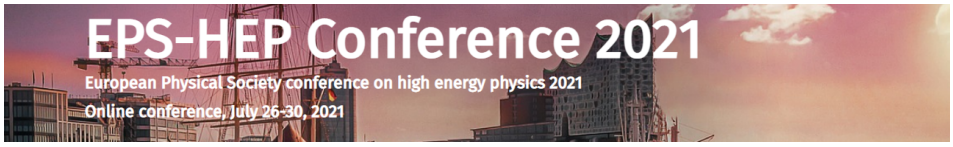

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Measuring the dark matter environments of black hole binaries with gravitational waves

Monday 26 July 2021 15:15 (20 minutes)

Black holes of astrophysical and primordial origin can compress their dark matter environments to extreme densities as they form and grow. This "dark dress" inevitably affects the dynamical evolution of binaries, and imprints a characteristic dephasing onto their gravitational waveforms that could be probed with upcoming interferometers. In this work, we study the prospects for detecting and characterizing the dark matter content of these systems with the Laser Interferometer Space Antenna (LISA). We introduce an analytical model for the dephasing of dark dresses motivated by the interplay between the gravitational wave emission and disruption of the dark matter halo that governs their evolution. We demonstrate that LISA could distinguishing dark dresses from standard black hole binaries and quantify how precisely their parameters could be measured. Through such measurements, future gravitational wave detectors could be a powerful tool for probing the particle nature of dark matter.

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Collaboration / Activity

None

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