.S.Letokhov, Yu.E.Lozovik, B.N.Mavrin, G.N.Makarov, A.G.Malshukov, Yu.A.Matveets, M.N.Popova, E.A.Ryabov, A.N.Ryabtsev, S.V.Chekalin, V.A.Yakovlev.

The Institute has a Specialized Scientific Council that gives qualification of Dr. and Prof. of the specialties "Optics" and "Theoretical Physics" (Council Chairman is E.A.Vinogradov, Scientific Secretary is M.N.Popova).

The Quantum Optics Department (Chairman is Prof. E.A.Vinogradov and Deputy Chairman is Dr. V.G.Koloshnikov) of Moscow Physical-Technical Institute is attached to the Institute of Spectroscopy and guarantees entering of talented and promising young researches.

In 2000 was prolonged the Institute licence for education activities in the field of post graduate education for the next specialties: "Optics", "Theoretical physics", "Solid State Physics" and "Laser Physics".

The scientific and technical library of the Institute has one of the most perfect in Russia literature selection on spectroscopy.

The successes of the Institute scientists were recognized with a number of the highest scientific prizes:

S.L.Mandelstam was awarded the USSR State Prize for the works on x-rays Solar emission (1977);
- Academician D.S.Rozhdestvensky Prize for the works on the spectroscopy of multiply ionized atoms (1977);
V.S.Letokhov (together with V.P.Chebotaev) was awarded the Lenin Prize for the works on nonlinear laser spectroscopy (1978);
A.A.Makarov, Yu.A.Gorokhov, A.A.Puretsky, E.A.Ryabov, N.P.Furzikov were awarded the Lenin Komsomol Prize for the works on laser separation of isotopes 1978);
M.R.Aliev - Prize of the USSR and Czechoslovakia Academies of Sciences for the works on the theory of vibration-rotational spectroscopy of molecules (1982);
V.G.Koloshnikov and Yu.A.Kuritsyn (in cooperation with researches from Ac. Sci. Phys. Inst. and others) were awarded the USSR State Prize for the works on diode laser Spectroscopy of high resolution (1985);
E.I.Alshits, L.A.Bykovskaya, R.I.Personov, B.M.Kharlamov (in cooperation with the scientists from the Estonian Acad. Sci. Phys. Inst. and others) were awarded the USSR State Prize for the works on selective laser excitation of the luminescence in frozen solutions (1986);
V.M.Agranovich was awarded the Alexandre-fon Gumboldt Prize (Germany , 1992), the P.Kapitsa Prize (United Kingdom, 1993) for the works on solid physics, and Academician L.I.Mandelstam Prize (Russian Academy of Sciences for theoretical investigations on surface spectroscopy (1997);
R.I.Personov was awarded the Alexandre-fon Gumboldt Prize (Germany , 1995);
V.S.Letokhov - Honoris Causa Doctor of Paris-North University (France , 1995);
V.S.Letokhov - Quantum Electronics Prize of the European Physical Society in 1998 for pioneering and far reaching contributions to the study of laser matter interactions, including atom optics, laser cooling, laser induced chemistry and laser analytical techniques (1998);
V.S.Letokhov, V.I.Balykin, V.G.Minogin were awarded Academician D.S.Rozhdestvensky Prize for the cycle of works “Laser cooling and traping of atoms” (2001);
O.N.Kompanets - Gold medal and Diploma of the 50th World Exhibition of Innovation, Research and New Technology (Brussels, "Eureka", 2001);
V.S.Letokhov, E.A.Ryabov were awarded the State Prize of Russian Federation in science and technology (2002) for their contribution to development of “Scientific and Technological Fundamentals of Laser Isotope Separation Based on Selective Dissociation of Molecules”;
Yu.E.Lozovik - “Nauka-Interperiodika” Prize for the best publication in physics (2002);
O.N.Kompanets - Grand-Prix and Diploma for the victory in the 2nd Competition of Russian Innovations (Moscow , 2003);
G.N.Makarov - “Nauka-Interperiodika” Prize for the best publication in physics (2003);
V.I.Balykin - The Alexandr fon Gumboldt Prize (Germany , 2004);
Yu.G.Vainer - Academician D.S.Rozhdestvensky Prize of Presidium of RAS for the notable works on optics (2004);
A.V.Naumov -
- Medal and Prize of Presidium of RAS for the young scientists of Russia (2004);
- European Academy of Sciences Prize for the young scientists of Russia, Division “Physics” (2004);

- Physica Status Solidi Young Researcher Award for his lectures offered at the 11th International Conference on Phonon Scattering in Condensed Matter (2004);
- SPIE Prize for the best poster lecture at the Higher Laser Workshop in memory of A.Akhmanov (2004);
V.S.Letokhov - Honoris Causa Doctor of Lund University (Sweden, 2005);
V.M.Agranovich - Honoris Causa Doctor of B.Pascal University (France, 2005).
The Institute of Spectroscopy has close connections with advanced research centers in Australia , Canada , China , Denmark , England , Finland , France , Germany , India , Italy , Japan , Korea , Spain , Switzerland , Sweden , USA , and carries out joint research works.

Department of Atomic Spectroscopy - 2003
Laboratory of Atomic Spectroscopy
Laboratory of Plasma Spectroscopy

The Department of Atomic Spectroscopy was created by the founder of the Institute, the Corresponding Member of the USSR Academy of Sciences Prof. S.L.Mandelshtam, who had been in charge of it right until his retirement in 1989. The department consists by two laboratories: Atomic Spectroscopy Laboratory (Prof. A.N.Ryabtsev) and Plasma Spectroscopy Laboratory (Dr. K.N.Koshelev). The purpose of the department is the receiving of experimental and theoretical data about energy structures of atoms and ions which are necessary for astrophysics, for works on controlled thermo-nuclear synthesis, for the creation of vacuum ultra-violet and X-ray lasers, and also for the development of spectral diagnostics of high temperature plasma. 20 researchers including 3 Professors and 8 Doctors of Science work in the Department.

Department of Molecular Spectroscopy - 2003
Laboratory of High Resolution Molecular Spectroscopy and Analytical Spectroscopy
Section of Electronic Spectra of Molecules
Section of Microwave Spectroscopy

Department of molecular spectroscopy was founded in 1986 under the leadership of Professor R.I. Personov , who was the permanent head of the department up to his untimely death in 2002. The department consisted of three laboratories: Laboratory of Electronic Spectra of Molecules (Prof. R.I.Personov), Laboratory of High Resolution Molecular Spectroscopy and Analytical Spectroscopy (Dr. V.G.Koloshnikov) and Laboratory of Vibration-Rotation Spectra of Molecules (Prof. M.R.Aliev), and also thematic group “Vibrational spectra of molecules”. After sudden death of M.R. Aliev in 1988, and then death of R.I. Personov the department was restructured. At present, the department consists of Laboratory of High Resolution Molecular Spectroscopy and Analytical Spectroscopy (Dr. V.G.Koloshnikov) and two Sections: Section of Electronic Spectra of Molecules (Dr. Yu.G. Vainer) and Section of Microwave Spectroscopy (Dr. B.S. Dumesh). There are 32 employees in the department, among them are 3 Doctors of Sciences and 10 PhDs. The Department is headed by Dr. V.G. Koloshnikov. Various modern experimental setups are at the disposal of the department; widespread experimental and theoretical investigations on high resolution molecular and solid state spectroscopy are conducted in it.

Much attention is given to applications of fundamental research for spectral analysis and for spectral instrumentation.

Department of Solid State Spectroscopy - 2003
Laboratory of Spectroscopy of Condensed Matter
Laboratory of Semiconductor Structure Spectroscopy
Section of Fourier Spectroscopy

The department was organized in 1985 (Head Prof. G.N. Zhizhin) and it included two laboratories: Laboratory of Crystal Spectroscopy created in 1969 (Head Prof. G.N. Zhizhin) and Laboratory of Disordered Structures Spectroscopy (Head Prof. E.A. Vinogradov) changed from the group "Spectroscopy of High Resolution" in 1984 split from Laboratory of Crystal Spectroscopy in 1982.

At present the head of the department is Prof. E.A. Vinogradov (his Deputy is Prof. B.N. Mavrin). Now the department includes two laboratories: Laboratory of Condensed Matter Spectroscopy (Head Prof. B.N. Mavrin), Laboratory of Semiconductor Structures Spectroscopy (Head Prof. E.A. Vinogradov), and Center for Fourier Spectroscopy (Head Prof. M.N. Popova). The structure of the department changed since 1985, but its basis was Laboratory of Crystal Spectroscopy aimed on the development of the infrared and far infrared (FIR) techniques, the Raman spectroscopy (RS) of the organic and inorganic compounds, the study of the physical principles of coupling of the spectroscopic parameters with the structure and properties of crystals and their components (molecules and molecular ions), the spectroscopy of surface states of both solid and the surface formations on it (adsorption, chemosorption, corrosion and al.), and also the development of new automatic facilities maintaining the broad range of wavelengths (1-500 ?m) in combination with high resolution (0.001 cm-1), high photometric accuracy (0.3 %) and very high ability to the detection of spectra of monolayer and submonolayer of organic and inorganic compounds on metals or dielectrics. The second main laboratory of the department was Laboratory of Molecular Spectroscopy created in 1969 (Head Dr. Kh.E. Sterin) and changed in Laboratory of Vibrational Spectroscopy of Condensed Matter in 1987 (Head Prof. B.N. Mavrin). The Raman and hyper-Raman spectroscopy of crystals, new carbon materials, porous semiconductors, superconducting and superionic crystals, the film structures, amorphous materials and liquids is the main goal of this Laboratory.

Department of Laser Spectroscopy - 2003
Laboratory of Laser Spectroscopy
Laboratory of the Spectroscopy of Excited States in Molecules
Laboratory of the Spectroscopy of Ultrafast Processes

The Department of Laser Spectroscopy originated in 1970 with the establishment of two laboratories united by a common scientific program, common experimental instrumentation, and common research staff. These were the Laboratory of Laser Spectroscopy headed by Dr. V.S. Letokhov and Sector of Spectroscopy of Excited States under the guidance of Dr. R.V.

Ambartzumian and later headed by Dr. E.A. Ryabov. The core of the department was constituted by young scientists invited from the Department of Quantum Radio Physics of P.N. Lebedev Physics Institute and students at Moscow Physics-Technical Institute, for whom the Institute of Laser Spectroscopy became the basic study center to specialize in quantum optics. At the root of the scientific program of the laboratories were the original ideas concerning new laser spectroscopy techniques and selective action of laser light on matter that passed ahead of similar ideas put forward in other countries. This largely determined the success of the program, despite the fact that the performance level of the scientific equipment available was noticeably below that of similar instrumentation abroad. Later on the group of laser laboratories was extended to include the Laboratory of Picosecond Spectroscopy headed by Dr. P.G. Kryukov and later by Dr. Yu.A. Matveets. This laboratory succeeded in widening the circle of scientific problems under study and made the Department of Laser Spectroscopy full-fledged, its staff running to some 50 persons by 1985. The Department is a unified body of closely related investigators and specialists united by common objectives. During the course of "perestroika", when the Russian Academy of Sciences experienced difficulties in financing its daughter research institutes, the Department managed to concentrate on the most pressing problems while employing a smaller staff (25 persons in 2003). Additional funding was obtained at the time from grants awarded by the Russian Foundation for Basic Research, from finances allotted by the Ministry of Science for some scientific-technical programs, and from joint research works financed by foreign organizations.

Laboratory of Nanostructure Spectroscopy - 2003

Nanooptics and Nanolithography
Mesoscopic clusters. Quantum dots, "molecules" and "crystal" of quantum dots
Computer simulation
Quantum electrodynamics of microcavity. Femtosecond spectroscopy of microcavity
Superfluidity, Superconductivity and magnetism of mesoscopic particles and arrays of mesoscopic particles
General problems
Optics of ultrafast processes in solids
Nanomechanics. Nanotubes. New cluster materials
List of publications
Optics and electronic properties of nanostructures
Solid state spectroscopy

Single-component systems
Atoms and molecules

The study of low-dimensional electron systems in nanostructures, quantum dots, quantum wires and clusters is now one of the hottest fields of physics. On the one hand it is connected with the considerable promise of these systems for the use as elements of a new generation of micro- and nanoelectronic devices. On the other hand this field is very interesting for the basic science. For example, for an explanation of the Integer and Fractional Quantum Hall effect the standard

methods of the many-particle theory had failed and therefore the introduction of new topological occurred to be were necessary. In 2D systems in magnetic fields not only the hierarchy of the incompressible quantum liquids connected with the quasiparticles with the fractional electric charge but also compressible phases of the composite fermions and phases that connected with the quantum crystallization of electrons were discovered. It is these regions of physics the Laboratory of nanostructure spectroscopy deals with. The head of the Laboratory is Prof. Yurii E.Lozovik. The Laboratory includes two scientific Groups (theory and computer simulation Group, the leader is Yu.E.Lozovik; experimental Group, the leader is senior scientific researcher S.P.Merkulova). The main fields of research in the Laboratory are theory computer simulations and experimental studies of nanostructures that are a base of future nanoelectronics and nanooptics. The basic theoretical problems such as the superfluidity of excitons, composite fermions, quantum clusters and crystals, quantum mechanics of particles with fractional statistics, quantum electrodynamical processes in optical microcavities *etc.* are also studied in the Laboratory.

Among the fields of investigations are also nanoptics, nanotechnology, photonic crystals spectroscopy of nanostructures, physics of ultrafast processes initiated by ultrashort laser pulses, physics of clusters and new cluster materials, nanomechanics and mesoscopic physics. The general principle of the laboratory is the combination of analytical calculations based on modern possibilities of mathematical technique with computer simulations by molecular dynamics, quantum molecular dynamics, Monte-Carlo, part integral and diffusion quantum Monte-Carlo techniques . *Ab initio* simulation is used for study of complex systems in the cases where analytical calculations are impossible due to the the absence of small parameter. Computer simulations that are free, unlike physical experiments, from the influence of unimportant details, are exploited for verification of theoretical models and in search for optimum parameters for physical experiments on apertureless near field optics and nanotechnology in the Group of S.P.Merkulova. Our activity resulted in more than 400 published scientific works (including a number of reviews and collective monographs), and more than 30 Ph.D. theses (supervisor is Yu.E.Lozovik).

Some projects of the Lab were performed in the cooperation with the Laboratory of Spectroscopy of Ultrafast Processes and other laboratories of the Institute, Physical Department of Moscow State University (MGU), Institute of General Physics RAS , as well as with Technical University of Berlin, University of Goeteborg and Berkley University .

Nanooptics and Nanolithography

The plasmon surface optics with the femtosecond temporal resolution was proposed and experimentally realized in the Laboratory (in cooperation with MGU). The possibility to increase the signal of the surface plasmon was demonstrated. The proposed method was used for direct measurement of surface plasmon damping. Second harmonic at the interaction between femtosecond laser pulse and metal surface with periodic relief at conditions of ‘plasmon resonance' was studied. The noncollinear interaction between two surface plasmons was investigated for one-beam and two-beam regimes. The visualization of the surface plasmons by

acoustic microscope was studied.

A new method of optical measurements which incorporates high temporal and spatial resolution was proposed in the Laboratory. This method uses the local enhancement of the light intensity in the vicinity of the tip of a scanning probe microscope, excited by a laser pulse. This enhancement is due to the “lighting rod” effect and excitation of local plasma resonances in the tip-substrate system. Eigenfrequencies and spatial distributions of optical fields near the tip were analyzed in detail. A new method of ultrahigh laser writing (?/40 where ? is wavelength), using the strong near field (see above), has been realized on different materials. Namely, the formation of the surface *nanostructures* at the nanolocal influence of femtosecond laser pulse were observed. The strong near field can be used also for investigations of linear and nonlinear optical properties of nanostructures with the sub wavelength (nanometer) spatial resolution.

Fig.1. Nanolithography: cross-like structure with line width < 10 3 Å, created by apertureless near field method (see [57] and references therein).

Other activities:

· The cavitational processes and self-organization under the laser action on material were also studied.
· The spectra of plasmons localized near the impurities and in different inhomogeneous systems were analyzed.
· The Raman scattering on the localized plasmons and the damping of these plasmons were calculated.
· The supertransmission of the metal film with nanoholes due to the local plasmons excitation was analyzed.
· The properties of photon crystals with metal elements were studied in detail. The anomalous suppression of the electromagnetic waves scattering from the system of particles with the magnetic covering (nonreflecting covering) was predicted. The theory of the scanned capacitive microscopy was developed.
· Light backscattering in disordered 2D media due to weak localization phenomena was studied.

Quantum electrodynamics of microcavity. Femtosecond spectroscopy of microcavity.

The control Lamb shift of an atom in a cavity was considered. The new effect, namely, photonless excitation of an atom in the nonstationary microcavity due to nonadiabatic modulation of Lamb shift by nonstationary zero-point oscillations of electromagnetic field we called this effect as -the dynamical Lamb effect- was predicted. The nonstationary Casimir effect, that is the generation of photons in a vacuum at the instant shift of the neutral walls was quantitatively calculated for the first time. The statistical properties of the irradiation in dynamical Casimir effect, their angular distribution and intensity were calculated. The realistic experimental scheme was proposed for the observation of the photon generation based on the use of the femtosecond laser pulses generating in femtosecond time scale electron-hole plasma in initially transparent semiconductor film, that plays the role of ‘instantly' arising cavity wall. The nature of the experimentally observed ultrafast switching of the microcavity modes in the system

semiconductor film – metal was analyzed.

Optics of ultrafast processes in solids.
The understanding of basic processes in nanostructures in a femtosecond temporal scale is important for the elaboration of a new class of ultrafast devices and principally new basic elements for nano- and optoelectronics, for the development of principles of coherent control of excitations (e.g. excitons), for coherent control of chemical reactions (femtochemistry) and *etc.* Moreover the spectroscopy with ultrahigh temporal resolution gives the unique information about ultrafast relaxation in solids in ‘real time' and allows do select a relaxation of different groups of charge carriers. The new method for study of the Fermi-liquid properties of the electron subsystem in metals and superconductors was developed in the Laboratory. The method is based on the analysis of the spectral dependence of the ultrafast photoinduced response relaxation time studied by femtosecond pump – supercontinuum probe spectroscopy. The behavior of the spectral dependence of the ultrafast photoinduced response relaxation time was predicted for a set of conducting materials. The method is based on the experimental study of the electron relaxation rate near the Fermi surface by pump-supercontinuum probe spectroscopy. The relaxation time dramatically increases for optical transitions near the Fermi surface that gives the possibility for the direct determination of the Fermi level. The linear dependence of the electron relaxation rate observed for the underdoped oxide superconductor YBCO demonstrates the nonFermi behavior of carriers connected with strong electron correlation effects. These studies the manifestation of new type of spectroscopy, spectroscopy of relaxation times.
The electromagnetic response of superconductors for any ratio between coherence length and London penetration depth have been calculated. The theory for transitions from the valence band to the conductivity band in superconductors have been developed. The behavior of superconducting gap in this transition was analyzed. This theory was confirmed by means of the femtosecond laser spectroscopy. The new method for study of electron-phonon interaction parameters on femtosecond laser spectroscopy was proposed and experimentally realized.

The photoinduced processes in ? 60 were investigated at the femtosecond temporal scale for the wide spectral region. The processes and mechanisms of the ultrafast energy relaxation of charge carriers were studied in details that is important for the possible use of fullerenes in optoelectronics. The new method for determination of mobility edge in disordered materials by femtosecond pump-supercontinuum probe spectroscopy was proposed and experimentally realized. The method is based on the determination of the spectral dependence of a stretched exponential relaxation in a wide probing spectral range. The studies in this region are carried out in the cooperation with Technical University of Berlin, University of Goeteborg , Berkley University , Moscow State University , Institute of Chemical Physics RAS , and the Lab. of Spectroscopy of Ultrafast Processes of Institute of Spectroscopy.

Optics and electronic properties of nanostructures
Two-component systems. The spectra of excitons and biexcitons in coupled quantum wells and their behavior in strong magnetic fields have been studied. The dispersion engineering of interwell excitons and luminescence control by parallel magnetic field were proposed and experimentally

realized. This gives the possibility to determine experimentally the exciton dispersion law (with the help of fluorescence) and the dependence of the exciton mass on the magnetic field. It was shown that in strong magnetic fields, in accordance with the theory developed in the Laboratory, the magnetoexciton effective mass is determined by the relation between center of mass motion and the internal structure of exciton and this effective mass in high magnetic fields is much greater than sum of the electron and hole band masses. The instant transformation of exciton in weak magnetic field with the increase of the exciton momentum was studied.

The different phases of the system of indirect excitons and magnetoexcitons in coupled quantum wells have been considered, in particular, the properties of superfluid and crystal phases have been predicted. The magnetic characteristics and Josephson-type effects (in the nonsuperconducting system !) in coupled quantum wells with spatially separated electrons and holes have been analyzed in detail. It has been discovered that in a magnetic field smaller than some critical, CQWs behaves as weak diamagnetic. In fields greater than the critical one, the vortexes of this field penetrate into the space between wells. These works and previous works performed in the Laboratory have opened up the new physics of interwell exciton system in quantum wells. Now the very interesting experimental results were obtained in this field of physics (V.B.Timofeev *et al.;* L.V.Butov, D.Chemla; D.Snoke *etc.*). Our studies in this field carry out in the cooperation with the Berkley University and Institute of Solid State Physics RAS .

The problem of the exciton absorption in the quasi-two-dimensional nonuniform systems in the strong transverse magnetic field *H* have been considered. The photoabsorption for the random fields in single and coupled quantum wells was calculated. In the strong magnetic fields the absorption factor decreases as *H* increases in agreement with the experiment. The transport times and free path lengths for the magnetoexcitons in quantum wells have been calculated. The similar calculations have been performed also for the spatially direct and indirect magnetoexcitons in coupled quantum wells in the random field.

The weak localization of the direct and indirect excitons and magnetoexcitons in a the random potential have been studied for the first time.

The influence of the disorder on quasi-two-dimensional Bose-condensation and superfluidity of the exciton was considered. It is interesting that they are suppressed in different rates (so the possibility of the existence of superfluid without base-condensate is not excluded in the disordered exciton system!). The weak localization of Wannier-Mott excitons and plasmons in the disordered semiconductors was considered.

The dissociation and change of the ground state of the biexciton induced by magnetic field is predicted.

The theory for the two-dimensional (monolayer) electron-hole systems in the strong magnetic fields was developed. In the framework of the theory the detailed diagram analysis of the many-

particle system with macroscopical degeneration was performed for the first time. The theory gives the unexpected (at first view!) result that due to the symmetry of the interaction the magnetoexciton system in the strong magnetic field limit at any Landau level filling is the Bose-condensate ideal gas of magnetic excitons. This result was demonstrated in the framework of two approaches, the mentioned diagram analysis and by operator algebra (that is new exact solution of many-particle quantum problem was obtained!). These works were confirmed later by set of theoretical and experimental studies. The spectrum, phase diagram, and thermodynamical properties of the system were studied in detail in strong and intermediate magnetic fields.

The theory of 2D electron-hole systems with spatially-separated electrons and holes in strong magnetic fields was developed. In particular in a small density system the problem can be reduced to a system of rarefied bosons in the absence of magnetic field but with masses and interactions depending on the field. A quantum phase transition gas-liquid has been investigated in the interwell exciton system with growth interlayer separation of D. The temperature of Kosterlitz-Thouless transition to the superfluid as function of D was calculated. The quantum Mott transition metal-dielectric has been considered for anisotropic electron-hole system in coupled quantum wells. The instability of the ground state of the system of interacting indirect excitons on a film of superlattice with intermitting layers of electrons and holes has been revealed.

The stable system in the latter case occurs to be the system of indirect quasi-2D biexcitons consisting of indirect excitons with oppositely directed dipole momenta. The radius and energy of indirect exciton coupling we are calculated. The spectrum of collective modes of rarefied system of quasi-2D indirect biexcitons interacting as quadrupoles has been investigated. The density of superfluid component and the temperature of Kosterlitz-Thouless transition to the superfluid state have been analyzed in the system of indirect biexcitons.

