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The susceptible GW sources in the AGN accretion disk

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Extreme-mass-ratio inspirals (EMRIs) and intermediate-mass-ratio inspirals (IMRIs) are important gravitational-wave (GW) sources for the Laser Interferometer Space Antenna (LISA). So far, their formation and evolution are considered to be independent, but recent theories suggest that stellar-mass black holes (sBHs) and intermediate-mass black hole (IMBHs) can coexist in the accretion disk of an active galactic nucleus (AGN), which indicates that EMRIs and IMRIs may form in the same place. In this presentation, I will talk about our study on the interaction between a gap-opening IMBH in an AGN disk and the sBHs surrounding it, motivated by the fact that a gas giant migrating in a protoplanetary disk could trap planetesimals close to its orbit. We analyze the torques imposed on the sBHs by the disk as well as by the IMBH, and show that the sBHs can be trapped by the IMBH if they are inside the orbit of the IMBH. We implement the torques in our numerical simulations to study the migration of an outer IMBH and an inner sBH, both embedded in an AGN disk. We find that their migration is synchronized until they reach a distance of about ten Schwarzschild radii from the central supermassive black hole, where the pair break up due to strong GW radiation. This result indicates that LISA may detect an EMRI and an IMRI within several years from the same AGN. Such a GW source will bring rich information about the formation and evolution of sBHs and IMBHs in AGNs.

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