

Revisiting Primordial Black Hole Formation from Primordial Gravitational Waves

Sunday, 8 November 2026 17:30 (30)

Primordial gravitational waves generate radiation density perturbations at second order, providing a possible connection between small-scale tensor power and primordial black hole (PBH) formation. In this talk, we revisit this connection using a finite-time semianalytic solution for arbitrary source momenta. The solution retains the regular homogeneous contribution fixed by the initial spatial curvature and separates it from the subsequent tensor source. For Gaussian primordial tensors, we calculate the probability distribution of the quadratic density contrast smoothed at horizon reentry and compare the resulting PBH abundance estimates with a Gaussian density approximation. We examine how the positive density tail depends on the specified initial geometry and illustrate the effects of finite-width tensor spectra. We also assess perturbative validity by evaluating the tensor strength in regions exceeding the adopted density threshold. In the cases studied, the inferred tensor powers and the conditional mean squared tensor amplitudes are of order unity. These results clarify the assumptions underlying PBH bounds on primordial gravitational waves and motivate nonlinear evolution with a collapse criterion calibrated for tensor-induced density profiles and shear.

Primary author(s) : Dr ZHI-ZHANG, Peng (Yangtze University)

Presenter(s) : Dr ZHI-ZHANG, Peng (Yangtze University)

Session Classification : Parallel-Cosmology