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Primordial black holes in peak theory with a non-Gaussian tail

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In this work, we update the peak theory for the estimation of the primordial black hole (PBH) abundance, particularly by implementing the critical behavior in the estimation of the PBH mass and employing the averaged compaction function for the PBH formation criterion to relax the profile dependence.
We apply our peak theory to a specific non-Gaussian feature called the exponential tail, which is characteristic in ultra slow-roll models of inflation. With this type of non-Gaussianity, the probability of a large perturbation is not suppressed by the Gaussian factor but decays only exponentially, so the PBH abundance is expected to be much enhanced.
Not only do we confirm this enhancement even compared to the case of the corresponding nonlinearity parameter $f_{\rm NL} = 5/2$, but also we find that the resultant PBH mass spectrum has a characteristic maximal mass which is not seen in the simple Press–Schechter approach.

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