

Dynamical Formation of BH Binaries in AGN Accretion Disks

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Mergers of black hole (BH) binaries embedded in the active galactic nucleus (AGN) accretion disks have recently received significant attention as an interesting type of gravitational wave (GW) source. Studying the formation processes of these binaries allows us to better understand the rate and the observational properties of their mergers. In this talk, I will present our work on the mechanisms of forming tightly bound BH binaries in AGN disks via close encounters between two single BHs. In particular, using a series of high-resolution 2D global hydrodynamical simulations, we demonstrate that binaries can be formed by the collisions of the BHs' gaseous minidisks. The majority of the binaries assembled in this scenario have retrograde rotations (i.e., the relative angular momentum of BHs in a binary is anti-aligned to the angular momentum of the AGN disk). Several recent studies have shown that, after formation, these retrograde binaries are expected to shrink a few times faster than their prograde counterparts and may undergo eccentricity excitation. Our results can be combined with these studies to illustrate a pathway to form high-mass, eccentric, and possibly negative-effective-spin GW events.

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