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Astrophysical significance of tidal interaction between white dwarfs and intermediate-mass black holes

Tidal disruption of white dwarfs (WD) is an astrophysical transient phenomenon capable of revealing significant information on the presence of intermediate-mass black holes (IMBH). Using hydrodynamical simulations, we explore the observable properties of these astrophysical events. We accurately calculate the fallback rate of the tidal debris during its accretion onto an IMBH. We find the remnant core's mass fraction, tidal kick velocity, its trajectory deviation, as well as their dependence on binary mass ratio and orbital eccentricity in partial tidal disruption events. For an IMBH-WD system, we also simulate the burst-like gravitational wave (GW) emission, expected to be detected by LISA. After disruption, the tidal debris is not compact enough to produce the GW signal. Thus, using both the electromagnetic and GW signals, we identify the observable signatures to decipher binary parameters, including the mass of the black hole, the interior structure of the WD, and orbital specifications. We implement this method to investigate a class of modified gravity theories that leaves its footprint inside the WD by altering its mass-radius relation and tidal radius even in the Newtonian limit.

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