Using a Novel Methodology to Constrain the Supermassive Black Hole-Galaxy Coevolution and Analyze the Selection Bias

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This project studied the effects of supermassive black holes (SMBHs) on their host galaxies in relation to their inherent properties. It also shed light on the Shankar et al. (2016) controversial argument about a selection bias present in massive SMBHs. Unique from previous studies, we used a novel, empirically-driven convolution methodology. We then created number density models of velocity dispersion and stellar mass properties. By constructing the black hole mass function (BHMF) and comparing those property relations, we discovered excellent agreement with past observational inferences. We also found a stronger link between those properties than previously believed. We then estimated the redshift evolution of the BHMF and, from that, compared mass growth histories between SMBHs and galaxies. In seeing their respective accretion rates diminish at similar redshifts, we provided firm evidence for an SMBH-galaxy coevolution. Additionally, we utilized a data compilation of 542 galaxies and classified them by their morphologies to analyze the effects of Shankar's proposed bias. Since we found insignificant changes in our results, we proved that such a bias had little impact on SMBH-galaxy relations. We conclude that the galaxy sample is a fair representation of the local universe and argue that our BH number density and scaling relations have incredible potential to be employed in constraining relevant mechanisms for galaxy formation. Due to our novel methodology, property comparison, bias test, and evidence, we emphasize this very comprehensive study on the SMBH-galaxy coevolution.

Awards Won:

Second Award of $2,000