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Primordial black holes as the solution of many cosmological conundra

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Studies of primordial black holes (PBHs) usually focus on constraints on their abundance, since this has interesting implications for cosmology even if they never formed. However, recently attention has turned to the possibility that they may actually exist and solve various cosmological conundra. The most exciting possibility is that they provide the dark matter, although this is only feasible in a few mass windows. In particular, if they form at the QCD phase transition, the tiny collapse fraction required might naturally explain the cosmic photon-to-baryon ratio and the comparability of the PBH and baryon densities. Even if PBHs provide only a small fraction of the dark matter, they might still explain some of the OGLE and quasar microlensing events, the LIGO/Virgo gravitational wave events, the spatial coherence in the fluctuations of the source-subtracted cosmic infrared and soft X-ray backgrounds, some anomalies associated with Ultra Faint Dwarf galaxies, and the supermassive black holes in galactic nuclei. With a suitable extended mass spectrum, they might even explain all these anomalies. So an exciting new era in PBH research has begun, with various forthcoming observations able to probe this proposal.

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