The BCS-type instability of a bilayer system of composite fermions (at half Landau filling fraction) has been considered. The influence of composite fermion marginality (the absence of weakly damping excitations near the Fermi surface) on coupling has been analyzed.

The system of interacting spatially-separated excitons and electrons, particularly in the presence of Bose-condensate of excitons has been examined. The kinetic properties of the connected system with electron-exciton drag effects – the interaction of excitations in a subsystem of excitons and electrons have been studied. The expressions for linear response coefficients of the electron subsystem to the quantities magnitudes determining nonequlibrium state in the subsystem of excitons have been obtained. Experimental observation of these drag effects can give new information about the phase state of excitons on the electric response in the electron layer and, moreover, give a new way of control of excitons with the use of electrons transport.

An unusual Raman scattering and two-photon emission of Bose-condensed excitons, caused by simultaneous recombination (or creation) of two excitons with opposite momenta. These effects leaving unchanged the number of above-condensate excitons are possible only in the presence of exciton Bose-condensate in the system and thus can be used as a new method of its detection.

The possibility of coolling excitons by the coherent radiation in the regime of occupation trapping has been considered.

The phonon spectroscopy of a coherent phase of excitons has been studied. The possible control coherent phase of interwell excitons with the use of transverse electric and parallel magnetic fields has been analyzed.

Quantum and non-linear optics of coherent phase of excitons has been studied. The presence of angular correlation of photons due to coherent recombination of two or several excitons from Bose-condesate which can be studied in experiments of Hanbury Brown-Twiss type has been predicted. The induced backscattering from coherent phase of excitons and anomalous light propagation has been predicted (Fig. 2). A number of new many-photon effects have been predicted. The observation of these effects can serve as experimental criteria of exciton phase coherence.

Single-component systems

The quantum magnetic field initiated crystallization of 2D system of electrons in semiconductors and image forces influence on it has been predicted and studied in detail in microscopic and phenomenological approaches.

Quantum Hall effect has been considered in drift approach. The connection between quantized Hall conductance and geometric topological invariant in the system has been revealed. The drift resonance in 2D system of electrons in strong magnetic fields connected with resonance excitation of drift boundary currents along external and internal boundaries of the system. The consistent microscopic theory of collective excitations in quantum dos and arrays of quantum dots in strong magnetic fields has been developed.

The dynamic response of the system in the quantum Hall effect regime has been studied and it has been shown that it represents the properties of fractal contours of random potential. The phenomena of drift resonance in that system on the example of Fermi equipotentials has been predicted. The microscopic theory of boundary magnetoplasmons, based on the generalized random-phase approximation was developed.

The theory of composite fermions with attached two flux quanta in anisotropic system with the half Landau level filling was developed. It has been shown that shape of the Fermi-contour of composite fermions is the same as in the 2D system of electrons in the absence of magnetic field, but the dispersion laws are completely different.

The equation of state of a rarefied anions (quasiparticles with fractional statistics) system has been derived.

The spin polarization of composite fermions has been investigated. The theory is in good agreement with experiment.

In the frame of conform-invariant theory the classification of quasiparticles and gapless excitations of the system in the regime of fractional Hall effect has been introduced. The possibility of existence of a new non-Abelian type of statistics of excitations has been pointed out.

Mesoscopic clusters. Quantum dots, "molecules" and "crystal" of quantum dots

In works of laboratory for the first time mesoscopic electronic crystals and strongly-correlated states of electrons in quantum dots were investigated. Coulomb mesoscopic clusters as computer simulations and analytical calculations show in quasi-classical regime have crystalline shell structure reminiscent of hypothetic 3D or 2D Thomson atom with corresponding Periodic Table. With growth of temperature and/or ground-state oscillations (for example, with density variations) phase transitions take place in clusters. It is interesting to note that in mesoscopic 2D and 3D cluster melting occurs in several stages: at first mutual orientational melting of adjacent "crystalline" shells occurs (one or more shells remaining "crystalline" start to rotate relative to one another). Then, at appreciably greater values of control parameters, disappearance of shell structure and disappearance of "crystalline" order inside shells, i.e. the transition to Fermi-liquid take place. (See Fig.3 for illustration of such a quantum melting). This scenario is connected with smallness of barrier of relative rotation of shells relative to the barrier for the jump of particles between neighbor shells in its turn caused by incommensurability of shells of mesoscopic clusters and corresponding compensation of interactions of adjacent shells.

Fig.3 Quantum orientational melting and radial melting of mesoscopic electronic clusters. Evolution of distribution N=19 electrons with variation of steepness of confining potential (the transition from Wigner "crystal" to Wigner "molecule"). [40]

The influence of mesoscopic effects (the number of electrons in quantum dot) on the phase diagram of the system has beenstudied in detail.

Strong magnetic fields for large electronic clusters suppress the amplitude of ground-state oscillations and induce crystallization by the same way as for extended systems. But for small clusters another effect becomes essential – the growth of effective steepness of confining potential in strong magnetic fields, leading to the growth of equilibrium density of electrons. As a result the influence of magnetic field on the crystallization of the system of several electrons in quantum dots becomes non-monotonous. Analogous effects – shell structure, many-staged melting – has been discovered also for mesoscopic clusters of different nature – dipole; mesoscopic system of vortices in a superconducting island etc.

A topological classification of spherical clusters has been developed.

For calculations of quantum Coulomb clusters such methods as imaginary time method, variational method, and also some non-perturbative methods – expansion on dimensionless quantum parameter or reciprocal number of dimensions.

The reorganization of spectrum accompanying the variation of parameters of the system has been analyzed. The “molecules” of quantum dots, vertically and horizontally coupled quantum dots have been calculated , their spectra, the spontaneous magnetization– the spin reorganization with variation of structure parameters has been predicted.

Excitons and trions in quantum dots have been calculated.

The microscopic theory of low-lying collective excitations of quantum dots in strong magnetic fields, considering infinite subsequence of diagram of Coulomb interaction of the same order on small dimensionless parameter of the problem has been developed.

Superfluidity, Superconductivity and magnetism of mesoscopic particles and arrays of mesoscopic particles

· The system of mesoscopic traps with Bose-condensate of atoms (or excitons) was considered in detail. We proposed a new model describing the quantum fluctuations of the order parameter phases in the arrays of mesoscopic superfluid and superconducting structures, and their influence on the ordered state destruction. The model employs a consistent definition of the quantum mechanical ‘phase operator'. Developed theory allows studying the arrays of small traps, with very low average number of particles in a trap. In this case, the standard approach using the operators of phase and number of particles as conjugates, is not applicable. We discovered the essential difference between the phase diagrams of arrays of macroscopic and mesoscopic particles. Analogous results were obtained with the help of Bose-Hubbard model.

· The influence of weak localization of the quasiparticles in the disordered superconductor on its heat conductivity was studied.

· Transition into the superconducting state in layered systems was investigated.

· Anomalous dia- and paramagnetism of the mesoscopic particles was predicted. We have studied the properties of superconducting particles of nanometer size.

· We studied the formation and distribution of the nanometer size clusters in the dense media. The essential role of the Coulomb interaction in nanometer ballistic contacts and semiconductors was analyzed.

Nanomechanics. Nanotubes. New cluster materials

The recent progress in nanotechnology has enabled researchers to construct the nanomechanisms and nanoelectromechanical devices, in particular, using the nanotubes. In multi-walled carbon nanotubes, as the calculations show, energy barriers for the relative interlayer motion are low, and so one can use them as moving parts of nanomechanisms, that was experimentally realized recently. In this connection we proposed the classification of the multi-walled nanotubes' structures, calculated their potential relieves in detail, and analyzed the energy barriers for the

relative motion. We studied the double-walled nanotubes with the potential relieves corresponding to screw-nut threading. Various types of motion were analyzed in microscopic approach. The new nanodevices with the motion of screw-nut type were proposed.
The mechanisms of formation of new carbon nanostructures (fullerenes, nanoparticles, nanotubes and cones) were analyzed in detail. Effect of mutual orientational melting of the shells in multi-shell carbon nanoparticle (‘onion') was predicted. Potential barriers for the relative shells rotation in the carbon nanoparticle were calculated. We estimated the temperature of orientational melting of the nanoparticle. In light of the possible application utilization of the fullerites in optoelectronics we studied in detail the ultrafast processes in these materials.

Solid state spectroscopy
We have developed the microscopical theory of crystal oscillation spectra, that consistently takes into account all lattice anharmonicities of the same order in the small (up to the melting point) dimensionless parameter: the ratio of the mean squared atom's displacement from the lattice sites to its period (generalized Lindemann parameter). Summation of the infinite set of the diagrams of the same order in mentioned parameter gives the closed system of equations for the oscillation frequencies. Numerical solution of this equation shows that the phonons soften with the increase of controlling parameter (temperature density of particles, etc.). The spectrum softening is linear in the beginning at the small temperature, then it is sharper, and, at last, at some value of the controlling parameter, the real solution for the frequency of transversal oscillations disappears. This is the manifestation of instability connected with the disappearance of the shear modulus (or transverse long wavelength phonons). Thus one can find the melting point from the first principles, for given potentials of interaction between the particles. The calculations are in good agreement with the physical and numerical experiments. In addition, we explained the universality of the Lindemann parameter and other values.

. Convincing evidence in favor of this theory (in addition to the adequate analysis of the skeleton diagrams in anharmonicities in the perturbation theory) is the very good agreement of the theory conclusion with the results of physical and numerical experiments for a set of two-dimensional crystals. Empirical melting criterion, particularly Lindemann criterium was generalized and proved for the two-dimensional systems (usual Lindemann criterion is of no use for two dimensions, because the mean squared displacement of a particle from the site diverges in thermodynamical limit).

New methods for the phonon laser creation were studied. Weak localization of excitons, plasmons and quasiparticles with random masses in disordered system was investigated.
The phase transitions in a set of three-dimensional physical models, described by the XY-model, were studied. We described the phase transition spiral-ball for the vortices and discovered the connection between the fractal dimensionality of the essential topological excitations and critical exponents of the phase transitions.

Atoms and molecules
In a wide region of magnetic fields we studied the spectra, oscillator forces and other

characteristics of few and many-electron atoms, ions and molecules. The sharp change of structure of an atom moving in the strong magnetic field with the increase of its magnetic momentum was studied in detail. Velocity of an atom in the magnetic field is the non-monotonous function of its momentum. We have calculated the maximum possible transverse velocity of an atom in the given magnetic field. The atom mass dependence on the magnetic field was analyzed in detail. We also considered the paramagnetism of many electron atoms, and the molecular dissociation and reconstruction of the bond type in the ultrastrong magnetic fields. By means of the expansion in the inverse space dimensionality we analytically calculated the approximate dependencies of three atom binding energy *versus* the interaction parameters, obtained the condition of the cluster formation from several particles and its spectrum, and determined with the high accuracy (up to ten signs!) the constants of the van der Waals interaction (including the non-adiabatic corrections).

The toroidal atomic moment, connected with the parity nonconservation, was predicted and calculated for the first time. The methods of its measurement were analyzed.
The Bose-condensation of atoms and strong-correlation Tonks regime in the quasi-one-dimensional traps was considered. The drag effects in two vertically coupled traps with Bose-condensed atoms were studied.

Computer simulation
We developed new methods for the computer simulation of the quantum systems dynamics (Quantum Molecular Dynamics) based on the Wigner approach in the quantum mechanics and quantum tomography. The latter approach seems to be quite promising, because in its framework quantum mechanics is formulated through the introduction of the nonnegative function, in contrast to other approaches. This, in principle, allows to overcome the difficulties with the sign "problem" in Fermi-systems simulations.

By means of these methods we stimulated the tunneling of the wave packets, calculated the tunneling time, studied the influence of the interaction on the tunneling time, and also weak localization of electrons in disordered systems.

With the help of the Diffusion Monte Carlo we calculated the influence of the disorder on the Bose-condensation and the regime of strong correlation in the one-dimensional Bose system.
By means of the Path Integral Monte Carlo we investigated the coherent and strong-correlation states in a number of Fermi and Bose systems, particularly, in mesoscopic systems of electrons, atoms with induced dipoles or dipole excitons etc.

Using computer simulations we calculated the spectra, thermodynamic and structure properties, as well as the melting, of a set of infinite two-dimensional systems with Coulomb, dipole-dipole and van der Waals interactions.

By means of the computer simulations we investigated the nature of melting of the two-dimensional crystals and for the first time discovered the earlier predicted theoretically gexatic

(liquid crystal) phase in two-dimensional electronic system. We also demonstrated that the melting of the electronic crystal indeed takes place in two stages. Anharmonic structure of the spectra of crystals were investigated using the computer simulation. Its results show that with the increase of temperature the softening of the transversal phonons and hardening of the longitudinal phonons take place.

The mesoscopic electronic crystals and strongly correlation electronic states in quantum dots were investigated for the first time.

General problems

The general analysis of the phase transitions in the two-dimensional systems was performed using the conform field theory. We developed in detail the non-perturbative (by the interparticle interactions) method for the calculation of the bound states in quantum systems, that employs the e -expansion near the space dimension d=2, as well as the 1/d-expansion, where d is the space dimensionality.

The equation of state for the quasiparticles with the fractional statistics (anyons) was analyzed. The mechanism of quarks confinement, based on the stochastic behavior of the gluon fields and Anderson localization in the corresponding random static effective potential, was proposed.

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Scientific Organizing Department

The Department was organized as independent structure in 1995 on the base of scientific secretary personnel, and Scientific Secretary Dr. O.A.Tumanov became the chief of this Department. At now the chief of Scientific Organizing Department is Dr. E.B. Perminov. Actually there are working: assistant of direction V.M.Perkova, assistant of Scientific Secretary A.V.Letokhova, office chief G.T.Shevchenko, patent specialist V.N.Solyankina, workers of Xerox service - I.A.Yashin and R.Z.Naryshkina.
The main task of this Department is organizing ensuring of scientific researches of the Institute including:

preparing of meetings and documentation of Scientific Council;
preparing of plans and reports of the Institute;
organization of annual competitions of scientific publications;
planing of international contracts, organization of scientist's foreign trips and reception of foreign specialists in the Institute.

Department supervises the work of the scientific library (A.N.Makarova - chief, Z.N.Nazarova and E.A.Nikolaeva - library stuff).

The library fund has 58600 published units including 12150 Russian and foreign books on optics, spectroscopy and some associated subjects, 4500 periodical publications (36 Russian and 120 foreign journal titles) and also the fund of small circulation publications (theses, reprints, papers and so on). In the library funds there are also the collections of books of Russian Academicians A.S.Borovik-Romanov, G.S.Landsberg, L.I.Mandelshtam, S.L.Mandelshtam, E.V.Shpol'skii presented by their families.

Actually the Institute library receives journals of 24 Russian and 33 foreign titles. The library has connection with Internet and has 5 data bases: “Current Contents (PCES)”, “Publications of the Institute Spectroscopy workers”, “Books on Optics and Spectroscopy”, “Fullerenes”, “Surface Science”.

Once for two years the bibliography “Books on Optics and Spectroscopy” prepared by A.N.Makarova is published in Russian journal “Optics and Spectroscopy” under the redaction of V.B.Belyanin..

The work of the library is supervised also by Library Council consisted of Yu.E.Lozovik(head),V.G.Koloshnikov,E.A.Ryabov, A.N.Ryabtsev,O.A.Tumanov and A.N.Makarova. This council regularly discusses the Institute subscription policy and library needs. Every year the Scientific Council hears the library report.

The Institute Xerox service has modern copy equipment and ensures the copying materials for library, scientists and different institute services with the volume of copying about 7-10 thousand pages monthly.

Department supervises also the development and modernization of the Institute computer net (main responsible is D.V.Serebryakov). Computer net is constructed on the base of Ethernet UTP. Trere are the lines of 10 Mb for personal computers , server and two commutators are working with the speed of 100 Mb.Actually 150 PC are connected to this line.

As the result more than 100 scientists have a possibility of direct connection via Internet with different sources of scientific information.

Department spends many efforts for artistic preparing of materials for different exhibitions, seminars and conferences. Some of the last took place in the Institute conference-hall.
The conference-hall (for 145 persons)has very good acoustics and is equipped by modern projection technics. Different kinds of meetings take place there - general meetings of institute's workers, meetings of Scientific Council, annual publication competition conferences, all institute seminars (head of seminars is Dr. V.G.Koloshnikov), department and laboratory seminars. Big foyer allows to expose there exhibition materials, posters during conferences and to organize “coffee and tea breaks”.

Institute conducts the formation of scientific and scientific-pedagogical stuff in two directions: post graduate education (form principal) and the competition of doctor's degree without post graduate study. This activity is organized by V.M.Perkova.

During 5 last years (1998-2003) 16 post graduate students and 7 competitors passed their post graduate education in the fields: “Optics”, “Theoretical Physics” and “Solid State Physics”. Post graduate student guidance was realized by professors (4) and doctors of sciences(4) - essentially by the chiefs of departments and laboratories.

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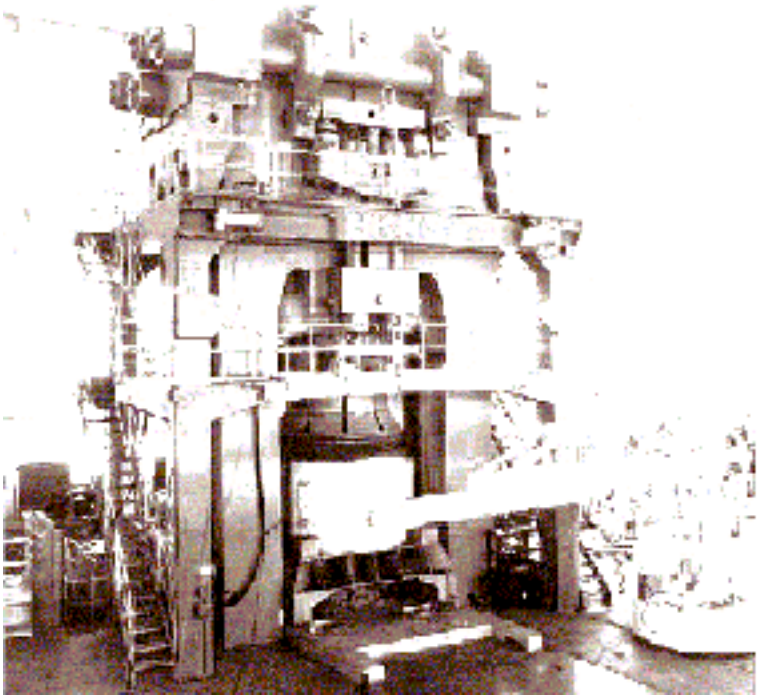
Institute of high-pressure physics of them. L of F of Vereschagina



The Institute, founded by Academician L.F. Vereshchagin in 1958, received international recognition in the beginning of 1960's due to the successful synthesis of diamond and cubic boron nitride. The original equipment and technologies, developed in the Institute, were introduced to more than 45 organizations and established the basis of the diamond industry in the USSR. The subsequent synthesis of a superdense silica modification, that won world-wide recognition and led the path for future investigations of the physics of the Earth and planets, confirmed the position of the Institute as a first-class scientific organization.

At the same time, a high pressure physics discipline was also developed at the Institute that included investigations of structural, elastic, and electronic properties of the solid under high pressures and resulted in many considerable scientific achievements. The Institute has received 2 certificates of discoveries (the synthesis of dense silica phase and detection of electronic topological transition under high pressure), about 400 patents of inventions (of these 48 abroad) and published more than 3500 papers.

At present, the Institute has 12 scientific and applied scientific subdivisions with 115 research workers, (20 Doctors of Science and 76 Candidates of Science). The scientific mission of the Institute concerns the investigation of substance properties in conditions of strong static compression that can be divided in two basic parts: Fundamental investigations of the structure, electronic properties, stability and phase transformations under pressure in various substances, including the construction of theoretical models of observed phenomena. High pressure materials technology, which includes syntheses of new materials and investigation of their properties. This direction covers the synthesis of diamond and cubic boron nirtide monocrystals, as well as new crystalline and amorphous forms of carbon; the development and investigation of new composite ultradispersed superhard materials and alloys; as well as the development of technology for producing various types of tools on the basis of superhard materials.

The Institute has a wide range of contacts with scientific organizations in Russia and abroad. Joint investigations are held with institutes of the Russian Academy of Sciences such as: the Institute of Crystallography, the Physical Institute, the Institute of General Physics, as well as the Joint Institute for Nuclear Researches, the Institute of Graphite, the Moscow State University, Los Alamos National Laboratory (USA), Geophysical Laboratory of Carnegie Institute (Washington, USA), Oxford and De Montfort Universities (UK), Grenoble High Magnetic Field Laboratory (France), the International Laboratory of High Magnetic Fields (Poland), and a number of other scientific organizations from Germany, Poland, France, USA, China, Japan.

Technological developments and scientific equipment made in the Institute are applied in many scientific centers and companies of Great Britain, Germany, France, USA, China, and other countries. Because efficient and up-to-date scientific work in the field of high pressure physics cannot be carried out in the framework of a single institute, no matter how large it may be, without using powerful sources of neutron and synchrotron radiations, highly efficient computers, etc, the institute continues to promote international scientific collaboration and is

always ready to cooperate in the field of fundamental and applied investigations.

Laboratory of Phase Transitions

Principal lines of investigations

Pressure induced quantum phase transitions

Low temperature magnetism and superconductivity, unconventional superconductivity, heavy fermions

Thermodynamic properties of substances in at high pressure

Basic equipment:

Helium gas high pressure installation and cryostat for studies of various properties of substances at hydrostatic pressures to 1.5 GPa and low temperatures down to 1.5 K.

Miniature clamped toroidal anvil cell supplied with a liquid-filled capsule for studies of electrical, magnetic and thermodynamical properties of materials at hydrostatic pressures up to 6 GPa and temperatures down to 1.1 K.

Installation for studies of thermodynamic properties of materials in the range 0-3GPa, 300-650K by the adiabatic pressure pulse technique.

Hydraulic presses (30-500 ton), liquid compressors, piston-cylinder and toroid devices for various high pressure applications.

Most important results:

Discovery of superconductivity in boron-doped diamond synthesized at high pressure

Observation of unconventional superconductivity in a heavy fermion material Ce2RhIn8 near antiferromagnetic quantum critical point at high pressure with Tc = 2.2K that is order of magnitude higher than Tcís of other known materials with magnetically mediated superconductivity.

Revelation a bridge between physics of HTSC cuprates and unconventional heavy fermion superconductors at studying of low temperature P-T phase diagram of CeCoIn5

Laboratory of Disordered Condensed Matter

Principal lines of investigations

Phase transitions; synthesis of metastable phases; investigation of phase diagrams using the ultrasonic method; non-equilibrium phase diagrams

Properties of melts under high pressure; quenching of melts under pressure

Solid-state amorphization; preparation and physical properties of new amorphous phases

Nonequilibrium transformation in disordered condensed matter

Structural transformations in new allotropic forms of carbon (fullerites, carbynes); synthesis of new carbon materials

Study of physical properties during plastic deformation and brittle failure of solids under high hydrostatic pressure

Basic equipment

Apparatus for investigating the elastic properties of poly- and mono-crystals by the ultrasonic method (*T=300 K*, *p<9 GPa*; *77<T<300 K, p< 2 GPa*).

A set of "toroid" - type high-pressure chambers with the working volume 10-100 mm3 (*p* up to *12.5 GPa*, *100<T<1800 K*), with the programmable rate of heating and cooling.

Complex apparatus for performing mechanical testing under pressure with the static and dynamic load up to *1.5 GPa*.
A set of the automated experimental facility for calorimetry *(300 <T<1450 K)*, dilatometry *(4.2 <T<500 K)*, and electro-conductivity measurements *(4.2 <T<500 K)*

Most important results
Transitions similar to those of the first order in crystals have been found in melts of several elements.

Bulk amorphous specimens of tetrahedrally-bonded semiconductors have been prepared for the first time using the method of solid-state amorphization.
Mechanical instabilities of crystalline lattices during solid-phase amorphization and structural transformations in the amorphous solids under pressure have been experimentally detected for the first time.

