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Primordial Black Holes, Extremality, and Dark Matter: Rethinking Evaporation Limits

Earlier studies investigating the allowed fraction of dark matter as primordial black holes (PBHs) tend to completely rule out PBHs with masses smaller than ~10^{-15} solar masses. This is due to the lack of evidence for Hawking radiation coming from the final evaporation stages of such small PBHs. These limits, however, make the key assumption that these PBHs can be modelled as uncharged, non-rotating Schwarzschild black holes. Extending either the modell of particle physics or of gravity can easily allow for a range of extremal black holes, that behave fundamentally differently in this regard. In this talk, we will present changes to these lower mass bounds when charge is included, i.e., by going to Reissner–Nordström black holes as models for PBHs. Concretely, we will add a "dark" U(1) charge, present in the early universe when the PBHs was formed; while not present in today's universe, it might still appear as a black hole charge. We use the Hiscock and Weems model of charged black hole evaporation, to correctly include the Schwinger effect. We then investigate and present the updated mass bounds for PBHs as dark matter candidates and their dependence on mass and charge of the corresponding "dark" electrons.

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