

Primordial Black Holes after 50 years: a positive perspective

Monday, 11 December 2023 09:50 (50 minutes)

This talk presents a historical perspective of the study of primordial black holes (PBHs), my first talk on the subject being 50 years since. PBH papers have usually focused on constraints on their abundance, this having interesting implications for cosmology even if they never formed. However, in recent years attention has turned to the possibility that they might actually exist and solve various cosmological conundra. Numerous arguments will be reviewed, based on observational evidence from a variety of lensing, dynamical, accretion and gravitational-wave effects. This represents what might be termed a positivist perspective. The most exciting possibility is that PBHs provide the dark matter, in which case their Poisson clustering could have important implications for later structure formation. Also 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 galactic and quasar microlensing events, the LIGO/Virgo/KAGRA 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 and observations are already probing this proposal.

Primary author: CARR, Bernard (Queen Mary University of London)

Presenter: CARR, Bernard (Queen Mary University of London)

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