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Probing high scale seesaw and PBH generated dark matter via gravitational waves with multiple tilts

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We propose a scenario where a high scale seesaw origin of light neutrino mass and gravitational dark matter (DM) in MeV-TeV ballpark originating from primordial black hole (PBH) evaporation can be simultaneously probed by future observations of stochastic gravitational wave (GW) background with multiple tilts or spectral breaks. A high scale breaking of an Abelian gauge symmetry ensures the dynamical origin of the seesaw scale while also leading to the formation of cosmic strings responsible for generating stochastic GW background. The requirement of a correct DM relic in this ballpark necessitates the inclusion of a diluter as PBH typically leads to DM overproduction. This leads to a second early matter dominated epoch after PBH evaporation due to the long-lived diluter. These two early matter dominated epochs, crucially connected to the DM relic, leads to multiple spectral breaks in the otherwise scale-invariant GW spectrum formed by cosmic strings. We find interesting correlations between DM mass and turning point frequencies of GW spectrum which are within reach of several near future experiments like LISA, BBO, ET, CE, etc.

Session

Astroparticle Physics and Cosmology

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