Contribution ID: **382** Type: **not specified**

The primordial black holes and secondary gravitational waves from string inspired general no-scale supergravity

Tuesday, 24 August 2021 16:00 (20 minutes)

The formation of primordial black hole (PBH) dark matter and the generation of scalar induced secondary gravitational waves (SIGWs) have been studied in the generic no-scale supergravity inflationary models. By adding an exponential term to the K\"ahler potential, the inflaton experiences a period of ultra-slow-roll and the amplitude of primordial power spectrum is enhanced to $\mathcal{O}(10^{-2})$. The enhanced power spectra of primordial curvature perturbations can have both sharp and broad peaks. A wide mass range of PBH is realized in our model, and the frequencies of the scalar induced gravitational waves are ranged form nHz to Hz. We show three benchmark points where the PBH mass generated during inflation is around $\mathcal{O}(10^{-16}M_{\odot})$, $\mathcal{O}(10^{-12}M_{\odot})$ and $\mathcal{O}(M_{\odot})$. The PBHs with masses around $\mathcal{O}(10^{-16}M_{\odot})$ and $\mathcal{O}(10^{-12}M_{\odot})$ can make up almost all the dark matter, and the associated SIGWs can be probed by the upcoming space-based gravitational wave (GW) observatory. Also, the wide SIGWs associated with the formation of solar mass PBH can be used to interpret the stochastic GW background in the nHz band, detected by the North American Nanohertz Observatory for Gravitational Waves, and can be tested by future interferometer-type GW observations.

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Session Classification: Early Universe Cosmology

Track Classification: Early Universe Cosmology