Systematic investigations of the behaviour of elastic moduli during structural and electron transitions have been carried out for a number of crystalline and amorphous phases.
The athermal movement of dislocations at low stresses and dependence of their mobility on the shear modulus *G(T,P)* have been detected for alkali-halide crystals.

DEPARTMENT OF MONOCRYSTALS
Principal lines of investigations
Structural and physical-chemical aspects of phase transformations.
Crystal growth, crystal structures, and properties of high pressure phases.
Basic equipment
Temperature controlled high pressure apparatus for synthesis, physicochemical investigations, and growth of monocrystals under pressure up to *10 GPa* and temperature up to *2000 K*.
Diamond anvils for X-ray and optic investigations under pressure up to *50 GPa*.
Spectrometer for the study of g-g correlations under pressure up to *30 GPa*.

In the course of scientific activities of the Department, a number of original results have been obtained. The sequence of polymorphic transformations and chemical reactions has been established in single- and multi-component systems of different types (oxides, hydroxides, fluorides, etc.) under variable *p, T* parameters; the corresponding generalized schemes have been constructed. Compressibility of a large number of elements and compounds has been measured, and equations of state determined. Several dozens of new high pressure phases have been obtained. Methods for growing monocrystals of high pressure phases of metals, semiconductors and dielectrics have been developed. Investigations of grown monocrystals have resulted in establishing the mechanism responsible for the formation of superdefect fluorite-like solid solutions. The phenomena of incommensurability, twinning and modulation of structural and thermal parameters have been found and studied. The role of pressure-induced electron transitions in the formation of new compounds of *d*- and *f*-transition metals has been established, and the competition between the magnetic, superconducting, and intermediate-valent states in

these compounds has been investigated.

The activity of Low Temperature Laboratory is concerned with the studies of pressure influence on the energy spectra and kinetic properties of electron system including the effects of interactions with spin and phonon subsystems as well as the investigations of the prospects of using high pressure for synthesis of such materials.

The main objects under study are superconductors (including HTSC), manganates, semiconductor structures with the 2DEG.

Experimental facilities include cryostats, superconducting solenoids up to 10 T, electromagnet up to 2 T, an assembly for obtaining pulsed magnetic field up to 25 T (duration 10-100 ms), a variety of low temperature cells of cylinder-piston type for pressures up to 3 Gpa, chambers for synthesis and automated systems for magnetic, magneto-transport, tunneling and thermoelectric measurements and structural investigations. The laboratory owns a liquid helium refrigerator

SCIENTIFIC-APPLIED LABORATORY OF ADVANCED MATERIALS AND TECHNOLOGIES

The laboratory investigates the possibilities of applying high pressures, including those in large volumes, for producing new materials with unique properties.

Principal lines of investigations

Development of technology for producing carbon-carbon composite materials.
Development of methods for obtaining large polycrystals and ceramics on the basis of superhard materials.
Studying fullerite transformations under high pressures.
Development of high-pressure equipment and the study of high pressure impact on microbiological and biological objects.

Basic equipment

A set of hydraulic presses with forces from *10* to *6000 tons*; the largest in the world, hydraulic press with the force *50000 tons* (the Big Press);
A set of the "toroid" type high-pressure chambers (hole diameter *10, 15, 35*, and *50 mm*).
A set of "piston-cylinder" high-pressure apparatus (piston diameter from *150* to *1000 mm*), in which free-flowing materials are used as a pressure-transmitting medium.
A set of high-pressure apparatus designed for investigation of biological objects under hydrostatic pressures up to *2 GPa*.

Most important results:

Technology for producing blanks from carbon-carbon composite materials with diametes up to *700 mm* and heights up to *500 mm* has been developed and brought into commercial practice (in cooperation with Institute of Graphite).

Technology for prepraring (sintering) diamond polycrystals (compacts) from synthetic and natural diamond micropowders with diameters up to *15 mm* has been developed and is being introduced into production;
Non-equilibrium *P,T* phase diagram of fullerite *C60* has been investigated quantitatively under pressures up to *9 GPa*.

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Institute of space investigations

As the leading organization of the Russian Academy of Sciences in the field of investigations of Outer Space, Solar System planets and other objects of the Universe, Space Research Institute (IKI) is primary in charge of long-range planning and elaboration of space research programs of which a considerable part is performed within the framework of international space research cooperation.

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Space Research Institute
Programs

High Energy Astrophysics

High Energy Astrophysics at IKI, Moscow

High Energy Astrophysics department at **IKI**, Moscow, is carrying out research in various fields of X-ray astronomy: physical processes in the vicinity of compact sources of x-ray emission, x-ray observations using Russian space observatories **MIR/KVANT** and **GRANAT**, development of scientific instrumentation for the **SPECTRUM-X-GAMMA** mission and **ALPHA** space station, participation in the **INTEGRAL** project and observations on the **RTT-150** optical telescope.

Planetary Exploration

The exploration of the planets figured prominently in the Space Research Institute (IKI) activity. Experimental studies are given priority. They are conducted by methods of optical and infrared spectrometry, photometry and infrared radiometry, mass-specrometry, gas chromatography, and X-ray fluorescent spectrometry.

Meteorological measurements are taken on the surface and in the atmospheres of other planets.

Alongside experimental studies considerable attention is given to the elaboration of theoretical problems, mainly in the field of the simulation of processes in planetary atmospheres, including the early stages of their evolution.

Laboratories

Planetary spectroscopy
Direct physical and chemical studies of planets
Dynamics of planetary atmospheres
Mass-spectrometry
Photometry and IR-radiometry
Optical studies of upper planetary atmospheres
Mass-spectrometry of plasma and gases

Missions and experiments

Lidar
Marses
Mars Climate

Some Images of Interplanetary Probes

Venera-8 (150k)
Venera-13 (268k)
Venera-15 (544k)
Venera-15 (561k)
Mars-3 (64k)

Data
Solar System Data Archive (SSDA) contains data sets passed through various levels of processing: the telemetry data and processed data. Telemetry data are grouped according to project name.

The processed data are divided into:
the planetary data subdivided into
atmospheres
surfaces
small bodies
planetary plasma
images sections;
the data collected by the spacecraft in the way from Earth to planets subdivided into
Sun
interplanetary space sections.

The SSDA includes also information in the form of templates in the PDS format. The SSDA includes also public domain data of some non-Russian planetary missions of interest for Russian users.

Space Plasma Physics
Space Plasma Physics is one of the main lines of theoretical and experimental investigations performed at the Space Research Institute (IKI). All stars, including the Sun, the interstellar and interplanetary medium, planetary upper atmosphere (ionosphere) - in a word, roughly 99% of matter in the Galaxy is in the plasma state. The processes of the transformation of some types of energy into other, which constitute the essence of active phenomena on the Sun and in the close vicinity (magnetospheres) of the planets, including the Earth, are of plasma nature.

The tasks of some theoretical and experimental laboratories at the Institute is to construct models of planetary magnetosperes and to study individual physical phenomena specific for such

complex and interlinked systems as solar wind - magnetosphere - ionosphere system.

Laboratories
Theory of space plasma processes
Acceleration processes in space plasma and radiation problems during space flights
Near-planetary and interplanetary plasma
Study of electromagnetic measurements
Study of solar wind
Physics of magnetosphere processes
Engineering and technical support of project experiments and applied works

Missions and Experiments
Interball
Prognoz 1 - Prognoz 12
Arcad
ROY
RESONANCE
Experiment Neutral-E @ MIR station
Experiment INTMINS @ MIR station
Scientific Research School Satellite-1 "Kollibri" ("SRSS-1") (also in Russian)

Data
Data of Interball project.
Interball-Tail Key Parameters
Description and WWW download service (including most recent data and orbits). A subset of these data is also available at CDAWeb site in NASA/GSFC.
Interball-Auroral Key Parameters
Description and WWW download service. A subset of these data is also available at CDAWeb site in NASA/GSFC.
IKI Satellite Situation Center Interball & Interball-related orbital information. Graphical and ASCII data with Interball orbits, expected crossings of magnetospheric regions and conjunctions with other spacecraft and ground facilities.
Entry to the open part of Interball FTP-archive (with auxiliary information). Not recommended unless you know what are you looking for.
Interball publication lists for 1996-1997, 1998, 1999. Some references are in Russian.
DD-system WWW interface. DD is a network system for storing, processing and plotting of any kind of scientific data. It includes selected Interball full-resolution field and particle data. Password is required (except description).
Space Weather service: ACE real time solar wind data and simple geomagnetic activity forecast.

Data of previous solar terrestrial missions: Prognoz-7,-8,-9,-10, Arcad, Active, Apex. Archive mostly containes copies of old 9-track IBM magnetic tapes.

WWW-sites of future and associated solar-terrestrial projects of IKI: ROY (definition study), Resonance (definition study), SPRUT, etc.

Guide to russian ground observation facilities (magnetometers, etc).

Links to our partners' home pages:
Goddard Space Flight Center
Inter-Agency Consultative Group
European Space Agency (ESA)
Institute of Space and Astronautical Science, Japan
CNES, France
MPI fur extraterrestrische Physik, Germany

Space Weather
Space Weather service: ACE real time solar wind data and simple geomagnetic activity forecast.

IZMIRAN forecast center of geophysical situation: Forecasts for atmospheric pressure, temperature and other parameters. Updated every hour.

Institute of Applied Geophysics: Geomagnetic situation forecast for the next week.

Today's Space Weather: Presented by the Space Environment Center.

Real Time Solar Wind Presented by the ACE.

SpaceWeather.com Science news and information about the Sun-Earth environment.

Earth Research
Scientific Departments
Satellite monitoring technologies
Earth remote sensing
Information and methodical support for targeted remote sensing projects
Seminar
Interdisciplinary seminar "Satellite methods and systems for Earth research" (chairman - corresponding member of Russian Academy of Sciences G.M.Chernyavsky)
Main Projects
SMIS Information System for Acquisition, Processing, Storage and Distribution of Satellite Data
Since 1995 provides automated acquisition, processing and archiving for data from NOAA satellites covering European Russia and Western Siberia. Provides operational access to satellite data and derived products. The system is used for testing and evaluation of new methods and technologies of processing, storage and dissemination of satellite data.

Information System "AVIALESOOKHRANA"

Developed for support of operations of Central Airbase of Russian Forest Defense Service ("Avialesookhrana"). In operation since 1996. The system is under continuous development by cooperation of specialists of Avialesookhrana, International Forest Institute, Institute of Solar-Terrestrial Physics (ISZF SO RAN) and Space Research Institute (IKI RAN). The system implements fully-automated technology for satellite data acquisition and distribution. Currently it presents automatically-updated information on observed wildfire conditions, fire elimination statistics and reports, results of specialized satellite data processing with almost whole Russia coverage.

Information System "Russia's Weather"
The system has been developed and is supported jointly by HydroMetCenter of Russian Federation and Space Reserach Institute (IKI RAN). In operation since 1997. Provides remote access to observed weather data and 6-day weather forecast, as well as access to corresponding satellite data. The information system implements automated data reception and processing scheme, as well as automated procedures for data transfer to various information sites and specialized information systems.

Information System "SPUTNIK"
The system is under development by collaboration between IKI RAN and SRC "Planeta" (of Roshydromet). In operation since 1997. Provides automatic collection, processing and cataloging of satellite data and remote access to information. The information system receives satellite data from ground centers located in Obninsk, Novosibirsk and Khabarovsk from the following satellites: RESURS-01, METEOR, OKEAN-01, OKEAN-O, METEOSAT, NOAA, GOES, GMS.

Information System "RESURS"
Developed and supported on behalf of "Center for Space Observations" (of Rosaviakosmos). In operation since 1999. Implements automatic collection, processing and cataloging of data from satellites RESURS, OKEAN-O and METEOR-3M. Data are received from ground centers in Elista, Priozersk and Irkutsk. Provides remote access to information.

Industrial Monitoring System of State Fishery Committee
Developed and supported jointly by experts of VNIERKh, KCCM, NCM, IKI RAN, VNIRO, ZAO "Atlas", ZAO "Vector". In operation since 2000. Intended to support fishing fleet and environmental conditions monitoring tasks. Provides facilities for collection and presentation of data on fishing vessels tracking and positioning and corresponding weather satellite data. Supports both local and remote access to information.

Automated System for Data Acquisition, Processing and Distribution of Kamchatka Center for Communications and Monitoring
Developed and supported by experts of IKI RAN, VNIERKh and KCCM as a subsytem of Industrial Monitoring System of State Fishery Committee. Automatically processes data and delivers information on cloud conditions, sea surface temperature and ice conditions in Okhotsk

Sea, Bering Sea and Japan Sea. In operation since early 2002.

ADI'DAS Project
"Advanced Detection and Interpretation of Oceanic and Atmospheric Signatures in Dual Polarization Airborne and Spaceborne Radar Imagery (ADI'DAS)"

IKI Satellite Situation Center

The situation analysis for the **space physics mission** is based on the orbit calculations and satellite position localization relative to the simulative magnetospheric structures.
Ballistic center of the M.V. Keldysh Institute of Applied Mathematics Russian Academy of Sciences (KIAM RAN) provides the definition of the orbital elements by using the orbital radio measurements.
IKI Satellite situation center (IKI SSC) provides the satellites motion calculation and prediction of the orbital situations. The produced tabular and graphical information is available via **WWW**.
The Scientific Community and Operation Group use the situation analysis results for the mission **science planning** and coordination with **groundbased investigations**.
The standard of the multiprobe's situation presentation developed for the multiprobes INTERBALL project was successfully transmitted to the multimission situation analysis.
The multimissions relative situation analysis is used for coordinated measurement planning and data analysis in the Space Physics campaigns.
The orbital elements of the NASA space physics missions are distributed by the IACG (*InterAgency Consultative Group*). This data are available as anonymous via WWW and FTP service of the **INTERNET**.

Russian Space Science Internet

Russian Space Science Internet (RSSI) is a successful result of RSSI Project. It is one of the non-profit networks in Russia. According to Acceptable Usage Policy (AUP) RSSI provides access to worldwide Internet for Russian science community, including:
- space oriented organizations;
- academic and research centres;
- medical organizations;
- educational organizations.

RSSI offers for its members :
direct IP connections via fiber-optic, digital or analog circuits;
dialup service ;
videoconferences via MBONE Internet protocol (there are 2 tunnels available now through the general IP network: one to NASA Internet, and another to Moscow State University);
technical support and consulting for RSSI members by high qualified engineering staff;
24 hours a day / 7 days a week network monitoring and user support by RSSI NOC staff.

RSSI interconnecting routing system bases on BGP4 protocol. It is designed so that all organizations connected to the RSSI gain access to the resources of Russian computer networks

as well as world wide Internet. As it is shown on RSSI Interconnections Map the current routing scheme is oriented to two peer interconnect exchange points in Moscow:
RMIX - Moscow Fiberoptic Backbone. Southern Moscow Fiberoptic Backbone uses TCP/IP as its transport protocol. It joins russian scientific community via FDDI (Fiber Distribute Data Interface) technology in its DAS (Dual Attached Stations) version. FDDI communication line was built by NPP &quotROTEK".
M9-IX - Internet eXchange at M9 node. Space Research Institute situated near M9 node connects to M9-IX via IEEE802.3 fiberoptic line (100 Mbps). Space Research Institute - M9 fiberoptic link is provided by NPP "ROTEK".
and one international data-transfer circuit:
512 Kbps between Space Research Institute RAS - NISN point in Telecom Centre (ROSTELECOM, Ostankino, Moscow) - Goddard Space Flight Centre (NASA, USA) .
The Yuri Gagarin Cosmonauts Training Center
"SPUTNIK" Server

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Data Archive
Data Archive (DA) was created in IKI in order to:
move data produced by previous mission from old 9-track magnetic tapes to modern media in order to save the data for future use;
data acquisition and distribution Interball
provide easier access to the data using IKI Local Area Network and make it reachable for external use;
create the catalog of available files so that it would be possible to know what data are available and to search for necessary data.

DA hardware

SUN SPARCstation 20/502 with 140GB of disk storage;
SUN SPARCstation 4;
SUN ELC workstation with 4GB of external disk storage;
9-track 1/2" tape drive;
CD-Recorder;
8mm tape Exabyte jukebox for nearline archive storage (10 tapes for total of 50 Gbytes);
Exabyte drive;
two 4mm DAT drives.

Currently DA contains scientific telemetry data sets of following missions:
Prognoz-7
Prognoz-8
Prognoz-9 (Relict)
Prognoz-10
Arcad
Active
Apex
Gamma

The same facility is also used for other projects including Interball Data Archive in order to provide archival storage and access for their data.
Marina Shevchenko,
Data Archive Administrator
mshevche@iki.rssi.ru

Current and future missions and experiments

Interball
Hend @ 2001 Mars Odyssey
Integral (INTErnational Gamma-Ray Astrophysics Laboratory)
Spectrum-X-Gamma
RTT150 - Russian-Turkish 1.5-m Telescope
ROY
Resonance
ISS-Obstanovka *new!*
CYGAM

Other Activities

Astronomy Letters - a journal of astronomy and space astrophysics
IKI cooperation for optical observations of cosmic gamma-ray bursts
Remote sensing of ocean - a collection of radar images

As the leading organization of the Russian Academy of Sciences in the field of investigations of Outer Space, Solar System planets and other objects of the Universe, Space Research Institute (IKI) is primary in charge of long-range planning and elaboration of space research programs of which a considerable part is performed within the framework of international space research cooperation.

Seminars & Workshops
Space Science Week
The 6th INTEGRAL workshop "The Obscured Universe", *2006, july 2–6*
IKI Seminar
Seminar on Mechanics, Control and Informatics
Conference Archive
Local mirrors of space and astronomy sites
Mars Pathfinder, Global Surveyor, Mars Surveyor 98 and Mars Surveyor 2001 missions
The Nine Planets - a multimedia tour of the Solar System
Views of the Solar System
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Crystallography institute of them. A. V. Shubnikov

The Shubnikov Institute of Crystallography of the Russian Academy of Sciences (IC RAS) was officially given the name of its founder and first director, Full Member of the USSR Academy of Sciences Professor Aleksei Vasil'evich Shubnikov, in 1971. In 1969, the Institute was awarded the Order of Red Banner of Labor.

The Institute is located in Moscow in buildings on Leninskii pr. 59 and ul. Butlerova 17a and has a division (Research Center for Space Materials Science) in the city of Kaluga.

The Institute Management and its departments are located in the Main Building.

Research is traditionally performed along three main directions-crystal growth, crystal structure, and crystal properties. Recently, great attention is also paid to developing the scientific program and the mathematic apparatus and methods for using synchrotron-radiation sources located in the Moscow oblast for structural studies of various organic and inorganic materials.

The information on the Institute of Crystallography is given in two languages — Russian and English. These two versions are not always identical, but both provide the same information on the major research directions and achievements of the institute. The Internet site allows one to get acquainted with the institute structure, its history and achievements, and its major publications.

One can also find information on the international cooperation of the Institute and its participation in the organization of various scientific conferences and seminars. The Section «News» (currently in Russian) provides the recent data on current and planned closely related to the Institute's research and activity. There you also can use the Message board to arrange your own information or take part in discussions carrying at the Institute Forum.

The Institute of Crystallography performs research along three main directions
Crystal Growth:
the study of the processes of crystal formation and crystal growth, the development of methods for synthesizing crystals and designing corresponding apparatus.

Crystal Structure:

the study of ideal *atomic* and real *defect* crystal structures.

Crystal Properties:
the study of symmetry and physical properties of crystals, search for crystals with valuable properties.

Priorities:
The search for new crystals and structures with preset properties and the development of methods of their growth.
Interaction of the X-ray and the synchrotron radiation, electrons, and neutrons with condensed media. Development of methods for studying structure and properties with the use of synchrotron radiation.
Biological materials science (methods for synthesizing, crystallization, and studying structures and properties of biological objects) and organic systems.
Space materials science.
Surface, subsurface layers, interfaces, and thin films. Synthesis, study of structures and properties, development of methods for crystal diagnostics.
Innovation activity in the field of crystal growth and designing apparatus for crystal growth and X-ray studies.
Designing of equipment for the above priority researches.
Preparation of scientific staff for research in modern fields of crystallography and crystal physics.

BASIC ACHIEVEMENTS

Theory of Symmetry
The theories of antisymmetry, similarity symmetry, and color symmetry groups were developed.

Structure
The atomic structures of several hundreds of materials were determined by modern X-ray, electron, and neutron diffraction methods from numerous minerals to the structures of biologically active crystals and macromolecules, and, first of all, of proteins. The imaging theory and the method of three-dimensional reconstruction from electron microscopy data were developed. The independent method of electron diffraction structure analysis was developed. The methods for studying structures of surfaces, thin films, and multilayer systems were developed including the structure-sensitive method of X-ray standing waves. First Russian diffractometers, X-ray cameras, multicrystal spectrometers, and other instruments were designed and manufactured. All the prerequisites for high-resolution diffraction experiments were created, including the design of special complexes of apparatus or «stations» for studying structures and

properties of various materials on the synchrotron-radiation sources and the development of all the necessary methods.

Properties
The relationships between the structures and the physical properties have been established for various ferroelectrics, optically active and liquid crystals, superionics, high-temperature superconductors and also scintillating, magnetic, nonlinear optical, acoustooptical, and other crystalline materials. New crystalline media with specific physical properties were discovered, including numerous lasing crystals, media for liquid-crystal displays, holographic media, etc. The Institute was the first to discover the phenomena of electrogyration and the photovoltaic effect, to develop the Fourier spectroscopy, and to establish the domain structure of ferroelectrics and ferroelectric properties of two-dimensional systems.

Growth
The theory of crystallization was developed including the fundamentals of elementary growth processes. A helical relief of the surface of a growing crystal was established. The method of artificial epitaxy of thin films was developed as well as the controlled growth of tip crystals and solid-phase intergrowth of single crystals. For the first time, single-crystal germanium and silicon layers were obtained, and a special method was suggested for growth of bicrystals. The first experiments on crystal growth under the microgravity conditions were performed onboard the Salyut-5 orbital stations. The method of horizontal crystallization of refractory materials was developed. Special technologies and apparatus were designed for growth of various specific crystals, including the crystals used as active elements of tunable lasers. The technologies for growing quartz, Rochelle salt, various piezoelectrics, ruby, and optically nonlinear crystals were developed and scaled-up for their industrial production.

DISCOVERIES

N.V. Belov
Morphotropy in the Homologous Series of Semiconductor Metals
(Discovery's Certificate no. 196, 1974).

N.V. Belov
Laws of Transformations of Layer Silicates Under Hydrothermal Conditions
(Discovery's Certificate no. 299, 1976)

I.S. Zheludev and O.G. Blokh
Electrogyration
(Discovery' Certificate no. 211, 19).

