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Massive black hole binaries in ultralight dark matter solitons

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Ultralight dark matter (ULDM) is a dark matter candidate composed of light axion-like particles, and is a promising alternative to cold dark matter. A unique feature of ULDM is the formation of solitonic cores at the centre of collapsed halos, which may increase the drag experienced by black hole binaries orbiting within the soliton. We present high-resolution numerical simulations of the dynamics of SMBH binaries in the soliton of a massive halo, finding that higher ULDM particle masses can potentially alleviate the final parsec problem. We show that dynamical friction from ULDM can suppress gravitational wave power in the PTA band. Through fits to our simulations, we develop a semi-analytic model for orbital decay due to ULDM with the aim of constraining ULDM particle masses through PTA data.

Session Classification: Parallel session - Gravity II