Comparing Direct Black Hole Mass Measurements in Active Galactic Nuclei (AGNs)

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ABSTRACT

Supermassive black holes appear to be ubiquitous in the nuclei of massive galaxies, and several large-scale galaxy properties have been to found to scale with black hole mass, leading to the interpretation that galaxies and their black holes co-evolve. There are only a few techniques that can directly constrain the mass of a black hole through its gravitational influence on luminous matter, of which the most commonly applied techniques are reverberation mapping and stellar or gas dynamical modeling. Each method has been applied to a modest number of black holes, while the vast majority of black hole masses in the literature are instead estimates that have been derived from scaling relationships that are based on direct measurements. Dynamical modeling results provide most of the commonly used scaling relationships for galaxies in the local universe, while outside of the local universe, reverberation mapping results provide the foundation for AGN scaling relationships. Thus there are two different black hole mass scales currently in use. The disparate technical requirements for these methods mean that only a handful of black holes have masses that have been constrained through more than one technique. In AGNs, the situation is even worse because active galaxies are rare and most are too far away to allow the spatial resolution needed for dynamical modeling. I will describe our ongoing project to directly compare black hole masses from reverberation mapping and stellar dynamical modeling in the nearest Type 1 Seyferts. Both reverberation mapping and stellar dynamical modeling are time- and resource-intensive techniques and the number of galaxies we can study is small, but the results will help uncover potential biases in these direct mass techniques and illuminate any differences in the black hole mass scales that are applied locally versus at cosmological distances.