LENIN PRIZE WINNERS

1. **A.V. Shubnikov**

for discovery of the piezoelectric textures (1947), for the studies of synthetic quartz (1950)
2. **N.V. Belov**
for studies of the atomic structures of crystals (1952), for cycle of studies on structural mineralogy (1974)
3. **V.R. Regel**
for development of the method of ship demagnetization (1942)
4. **S.K. Popov**
for synthesis of crystals (1950)
5. **V.V. Sukhodol'skii**
for design of scientific instruments (1952)
6. **L.M. Belyaev**
for synthesis of crystals (1953)
7. **N.E. Vedeneeva**
for the development of the new method of analysis of clay minerals (1953)
8. **?.?.???????**
???. ?????? (? ??????? ?????????? ?????? ?. ???????????, ???????? 50-? ??.)
9. **A.A. Shterenberg**
for synthesis of crystals (1965)
10. **Kh.S. Bagdasarov**
for design of new materials (1972)
11. **E.A. Fedorov**
for design of new materials (1972)
12. **V.G. Govorkov**
for design of new materials (1972)
13. **V.Ya. Khaimov-Mal'kov**
for design of new materials (1972)
14. **N.P. Il'in**
for design of new materials (1972)
15. **I.S. Zheludev**
for studies of ferroelectricity (1975)
16. **L.A. Shuvalov**
for studies of ferroelectricity (1975)
17. **L.A. Blinov**
for theoretical studies of liquid crystals (1985)
18. **S.A. Pikin**
for theoretical studies of liquid crystals (1985)
19. **N.A. Kiselev**
for the study of the structural basis of protein biosynthesis on ribosomes (1986)
20. **V.Ya. Stel'mashchuk**
for the study of the structural basis of protein biosynthesis on ribosomes (1986)

HONORARY TITLES

HONORARY SCIENTIST OF THE RUSSIAN FEDERATION

1. **Kh.S. Bagdasarov**
— Honorary Scientist of the Russian Federation
2. **B.N. Grechushnikov**
— Honorary Scientist of the Russian Federation
3. **G.F. Dobrzhanskii**
— Honorary Inventor and Innovator of the Russian Federation
4. **I.S. Zheludev**
— Honorary Scientist of the Russian Federation
5. **B.G. Zakharov**
— Honorary Scientist of the Russian Federation
6. **V.L. Indenbom**
— Honorary Scientist of the Russian Federation
7. **M.V. Klassen-Neklyudova**
— Honorary Scientist of the Russian Federation
8. **A.G. Kulakov**
— Honorary Inventor and Innovator of the Russian Federation
9. **A.N. Lobachev**
— Honorary Inventor and Innovator of the Russian Federation
10. **Z.G. Pinsker**
— Honorary Scientist of the Russian Federation
11. **V.R. Regel**
— Honorary Scientist of the Russian Federation
12. **V.I. Simonov**
— Honorary Scientist of the Russian Federation
13. **L.A. Feigin**
— Honorary Scientist of the Russian Federation
14. **D.M. Kheiker**
— Honorary Scientist of the Russian Federation
15. **I.N. Tsigler**
— Honorary Technologist of the Russian Federation
16. **L.A. Shuvalov**
— Honorary Scientist of the Russian Federation

History

1925 Organization of the Laboratory of Crystallography at the Mineralogical Museum of the USSR Academy of Sciences (Leningrad).
1934 Organization of the Crystallography Sector at the Lomonosov Institute of Geochemistry, Mineralogy, and Petrography of the USSR Academy of Sciences (Moscow).
1937 Organization of the Crystallograhy Laboratory at the USSR Academy of Sciences (Division of Gelological-Geographical Sciences).
Village of Filatovo (Ural, 1942-1943)
1941 (fall) Evacuation of the Laboratory to the Sverdlovsk Region, Ural.

Institute building at Pyzhevskii per. 10 (Moscow)
1943 (spring) Return to Moscow.
A.V. Shubnikov, the first Director of the Institute
November 16, 1943 the Crystallography Laboratory is transferred to the Division of the Physical-Mathematical Sciences and is renamed the Institute of Crystallography of the USSR Academy of Sciences.
February 9, 1944 Organization of the Institute of Crystallography. Professor Aleksei Vasil'evich Shubnikov is appointed its first director.
Institute main building at Leninskii pr. 59 (Moscow)
1961 the Institute of Crystallography moves to new buildings at Leninskii pr. 59.
Academician B.K. Vainshtein
1962 Professor Boris Konstantinovich Vainshtein is appointed the Director of the Institute.
Academician N.V. Belov
An outstanding crystallographer, Full Member of the USSR Academy of Sciences (Academician) Nikolai Vasil'evich Belov, worked at the Institute of Crystallography for more than 40 years. He was awarded the Honorary title *Hero of Socialist Labor* and also the Lenin and several State prizes.
Academician A.V. Shubnikov
1969 the Institute of Crystallography is awarded the *Order of the Red Banner of Labor*.
1971 the Institute of Crystallography is officially named after Alexei Vasil'evich Shubnikov, who was twice awarded the honorary title *Hero of the Socialist Labor*.
Institute building at ul. Butlerova 17a
1981 the Institute received additional new building at ul. Butlerova 17.
October 28, 1996 Full Member of the Russian Academy of Sciences (Academician) Boris Konstantinovich Vainshtein passed away. Vainshtein headed the Institute of Crystallography for thirty four years.
Professor V.I. Simonov
1996 Professor V.I. Simonov is appointed to fulfill the functions of the director.
Professor B.G. Zakharov
1997 the *Space Materials Science Research Center* is organized on the basis of the Division of the Institute of Crystallography in the city of Kaluga, Moscow oblast. The center is headed by Professor B.G. Zakharov.
Professor M.V. Koval'chuk
1998 Professor Mikhail Valentinovich Koval'chuk is elected the Director of the Institute of Crystallography.

s c i e n t i f i c s t r u c t u r e
GROWTH
Department of High-Temperature Crystallization:
laboratory of
High-Temperature Crystallization,
sector of
High-Rate-Grows Methods.

Department of Crystallization from Melts:
laboratores of
Acoustooptics and Acoustoelectronics,
Fluoride Materials.

Department of Crystallization from Solutions:
laboratory of
Crystallization from High-Temperature Solutions,
sector of
Solid Electrolytes.

Laboratory of
Crystallization from the Gaseous Phases.

Group of
Molecular Beam Epitaxy.

STRUCTURE
Department of X-ray Methods for Modern Organic and Inorganic Materials Science:
laboratores of
X-ray Optics and Synchrotron Radiation,
Protein Crystallography,
Small-Angle Scattering,
Diffractometry of Crystalline Layers,
sectors of
Reflectometry,
X-ray Topography.

Department of Electron Microscopy:
laboratores of
Electron Microscopy,
Electron Diffraction.

Department of X-ray and Neutron Diffraction Analyses:
laboratores of
X-ray Diffraction Analysis,
X-ray Diffractometry,
sector of
Neutron Diffraction Analysis.

Group of
Scanning Probe Microscopy.

PROPERTIES
Department of Crystal Physics:
laboratores of
Theoretical Studies,
Electric Properties of Crystals,
sectors of
Crystal Optics,
Optics of Nonlinear Materials.

Department of Track Membranes:
laboratory of
Nuclear Filters.

Laboratores of
Liquid Crystals,
Mechanical Properties of Crystals,
Resonance Methods,
Physics of Lasing Crystals,
Physics of High Pressures,
Physics of Optical Crystals.

Space Materials
Science
Research Center

Managerial
Departments

Special
Design Bureau

Innovation Department

Laboratory
Ruby,
Sector
Sapphire,
Groups of
Crystallization from Aqueous Solutions,
Treatment of crystalls

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The Institute of Radioengineering and Electronics (IRE) of Russian Academy of Sciences was founded in 1953. It is situated in the building of former Physics Department of Moscow State University at Mokhovaya street not far from the Kremlin. In 1955 a new part of the Institute in the city of Fryazino, 40 km from the centre of Moscow, and then two branches in Saratov and Ulyanovsk were founded.
Director of the Institute is academician Yu.V. Gulyaev
Outstanding scientists in radio science and electronics - academicians A.I. Berg, N.D. Devyatkov, Yu.B. Kobzarev, V.A. Kotelnikov, V.V. Migulin, B.A. Vvedensky,- were organizers of the Institute and leaders of it's first research divisions. Academician V.A.Kotelnikov was the honourable director of the Institute. The main scientific directions of the IRE are fundamental researchs in radio science, physical and quantum electronics, radioengineering, computer science. The Institute carries out applied researchs in the field of development of high technologies and designing of new scientific instruments. A large number of scientific and applied researchers of the Institute are awarded the States Prizes and documented as discoveries and inventions.
The Institute consists of several research divisions, it has Special design bureau and two engineering centres.
At present, when development of science in Russia has many problems, Institute continues to work. In spite of financial difficulties, the most talented and dedicated to science employees develop new research fields and obtain results of first class.

Structure or the institute:
IRE RAS - Moscow
branch in Fryazino
branch in Saratov
branch in Ulyanovsk

Research Activities
Computational Physics
Development of Programming Languages
Dynamic Chaos
Electromagnetic Tomography
Electromagnetism and Antennas
InformChaosLab
Magnetic Resonance and Spin Relaxation in Solids
Molecular Engineering in Quantum Electronics,
Lanthanide Spectroscopy, Powdered Lasers
Nonlinear Dynamics
Physics of Magnetic Phenomena
Plasma Processing Technologies for Micro- and Nanoelectronics

Radar Astronomy and Space Radio Science
Remote Sensing of the Earth and Atmosphere
Signal Processing and Telecommunications
Superconducting Devices for Signal Detection and Processing
Thin Film Oxide Electronics
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In 1968 (November 29) the Presidium of the USSR Academy of Sciences resolved in its decree No.863: "In accordance with the decision No.15, item 4 (March 26, 1968) of the USSR Government State Committee on Science and Technology the **Institute of Spectroscopy of the USSR Academy of Sciences should be organized** on the basis of the Laboratory of the Commission for Spectroscopy. The Institute is an institution of the USSR Academy of Sciences Department of General Physics and Astronomy".

Main scientific trends of the research work of the Institute were defined by that decision but their content changed in time, and nowadays they may be formulated in the following way:
1. Spectroscopy of atoms, ions, molecules, clusters, bulk and surface states of condensed media and development of new methods of spectroscopy optics of near field, nanooptics .
2. Laser spectroscopy with accent on specific influence of the light on a substance and its application for isotope separation, cooling of atoms, modification of molecules surrounding in matrices, and also in photochemistry, photobiology, analytical chemistry, etc.
3. Analytical spectroscopy and its application in technology control, in environmental monitoring, in life-support systems, in studies of natural and technologic disasters, etc.
4. Development and design of unique spectral instrumentation, analytical devices, lasers, registration systems, methods of measurements necessary for research work and applications.
5. Training of researchers of highest qualification.
The qualification and abilities of the Institute are generally recognized both in Russia and abroad. The founder of the Institute and its director during the first 20 years, the USSR Acad. Sci.

Corresponding Member Professor Sergey L. Mandelstam did a great deal for choosing trends of research work and gathering the scientific stuff representing various scientific traditions and schools. It was he who laid the principles covering all the main trends in spectroscopy, interaction of theoretical and experimental research works both in fundamental and in applied researches, close relations with universities and industry in the USSR and with advanced world research centers as well.

The Institute carries out spectral investigations of atoms, multicharged ions, plasma, molecules (both the simplest molecules in gas phase and complex organic ones in solid matrices), liquids, crystals and films, multilayer thin structures, superlattices, quantum wells, other nanostructures, high temperature superconductors, solid state surfaces, biological objects.

The important scientific trend of the Institute from the very moment of its foundation is provision with methods and apparatus for fundamental researches based on the use of new methods of investigation for designing the spectral instruments, and also the use of lasers, computers and other means for substantial increase in sensitivity, spectral, temporal and spatial resolution, precision and high speed of spectroscopic and analytical measurements. Many methods and devices were based on inventions and were designed in the Institute, and they are very promising as for their applications in national economy, defense, medicine and ecology.

The studied spectra cover a wide spectral range from X-rays to microwaves. The Institute has a series of unique spectral instruments and setups:

- instruments having high spectral resolution up to 10-6cm-1, time resolution up to 3x10-14s, and local resolution up to 5 nm.
- methods and instruments for ultrasensitive detection of atom traces (isotopes) and molecules in gaseous, liquid and solid samples with detection limit up to several femtograms (10-15gram) in a sample;
- methods and instruments for investigation of ultra thin films (down to monolayers) on the surface of metals and dielectrics and for new surface physics data;

Over whelming majority of researches corresponds to the very high world scientific levels.

During 35 years of existence of the Institute more than 100 researches were qualified as Candidate of sciences (PhD equivalent) and 40 researches as Doctor of phys.-math. sciences. The list of Doctor dissertation titles is in Appendix 1 as they do reflect the main trends of research works of the Institute.

During this period our researches published more than 4800 articles in scientific journals (about 2000 in leading international journals). 41 monographs are published, majority of them was translated in English. The list of them is in Appendix 2.

The next parts of the booklet is a brief survey of scientific activity of the Institute in the basic research field.

Nowadays scientific structure of Institute of Spectroscopy includes:

Atomic Spectroscopy Department - 18 researches, chief of department - Prof. A.N.Ryabtsev, includes Atomic Spectroscopy Laboratory (Prof. A.N.Ryabtsev) and Laboratory of Plasma Spectroscopy (Dr. K.N.Koshelev);

Molecular Spectroscopy Department - 32 researches, chief of department - Dr. V.G.Koloshnikov, includes Laboratory of Molecular Spectroscopy of High Resolution and Analytical Spectroscopy (Dr. V.G.Koloshnikov), Section of microwave spectroscopy (Prof.

B.S.Dumesh) and Section of Electronic Spectra of Molecules (Dr. Yu.G.Vainer),);
Department of Condensed Media Spectroscopy - 27 researches, chief of department - Prof. E.A.Vinogradov, includes Laboratory of Spectroscopy of Condensed Media (Prof. B.N.Mavrin), Laboratory of Spectroscopy of Semiconductor Structures (Prof. E.A.Vinogradov) and Section of fourier-spectroscopy of the Center of collective using "Optical-spectral measurement ISAN" (Prof. M.N.Popova);
Laser Spectroscopy Department - 31 researches, chief of department - Prof. V.S.Letokhov), includes Laser Spectroscopy Laboratory (Prof. V.S.Letokhov), Laboratory of Excited Molecular States Spectroscopy (Prof. E.A.Ryabov), Laboratory of Spectroscopy of Ultrafast Processes (Prof. S.V.Chekalin) and Section of femtosecond spectroscopy of the Center of collective using "Optical-spectral measurement ISAN" (Dr. Yu.A.Matveets);
Department of Laser-Spectral Instrumentation - 18 researches, chief of department - Prof. O.N.Kompanets;
Theoretical Department - 11 researches, chief of department - Prof. V.M.Agranovich, includes Section of Spectroscopy of Phase Transitions (Prof. A.G.Malshukov) and Section of Nonlinear Spectroscopy (Prof. S.A.Darmanyan);
Laboratory of Spectroscopy of Nanostructures - 10 researches, chief of laboratory - Dr. Yu.E.Lozovik;
Laboratory of Experimental Methods of Spectroscopy - 2 researches, chief of laboratory - Dr.E.B.Perminov.
The Institute is responsible for the **Rus.Ac.Sci. Scientific Council** on the Problem "Spectroscopy of Atoms and Molecules" – one of the oldest Council in the Department of Phisics Sciences RAS. During the long time the chief of department was The founder of the Institute the USSR Acad. Sci. Corresponding Member Professor Sergey L. Mandelstam . Actually the head of Council is Russian Acad.Sci. Corresponding Member Professor I.I.Sobel'man, the Deputy Chairman is Prof. E.A.Vinogradov and Scientific Secretary is Dr. L.A.Bureyeva. Scientific Council on the Problem "Spectroscopy of Atoms and Molecules" leads big scientific-organizing work under the help of ISAN. In 2001 XXII Congress on spectroscopy was held. In December 2003 was held XVII Conference "Fondamental Atomic Spectroscopy".
At present 256 persons work in the Institute, 160 researches are working in the scientific laboratories and scientific-technical divisions together with physics engineers and post-graduate students, including 30 Professors, 53 Doctors, 40 employees of Experimental Production Department, about 40 - in auxiliary services. Administrative and Management staff is 16 employees.
The founder of the Institute Professor S.L.Mandelstam was at the head of the Institute till 1989. The present Director of the Institute is Prof. E.A.Vinogradov, his Deputies are Prof. O.N.Kompanets (Scientific work), A.Yu.Plodukhin (Deputy Financial Director) and E.I.Yulkin (General problems), the Scientific Secretary is Dr. E.B.Perminov.
The Scientific Council considers all principal problems of the Institute scientific activity and consists of E.A.Vinogradov (Council Chairman), O.N.Kompanets (Deputy Chairman), E.B.Perminov (Scientific Secretary) and leading scientists: V.M.Agranovich, D.P.Antonyuk, V.I.Balykin, M.A.Bolshov, L.A.Bureeva, Yu.G.Vainer, B.S.Dumesh, A.M.Kamchatnov, V.G.Koloshnikov, K.N.Koshelev, V.S.Letokhov, Yu.E.Lozovik, B.N.Mavrin, G.N.Makarov,

A.G.Malshukov, Yu.A.Matveets, M.N.Popova, E.A.Ryabov, A.N.Ryabtsev, S.V.Chekalin, V.A.Yakovlev.

The Institute has a Specialized Scientific Council that gives qualification of Dr. and Prof. of the specialties “Optics” and “Theoretical Physics” (Council Chairman is E.A.Vinogradov, Scientific Secretary is M.N.Popova).

The Quantum Optics Department (Chairman is Prof. E.A.Vinogradov and Deputy Chairman is Dr. V.G.Koloshnikov) of Moscow Physical-Technical Institute is attached to the Institute of Spectroscopy and guarantees entering of talented and promising young researches.

In 2000 was prolonged the Institute licence for education activities in the field of post graduate education for the next specialties: ”Optics”, “Theoretical physics”, “Solid State Physics” and “Laser Physics”.

The scientific and technical library of the Institute has one of the most perfect in Russia literature selection on spectroscopy.

The successes of the Institute scientists were recognized with a number of the highest scientific prizes:

S.L.Mandelstam was awarded the USSR State Prize for the works on x-rays Solar emission (1977);

- Academician D.S.Rozhdestvensky Prize for the works on the spectroscopy of multiply ionized atoms (1977);

V.S.Letokhov (together with V.P.Chebotaev) was awarded the Lenin Prize for the works on nonlinear laser spectroscopy (1978);

A.A.Makarov, Yu.A.Gorokhov, A.A.Puretsky, E.A.Ryabov, N.P.Furzikov were awarded the Lenin Komsomol Prize for the works on laser separation of isotopes 1978);

M.R.Aliev - Prize of the USSR and Czechoslovakia Academies of Sciences for the works on the theory of vibration-rotational spectroscopy of molecules (1982);

V.G.Koloshnikov and Yu.A.Kuritsyn (in cooperation with researches from Ac. Sci. Phys. Inst. and others) were awarded the USSR State Prize for the works on diode laser Spectroscopy of high resolution (1985);

E.I.Alshits, L.A.Bykovskaya, R.I.Personov, B.M.Kharlamov (in cooperation with the scientists from the Estonian Acad. Sci. Phys. Inst. and others) were awarded the USSR State Prize for the works on selective laser excitation of the luminescence in frozen solutions (1986);

V.M.Agranovich was awarded the Alexandre-fon Gumboldt Prize (Germany , 1992), the P.Kapitsa Prize (United Kingdom, 1993) for the works on solid physics, and Academician L.I.Mandelstam Prize (Russian Academy of Sciences for theoretical investigations on surface spectroscopy (1997);

R.I.Personov was awarded the Alexandre-fon Gumboldt Prize (Germany , 1995);

V.S.Letokhov - Honoris Causa Doctor of Paris-North University (France , 1995);

V.S.Letokhov - Quantum Electronics Prize of the European Physical Society in 1998 for pioneering and far reaching contributions to the study of laser matter interactions, including atom optics, laser cooling, laser induced chemistry and laser analytical techniques (1998);

V.S.Letokhov, V.I.Balykin, V.G.Minogin were awarded Academician D.S.Rozhdestvensky Prize for the cycle of works “Laser cooling and traping of atoms” (2001);

O.N.Kompanets - Gold medal and Diploma of the 50th World Exhibition of Innovation,

Research and New Technology (Brussels, "Eureka", 2001);
V.S.Letokhov, E.A.Ryabov were awarded the State Prize of Russian Federation in science and technology (2002) for their contribution to development of "Scientific and Technological Fundamentals of Laser Isotope Separation Based on Selective Dissociation of Molecules";
Yu.E.Lozovik - "Nauka-Interperiodika" Prize for the best publication in physics (2002);
O.N.Kompanets - Grand-Prix and Diploma for the victory in the 2nd Competition of Russian Innovations (Moscow , 2003);
G.N.Makarov - "Nauka-Interperiodika" Prize for the best publication in physics (2003);
V.I.Balykin - The Alexandr fon Gumboldt Prize (Germany , 2004);
Yu.G.Vainer - Academician D.S.Rozhdestvensky Prize of Presidium of RAS for the notable works on optics (2004);
A.V.Naumov -
- Medal and Prize of Presidium of RAS for the young scientists of Russia (2004);
- European Academy of Sciences Prize for the young scientists of Russia, Division "Physics" (2004);
- Physica Status Solidi Young Researcher Award for his lectures offered at the 11th International Conference on Phonon Scattering in Condensed Matter (2004);
- SPIE Prize for the best poster lecture at the Higher Laser Workshop in memory of A.Akhmanov (2004);
V.S.Letokhov - Honoris Causa Doctor of Lund University (Sweden, 2005);
V.M.Agranovich - Honoris Causa Doctor of B.Pascal University (France, 2005).
The Institute of Spectroscopy has close connections with advanced research centers in Australia , Canada , China , Denmark , England , Finland , France , Germany , India , Italy , Japan , Korea , Spain , Switzerland , Sweden , USA , and carries out joint research works.

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Landau Institute for Theoretical Physics: Who We Are?
The L.D.Landau Institute for Theoretical Physics was founded in 1965. Initially, only five researches worked at the Institute, and all of them were Landau's students. Since then, the institute has grown to one hundred members. From the founding of the Institute until 1992, its

director was Professor Isaak M. Khalatnikov. Since 1992 a head of the Institute is Professor Vladimir E. Zakharov.

Landau Institute for Theoretical Physics has been in operation for more than thirty years now, and all this time it has been a unique scientific center having no match not only in Russia but in all of the world. The Institute has always employed specialists of the highest caliber in all branches of modern theoretical physics, and has provided them with an ideal environment for interaction and joint work. Landau Institute has always been the place in the world where the best and newest Science was being developed. However, the Institute has always been much more than just a scientific center; it has also been an unique scientific school, known across the world as the Landau School. New generations of theoretical physicists have been continuously trained by the Institute's top researchers in one of the world's most conducive environments for learning.

The main fields of scientific research in the L. D. Landau Institute for Theoretical Physics over the past thirty years have been:

Condensed matter theory
Quantum field theory
Nuclear and elementary particle physics
Computational physics
Nonlinear dynamics
Mathematical physics

Unlike many other scientific centers in Russia, Landau Institute has had the strength to survive during the crisis times of the nineties. Some of our best experts did leave Russia, and are presently working at the leading scientific centers all over the world. Most of them have kept their scientific ties with the Landau Institute and have formed a world-wide scientific Landau network, always being proud to be a part of the Landau School. The majority of our scientific experts, however, remain in Russia. At the moment the core faculty of Landau Institute consists 104 people. 47 of them have permanent positions in the leading scientific centers and universities in abroad.

Due to the support of the international scientific community as well as of our Landau network, the Landau Institute has continued its operation during this hard time. Here, as in the past, we are developing Science in spite of all odds. The process of training high-level young theoretical physicists is continuing, and continues to be one of the most important contributions of our Institute to the World's Science.

Vladimir E. Zakharov Full Member of RAS
Director of Landau ITP 1998-2003.

