



Extending the $M_{\text{bh}}\text{-}\sigma$ diagram with dense nuclear star clusters

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Abridged: Four new nuclear star cluster masses, M_{nc} , plus seven upper limits, are provided for galaxies with previously determined black hole masses, M_{bh} . Together with a sample of 64 galaxies with direct M_{bh} measurements, 13 of which additionally now have M_{nc} measurements rather than only upper limits, plus an additional 29 dwarf galaxies with available M_{nc} measurements and velocity dispersions σ , an $(M_{\text{bh}} + M_{\text{nc}})\text{-}\sigma$ diagram is constructed. Given that major dry galaxy merger events preserve the M_{bh}/L ratio, and given that $L \sim \sigma^5$ for luminous galaxies, it is first noted that the observation $M_{\text{bh}} \sim \sigma^5$ is consistent with expectations. For the fainter elliptical galaxies it is known that $L \sim \sigma^2$, and assuming a constant M_{nc}/L ratio (Ferrarese et al.), the expectation that $M_{\text{nc}} \sim \sigma^2$ is in broad agreement with our new observational result that $M_{\text{nc}} \sim \sigma^{1.57 \pm 0.24}$. This exponent is however in contrast to the value of ~ 4 which has been reported previously and interpreted in terms of a regulating feedback mechanism from stellar winds.

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