Particle Physics Challenges



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Black Holes' Dark Dress: The impact of local Dark Matter halos on the mergers of primordial black hole binaries

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The observation of gravitational waves from binary black hole mergers has renewed interest in the possibility of primordial black holes (PBHs) that are around 10 to 100 times more massive than the Sun. Such PBHs may form large numbers of binaries before matter-radiation equality and, if these binaries survive until today, they may contribute to the merger rate observable by LIGO and Virgo. However, if PBHs are a sub-dominant fraction of the Dark Matter (DM), they will be dressed in local DM halos which may disrupt the binaries through dynamical friction. I will present the results of N-body simulations and analytic estimates, studying the impact of this 'dark dress'. While the size and shape of PBH binaries is dramatically altered by local DM halos, there is a surprisingly subtle effect on the rate of mergers expected today. Limits on the merger rate observed by LIGO-Virgo may be translated into bounds on the fraction of DM in the form of PBHs. I will argue that our calculations place such bounds on a more solid footing, constraining the fraction of DM in the form of DM in the survey of the survey of DM halos around astrophysical black holes and their impact on gravitational wave signals.

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