The Origin of the Relationship between Black Hole Mass and Host Galaxy Bulge Luminosity

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The Origin of the Relationship between Black Hole Mass and Host Galaxy Bulge Luminosity

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Abstract. There is a strong decrease in scatter in the $M_\bullet$ – L_{bulge} relationship with increasing luminosity and very little scatter for the most luminous galaxies. It is shown that this is a natural consequence of the substantial initial dispersion in the ratio of black hole mass to total stellar mass and of subsequent galaxy growth through hierarchical mergers. "Fine-tuning" through feedback between black hole growth and bulge growth is neither necessary nor desirable.

Keywords: black hole growth, galaxies: fundamental parameters, galaxies: nuclei, galaxies: bulges
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The dispersions in the relationships between black hole mass, $M_\bullet$, host galaxy bulge luminosity, L_{bulge}, and stellar velocity dispersion have been shown [1, 2] to decrease strongly with increasing L_{bulge} (see Fig. 1). The trend in Fig. 1 can easily be modeled by assuming that bulges grow through mergers and that the $M_\bullet/L_{stars}$ ratio initially has a log-normal distribution with a substantial dispersion as is observed for the lowest luminosity galaxies. A substantial scatter in the initial $M_\bullet/L_{stars}$ ratio is required. "Fine-tuning" through feedback is unnecessary and produces too low a dispersion in $M_\bullet/L_{bulge}$.

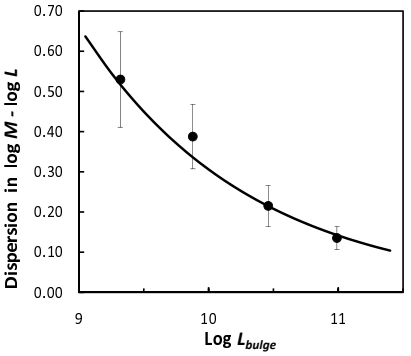

FIGURE 1. The 1-σ scatter in the AGN $M_\bullet$ – L_{bulge} relationship as a function of bulge luminosity [2]. The solid line shows the predicted decrease in scatter for hierarchical merging.

REFERENCES

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2. Gaskell, C. M. 2010, in *Co-Evolution of Central Black Holes and Galaxies, IAU Symposium 267*, in press [arXiv:1003.0036].