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Binary black holes in magnetized AGN disks

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I will present magnetohydrodynamic (MHD) simulations of a binary black hole (BBH) system embedded within a magnetized active galactic nucleus (AGN) disk, aiming to explore the accretion dynamics and the formation of outflows. Unlike traditional models that assume a circumbinary accretion disk around the binary, our approach allows the interaction between the binary system and the surrounding disk to govern the accretion flow. The evolution of BBHs in AGN disks depends on the intrinsic parameters of the binary, such as mass ratio, separation, orbital frequency, and the properties of the surrounding gas. Additionally, magnetic fields in AGN disks have been recognized as an important factor influencing the accretion process. Our MHD simulations do not assume a pre-existing circumbinary disk and instead focus on the self-consistent development of accretion flows driven by the interaction between the BBH and the disk. The results provide new insights into the complex dynamics of embedded BBH systems and highlight the critical role of magnetic fields in shaping accretion behavior, including the potential for episodic accretion events and outflow formation in the pre-merger phase, which could create favorable conditions for radiation to escape from optically thick AGN disks.

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