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Research topics
Mesoscopic electronic systems
Superconducting hybrid structures
Quantum phase transitions
2DEG and quantum Hall effect
Spintronics
Quantum magnetism and topological order
Physics of quantum computation

Publications 2006: by research topic

Mesoscopic electronic systems

Coherent transport in Josephson-Junction rhombi chain with quenched disorder
I. Protopopov and M. Feigel'man
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Universal temperature dependence of the conductivity of a strongly disordered granular metal
A.R. Akhmerov, A.S. Ioselevich
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Local correlations of different eigenfunctions in a disordered wire
M.A. Skvortsov, P.M. Ostrovsky
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Z. Radovic, I. Petkovic, and N.M. Chtchelkatchev
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Minigap in superconductor-ferromagnet junctions with inhomogeneous magnetization
D.A. Ivanov, Ya.V. Fominov
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P.M. Ostrovsky, Ya.V. Fominov, M.V. Feigel'man
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Incoherent multiple Andreev reflection in an array of SNS junctions
N.M. Chtchelkatchev
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Two dimensional electron gas driven by strong alternating electric field
A. Kashuba
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O.V. Dimitrova and M.V. Feigel'man
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Massless excitations at theta=pi in the CPN-1 model with large values of N
A.M.M. Pruisken, I.S. Burmistrov, and R. Shankar
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Divergent Coulomb screening in two dimensional electron gas driven by microwaves
A. Kashuba
83(7), 351-355 (2006)

Spintronics
2D SNS junction with Rashba spin-orbit interaction

O.V. Dimitrova and M.V. Feigel'man
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Quantum magnetism and topological order

Physics of quantum computation
Using qubits for measuring fidelity in mesoscopic systems
G.B. Lesovik, F. Hassler, and G. Blatter
Phys. Rev. Lett. **96**, 106801 (2006)
Decoherence from ensembles of two-level fluctuators
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M.A. Sillanpaa, T. Lehtinen, A. Paila, Yu. Makhlin, and P.J. Hakonen
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Condensation and vortex formation in a Bose-gas upon cooling
E.A. Brener, S.V. Iordanskiy, and R.B. Saptsov
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Quantum mechanics with a time-dependent random unitary Hamiltonian: A perturbative study of the nonlinear Keldysh sigma-model
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On magnetic susceptibility of a spin-S impurity in nearly ferromagnetic Fermi liquid
I.S. Burmistrov
e-print cond-mat/0602650
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The IPM RAS was founded in 1993 on the basis of the Solid State Physics Division of the Institute of Applied Physics RAS.
IPM RAS is aimed at the fundamental investigations in the fields of surface physics, physics of solid state nanostructures, high temperature superconductors and soft X-ray optics as well as technology and applications of thin films, surfaces, interfaces and multilayer structures.
The IPM RAS staff numbers 255, among them about 100 scientists (18 Doctors of Sciences and 66 Candidates of Sciences (Ph.D.), 11 State Prize winners).
The IPM RAS facilities include high-quality research and technological equipment. 9000 m2 specialised laboratory building was brought into service. It offers specially protected clean rooms, deionized water supply, air conditioning, layout of gas and other service facilities.
IPM RAS has close ties with Nizhny Novgorod State University: over 20 staff members also hold teaching positions at the University and, in particular, occupy 2 Chairs with facilities both at the University and at IPM.

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Institute of solid state physics

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The Institute of Solid State Physics (ISSP) was organized in 15 February, 1963 by the USSR Academy of Sciences in order to realize an optimal combination and interplay of fundamental studies in condensed matter physics and materials science. The decisive contributions to the formation of problems and principles of organization of the ISSP were made by the prominent physical metallurgist academician Georgii Viatscheslavovich Kurdyumov, academician Jurii Andreevich Ossipyan, and corresponding member of the USSR Ac Sci Tscheslav Vasil'evich Kopetskii.

At became clear by the moment of the ISSP establishment that our domain of science, combining high activity factors, demand for new results, and unexpectedness of the already obtained ones, had a very great potential. Further advancement confirmed the validity of the starting ideas that laid the foundations for our Institute. Presently, the ISSP is one of the leading academic institutes of physics, a recognized scientific center that has successfully been developing many and varied works on a wide font of scientific problems. It is also an educational center with long-term experience in training specialists of high competence. Since the time of the ISSP organization more than 60 specialists received the degree of Doctor Sci and more than 300 the degree of candidate Sci. Two researchers are Full Members and three Corresponding Members of the Russian Academy of Sciences (RAS) .

The scientific problems facing the ISSP are a combination of the major components:
experimental and theoretical directions of physics of solid as a division of physics;
materials science as the body of meeting divisions of fundamental physics, physico-chemistry, mechanics.

The necessary experimental and technological basis ensures the conducting of fundamental and applied studies.

The following technical basis has been developed to contribute to the successful solution of scientific problems.

cryogenic facilities, including helium liquefaction plant;
equipment for investigation of electronic and optical properties of materials at liquid helium temperatures (and lower), and in ultrahigh magnetic fields: EPR, NMR, luminescence, Raman scattering, transport measurements, etc. (about 200 working sets altogether);
equipment required for an analysis of crystalline structures; present-day automated diffractometers provided with adapters for low and high temperatures, electron microscopes(scanning, transmission electron tunneling, anger-electron microscopy);
specific high pressure equipment (to 500 kbar) is used to study structural transformations and for synthesis of novel hydrides of intermetallic compounds;
techniques of ultrahigh magnetic fields and extra-low temperatures are employed in runs with macroquantum objects;
diverse crystals of semiconductors, dielectrics, refractory metals, high-temperature superconductive single crystals are grown, there is a real experience in synthsiziny large crystals of fullerene a novel form of carbon, the required level of chemical methods for analysis, decontamination and synthesis are available;
different methods are available to treat the materials, single crystals and their products included: plastic straining by rolling, compacting, annealing in a protective atmosphere of molybdenum, niobium, tungsten;
there are works concerned with composite and nanocrystalline materials, including production of alloys, mechanical tests at present temperatures.
Our experience suggests that the developed and constantly renovated experimental basis is efficient enough for solving the problems which may arise in the present-day conditions of rapid evolution of materials science and its applied areas connected with high technology.

The Institute includes:
Laboratories
22
Production departments
5
Scientists
203
including
 candidates of Sci
146
doctors of Sci
48
members of Ac Sci
5
postgraduates, undergraduates
59
Engineers and technicians
343
The ISSP is situated in Chernogolovka - one of the leading Scientific Centers of Russia , on

picturesque glades in woods near Moscow . Currently, there are 9 well-known scientific institutions of the RAS, about 1000 scientists. Many students from Moscow Institute of Physics and Technology, the physical branch of the Subdivision of Moscow State University, and other institutions of higher education have an opportunity of gaining knowledge after their own hearts and getting charged from the powerful scientific potential.

LABORATORIES

Laboratory of Spectroscopy of Defect Structures (LSDS)
Head: Vitalii Vladimirovich Kveder
Tel: 2-23-44 , e-mail kveder@issp.ac.ru
Main research directions

1. Engineering of defects in semiconductors
2. a) Electronic, optical, and magnetic properties of extended defects in semiconductors
3. b) Interaction and reactions of defects in semiconductors. Metastable states and reorganization of the atomic structure of defects at a change in their charge of spin state and under the action of external fields
4. Physics of heterostructures on the base of superionic conductors
5. Electronic properties of fullerenes and of fullerenes-based molecular complexes and heterostrctures

Laboratory of Nonequilbrium Electron Processes (LNEP)
Head: Vladimimir Dmitrievich Kulakovskii
Tel: 2-26-91 , e-mail kulakovs@issp.ac.ru
Main research directions

1. Bose-condensation of interwell excitons
2. Quasi 2D electronic system in semiconductive heterstructures
3. Excitons in semiconductive quantum points
4. Magnetic polarous in quantum points
5. Low-dimensional polarions in semiconductive microcavities

Laboratory of Electron kinetics (LEK)
The work in the Laboratory concentrates on basic research of those aspects of low-temperature transport which are influenced by electron correlations. These include
electron scattering,
metal-insulator and superconductor-insulator transitions in metastable alloys and in metal oxides, superconductivity of high-Tc superconductors.
Wide spectrum of transport mechanisms is under consideration, from Drude conductivity and Josepson tunneling to hopping. Mainly bulk materials are studied though some aspects of electron scattering in heterostructures are also investigated. The main properties measured experimentally are dc resistance, magnetoresistance, microwave impendance, nonlinear microwave response and ac-susceptibility.

Laboratory of Quantum Transport (LQT)
Head: Valerii Timofeevich Dolgopolov
Tel: 2-29-46, e-mail dolgop@issp.ac.ru

Main research directions
Investigation of two-dimensional electronic systems with a strong electron-electron interaction
Investigation of electron spectrum of two-dimensional electronic systems in a quantizing magnetic field in strong interaction conditions
nvestigation of the processed of current flow between edge channels under strong disbalance conditions

Laboratory of Quantum Crystals (LQC)
Head: Prof. Leonid Pavlovich Mezhov-Deglin
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Main research directions
Physics of quantum crystals and liquids.
Nonlinear waves in the bulk and on the surface of quantum liquids.
Transport phenomena in condensed matter
Design of instrumentation for cryogenic medicine

Laboratory of Spectroscopy of Metal Surfaces (LSMS)
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Generation of mugnons under transmission of a high-density electronic current
Kinetics of conduction electrons at low temperatures

Laboratory of Superconductivity (LSC)
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Main research directions
Investigation of specific features of the electron transport in hight-temperature organic super-conductors and Synthetic superlattices
Phase transitions and the dynamics of vortex structures in HTSC, layered superconductors and 2D josephson networks
Multilayered and multiphased magnetic structures prospective for use in magneto-electronics (spintronics)
Josephson superconductor-ferromagnetic-superconductor structures (SFS junctions)

Theoretical department (TD)
Head: Valerii Borisivich Shikin
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Main research directions
Investigation of properties of low-dimensional electronic systems. Sollective excitations in strong - correlated low-dimensional electronic systems, 2D charged systems on a helium surface
Role of spin-orbital interaction in physics of low-dimensional systems, problems of spin-orbital electron transport
Investigation of protonic ordering in the bulk, near the surface, at the interface and its effect on adhesion and friction of ice

Laboratory of Structural Research (LSR)
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Main research directions
Structure, phase transformations, correlation of the structure and properties
in amorphous and nanocrystalline materials
in low-dimensional organic compounds
in scintillators
Structure and phase transitions
in metals, alloys, oxide systems
in binary systems of sp metals under high pressure
in fullerenes and fullerene complexes
Real structure and defects in crystals

Laboratory of Real Structure of Crystals (LRSC)
Head: Valerian Ivanovich Nikitenko
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Main research directions
Nonlinear dynamics and micromechanisms of nucleation of topologic defects in ordered structures
nvestigation of elementary acts of remagnetization in exchange-bound nanocomposite magnetic structures
Magnetooptical strudies of remagnetization processes in HTSC
Optical microscopic study of dynamics of domain boundaries and inhomogeneous phase transitions ferroelectrics

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IPP is currently one of the leading research and educational institutions in low temperature physics.

The main fields of research are:
Quantum fluids and solids
Quantum theory of condensed matter
Superconductivity
Low temperature magnetism
Scanning tunnel microscopy for study of materials
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Special astrophysical observatory
Special Astrophysical Observatory (SAO) is a research institution of the Russian Academy of Sciences. The principal instruments of the Observatory are the optical telescope BTA (Bolshoi Azimuthal Telescope) with a 6-m primary mirror and the radio telescope RATAN-600 (RAdio Telescope of the Academy of Sciences) with a ring multi-element 600-m antenna. The Observatory provides astronomical observations at the telescopes in accordance with decisions of the Allocation Committee and carries out its own investigations in different fields of astrophysics.
http://www.sao.ru/Doc-k8/Telescopes/small/Z2000/

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HISTORY

Kola Science Centre of the Russian Academy of Sciences - is an integrated scientific Institution in the Euro-Arctic region that pursues fundamental researches over the features of the globe`s high-latitude area and forms the scientific basis to assess a resource potential, and works out a rational strategy in the Arctic development.

The Centre was originated from the Khibinskaya mountain station (1930) of the USSR Academy of Sciences. As the range of tasks became wider and an analytical and experimental potential was being developed, the Station was successively transformed into the Kola base of the USSR Academy of Sciences (AS) (1934), Kola Branch of the USSR AS (1949), Kola Science Centre (KSC) of the USSR AS (1988). In 1992, when the Russian Academy of Sciences was set up, the KSC was included into it as a regional science centre. At present, the KSC RAS comprises 10 research Institutes and a great complex of auxiliary subdivisions and experimental testing grounds throughout a vast area between Spitsbergen and Franz Josef Land, in the north, to Amderma, in the east, and Tedino and Plisetsk, in the south. Since 1961, the base academic facilities (named as an "Academic town") and the Presidium of the KSC RAS have been in Apatity, the Murmansk

region. By 1991, the total number of the employees working in the KSC RAS was as high as 3600 people but, during the period of 1992-1998, the staff has become twice as less, and by the 70-th anniversary, it has been stabilized, amounting 1900 people. There are 654 research associates in the KSC`s staff now. Among them there are four academicians, 80 professors and Doctors of Sciences, more than 300 Candidates of Sciences.

For many centuries, the Murman area (the Kola peninsula and all the northern seas washing it) was an uninhabited outlying district of the Russian empire: 3-5 thousand people lived there. They were occupied with reindeer-breeding, hunting and fishering, with seasonal fishing-out amounting 160 th.tons. The mineral resources of the region were used periodically: in the XIII-th century, muscovite mica was mined to be used in windows like the to-day`s windows-glass, and in the south coast, from 1733 to 1742, about 100 poods (1 pood = 16.38 kg) of silver were mined out, from which the first Russian silver rubles were minted. The scientific research of the region`s natural resources was started only in the late XIX-th century. The first investigation results obtained by Yevgraph Fedorov, Dmitry Belyankin, Alexander Polkanov, the members of the Russian Academy of Sciences, have shown that the region possesses a significant ore potential. At its full extent, this unique scale of mineral resources was evaluated only in the period from 1920 to 1930, and the primary role was played therewith by the Council on the Study of the productive forces of the USSR AS and the Northern research-trade expedition (NRTE) VSNKh. The research programme was outlined in spring of 1920 when two outstanding geologists came to the Murman region as members of the Government commission - academician A.P.Karpinsky, President of the RAS and Honourable Chairman of the NRTE, and academician A.Ye.Fersman, a member of the Scientific Council of the NRTE. In August, 1920, A.Ye.Fersman came back to the Khibiny area with the first academic expedition that was composed of geologists B.M.Korpletsky, E.M.Bonshtedt, Ye.Ye.Kostylyova, A.H.Labuntsov. In 1921, first blocks of apatite ore were found in the Vudjavr valley, and in 1923, "a?atite ?lacers" were found on the Rasvumchorr plateau. The Khibiny apatite properties were first described by N.N.Gutkova, and a possible use of nepheline in glass-making was substantiated by Professor P.A.Zemyatchinsky. In 1926, A.N.Labuntsov discovered the first great primary deposit, named as the Kukisvumchorr, and later some other deposits - the Yukspor, Rasvumchorr - were found. The years of those geological discoveries, made in the Khibiny, were named later by A.Ye.Fersman as the "Khibinskaya epopee". In 1927, a special commission, attached to the USSR AS, was established to study the productive forces of the Kola peninsula. According to the then geologists? assessment, the hypothetical ore reserves were of a fantastic, for that time, level, exceeding 2 billion tons. In August, 1929, the first exploratory well was drilled and a trial batch of apatite nepheline ores was mined out, and, in November, 1929, a government decision on the establishment of the mining trust "Apatit", first in this region, was adopted, and that was the date of the beginning of building the town of Khibinogorsk, the town for miners (renamed later, in 1934, as the town of Kirovsk).

"Out of all emotional experience of the past, among various sceneries and economical activity patterns it was the "Hibiny" complex that produced the greatest impression on me. This scientific epic work for almost 20 years seized my train of thought and took possession of all my essence, tampered my will and gave me food for thought and hopes. It was persistence, perseverance and hard work on the Hibiny that made this wonderful land bear fruits and disclose its richness". A.Ye. Fersman

As this uninhabited subarctic region was being developed, the necessity was realized of setting up a stationary science Institution whose role would consist in making a comprehensive study of natural conditions and in making a search for ways of rational use of both ore potential and biological, soil, and power resources.On the initiative of A.Ye.Fersman, the Khibiny mountain station of the USSR AS was opened on July 19, 1930, being located near apatite mines that were constructed at that time. Officially, this Station became one of the scientific Institutions of the Academy of Sciences on October 2, 1930, by a decision of the General Meeting of the Academy of Sciences. This decision was approved by the Central Executive Committee of the Supreme Soviet of the USSR on October 18, 1930. These are three memorable dates from which the Kola Science Centre of the Russian Academy of Sciences starts its history.

Academician A.Ye.Fersman was the first head of the Station, named later as the Kola base of the USSR AS, managing for fifteen years running.A pleiad of Soviet geologists, geochemists and mineralogists was attracted by him to work in the Kola peninsula. As many as 30 academic teams were exploring the remoted areas of the peninsula annually. So, the period from 1927 to 1937 has become a decade of great discoveries: 1927 - the commercial zirconium (eudialyte) ore reserves of the Lovozerskiye tundry massif were-substantiated by Ye.Ye.Kostyleva;1928 - rare-metal alkaline granite and abrasive garnet deposits were discovered in the Keivy by O.A.Vorobyova, B.M.Kupletsky, and cyanite schists - by academician A.A.Grigoriev; 1929 - mica deposits are discovered in the Kandalaksha (Ionsky) area by B.M.Kupletsky; 1930 - A.Ye.Fersman discovers sulphide copper-nickel ores in the Moncha-tundra massif; A.A.Grigoriev discovers great diatomite deposits in the Lovozersky massif; N.N.Gutkova discovers primary lovchorrite deposits in the Khibiny massif; 1934 - O.A.Vorobyova discovers commercial loparite ore reserves in the Lovozersky massif; 1935 - B.M.Kupletsky discovers titanium-magnetite and perovskite ore deposits in the Afrikanda massif. This incomplete list of "applied" results of academic researches should be increased by some discoveries made by field geologists: 1932 - D.V.Shifrin and N.S.Zontov discovered iron ores in the Priimandrovsky area; 1933 - A.M.Koshits discovered a magnetite deposit in the Yono-Kovdorskoye area; 1935 - V.A.Afanasiev discovers an olivinite deposit in the Khabozersky massif; 1937 - L.A.Kosoi discovers a muscovite mica deposit in the Strelninsky area; 1936-1939 - P.V.Sokolov substantiates the presence of gigantic commercial reserves of cyanite ores in the Bolshye Keivy massif.A fundamental monograph "Useful minerals of the Kola Peninsula" (1941) by A.Ye.Fersman has reviewed the "decade of discoveries", showing the outlooks of the development of a high-capacity mining-and- metallurgical complex in the region.

By the time the book had appeared, the apatite, cooper, nickel, mica, and dolomite deposits were

in operation; the towns of Kirovsk and Monchegorsk had been built; the "Apatit" ore- dressing plant supplied most supperphosphate plants with a raw materials; the "Severonikel" integrated works produced over 90% nickel for the defense industry. These giant industrial plants could be considered, however, as the initial stage of the industrial development of a small share of the region?s resource potential that was outlined by the great seer.

The research strategy of the Kola base of the USSR AS was being formed under the great influence of academician V.I.Vernadsky, a teacher and tutor of A.Ye.Fersman, who intensively developed, during those years, a teaching on the noosphere. The essence of the noosphere is a notion of the ecological imperative as an obligatory requirement for co-existence of technosphere and biosphere, of industrial centres and nature.

Following this conception, the Academy of Sciences has foreseen the setting up of the Department for Geocoenosis Researches in the structure of the Kola base, setting up, the first in the world, high latitudinal Polar-Alpine Botanical Garden near the town of Kirovsk. Under the leadership of Professor N.A.Avrorin, a system of reference testing grounds was formed for long-term monitoring on the change in the subarctic biocoenosis under the accelerated urbanization of the region. So started were the experiments on introduction of plants in the Arctic. The practical importance of botanical researches was clearly shown in the title of one of the first monographs written by the researchers of the Botanical Garden at the Great Patriotic war?s eve - "What trees and shrubs are to be planted in towns and settlements of the Murmansk region and northern areas of the Karelian-Finland SSR" (Avrorin, 1941).

In the war years, most employees of the Kola base went to the front; some employees were evacuated to the Komi ASSR where they studied the industrial potential of the Republic in order to use it for the defence needs. Some employees of the Botanical Garden stayed in the near-front Kirovsk to preserve the collection funds of plants and render the assistance to military units and hospitals with herbs, vitamin and food plants. About 200 kinds of local and introduced plants, as vitamin and sugar raw materials, have been studied, simple methods of processing local berries have been developed to produce juices, syrups, jams, with no sugar added and maximum vitamin C preserved. B.A.Mishkin has worked out methods of different concentrates preparation.

N.N.Diachkov and A.L.Kursanov (academicians, in the future) have implemented a glucose treacle and pure glucose method from tundra lichens using a special device made jointly with the "Apatit" Trust. Inspite of all the difficulties, all the collection plants had been preserved, and the studies were resumed during the after-war years. The work, which the Garden was employed on during the war years, was similar to a battle task. So, as it was successfully fulfilled, many, engaged in it, were rewarded. N.A.Avrorin, head of the Garden, was decorated with Order of the Red Star and some medals.

In 1945, after A.Ye.Fersman had died, the Kola base of the USSR AS was headed by academician D.S.Belyankin, an outstanding pertrographer. Under his guidance, geological, mineralogical, geochemical and chemical-and-technological studies, biological, soil-science and zoological studies

were being continued (A.A.Chumakov, S.S.Kurbatov, Ya.G.Goroshchenko, B.N.Melentiev, S.A.Kasparova, I.P.Savvatimsky, N.P.Belov et al.). Later, studies in the field of hydraulic power engineering were started (P.A.Kuznetsov, S.V.Grigoriev). During that period, a great number of studies, suspended because of the war, on industrial exploitation of iron ore deposits in the Kovdor and Olenegorsk areas and on assessment of the resource potential of the north-western area of the Murmansk region, were completed.First soil-and-vegetation maps of the Murmansk region were compilated, enabling to allocate areas, in the vicinity of industrial areas, suitable for agriculture development.Taking into account the extension of problems to study and that most investigations were to be carried out by its own staff, the Kola base was transformed into the Kola Branch of the USSR Academy of Sciences (KFAN) in 1949.

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Academician
D.S.Belyankin
Academician
?.*V.Sidorenko*
Dr. E.K.Koslov
Corr. Member
G.I.Gorbunov
Academician
V.?.*Kalinnikov*

From 1952 to 1961, the KFAN was managed by A.V.Sidorenko, a corresponding-member of the Russian Academy of Sciences. He was one of the brightest representatives of the Soviet geological school, being elected, after having worked in the Kola peninsula, an academician, vice-president of the USSR AS. Later, he managed the Ministry of Geology of the USSR. The discovery of the greatest in the world mica deposits in the Murmansk region is connected with his name, for which he was rewarded with the Lenin prize in 1965.Thanks to his great talent for organization and indomitable energy, an integrated system of scientific Institutions has been set up, allowing to carry out an integrated study of natural resources, make up effective technologies to use resources and, on this basis, develop the programmes for economic development of the region. These were - the Geological Institute (1951), Institute of Chemistry and Technology of Rare Elements and Mineral Raw Materials (1958), Mining-and-Metallurgical Institute (1961) that was later renamed as Mining Institute (1973), Department for Economic Investigations (1965).In 1953, the Murmansk Marine Biological station, situated in the settlement of Dalny Zelentsy, was included into the KFAN, and, in 1958, it got a status of a research Institute. In 1960, on the basis of the stations of the Institute of the Terrestrial Magnetism, Ionosphere, and Radiowave Propagation of the USSR AS (IZMIRAN), the Polar Geophysical Institute was formed and included into the KFAN. A great contribution was made into the formation of new scientific directions and development of scientific Institutions by G.I.Gorbunov, Ye.K.Kozlov, M.D.Fugzan, I.V.Bel`kov, O.S.Ignatiev, V.I.Belokoskov, I.A.Turchaninov, A.I.Arsentiev, N.A.Voronkov, S.I.Isaev, O.M.Raspopov, T.A.Kozupeyeva, G.N.Andreyev, V.I.Gerasimovsky,

P.M.Kamshilov, I.B.Tokin, M.K.Mazurov, V.A.Fedoseyev, A.P.Panin and others.

