

Dark matter and black holes



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When Tiny Halos Stir Spacetime: Gravitational Waves from the Fifth Forces

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Dark matter fermions interacting via attractive fifth forces mediated by a light mediator can form dark matter halos in the very early Universe. Motivated by the scenario, we discovered that the bound systems composed of such halos, even very light, are capable of generating Gravitational Wave (GW) signals detectable today. Due to the additional strong force that contributes to the acceleration of the orbit, such binaries can lead to strong gravitational waves with initially extremely high frequencies—and cosmological redshift shifts these signals into the observable frequency bands today, i.e., the PTA surveys. The resulting gravitational wave from a single event can carry distinctive features in the waveform that enable future observations to distinguish them from conventional ones solely due to gravitational interaction, providing a new avenue to probe the macroscopic properties of dark matter through gravitational wave observations.

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