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Effect of nonlinearity between density and curvature perturbations on the primordial black hole formation

Primordial black holes (PBHs) have been attracting much interest as a candidate of DM or binary black hole mergers observed by LIGO-VIRGO collaboration. We study the effect of the nonlinear relation between density and curvature perturbations on the formation of PBHs. As a criterion for PBH formation, the compaction function is used and it is found that larger curvature perturbations are required due to the nonlinear effect. We estimate the PBH abundance based on the Press–Schechter formalism with non-Gaussian probability density function during the radiation dominated era. It is found that the nonlinear effect slightly suppresses the PBH formation.

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