The previous working base in small wooden houses in the settlement of Kukisvumchorr (the Apatitovaya Gora from Saami) was too tight and did not meet the needs of a new "canstellation" of academic Institutes. So, according to the intention of A.B.Sidorenko, a set of modern laboratory buildings, named as Academic Town, was built not far from the railway station Apatity. The Seismological Station (1960) and Geological Institute(1961) were the first to give house-warmings in stone houses of the town of Novy (New) (named later as Apatity in 1966). After A.V.Sidorenko, the future development of Academic Town has become a concern of his comrades-in-arms, well-known explorers of ore deposits in the region - Ye.K.Kozlov, Dr.Sc. (Geology-Mineralogy), who was Chairman of the Presidium of the Kola Branch of the Academy of Sciences from 1961 to 1971, and G.I.Gorbunov, a corr.-member of the Russian Academy of Sciences, who headed the Presidium of the Kola Branch of the Academy of Sciences from 1971 to 1985.
E.K.Koslov , I.V.Bel`kov, G.I.Gorbunov, A.V. Sidorenko

The laboratory building of the Institute of Chemistry and Technology of Rare Elements and Mineral Raw Materials was put into operation in 1967; the building of the Polar Geophysical Institute was built in 1970; the Building for pilot tests and model plants used for the development of ore beneficiation technologies and ore concentrate processing by hydrometallurgical methods, was built in 1973, the Mining Institute?s laboratory building built in 1973.To ensure the activities of the Institutes and comfortable living conditions for the staff under the specific arctic conditions, some engineering and technical, information and social-consumer infrastructures were set up that included experimental production technical services, dwelling-public services, kindergartens, sanitation and medical-prophylactic establishments. Strengthening the scientific potential of the Murmansk region was highly assessed by the government: according to the decision of the Presidium of the Supreme Soviet of the USSR of April 20, 1967, the Kola Branch of the USSR Academy of Sciences named after S.M.Kirov was decorated with Order of Lenin. At the 50-th anniversary of the KFAN (1980), 30 research associates were rewarded with orders and medals of the USSR, and 57 research associates were rewarded with Diplomas of Honour and with medals of the Exhibition of Economic Achievements of the USSR (VDNKha). On November 25, 1980, a monument to A.Ye.Fersman, the founder of the Kola Branch of the USSR Academy of Sciences, was erected in the centre of Apatity. .

The Mining Institute dealt with the problems of geomechanics that with setting up the mining-and-processing industry under the specific arctic conditions. The occurrence of horizontal tectonic stresses in the basement cristalline rocks and in the metamorphosed series of the upper layers of the Earth`s crust was proved by experiment and given a substantiation; some cardinal engineering suggestions were given on how to take these stresses into account in mining operations and in construction of underground facilities for the Apatit Industrial Amalgamation and Kovdorsky GOK; the problems connected with control over ore mass flows passing through ore chutes in the greatest in the world mountain open pits were solved; the ways of safe dump

formation on steep slopes during intensive snowing were determined. To comprehensively process mineral raw materials in closed water cycles some methods were developed and some apparatus designed; new reagents and reagent regimes for selective flotation of phosphate, alumina, titanium, feldspar and of other ores were synthesized, enabling high grade concentrates to be produced from rebellious ores of a complicated mineralogical composition. For the first time were the apparatus designed that enabled minerals to be separated on the basis of their magnetic-gravitational and flotation properties.

The visit of M.S. Gorbachev to the Murmansk region in 1988
favoured the Governmental resolution to create Kola science center and a number of institutes in its structure.

The Institute of Chenistry developed new technological processes of the niobium and tantalum, production, zirconium-niobium alloys and hardeners; the principles of loparite and perovskite hydrometallurgical processing were established; methods of the extremely pure alkali metals production have been suggested. To implement the plans, designed by A.Ye.Fersman, on non-waste utilization of apatite-nepheline ores, research chemists developed a high-effective technology for rare-earth elements recovery from apatite concentrate, and, jointly with the Apatit Industrial Amalgamation, they worked out industrial methods of the titanium pigments production from the Khibiny sphene. Under the guidance of D.L.Motov, Honoured Inventor of the USSR, the production of a titanium tanning agent having no analogues, was introduced at the plants (later, the licences for the technology were sold to many countries, resulting in a 2 billion profit return for the academy). To diminish the impact on the environment, a number of technologies were worked out and introduced at the industry. These are the silicate brick production from iron ore waste produced by the Olenegorsk integrated iron-ore works, the production of slag wool, sorbents and concrete from slag produced by the Severonikel combine. New low-temperature glass-ceramic connectives for the abrasive instruments production using the Kola mineral raw materials were synthesized.

The Polar Geophysical Institute in co-operation with the IZMIRAN and some French research organizations carried out the unique experiments "Araks" and "Zarnitsa" on active change of the local parameters of the polar ionosphere by the r.f. emission and electron beam injection. A system of all-planetary ionospheric distribution of nonuniformities dissipating the ultrashort radiowaves was determined, and a shortwave high- latitudinal radio connection prediction technique, taking into account noise effects produced by the Aurora lights, was created. With the help of baloon measurements the structure and dynamics of high-energy electron flows in the magnetosphere within the periods of its disturbances was investigated; physical principles of forecasting a radiation situation in the high latitudinal stratosphere and near-Earth space were developed. The Institute became a co-author of a scientific invention known as Getmantsev`s effect. For further development of investigations in the field of geophysics, the High-Latitudinal Ionoshere Complex of the USSR Academy of Sciences was planned to be set up to carry out a comprehensive investigation of the dynamics and structure of the high-latitudinal ionosphere; the investigations of interaction between the ionosphere and magnetosphere, and those of peculiarities of wave propagation in high latitudes. Some apparatus and a theoretical

substantiation developed by a group of scientists under the guidance of Ye.D.Tereshchenko, made it possible, some years earlier than in the leading foreign centres, to master the radiotomographic methods for measurement of the 2D electron density distribution in the subauroral and auroral ionosphere (these works were later rewarded with two State Prizes). With the help of a unique plant for partial reflection designed in the testing ground near the settlement of Tumanny, it became possible, for the first time, to record specific wave reflections, in the medium frequencies (2.7 MHz), from the polar summer ionosphere region that are analogous to the mesosphere echo PMSE that is observed by the MST- and incoherent scattering radars.
The Murmansk Marine Biological Institute discovered the biological regularities determining the Barents sea productivity, including the hydrochemical regime, the organic substance turnover; the metabolic processes in marine ecosystems; the physiological principles and the behaviour mechanism of fish and invertebrates as well as the pollutants impact on the marine organisms. Ways of bringing the coastal ecosystem and food-fish cultivation to a commercial level were being determined. Research base and sea transportation facilities for sea research expeditions have been developed in a planned way. The Institute was equiped with a research ship "Dalny Zelentsy" of an unlimited cruising range and of 120-t displacement. An international biological station in the Franz-Josef Land (the Tikhaya Bay, the Guker island) and an experimental base in the White Sea coast (the settlement of Khyazhaya near the Kandalaksha Bay, the White sea) were set up. An experimental aquacomplex was constructed to carry out experiments with marine mammals and fish, and there was a pilot seaweed plantation for the laminarium growing technology development.
The Polar-Alpine Botanical Garden was granted a status of a research institute in 1967, which testified the fact that the contribution of the Kola school of botanists to the investigations of the subarctic vegetation was recognized. The Institute compilated and published a multivolume summary "Flora of the Murmansk region", "A vegetation map of the Murmansk region", "A Red Book of Flora of the Murmansk region", and a "Soil map of the Murmansk region" at a scale of 1:500,000. The scientific principles of podsolic and peaty-boggy soils cultivation were developed; effective ways of recultivation of the areas disturbed by mining activities and those of the development of the ornamental gardening in the northern areas were suggested. In 1981, the Polar- Alpine Botanical Garden-Institute was awarded to Order ?Badge of Honour¬ for its practical success in study and mastering the biological resources of the region.
In 1960, the Department of Hydroelectric Power was set up as a structural subdivision for investigations in the field of power, being included into the KFAN. When the Mining-Metallurgical Institute was set up, the Department of Hydroelectric Power was included into it as a Laboratory of Power and Integrated Water Supply Problems. By the 1960s the hydrologists and power engineers have compilated a Catalogue of rivers and lakes, and Power Cadastre of the Murmansk region; the recommendations given by power engineers were made use of in the construction of the Voronia and Teriberka Hydros. During those years to optimize of the fuel and power balance in the North-West area of the USSR, the works on optimization of the power consumption regimes at the industrial enterprises, and on that of the heating regimes in a dwelling complex, were started. At the late 1960s first integrated investigations were carried out on the evaluation of the pollution level in Lake Imandra where the industrial waste produced by mining and processing combines, were discharged to, and the recommendations concerning the pollution

decrease in the lake, its fishing potential rehabilitation, and utilization of the lake for recreation purposes was elaborated. Having become an independent subdivision (1972), the Department of Power headed by I.R.Stepanov, Dr. Sci.(Eng.), paid a great attention to the investigations connected with the future development of the power facilities, to the development of integrated problems of fuel and power supply. The forecasts and programmes concerning the development of the regional power and the power of the European North of the USSR for a long period of time (15-20 years) were developed. Wind power cadastres of the Murmansk region and those of the European North of the USSR were worked out. Some questions on atomic power- and-heat generation in the Murmansk region were discussed including the substantiation of the construction of an underground nuclear thermoelectric plant near Murmansk, and the substantiation of heat supply to the settlements located near the Kola NPP. Some works on improvement of the power lines and substations protection from thunderstorms under the increased soil resistivity were carried out.

The resolution of the Presidium of the AS to create KSC was prepared by a commission from the AS, consisting of academicians M.I. Shults, N.M. Zhavoronkov, G.I. Marchuk and corr.-mem. V.I. Revnivtsev. Memorable photo in the Presidium of KBr of the AS.

The Department of Economic Investigations carried out a great number of investigations connected with the elaboration of the prospects of the future socio-and-economic development of the Murmansk region, with the economic evaluation of comprehensive utilization of natural resources. Schemes of the productive forces development and allocation in the Murmansk region over a 5-year period and long-term programmes of their development as well as the regional labour resources formation over a 5-year period, were being regularly elaborated. In co-operation with the Karelian and Komi Branches of the USSR AS, a forecast for a comprehensive utilization of natural resources was made, and the main directions of the productive forces development in the European North of the USSR during the period from 1981 to 2000 were elaborated. The investigations carried out revealed the main directions aimed at making the production more efficient at the leading enterprises of the specialized branches of industries of the Murmansk region as well as in agriculture; determined the economic efficiency of the fixed production assets and of capital investments under the Arctic conditions; made it possible to elaborate an optimal perspective plan of an comprehensive utilization of the Khibiny apatite-nepheline ores and modernize their cost estimation technnique, reveale the technical-and- economic premises for commercial mining and processing low-grade copper-nickel ores of the Kola peninsula; on the basis of rational utilization of useful minerals, to elaborate an optimization technique for setting up, development and allocation of industrial complexes.

Since the late 1970s, some works were launched on preservation and improvement of the environment under the Arctic conditions, the forecasts of its change under the enhanced rate of the economy development being elaborated. Many research and technological problems were solved by research miners, chemists and botanists. To make these problems more ecologically orientated, the Laboratory of Nature Protection (headed by V.V.Kryuchkov, Dr. Sci. (Biol.)) was set up within the KFAN.A long-term plan for territorial development of reserves" and zakazniks (reserves), for protection of objects of nature in order to the ecological balance in the Kola

peninsula, was elaborated; the regularities of the impact zone formation around the industrial centres effecting the environment, atmosphere, snow and soil-vegetation covers, water bodies, are being studied; the questions concerning the rational utilization and protection of unique Lake Imandra and those of chemical and biological recultivation of waste generated by processing industry being solved.

The Kola Science Centre?s (KSC) structure, as of the 1950s-70s period, allowed to solve the tasks of a wide sphere of scientific-and-technological problems facing the economy and life and survival in the Arctic conditions; carry out fundamental investigations on problems determined by and related to a specific geography of the region. The integrated interdisciplinary investigations carried out in the KSC resulted in broadening data and knowledge bases necessary for revealing the most important factors and regularities responsible for the state and dynamics of interactions between nature systems in the polar region of the Earth as well as those determining the resource potential and keeping stable conditions necessary for life and efficient activity of people.

At the same time, the importance of some new factors of a technological and geopolitical nature increased, which required changing the trend of the scientific potential development, which was presented mainly by the academic science in the region.The intensive development of the mining complex, the prospects of oil and gas development in the Barents shelf made the investigations on the environmental protection in the Barents region of the first priority, in which, against other Arctic regions, the impact exerted on its ecological systems by man`s activities has reached its critical level. The technical revolution determined by general and wide-scale application of computing machinery required to launch the investigations in the field of informatics and mathematical modelling of technological and socio-and-economic processes. Being intensively developed, the Russian sector of the Barents region, turned into the most economically developed and urbanized region against the other near-arctic regions of the Earth whose economy was based on industries exploiting the nature. The regional industrial complex and traditional system of economic and natural resources management, however, needed urgent improvement because these did not provide for, in terms of technology, a complete comprehensive utilization of raw materials resources, and initiated only the processes of non-reversable degradation of the biosphere, and, in terms of economics, the system was unstable, having no reserves to improve its efficiency even in the economic medium of that period. During its first steps which were made by the state towards its integration into the world economy, the geographic location of the region opened new opportunities for its socio-and-economic development, which have to be effectively and quickly used.

The leaders of the KFAN and Academy of Sciences have made the most of the situation formed. It was decided to strengthen the scientific potential of the region, to orientate the activity towards high technologies and new scientific directions. In 1985 the Kola Branch of the USSR Academy of Sciences was headed by V.T.Kalinnikov, a corr.-member of the RAS (in the year 2000 - was conferred with a title of Academician). Some Institutes are headed by the future academicians of the RAS - F.P.Mitrofanov, Dr.Sci.(Geol.-Min.), N.N.Melnikov, Dr.Sci.(Eng.), G.G.Matishov, Dr.Sci.(Geogr.).

The scientists of the KFAN develop and advance the idea of the Kola mining complex (KMC)

formation on the basis of comprehensive utilization of mineral raw materials of the Kola peninsula. The Interdepartmental territorial commission of the State Planning Committee of the USSR (Gosplan of the USSR) on the development of the KMC was set up in 1984, in 1985 a Programme of Comprehensive Utilization of Raw Materials of the Kola peninsula was developed and in 1986 it was approved by the decision of the USSR N1226 "On comprehensive utilization of minerals of the Kola Peninsula".

The museum of the Arctic research and development of the International center of science, culture and education development in the Barents Region.

To implement this decision and to develop works on the problems of the Extreme North economy, the Department of Economic Researches was transformed into the Institute of Economic Problems (G.P.Luzin, Dr.Sci.(Econ.) as Director). Then some proposals on acceleration of socio-economic development of the Murmansk region were elaborated, forming the basis of Decision N338 passed by the Government of the USSR in 1988 "On measures on acceleration of socio-economic development of the Murmansk region in the 1988-90 period and up to the year 2005. In accordance with this decision, the Kola Branch of the USSR Academy of Sciences has got a status of the Science Centre of the USSR Academy of Sciences, and some measures were provided for further strengthening its material base and expand the network of scientific institutions. Some Institutes were set up - 1989 - the Institute of Informatics and Mathematical Modeling of Technological Processes - IIMM: (V.A.Putilov, Dr.Sci.(Eng.) as Director), and the Institute of Problems of the Industrial Ecology of the North - IPIEN (G.V.Kalabin, Dr.Sci.(Eng.) as Director); 1991 - the Kola Regional Seismological Centre - KRSC (I.A.Kuzmin, Dr.Sci.(Phys.-Math.) as Director); 1990 - the Department of Power was transformed into the Institute of Physical-and-Technological Problems of the Power of the North - IPTPPN (A.A.Papin, Dr.Sci.(Eng.) as Director).
The major task facing the Institute of Problems of the Industrial Ecology of the North was the elaboration of scientific principles of ecological optimization of nature management in the North, with the Kola peninsula taken as an example, as the most developed mining-and-metallurgical region of the Russa`s North..
The Institute of Physical-and-Technological Problems of Power Industry of the North was to tackle the regional problems connected with power industry, to determine the strategy of its development, to inhance the reliability of power supply, and to accomplish the practical tasks connected with the implementation of the programmes on heat-and-power supply.The Kola Regional Seismological Centre was aimed to provide for seismic monitoring within the North-European area of Russia as a region with plenty of nuclear objects as well as due to the plans concerning with the construction of some facilities involved in oil-and gas-development in the northern sea shelf.The Institute of Informatics and Mathematic Modeling of Technological Processes dealt with the development of scientific and applied problems on informatization of technological processes.The factors mentioned above were also the determining ones in the consequent years for the directions of scientific researches carried out by the KSC. (The present state of the scientific institutions of the KSC and their basic achievements are summerized in brief below).The accelerated convertion of the economic complex of the country into a maket

system after 1991 and the change in the federative relations have significantly corrected only the spectrum of economic studies. Negative effect on the development of researches in Russia as a whole was produced by a sharp reduction in financing science, resulted in reduction of researches and personnel. The period of growth of the KSC, observed since the 1930s, had changed to a period of reduction after the IIM, IPIEN, and IPIEN had been set up: the personnel was twice as less by the year 2000, amounting about 1900 people. Nevertheless, in spite of a very complicated economic and social situation, they managed to preserve and strengthen the material base necessary in carrying out fundamental academic researches in the Euro-Arctic region, to strenthen the personnel potential and create the necessary conditions for efficient and creative work carried out by researchers. The scientific activity of the institutes of the KSC is concentrated on system investigations on the key problems determining the current day strategy in nature management and life support in the Euro-Arctic region. There were new scientific schools formed in the region that occupied a leading position in studies on the peculiarities of nature and socio-and-economic sphere of the Western Arctic. At present the researches are carried out using modern information technologies (including GIS-technologies, computer databases, simulation modeling etc.). A local information-communication network enabling the access to the WWW was set up in Academic Town.Due to a target-oriented support rendered by the RAS, the analytical and monitoring laboratories of the KSC have been equipped with a number of unique instruments for geochemical and material-.... investigations; the expeditionary ships are equipped with some devices for satellite navigation.

The co-operation with a number of foreign research organizations and universities, in the Barents region primarily, was extended. Some international teams were formed within some projects concerning the natural protection themes, the ecological, including nuclear, safety, as well as the sphere of economics. The greater role in broadening the international contacts is being played by the International Centre on Science, Culture and Education Promotion in the Barents region that is known abroad as ."Nordic Study Centre".

The science and higher schools have been successfully integrated. By the initiation of the KSC, a set of higher schools based on the KSC`s potential, are being formed including the Branches of Petrozavodsk State University and Murmansk Technical University, St.-Petersburg Engineering and Economic Academy.This contributes the strengthening of the KSC`s position in the region, forms a potential used in the research pesonnel renewal at the expense of students and graduates involvement into various scientivic activities. The staff of the KSC is replenished with skilled personnel taking post-graduate studies. In the year 2000, 82 post-graduates and 97 Doctoral candidates were taking a post-graduate course on 18 specialities. Four specialized scientific councils on theses defence were formed at the KSC: for a doctor`s degree - on three specialities, and for a candidate`s degree - on four specialities.

An illustration of the scientific potential qualitative growth and of highly effective researches made by the scientists of the KSC was the fact that a number of leading scientists were elected to the Academy of Sciences as its members, some scientists have received academic ranks, State Prizes and awards. Since 1985 the staff of the KSC has been replenished with 4 academicians and 2 corresponding-members of the RAS; 9 leading scientists of the KSC received a title of "?onoured Scientist of the RF"; 3 scientists received a title of "?onoured Economist of the RF";3 scientists received a title of "Honoured Inventor of the RF";16 scientists were approved as

Professors;23 scientists have become State and Government Prize winners;14 collaborates of the KSC received government awards.The activitiy of the KSC was reported at the meeting of the Presidium of the RAS in 1994, being positevely assessed. In 1999 all the Institutes of the KSC have passed the state accreditation, the Kola Regional Seismological Centre was included into the Geophysical Survey of the RAS.

In connection with the 50-th anniversary of the KBr of the AS received governmental awards
Strengthening the material base favoured making researches. A school created by A.V.Sidorenko in the Geological Institute developed a new research direction such as the Precambrian exogenic geology; a notion of the preglacial weathering crusts presence in the Fennoscandia was substantiated; under the guidance of I.V.Bel`kov, an honourary scientist of the RSFSR, the principles of the analysis of the Precambrian magmatism formation were further developed; the dating methods and methods of correlation of the most ancient rock associations were improved; an active contribution made by deep-seated hydrocarbon and helium flows to the formation of cristalline rocks composing the upper layers of the Earth?s crust was revealed; under the leadership of A.A.Zhamaletdinov, Dr. Sci. (Geol.-Min.) and academician Ye.P.Velikhov, the geophysicists of the Geological Institute, in co-operation with the Institute of Atomic Energy (IAE) named after I.V.Kurchatov, carried out the greatest in the world experiments "Khibiny" and "Volga" on the depth probing of the Earth`s crust.

By a Presidential decree No 481 of 17th May 2006 ***Lobanova Vera,*** chief accountant and head of the department of finance of KSC RAS was awarded the title of “Honored Economist of the Russian Fredericton” for her services in the field of economics and financing.

By a decree No 491 of 17th May 2006 the director of the Geological Institute ***acad. Felix Mitrofanov*** was awarded the order of Honor and the deputy director of the Polar Geophysical Institute ***Vladimir Ivanov*** was awarded a medal “For services to Motherland” of the 2nd degree.

By a presidential decree of 20th April No 408 the director of the Polar Geophysical Institute KSC RAS ***Tereshchenko Eugeniy*** was for his long-term fruitful work and substantial labour progress awarded the Order of Honor.

A group of researchers of the Center was given governmental awards by a presidential decree of 18 February 2006, no. 125. Among the recipients are ***Valentine Petrov*** (Order of Friendship); ***Petr Gromov, Nikolai Kozlov, Anatoliy Kozyrev, Anatoliy Usov*** (medal of the order “Services for Motherland” of the 2nd degree); ***Vladimir Denisov*** (“Honored Scientist of the RF”); ***Leriy Kazakov*** (“Honored forestry specialist of the RF”); ***Nadezhda Perelomova*** (“Honored worker of housing and communal services of the RF”); ***Tatyana Pisareva*** (“Honored culture worker of the RF”), ***Pereverzev Vladimir*** (“Honored agricultural worker of the RF”); ***Victor Snegov*** (“Honored transport worker of the RF”) and ***Nikolai Kashulin*** (“Honored ecologist of the RF”).

Academician ***Gennadiy Matishov*** and ***Gennadiy Tarasov,*** Dr.Sc. (Min.-Eng.) were given a Governmental Award of the Russian Federation in the Field of Science and Technologies for 2005 for development, scientific substantiation and introduction of advanced technologies aimed at creation of ecological and geological grounds for resources management at the West-Arctic shelf of Russia.

Resolution GMS
Acievements of scientific and organizing activity of Kola Science Centre in 2005
Scientific manpower 2005
Prize-winners of the competitions, dedicated to the 75-th anniversary of the Kola Science Center RAS

Staff: Staff: 378 doctors, more than 1200 high graduated researches and engineers apart from auxiliary personnel.

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Institute of mechanics and machine building of wounds

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History

Kazan long since was one of centers of development of the mechanics in Russia. In different time here worked corresponding member of the Peterburg Academy of Sciences A.F.Popov, professor I.S.Gromeka, dynasty of Kotelnikov, dynasty of Lavrentyev, corresponding members of the Academy of Sciences N.G.Chebotarev and N.G.Chetaev.

The outstanding mechanical engineer professor H.M.Mushtary was the first director (1946 - 1972) of Kazan Physical Technical Institute, in which he was the chief of the Department of the Theory of Shells more than 30 years. Corresponding member of the Academy of Sciences N.G.Chebotarev has organized in 1946 Sector of Mathematics. Since the fiftieth years the main scientific direction of Sector of Mathematics has become the Theory of the Filtration. A valuable contribution to the development of mechanics at Kazan Physical Technical Institute was made by the famous scientists mechanical engineers K.Z.Galimov, G.Z.Salehov, M.A.Ilgamov, M.S.Kornyshin and others.

The Institute of Mechanics and Engineering of Kazan Scientific Center of the Russian Academy of Sciences is founded in accordance with the Resolution of the USSR Academy of Sciences Presidium No.165 dated the 28th May 1991 on the base of mechanics departments of Kazan Physical Technical Institute. Organizer and first Director (1991 - 1996) of the Institute was corresponding member of the Russian Academy of Sciences M.A.Ilgamov (at present being the scientific adviser of the Institute).

