

Resolving the Critical Ambiguities of the M-Sigma Relation

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Scientific Category: AGN/QUASARS

Scientific Keywords: BLACK HOLES, DYNAMICS, GALAXY BULGES, GALAXY FORMATION
AND EVOLUTION, HOST GALAXIES

Total Budget Amount: \$160,000 (Budget to be split over two years.)

Abstract

Determining the best estimates of the masses of supermassive black holes (SMBHs) and their uncertainties is crucial for constraining the slope and scatter of the SMBH mass vs. stellar velocity dispersion (M-sigma) relation and for understanding the relation between SMBHs and their host galaxies. We propose to critically evaluate the values of the SMBH masses in a sample of 23 galaxies using data derived from STIS long-slit spectroscopy. This study will directly achieve three significant and fundamental improvements to the M-sigma relation. First, we will use all suitable STIS long-slit data to analyze SMBH masses in an entirely homogeneous fashion. Second, we will substantially increase the SMBH sample size with new estimates. Finally, we will use our state-of-the-art Schwarzschild code, which will, for the first time and independently of the modelling parameters, explore the full range of SMBH masses that give statistically acceptable fits to a given data set. These analyses can be carried out with unrivaled efficiency using the cutting-edge computing facilities available at RIT. This work will result in the most accurate and reliable estimate of the form (slope and scatter) of the M-sigma relation; to date improvements have only been somewhat incremental. Such a study will place important constraints on some of the most fundamental problems remaining in contemporary astrophysics.

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