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Detectability of gas-rich E/IMRI's in LISA band: observable signature of transonic accretion flow.

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Real extreme/intermediate-mass ratio inspiral (E/IMRI) systems are likely to contain large accretion discs which could be as massive as the central supermassive black hole. Therefore, contrary to its ideal model, a real E/IMRI system contains a third important component: the accretion disc. We study the influence of these discs on the emitted gravitational wave (GW) profile and its detectability through proposed LISA observation. We use a semirelativistic formalism in the Kerr background for the case of transonic accretion flow which is a potential candidate to describe the accretion flows around active galactic nuclei. The hydrodynamic drag of the discs modified the motion of the companion as a result of the emitted wave changes in amplitude and phase. We found that these changes are detectable through the last few years of observation by LISA (in some cases as small as 6 months) for EMRIs residing within redshift $z = 1$ from the detector and for the accretion rate of the primary black hole of the order of one Eddington rate. These choices of parameter values are consistent with real systems. The drag effect and hence the detectability of the emitted GW is sensitive to the hydrodynamical model of the disc. Therefore, we vary the disc parameters, accretion rate, and duration of observation of E/IMRIs, and find that in comparison with other disc models, transonic solution
of fers relati vely better observ able signatures in detecting the gas-rich E/IMRI's within the LISA band. Such observations will help one to probe the nature of the accretion flow and verify various paradigms of accretion physics.

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