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Primordial Black Holes: formation and cosmological impact in the current Universe

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Primordial black holes (PBHs) could have been formed in the very early Universe from large amplitude perturbations of the metric. Their formation is naturally enhanced during phase-transitions, because of the softening of the equation of state, from the electron weak transition, corresponding to PBHs as CDM candidate, till the Nucleosynthesis, when the PBHs formed could be the seeds of SMBHs. The quark-hadron phase in particular has received lots of attention recently, with a characteristic scale between 1 and 3 solar masses and the abundance of PBHs significantly increased. Performing detailed numerical simulations we have computed the modified mass function for such black holes, showing that the minimum of the QCD transition works as an attractor solution. Making then a confrontation with the LVK phenomenological models describing the GWTC-3 catalog, we have found that a sub-population of such PBHs formed in the solar mass range is compatible with the current observational constraints and could explain some of the interesting sources emitting gravitational waves detected by LIGO/VIRGO in the black hole mass gap, such as GW190814, and other light events.

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