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Primordial Black Holes from Critical Higgs Inflation

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Primordial Black Holes (PBH) arise naturally from high peaks in the curvature power spectrum of near-inflection-point single-field inflation, and could constitute today the dominant component of the dark matter in the universe. In this talk we explore the possibility that a broad spectrum of PBH is formed in models of Critical Higgs Inflation (CHI), where the quasi-inflection point is related to the near-critical value of the RGE running of both the Higgs self-coupling $\lambda(\mu)$ and its non-minimal coupling to gravity $\xi(\mu)$. The peak in the matter spectrum arises at sufficiently small scales that it passes all the observational constraints from the cosmic microwave background (CMB) and large scale structure (LSS) observations. The model predicts a log-normal PBH broad-mass distribution peaked at $\mu_{\rm PBH} = 4 \times 10^{-11}\, M_\odot$, with dispersion $\sigma_{\rm PBH} = 1.4$, which is consistent with the present constraints on PBH and may eventually be discovered with microlensing experiments. The stochastic background of gravitational waves coming from the unresolved black-hole-binary (BHB) mergings could also be detected by LISA or PTA. Furthermore, the parameters of the CHI model correspond to a Standard Model Higgs couplings that are consistent, within 2σ, with those measured at the LHC. Future measurements of the PBH mass spectrum will allow us to determine the SM couplings of the Higgs and their running from the electroweak scale to almost the Planck scale.

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