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The impact of primordial black holes on the stellar mass function of ultra-faint dwarf galaxies

In the hypothesis of primordial black holes constituting the dark matter, stars forming in dark matter dominated environments with low velocity dispersions, such as ultra-faint dwarf galaxies, may capture a primordial black hole at birth. The capture probability is non-negligible for primordial black holes of masses around 10^{20} g, and increases with the stellar mass. Moreover, infected stars are turned into virtually invisible black holes in cosmologically short timescales. Hence, the number of observed heavy stars in ultra-faint dwarf galaxies should be suppressed if the dark matter was made of asteroid-mass primordial black holes. This would impact the measured mass distribution of stars, making it top-light (i.e. depleted in the high-mass range). Using simulated data that mimic the present-day observational power of telescopes, we show that already existing measurements of the mass function of stars in local ultra-faint dwarf galaxies could be used to constrain the fraction of dark matter made of primordial black holes in the —currently unconstrained —mass range of 10^{19}–10^{21} g.

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