Nov 7th, 4:15 PM - 5:30 PM

Dance of Two Supermassive Binary Black Holes

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Black holes exist in a various range of masses ranging from stellar mass (~ 10 Solar Mass) to Supermassive black holes (SMBHs, million to billion Solar Mass). It is expected that as the separation between the black holes decreases, emission of gravitational waves will grow stronger, which makes binary black holes one of the most promising sources for gravitational radiation detection. Gravitational waves from merging stellar-mass black holes have recently been discovered by LIGO; however, we are yet to detect them from binary SMBHs. These massive black holes reside at the heart of most of the galaxies and when two such galaxies collide, a binary formation takes place. However, the number of such confirmed systems is a handful. This raises questions such as how often do galaxies collide? Does a collision give rise to a binary system, and how quickly do these black holes merge after binary formation? Understanding these systems is important to understanding fundamental astrophysical problems ranging from galaxy evolution to active galactic nuclei to black hole growth.

We know about one system where the two black holes are in the process of merging. The radio galaxy 0402+379 was discovered by Maness et al. (2004), to have two core components with flat spectra. With a projected separation of 7.3 pc, this system is the most compact supermassive binary black hole, which makes it one of the best candidates to study. We present the latest results from 12 years of observations to constrain the motion, orbit, and the mass of the compact sources.