In the Institute the scientific researches on the theory of shells (scientific school of H.M.Mushtary), aerohydroelasticity (scientific school of M.A.Ilgamov), non-linear stability and control theory (the scientific consultant academician V.M.Matrosov), dynamics of multiphase media (the scientific consultant academician R.I.Nigmatulin) will be carried out.

The most important achievements
1946 - 2000

The basis of up-to-date non-linear theory of elastic shells were laid (H.M.Mushtari, K.Z.Galimov). The monography of H.M.Mushtari, K.Z.Galimov "The non-linear theory of elastic shells" (1957) was republished in foreign languages and became the classic one in its field of knowledge. Under the guidance of H.M.Mushtari the Kazan school of the theory of shells was formed.

H.M.Mushtari, K.Z.Galimov

Efficient numerical and variation methods of analysis of non- linear behaviour of elastic and elastic-plastic shells, including the composite ones were worked out. The results were widely adopted in aircraft building, rocket production, shipbuilding, chemical engineering industry.

H.M.Mushtari, K.Z.Galimov,M.S.Kornyshin, I.G.Teregulov, I.V.Svirsky, M.S.Ganejeva, H.M.Yakupov and others

Non-linear theory of thin-walled structure elements interaction with working mediums (liquid, gas, soils) was developed. The results are used in mechanical engineering, engine production, pipeline and parachute systems projection.

Equations of dynamics of three-layer plates and shells with structure nonsymmetric in thickness were derived, analysis of static and dynamic stability, forced and parametric oscillations was conducted. A large series of investigations was performed on oscillations of cylindrical shells with a gas and a compressible fluid. Dynamic interaction of the cylindrical and spherical shells, the continuous elastic filler and the gas in the space was studied. Axisymmetrical shapes of oscillations of thin-walled cylindrical tube were studied theoretically and experimentally, generation of waves in the circular direction and catastrophic failure were found. Behaviour of plates, shallow panels, shells and parachutes in a flow of incompressible ideal liquid was studied. Experimental models of wave propellers were created.

M.A.Ilgamov, B.V.Gulin, V.A.Ivanov, Zh.M.Sakhabutdinov, V.V.Ridel, R.G.Yakupov, A.N.Gilmanov, R.G.Zaripov, V.L.Fedyajev, M.V.Taldykin, Z.V.Skvortsova and others

Analytical and numerical methods of oil-content contour determining in working conditions of supercharging and extracting wells were devised.

G.S.Salehov, V.D.Chugunov,V.L.Danilov, V.V.Skvortsov, M.H.Hairulin, A.I.Nikiphorov and others

There were made experimental and theoretical investigations of the shock waves in gas in the closed and open tubes. The processes of moving away gases cleaning by aerosols were examined. By means of analytic-numerical methods there were studied non-linear and chaotic oscillations of cylindrical shell in a stream of gas; of a gas cavity in liquid in sonoluminescence condition; of a tube with liquid; of a superconducting cable. A linear theory on the propagation of waves of different geometry in the polydispersed vapor-gas-droplets suspensions was developed. The nonsteady wave discharge of a boiling liquid from high-pressure pipes during its accidental depressurization was studied.

M.A.Ilgamov, D.A.Gubaidulin, R.G.Zaripov, A.A.Aganin, A.L.Tukmakov and others.

There was developed the theory and methods of calculating stresses, strains and stability of shells of multiplex geometry under intensive thermoforce loading, consideration physical and geometrical nonlinearity, interaction with agressive media. There were suggested the methods of reduction of strains and stresses concentration in dangerous zones of a reservoir for cryogen liquid (M.S.Ganejeva and others). It was made durability prediction of large-scale cooling towers

constructions (N.M.Yakupov and others)
It was created the universal procedure of numerical solving the tasks of the viscous gas stream flow about aerodynamic objects (A.N.Gilmanov and others); of gas motion in three-dimensional regions of intricate configuration consideration chemical transmutations and intensive heat supply (Zh.M.Sahabutdinov and others). It was analysed the deceleration of supersonic gas stream in a flat channel. Special features of working processes in the chamber of internal-combustion engine, in a furnace of a spectrometer were studied.
There were worked out special methods of numerical solving the tasks of water flooding the oil pools in complicated physical- geological conditions; of determining the filtering parameters while the nonstationary filtration on the base of incorrect problems theory; of discovering the situation of a source of water-bearing stratum pollution. Variation principles were built for the problem of filtering in the deformated medium of compound reology (M.H.Hairullin, A.I.Nikiforov, P.A.Mazurov and others).
Mathematical models were created, on the basis of which there were studied physical-mechanical processes of electric arc welding and thermo-hardening the hardware;the motion of steam-gas-drop mixture in cooling towers (A.B.Mazo, V.L.Fedyajev and others); the streams of thermo-unbalanced plasma in discharging cameras of plasma generators (F.A.Saljanov).
The method of vector functions by Lyapunov was developed for investigating the stability of non-linear logycal-dynamic systems of control and systems with random structure changes (A.I.Malikov). There were studied the flow of liquid with free surface consideration the contact line of three phases division (F.H.Tazjukov and others); the processes of heat mass transfer while fraction crystallization (P.P.Osipov). There were obtained analytical solutions of the problem of control of mass flow rate of space objects for the future (U.N.Zakirov).

The main investigation tendencies

- Non-linear mechanics of thin-walled constructions, hydroaeroelastic and wave systems
- Dynamics of multiphase multicomponent media in porous structures and technological plants
- Non-linear stability theory of control systems with changeable structure

Departments

- The Laboratory of Continuum Mechanics
- The Laboratory of Numerical Dynamics of Continuous Medium
- The Laboratory of Nonlinear Mechanics of Shells
- The Laboratory of Computational Simulation of Filtration Processes
- The Laboratory of Underground Hydrodynamics
- The Group Computational Simulation of Hydrogeological Processes
- The Laboratory of Modelling of Technological Processes
- The Laboratory of Stability and Control

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Nuclear Safety Institute

General information
The Nuclear Safety Institute (IBRAE) was founded in November, 1989, in the Academy of Sciences under the direction of the Soviet of Ministers of USSR with the goal to extend fundamental researches on safety analysis of operating nuclear power plants (NPPs) and those under construction, prediction of radiation accident consequences, as well as their effect on the

environment and humans. Academician Evgeni P. Velikhov, vice-president of the Russian Academy of Sciences, was charged as a director and organizer of the Institute. In 1991, correspondent member of RAS Leonid A. Bolshov was elected as a director of the Institute.
The main feature of the Institute activity is a complex safety analysis of nuclear power facilities and fuel/power complex (FPC) using complex computer codes integrating the bases of prediction, theoretical, experimental and operating knowledge.
The Institute staff is a combination of specialists in theoretical and applied physics, nuclear power engineering, biophysics, radioecology, computational mathematics and computer science. This makes it possible to develop the up-to-date approaches to safety analysis of nuclear power and FPC. The approaches are complex in nature and based on the development and application of modern mathematical methods and physical models, mathematical statistics, theory of reliability, probabilistic safety analysis, detailed investigation of fundamental aspects of the evolution of the emergency processes, migration of radioactive and chemically hazardous substances in the environment and their impact on the habitat and human beings.
At the moment, the main research activities of the Institute are focused on the following directions:

1. Safety of the FPC facilities, including nuclear power and industry.
2. Operator support systems and improving operational safety of NPP.
3. Ecological effect of the FPC facilities on the environment and population.
4. Emergency response in radiation accidents. Scientific and technical support in decision making on protection of population and territories.
5. Development of the concept of safe decommissioning and utilization of nuclear submarines in Russia.
6. Concept of nuclear power development considering engineering and ecological NPP safety and social and economic factors. Investigation of the efficiency of the advanced NPP in the regions of Russia.
7. Expert-Geoinformation and graphic information systems for FPC tasks.

Within the longterm agreements, IBRAE cooperates with Minatom of the RF, EMERCOM of Russia, concern "Rosenergoatom", Gazprom, RAO "EES of Russia", DOE and NRC (USA), Commi'sariate I'Energi'e Nuclear, France (IPSN).
IBRAE participates the implementation of the projects of CEC, OECD, International Scientific and Technical Center, INTAS, and Russian Foundation for Basic Research.
For many years, IBRAE supports the cooperation with the STC of Gosatomnadzor, RSC "Kurchatov Institute", Mintopenergo of Russia, OKBM (Nizhny Novgorod), 0KB "Gidropress", NPO "Mayak", VNIIEF (Arzamas-16), Atomenergoproekt, Institute for High Temperatures of the RAS.

Safety of nuclear power and industry objects

Investigation into safety analysis of nuclear power objects are one of the most important directions of the IBRAE activity. The Institute carries out works on calculation -theoretical analysis and designing of computer codes to describe NPP at various stages of the accident and to verify the developed modules against the experimental data in the framework of the international

and national programs. Great attention is paid to the development of the methodology and mathematical methods of the probabilistic safety analysis (PSA). Application of these methods enables qualitative and comparative quantitative assessment of NPPs and fuel-power complex facilities.

Probabilistic Safety Analysis (PSA)

The Institute developed probabilistic methods and complexes of computer codes to solve the problems of the safety analysis and risk assessment in nuclear power industry. The methods are used to obtain probabilistic estimates of the emergency sequences, to evaluate system reliability, significance and sensiitivity of the initial data and models. The second-generation methodology and mathematical methods for the probabilistic safety analysis (PSA) are developed. The methods are based on analytical and statistical modeling and allow taking combined account of deterministic and random processes, evaluate the significance, sensitivity and uncertainty of random and deterministic parameters of emergency processes. The methods are unparalleled in the world practice.

The analytical and statistical method was tested in the optimization task of RBMK reactor upgrading task of RBMK reactor upgrading and the analysis was done of the reconstruction priority based on the method of risk assessment of emergency scenario and cost indexes of various kinds of reconstruction for the Kursk NPP unit III.

Under the CEC project of TASIC program, works are carried out together with VNIPIET on probabilistic safety analysis of the RT-2 waste fuel storage facility and preparation of the input data for the probabilistic safety analysis and ecological risk for the RT-2 plant based on the design data.

At the moment, the Institute in cooperation with BNL conducts works on the Critique Overview and Quality Assessment of the works on probabilistic safety analysis of the Kola NPP (KOLISA Project) and Novo-Voronezh NPP (NOVISA Project) funded by the US DOE.

Integral Codes

The integral package of computer codes "SVECHA" developed by IBRAE is aimed at the modeling of physical processes of the core degradation at the initial phase of NPP severe accident. The package comprises the models for physico-chemical interaction of materials in the core heat-up induced by the loss of heat removal; models of liquid component draining; model of the mechanical behavior of the fuel cladding; model of yield of hydrogen and fission products. The models developed bv IBRAE gained world-wide international apprehension. They were implemented into known foreign computer codes lice ICARE-2 (France), SCDAP/RELAP-5(USA), and ATLET CD (Germany).

Core Confinement

In the framework of the OECD program, IBRAE, in cooperation with the RSC "Kurchatov Institute", implements the project "RASPLAV". The objective of the project is to provide experimental and computational-theoretical investigation of the possibility of the core melt confinement inside the reactor vessel.

Three-dimensional thermohydraulic models of the melt behavior in the reactor vessel were developed at IBRAE to validate the concept of melt confinement in the reactor vessel.

Efficient mathematical models and computer codes for the analysis of the spread and interaction of the core melt with the concrete foundation have been designed at IBRAE to provide for

effective core catchers outside the reactor vessel. The computer codes have been verified against numerous experimental data.

Mechanics of the Equipment and Constructions

The works are performed at the Institute on the analysis and expertise of the dynamical stability of the NPP protective structures and designs in case of explosions, impact, and thermal loads. Based on the developed algorithms and computer programs for calculating the stressed-strained state and dynamic strength of NPP structures in explosions, welding, impact and thermal Loads, the analysis was made of the load-carrying capacity of the pressure vessel of the pressurized water reactor in severe accidents with core melting and stream explosions.

The methodology, mathematical models and software modules have been designed for the analysis of the containment stressed-strained states under the effect of operational and emergency loads (CONT package). The package enables the analysis of the containment states at all loading stages: loads from prestresses of the reinforcing lines, combined action of the reinforcing lines and internal pressure up to the construction failure. The "CONT" computer code was verified by comparing the predictions with the natural data of the Kalinin NPP Unit 2 and experimental data from the 1/6-scale Sandia (USA) containment model.

NPP Operator Support Systems

The PC-based computer package "PROGNOZ" was designed at the IBRAE RAS for the on-line calculation of variations in 3D neutron fields, energy release, moderator temperature, etc., for local reactivity insertion into the reactor core. The package makes it possible to arrive at a real-time virtually exact solution of a steady-state problem. At the moment, it is undem'mplementation at the Ignalina NPP.

Works are conducted at the Institute to generate the integrated on-line diagnostic and operator support system (ODOSS). The "ODOSS" development is based on the "SPRINT" and "DIAG" computer packages being in use since 1986 at the Ignalina NPP Unit π1.

The diagnostics covers over 20,000 faults of 27 basic technological systems (60 subsystem); the knowledge base comprisses over 30,000 rules. According to the most comprehensive tests, the system failed diagnosing 20 out of over 1,000 regular and irregular dynamics modes under strong noise (failure of up 1/3 of sensors in certain systems; these failures are also being diagnosed).

Problems of the NPS Utilization

The utilization of the decommissioned Russian nuclear submarines is an acute problem. As nuclear fuel after burnup at the majority of decommissioned nuclear submarines is of at least 20% of initial enrichment, this is considered as high-enriched uranium and is subjected to the nonproliferation status. Therefore, the nuclear submarine spent fuel handling and monitoring its storage and maintenance shall be specially studied at the international level. In 1995 and 1997, IBRAE participated in the organization of International Conferences "NPS-95" and "NPS-97" in Moscow, devoted to the problems of decommissioning and utilization of NPS and to the generalization of the gain world experience in solving the relevant problems.

The Institute performs investigations into the analysis of the ecological safety of various variants of the NPS utilization investigations into the analysis of the ecological safety of various variants of the NRS utilization under leadership of Academitian A.A.Sarkisov, advisor to the Presidium of RAS.

Ecological impact of nuclear power and industrial facilities

An important factor that determines the development perspectives of various branches of power industry is their ecological safety. The IBRAE activity in this direction covers the complete set of problems in estimating the ecological impact of the fuel-power complex facilities operating under normal and emergency conditions.

Consequences of the Chernobyl Accident

Since the Institute setup, it performs investigations into the problem of the consequences of the Chernobyl NPP accident. Starting from 1991, IBRAE is the head organization for the system-analytical support of the Chernobyl program.

IBRAE RAS, in cooperation with other institutions of RAS, Ministry of Health, Ministry of Agriculture, Rosgidromet, Academy of Medical Sciences has developed the integrated computer geoinformational expert system for accessing the radiation accident consequences and preparing recommendations for planning long-term post-accident measures. The system is world's unparalleled with respect to the database completeness and software combination. The system incorporates the Central Bank of generalized data (CBGD), unique base of radiation-hygienic and medico-demographic data for over 12,000 settlements areas of Russia, including areas with Cs-137 radioactive contamination above ICi/km2, electronic map bases, bank of models, and the computer package for data processing. The Control Information System (CIS) "Chernobyl" was created and operates in the EMERCOM of Russia on the base of the CBGD.

The CBGD incorporates over 18 sections ó from the data banks on radiation contamination of the territories, feeding products, farming and forest areas, doses of internal and external radiation, to the personal database of the participants of the liquidation of the Chernobyl accident consequences (information on 240 thousand of liquidators).

One of the GRBD sections - the medical and demographic data bank - includes the data of the official statistics on age and sex structure of the population, causecase mortality, cancer diseare, etc., for all RF subjects starting from 1982. The class of neoplasms in subdivided according to 23 cancer localizations.

Radioecological Models and Expert Geoinformation Systems

Since 1990, works have been speed up at IBRAE RAS to develop the problem-oriented geoinformation system, electronic map bank and tools for designing specialized geoinformation systems. The Institute created the Fund of computer codes and algorithms, which includes codes for calculating radiation doses, relative and absolute radiation risk, migration and transfer of radionuclides etc. The designed tools are supported by known and original technologies. The generated bank of regional digital maps ensures plan mapping and linking of the attributive information to spatial objects. On the basis of the designed tools and the CBGD on the consequences of the ChNPP accident, an original specialized geoinformation system RVS was created for the regions with the increased radiation risk. The system includes the information from the CBGD.

The up-to-date methodology of the analysis, processing and presentation of the radiological monitoring spatial-distributed data has been worked out. It incorporates statistical and fractal analysis of the monitoring networks, statistical and spatial correlation analysis of the radioecological data, cross-validation, comparative analysis of various deterministic and statistical methods of spatial interpolations, analysis and description of space variability and uncertainty of the data using geo-statistical and fractal stochastic simulation, probabilistic mapping. The new

methodology of the geostatistical analysis and stochastic modeling of the spatial-distributed environmental data using artificial neuron networks was developed and verified against real Chernobyl data.

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Along with the models for evaluating the radiation risk, IBRAE, in cooperation with the IRFChP of the National Academy of Sciences of Belarus, develops computer codes for risk analysis related with chemically hazardous substances (cancerogens and system toxines). The model uses the IRIS database that includes the characteristics for over four thousand of chemically hazardous substances. The IRIS database is supported by the US Environmental Protection Agency (US EPA). Using the computer models of atmospheric transfer and chemical risk evaluation, the Institute conducts works on the analysis of the ecological impact of the power plants with various types of fuel on the environment and the population.

Emergency responce scientific and technical support of decision making

The Institute develops research into the expert systems supporting the process of decision making and into the problems of scientific-technical support of measures to protect the population and territories at radiation and chemical accidents. These works are based on the results of the fundamental investigations in modeling the NPP severe accidents and scientific potential on the analysis and prediction of the consequences of the radiation catastrophes.

Models and Computer Packages

The Institute carries out a great deal of work to design a standard information and simulation system for atmospheric transfer of radioactive release and its impact on the health of the population and the environment in regular operating conditions and radiation accidents at NPP and other nuclear power facilities.

The "NOSTRADAMUS" computer package is designed to support decision making on mitigation of the environment and population impact of the radiation accidents at the initial and "acute" stages. The system was used for the preparation of scenarios and in Russian and international business games and training. The system makes it possible to analyze accidents varying in scale ó from the local accidents (of several hours in duration and dozens of kilometers of exposure area) to rather severe accidents (of several days of release or propagation area of up to thousand kilometers).

The "NOSTRADAMUS" comuter system includes units for prediction of initial parameters of release at fire ("FIRE") and explosions ("EXPLOSION").

The technique was developed to find average values of the integral activity of radioactive release, height of raise of radioactive products and rate of precipitation of particles released to atmosphere, and the confidence intervals for these characteristics using surface activity field

measurements ("REVERS" package). Analytical estimates were obtained with the accuracy of determination of the source integral characteristics as function of relative fluctuations of surface activity. The model was verified using the South Urals radiation accident as an example. The computer codes use geo-information systems designed at IBRAE RAS with a possibility to connect predictive models ensuring operation with the F1M format.
The format is used by the Geodetic and Cartographic Federal Service . The formats for storing the map graphical information can be converted into international formats. The "TRACE" system. The system is based on a fast integral computer code using the Gauss model of atmospheric transfer. The code generates the predictions of contamination densities (total and by isotopes), effective equivalent dose of whole body and organs (thyroid, gonads, lungs, red bone marrow, etc.) for various age groups as functions of time. Data are presented in the digital, table and map format.
By the order of the Ecological Department of Ministry of Defense of RF, works are being conducted at IBRAE RAS to develop an information and analytical system, based on geo-information tehnologies for storing and processing the data on radiation and chemically hazardous facilities. The data bank includes information on:

1. NPP;
2. ecologically hazardous facilities of the Armed Forces dealing with operation of nuciear ana cnemical weapons, nuclear fleet, rocket complexes, etc.;
3. ore production and processing factories (including radioactive ores);
4. nuclear fuel production and spent fuel processing factories;
5. radioactive and toxic waste management factories;
6. chemical facilities dealing with strong toxic substances;
7. territories contaminated by nuclear explosions, Chernobyl catastrophe, and other accidents and incidents associated with release of toxic and radioactive substances.

Training, Exercises

IBRAE RAS took part in organizing and conducting business games and exercises on radiation hazardous facilities with full-scale simulation of the radiological situation in the contaminated areas. In so doing, the computer simulation experience was applied for simulation of severe accidents for NPP employing various reactors, including scenarios of radioactive release; predictions of radioactivity transfer under various weather conditions with forecasting of the radiation situation on the territory as applied to the NPP site; development and generation of simulating full-scale data bases on radiation and hygiene situation and radiation exposure of the population in the suffered regions; dynamic modeling in the course of the exercises and business games of additional primary data on the radiation situation accounting for the implemented measures on the population protection; simulation of environmental contamination; operative interaction with foreign experts, including technical crisis centers.
Various computer systems have been developed to simulate the radiological data in the large-scale radionuclide contamination of the territory for traning the specialists in the population protection. The recent developments in this direction are the "PARIS" post-accident radiological situation simulation and the "ENVELOPPE" system for generation of measurement results of the environmental contamination created on the order oftheIPSN CEA (France).
Starting from April, 1996, a Technical Support Center of the Crisis Center of the Rosenergoatom

Concern (REA) is operating in IBRAE by the agreement with the REA Concern. The task of the Technical Support Center is scientific and technical support of the activities of the managerial board of the Concern in case of NPP accident for minimization of damage due to radiation impact on the population and personnel.

Expert geoinformation and grafical information systems in power industry

On the order of the Ministry of Fuel and Energy RF, Federal Energy Commission RF, Centralized Dispatcher Agency of "EES of Russia" RJS Company and the Department of Fuel and Energy of the Tula Regional Administration, IBRAE developed MAPINFO-based applied geo-information systems using the up-to-date information technologies. The systems enable the solution of a wide spectrum of tasks, including:

maintaining classifiers (directories) of various objects;

maximum possible fast and convenient access to attributes and performance characteristics of facilities mapped;

on-line search for facilities with given properties in the list, map or scheme;

illustrative and compact presentation of a complex structure of the data irrespective of its origin;

illustrative presentation of the dynamics of time-dependent parameters;

aggregation (summation and averaging) of the data against various strata;

allowing for multi-variable changes of characteristics in future.

The system "ELINFO" for representation and analysis of the electric power market is a flexible tool for the representation and analysis of information on the power industry in the Russian Federation. The maps display such objects of the power industry as: power zones/united energy systems; energy supplying enterprises ("AO-energo") with the covered territories; wholesale consumers of the electric power; electricity transmission lines etc. The balance schemes visualize the relations between the subjects of the wholesale market of the electric power. The schemes are built automatically, according to the relation structure.

Economics of the Nuclear Power Industry

IBRAE performed investigation of economic efficiency of NPP as compared with other types of power plants with the account for the parameters of technical and ecological safety and market conditions. From 1996 to 1997, IBRAE performed investigation of economic efficiency and competitiveness of NPP of medium capacity employing NP-500 (VVER-640) reactors. NP-500 unit performance characteristics were obtained in Joint Parallel Investigations of the Nuclear Development Alternatives (JPINDA) and the finding of the Joint Research of Power Generation Development Alternatives (JRPGDA) in Russia made for the Russian-American Commission on Economic and Technology Cooperation (the "Gor-Cherno-myrdin" Commission). The original technique has been worked out at the Institute for the analysis of energy technologies. Using this technique and the data base of JRPGDA studies were performed of competitiveness of energy technologies. The results indicated NPP with NP-500 (VVER-640) units to be economically efficient in most regions of Russia.

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Institute of Metal Superplasticity Problems
(*UFA SCIENTIFIC CENTER*)

Institute for Metals Superplasticity Problems of Russian Academy of Sciences was founded in 1985 on the base "Tantal" Special Design Office and Material Sciences Department of Ufa State Aviation Technical University.

The Institute is part of Power Engineering, Machine-Building, Mechanics and Process Department of the Russian Academy of Sciences.

