

Black Holes and Their Evolution: Combining Multiwavelength Observations and Theory

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It has been over a decade since the discovery that the mass of a central black hole scales with the properties of its host galaxy. Because of these remarkable scaling relations, the idea that galaxies and black holes coevolve through some sort of self-regulated feedback has come to dominate scientific discussion. But do we really understand what the scaling relations are telling us? I will review state of the field and present recent developments from the observational perspective of the black hole scaling relations, including our discovery of a $1.7e10$ solar mass black hole in a galaxy with stellar mass only $1.2e11$ solar masses, discussing how well coevolution models and their alternatives can handle this.

In addition to coevolution, the scaling relations in the local universe inform the study of formation of black hole seeds, black hole density functions across cosmic time, and the disputed claims of evolution of the scaling relations with redshift. I will discuss my theoretical works in these areas as well as my work on a new tool for using X-ray and radio measurements to measure black hole masses. I will conclude by exploring what important, observational and theoretical questions still need to be answered.