

Inflation and Dark Matter Primordial Black Holes

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Primordial Black Holes (PBHs) are gravitationally collapsed objects that may have been created by density fluctuations caused by Inflation in the early universe. A broad range of single field models of inflation are analyzed in light of all relevant recent cosmological data, checking whether they can lead to the formation of longlived PBHs as candidate for dark matter. To that end we calculate the spectral index of the power spectrum of primordial perturbations as well as its first and second derivatives. PBH formation is possible only if the spectral index $n_s(k_0)$ increases significantly at small scales. Since current data indicate that the first derivative α_s of the spectral index is negative at the pivot scale, PBH formation is only possible in the presence of a sizable and positive second derivative (running of the running) β_s . Among the studied models, only the running-mass model allows PBH formation. As a by-product, we also show that the nonproduction of (long-lived) PBHs puts a stronger upper bound on β_s .