The main field of scientific investigations of the Institute comprises the following: physics of solid state, materials science and plastic metal working.
Director of IMSP - Professor Oscar Kaibyshev .

Institute for Metals Superplasticity Problems, founded in 1985, is one of the country's leading research and development centers in the field of materials science and processing. The foundation of the Institute was prepared by intensive research activity of a group of scientists launched at one of the Departments of the Ufa Aviation Institute in early 70's.
The main field of scientific investigations of the Institute comprises the following:
- physics of solid state,
- materials science,
- plastic metal working.

Fundamental directions of investigations:
- physics of strength, plasticity and superplasticity of polycrystalline materials;
- theoretical and experimental studies of structure and properties of grain boundaries in metals,

alloys , intermetallics and ceramics;
- development of methods and investigations of physical and mechanical properties of nanocrystalline and submicrocrystalline materials;
- mechanics of superplastic flow and mathematical modeling of forming processes in superplastic conditions;
- creation of scientific basis for processing composite materials with metallic, intermetallic and ceramic matrixes;
- development of basic principles for creation of integral technologies comprising concurrent processes of solid state joint formation and forming of structures from sheet materials;
- creation of scientific basis for developing new lubricants to be used with superplastically processed materials.
The Institute has developed a number of advanced resource saving technological processes by using the effect of superplasticity such as:
- processing of large scale semi-products with submicrocrystalline and nanocrystalline microstructures out of different materials;
- production of precise billets with minimal allowances by die forging in conditions of superplasticity;
- processing of complex shape and large size articles by the method of local deformation in a regime of superplasticity;
- technology for producing multiple layer cellular structures by the combined method of superplastic forming and solid state joint formation;
- technology for manufacturing automobile wheel discs by using liquid forging , etc.

Many technological processes developed by the Institute have been implemented.
Scientific achievements of the Institute and the industrial technological processes developed on their base were displayed in more than 500 scientific publications and the scientific discovery registered. The inventions made by the Institute were defended by several hundreds of patents, including international ones. Post-graduate course and two specialized Ph.D and Doctoral theses defense Boards functionate at the Institute.
The Institute cooperates with a number of Scientific Research Institutes, RAS and Institutes of Higher Education of Russian Federation and Republic of Bashkortostan. It performs joint investigations with scientific centers, institutions and companies of Germany, France, Italy, India, China, Canada, USA, Japan and Republic of Korea.

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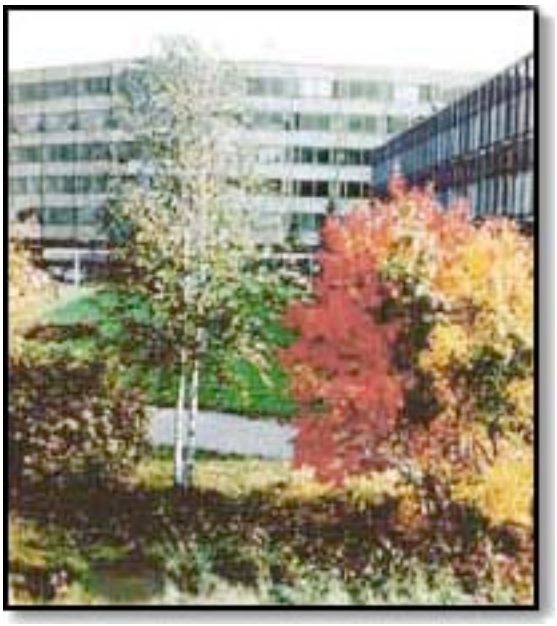

Brief History of the Institute

The Institute of Automation and Remote Control was founded in June 1939, under the auspices of the Technical Sciences Department of the USSR Academy of Sciences. The Institute was assigned the task of expanding fundamental research in the field of automatic control, in close connection with the solution of important practical problems related to this field. The two directions taken by the Institute were the theory of automatic regulation and the creation of components of automatic devices.

The Institute was the first to recognize these studies as a specialty, and concentrated its efforts in forming a Research Board, which brought together many recent graduates of high schools and universities. Many world-renowned scientists have matured within the walls of the Institute, by aiding in the process of solving these new scientific problems. A large number of well-known leading scientists have showed their interest in this newly developing branch of science by participating in the research work of the Institute.

They have shared their experience in the statement of scientific problems, in finding ways of solving the assigned problems, and in creating the basis of a work style and ethics of personal contacts in scientific society (corporate ethics and helping to establish the network of professional contacts with International scientific society) . It is important to point out, that in the year of its foundation the Institute was the only independent scientific organization in the field of automatic control.

In the course of its own development, the Institute promoted the growth of new scientific organizations, providing them with its own laboratories and Institute branches. Thus, the

laboratory of Communications of the Institute separated to become the Institute for Information Transmission Problems, Russian Academy of Sciences – (RAS). The laboratory of Electronic Devices was eventually included in the Institute of Radiotechnics and Electronics, RAS,-- and now plays the role of a scientific center dealing specifically with the development of electronic devices.

The Lyvov Institute branch became the basis of the Automation and Machine Science Institute of the Ukrainian Academy of Sciences, while the Leningrad (St. Petersburg) Institute branch served the basis for the foundation of the Electromechanical Institute, RAS. Additional sections of the Institute formed and established the International Scientific-Research Institute of Control Problems, and the Institute of Physicotechnical Problems, RAS. The Institute also enabled the creation of many other scientific centers in this country. In 1969 Institute of Control Sciences, since the range of its scientific expertise had become the Institute was renamed in the greatly extended.(had extended drastically)

Important Dates

1934 - the Commission on Remote Control and Automation to co-ordinate activities in the field of automatic control was found by the Presidium of the USSR Academy of Sciences.
1936 - the journal Automation and Remote Control, was founded. It was the first world publication especially devoted to the problems of automatic control.
1938 - the Commission on Remote Control and Automation was reorganized by the Presidium of the USSR Academy of Sciences. As a result of these changes the Committee on Automation and Remote Control was established to start independent scientific research.
In 1939 - the Institute of Automation and Remote Control was established.
In 1969 - the Institute acquired a new name - Institute of Control Sciences.

Main Directions of Scientific Research:

Theory of Control Processes
The theory of control processes is traditionally one of the main directions of the Institute's fundamental research. Presently, ICS focuses on the following twelve primary areas of research:
qualitative theory of control processes, (including optimal control)
control of distributed parameters systems
control of deterministic and stochastic systems
theory of observation and estimation
identification of structures and parameters of controlled systems
adaptation and robust control
theory of control of competing and confronting systems
expert systems and artificial intelligence
application of analytical and computational research methods for analysis of synthesized system behavior
development of optimization methods for distributed systems and systems with logical and discontinuous control
development of methods for estimating the optimal risk in decision making and finding sub

optimal decision rules for dynamical objects and information systems.
Development of Methodology of Designing Problem-Oriented Automatic Control Systems
Since the beginning of the sixties the Institute has been intensively solving the problems of production automation on the basis of computers. Some of the first computer-aided control systems constructed in the Former Soviet Union were the result of the participation and scientific guidance of the Institute. Currently, the main directions of the Institute in this field are:
· development of methods and models of planning and on-line control systems for complex manufacturing processes, transportation systems, prospecting and developing of raw materials resources and the natural resources, development of computer-aided control systems in biology, medicine, and sociology;
· development of algorithmic support, software and hardware to realize adaptive and terminal control of moving objects;
· development of the methodology and software and engineering means for CAD-systems;
· development of methods and models to realize computer-aided control of production processes in the agricultural and industrial sector;
· development of methods, description, and means of analysis and control of flexible integrated production;
· automation and computerization of various fields of activity;
· development of software for problem oriented expert systems (diagnostic systems for estimating and forecasting the state of complex dynamic objects).

Technology of Control Systems
The main directions of the Institute research in this field are:
· theory and methods of organizing measurement processes in control systems;
· development of construction principles for modern technical means of automation and computer engineering (sensors, processing means based on new physical principles with new functional properties and improved characteristics, new micro- electronic base);
· development of principles to construct computer control systems (parallel computer complexes, super-computers, fault-tolerant systems, local networks);
· development of machine systems software for engineering design (modeling the functioning of parallel computer complexes, designing of the micro- electronic base, diagnostic modeling, solution of complex optimization problems);
· elaboration of methods, recommendations and instructions and guides to provide the reliability of technical facilities (trouble-shooting of potentially unreliable item components, go/no-go testing, individual forecasting of technical component reliability, support of computer system fault-tolerance, communication with the objects);
· elaboration of methods and recommendations of diagnostic support for complex objects (checkability, testability, self-testing, self-testing of discrete objects and diagnosis of dynamical systems).

International Relations
The Institute has wide and well-established international relations. After the Institute joined the International Federation on Automatic Control (IFAC) in 1957 these relations have been

especially consolidated and extended. Professor A.M.Letov, a researcher of the Institute, was elected Vice-president and then President of IFAC in 1959-1960 in acknowledgement of his scientific achievements in Automatic Control.

The first IFAC World Congress was prepared and held in 1960 in Moscow with the active participation of the Institute scientists. The Institute took an active part in holding all IFAC congresses that followed and particularly in organizing and holding the XI IFAC World Congress in 1990 in Tallinn. International cooperation is realized by the Institute in the following forms:
· a fulfillment of joint scientific research work
· participation in international congresses, symposia, conferences, seminars, workshops and exhibitions
· fulfillment of work on the basis of contracts and agreements
· offering consulting services
· joint activities in the international scientific institutions, federations and associations
· participation in the work of editing boards of the international journals and of collected works
· participation in the activities of joint ventures which were organized as a result of active cooperation with the Institute

Membership in Joint Ventures, Associations and Share-Holding Societies
The high scientific potential and flexibility of organizational structure make it possible for the Institute to participate in theoretical as well as in the applied support of market economics. The Institute acts as founder in many of the new Russian scientific and commercial structures such as joint ventures, associations and share-holding societies.

Joint Ventures
The Institute acts as a founder in the following Joint Ventures (JV):
· SIDIAMED- Russian Swiss-American JV
· CLODICS - Russian-Chinese JV
· OLICS - Russian-Italian JV
· VIAT - Russian-American JV
· INTERCONTROL Russian-Italian JV
· SYSDEC - Russian-Austrian JV
· PETROCOM - Russian-American-German JV
Associations
The Institute has initiated and actively participates in some associations whose members represent Russia and other republics of the former Soviet Union. Among these associations are:
· Saprmash
· Systemcomplex
· PICK users' association
· Diagnostics and fault-tolerance techniques
· Soviet association of artificial intelligence
Share-holding Societies
The Institute is a co-founder of some share-holding societies of open and closed type:

· Logovaz – shareholding society with participation of foreign countries
· Avtex
· Takt
· Systema
· Golem
· Systeminform
· TKT
· INIT
· Tunecs
· Avtomatika

Institute Structure
The Institute maintains flexible and dynamic structure, capable of adapting to solving new problems both fundamental and applied. Functional orientation is not the main factor used in setting-up of the Institute laboratories. For example, there are no laboratories dealing with control processes in metallurgy, power industry, etc. However, the Institute has laboratories engaged in identification, management control, modeling, computer-aided design, etc. In a number of cases some "over-and-above structure" divisions have been created in the Institute to achieve prompt solution of concrete problems.

The Board of Directors does general guidance of the Institute. The Board includes Academician Ivery V.Prangishvili and two Deputy-Directors, B.V.Pavlov and A.N.Shubin, who provides scientific activity guidance. The board also includes two deputy-directors on economical and general aspects. The Scientific Council headed by the Institute director coordinates the scientific research in the Institute. Seven sections of the Scientific Council are responsible for the following directions of the works:
· theory of control systems;
· control in social and medical-biological systems;
· technical means of "hardware" of automation and computer engineering:
· systems for control of technological processes;
· software for complexes and networks;
· computer-aided management systems;
· control of moving objects;

The Institute Leading Body
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A.N. SHUBIN
Deputy Director (Science)
B.V. PAVLOV
Deputy Director (Science)
V.T. POPOK
Deputy Director (General Problems)

F.F. PASHCHENKO
Scientific Secretary

List of Laboratories

Number	Head	Title
1	B.V.Pavlov	Dynamics of Controlled Processes
2	A.N.Shubin	Pneumatic Tools of Automation
3	S.A.Amtbartsumian	Discrete Systems
4	V.V.Ignaushenko	Multi-computer, Multi-terminal Real-time Complexes
5	B.G.Volik	Structures and Methods of Complex Control Systems Design
6	V.P.Zhukov	Invariant Control Systems
7	B.T.Polyak	Adaptive and Robust Control Systems
8	Yu.P.Portnov-Sokolov	Terminal On-board Control Systems
9	A.F.Volkov	Structures of Control Machines
11	O.P.Kusnetsov	Methods of Realization of Automata
12	B.P.Petrukhin	Physical Reliability Foundation of Hardware
14	V.S.Semenov	Research of High-Density Memory Devices on Magnetic Films
15	V.D.Zotov	Man-machine Systems
16	Ye.S.Pyatnitskiy	Dynamics of Nonlinear Control Systems
17	V.A .Zhozhikashvili	Queuing Systems
18	Ye.I.Artamonov	Computer Graphics
19	V.N.Kulibanov	Multiple Connected Control Systems
20	V.V.Kulba	Methods of Data Processing In Automatic Control Systems for Non industrial Sphere
21	I.I.Paishev	Software Support for Real time Multi-computer Complexes
22	V.I.Utkin	Discontinuous Control Systems
24	A.A.Romashehev	Ferromagnetic and Semiconductor Devices
25	F.T.Aleskerov	Hierarchical Control Systems
26	A.N.Anuashvlli	Coherence-Wave Methods for Non-stationary Media State Control
27	P.P.Parkhomenko	Technical Diagnostics
28	I.N.Vorontsov	Large Scale System Modelling
29	Yu.S.Legovitch	Computer-aided Research and Design of Control Systems
31	I.V.Prangisvili	Computer Systems with Adaptive Structure
32	L.I.Mikulitch	Design Principles of Industrial Branches Automatic Control Systems
33	A.D.Tsvirkun	Control Problems of large-scale Systems Structure

		Development
34	V.A.Filippov	Computer-Aided Support Systems for Planning and Management Decision Making in PICK Operation Environment
35	E.L.Itskovitch	Systems of On-line Control and Management In Continuous Production
36	K.B.Norkin	Computational and Optimization Methods
37	V.A.Gruzman	Computer-aided Control Systems Design
38	Ye.P.Maslov	Processes of Control and Management Based on Incomplete Data
40	F.F.Pashchenko	Computer-Aided Systems of Control for Technological Processes In Nuclear Power Plants
41	V.A.Lototsky	Identification of Control Objects
42	V.Yu.Rutkovsky	Self-adjustable Control Systems
43	V.B. Gusev	Management of Multipurpose Projects and Self-developing Systems
44	A.A.Onopko	Automatic Control of Technological Processes in Nuclear Power Plants
45	V.F.Krotov	Theory of Optimal Control Systems
46	V.G.Lebedev	System Programming
48	B.V.Lunkin	Wave Methods and Tools for Non electrical Parameters Control
49	M.Kh.Dorri	Control Systems for Complex Multipurpose Objects
50	A.M.Shubladze	Adaptive Control Systems for Dynamic Objects
51	V.V.Nosov	Electromagnetic Compatibility of Control Hardware
52	I.B.Semenov	Methods and Tools for R&D Management
55	A.A.Dorofeyuk	Processing of large Information Arrays In Hierarchic Systems
56	R.R.Babajan	Micro- and nano electronics elements and devices for control systems
57	V.N.Burkov	Business Games and Active Systems
59	V.P.Razbegin	Multiprocessor Systems Software Development
62	V.Yu.Kneller	Theory and Tools for Measurement Data Transformation
63	A.G.Butkovsky	Distributed Parameters Systems

Structure and Number of Employees

The Institute of Control Sciences is one of the largest and significant scientific institutions in the Russian Federation. When founded, the Institute had 22 employees, of which only 6 scientists had scientific degrees. At present there are over 800 scientific researchers including 2 RAS Corresponding Members, over 70 D.Sc. and almost 350 Ph.D. working in the Institute. The Institute paid great attention to training of specialists and personnel from the very start of its

existence.

During the first year of its foundation a post-graduate chair was set up and the first group of post-graduates passed the admission exams. The first dissertations (theses) were submitted in 1944. Among those who completed the post-graduate course, over 1000 scientists defended doctoral and candidate theses and many of them became leading specialists in their republics and countries. The scientists of the Institute deliver lectures at the well-known Moscow high schools and universities – Physico - Technical, Aviation, Power Engineering and others.

A great number of highly skilled foreign specialists was specially trained for the research activities in their home countries such as Hungary, Czech & Slovakia, Poland, Bulgaria, Vietnam, etc. The scientists of the Institute are well known all over the world. Their articles, monographs are published in various languages in different countries. The journal "Automation and Remote Control", which is closely connected with the Institute from the very beginning of its history, is also a well-known international publication.

The institute gives great attention to training of highly skilled scientists and personnel. The training focuses on the Institute Post-graduates Board. There are many Academicians and leading specialists of the republics in the former Soviet Union among those who completed its course. The quality of this training course center is convincingly demonstrated by the fact that the Institute Director, his three Deputy- Directors, Scientific Secretary, most of the of laboratory directors, as well as leading researches are actually those who successfully completed the Institute post-graduate study course.

Engineering Support (Facilities, Devices, Tools)
The building complex of the Institute provides facilities for its normal functioning for over last 25 years. A scientific library and a large reading hall are at the disposal of the scientists. The Institute has large and small conference halls with seating capacities of 750 and 250 people. These conference halls are always in use and are equipped with all technical facilities to support the working procedure of conferences and meetings, including simultaneous translation facilities, internal TV system and modern projection devices.
Scientific seminars, sessions of the Scientific Council and its sections as well as the conferences organized by the Institute are constantly held there. The Institute has up-to-date scientific research equipment, which allows carrying out the most complex fundamental and applied research. The Institute Computer Center actively utilizes highly efficient computer network, which enables concurrent work of a great number of users. The Center also provides the facilities to use color printers, plotters and Tektronix graphic workstations.

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Institute Laboratories

Laboratory of Radiation Sources
Head of the Lab Dr. V.Ch.Bokun
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Radiation Chemistry;
Chemistry of Low Temperature Nonequilibrium Plasma (LTNP);
Chemical and Physical Processes in the Radiofrequency Fields (RFF);
Polymerisation Systems.
For more information click here

Laboratory of Quantum Systems
Head of the Lab Professor E.B.Gordon
For more information click here

Laboratory of Mass Spectrometry in Ecology
Head of the Lab Dr. V.I.Kozlovskii

Laboratory of Photo- and Radio-Energy
Head of the Lab Dr. S.D.Babenko

The main fields of research are as follows:
direct transformation of solar energy into another kinds of free energy, including hydrogen chemical energy;
electrophysical properties of materials, including composite materials, dissipation of microwave energy, dielectric and ESR spectroscopy;
direct fluorination of polymers.
For more information click here

Laboratory of Ionizing Processes in Condensed Substances
Head of the Lab Dr. A.A.Balakin

The main directions of the work
Investigations of electronic and ionic processes in disordered dense media including study of initial stages of ionization, transport and reactions of both electrons and ions in dielectric liquids. Investigations of an extraction of ions from liquids in strong electric fields. Study of the field evaporation of ions from liquid solutions with use of polymer track membranes. Elaboration of new types of membrane ion sources, specifically, ion sources for the mass spectral analysis of complicate nonvolatile bio-organic substances which are of an interest in biological and medical investigations.

Study of an energy exchange between non-relativity electrons and a non-homogeneous medium.
For more information click here

Laboratory of Applied Mathematics
Head of the Lab Dr. V.V.Raznikov

Directions of research work:
Development of methods and software packages for acquisition and processing of experimental data (mainly mass specrometric and chromatographic data).
Mathematical and computer modelling of processes important for new instruments and experimental installation (for mass spectrometry mainly).
For more information click here

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(*Irkutsk research centre*)
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The Institute of Informatics Problems of the Russian Academy of Sciences (IPI RAN) was

founded in 1983 with a goal of conducting fundamental and applied research in the area of hardware and software for mass application and in the area of relevant computer systems. The Institute is a member of the Department of Information Technologies and Computing Systems of the Russian Academy of Sciences. The Director of the Institute is Igor Sokolov, Corresponding Member of the Russian Academy of Sciences.

IPI RAN carries out fundamental research in computer science and development of application software, hardware and computer systems.

IPI RAN is situated in Moscow, Russia. The Institute has branches in the towns Orel and Kaliningrad and also R&D department in the town Taganrog. IPI RAN has a number of affiliated small entities created and acting in the area of R&D applications (AMSD, Informatica, Inteh, NatComp, Algosoft, Atik, etc.).

The Institute has a basic chair in MIREA (The Moscow Higher School of Radio Electronics and Automation).

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GENERAL INFORMATION
The Institute on Laser and Information Technologies of the Russian Academy of Sciences (ILIT RAS) (Scientific Research Center for Technological Lasers of the Russian Academy of Sciences √ NICTL RAN till 1998) was founded in 1979. It was Academician E.P.Velikhov who suggested the idea of the Center establishment.

In accord with the Certificate of National Accreditation of a Research Institution No.3063 of

September 11, 2001, the Institute on Laser and Information Technologies of the Russian Academy of Sciences has the status of a public institution.

The Institute makes a part of the Department of Information Technologies and Computation Systems of the Russian Academy of Sciences.

ILIT RAS collaborates in the Coordinating Council on Optics and Laser Physics at the Presidium of the RAS.

The Institute is involved in working out the basic and applied problems of laser and information technologies. It is one of the leading national institutions producing high-power industrial CO2 lasers and related technologies and equipment.

MAIN LINES of the Institute activities:
Laser and information technologies:
formation of submicron structures, development of base elements for optoelectronics and information optical systems;
procedures and intellectual laser systems for synthesis of 3D objects with complex topology, using computer models and tomography data, laser stereolithography systems among them;
methods and systems of adaptive optics for data processing and control of material treatment;
method of local modification of nano-porous and polymer materials, based on supercritical impregnation
Laser application in biomedicine:
laser and information technologies for remote biomodelling of 3D objects;
laser systems for transmyocardial revascularization;
hyperthermia of cartilaginous tissues;
reconstructive bioengineering for oncology;
laser, optoacoustic and optical devices for medical diagnostics;
synthesis of new mineral-polymer composites for implantology and tissue engineering;
optical and information methods for studying biological objects
Industrial lasers, laser computer systems and material processing technologies:
development and production of industrial CO2 lasers providing 0.5-1.5kW power and high optical quality of radiation;
laser technologies of material processing and automated laser complexes equipped with adaptive control systems to perform cutting, welding, and surface modification;
development and production of optoelectronic laser systems for nondestructive diagnostics of the near-surface structure of materials

ILIT RAS is situated in the town of Shatura (Moscow Region) and has a branch in the town of Troitsk. The staff of the Institute amounts to 270 employees, 95 of them being research workers (60 of the latter have the degrees of Doctors and Candidate of Sciences).

ILIT RAS is a collective member of the Russia Chapter (SPIE/RUS) of the International Society

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The Institute maintains close contacts and collaborates with the key universities, research centers and companies of Russia, Ukraine, Belarus, USA, Japan, Germany, Great Britain, Poland, Bulgaria, Greece, Italy, India, and China.

The Director of ILIT RAS, Corresponding Member of RAS, Honoured Scientist of the Russian Federation, Professor V.Ya.Panchenko was the Chairman of the Council of the Russia Chapter of the International Society for Optical Engineering (SPIE) and a Member of the International Council of Optical Society of America (OSA). Professor T.Yo.Karu is a Vice-President of the World Association on Photobiology. The grants of the Russian Foundation for Basic Research and of INTAS, regularly conferred to the scientists of ILIT RAS, and the projects of ILIT RAS accepted by the Federal Research Programs of the Russian Federation bear the witness of the international and home recognition won by the research activities of the Institute in the fields of laser physics, photonics, high optical and information technologies. The scholars of ILIT RAS are fellows of editorial boards of a wide range of international and Russian journals.

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Law department
Organizational department
Protocol sector
Scientific research management
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