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Black Holes' Dark Dress - Detecting Particle Dark Matter around Primordial Black Holes with Gravitational Waves

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Primordial Black Holes (PBHs) can form binaries very efficiently in the early Universe, some of which could be observed merging at low redshift. Searching for such mergers, current Gravitational Wave (GW) observations constrain Solar-mass PBHs to make up less than around one thousandth of the Dark Matter (DM) in our Universe. Such a sub-dominant PBH population is therefore likely to be accompanied by a new particle species making up the majority of the DM. I will review the process by which particle DM can form large overdensities around sub-dominant PBHs and present on-going efforts to understand how these 'dark dresses' can affect the merger rates of PBH binaries and therefore affect GW constraints on the PBH abundance. In addition to altering merger rates, the presence of dark dresses can also have a detectable effect on the shape of GW signals we would observe from PBH binaries. I will discuss the prospects for detecting these effects in current and future GW observatories, and consider what we might learn about both Dark Matter and Primordial Black Holes if we do.

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