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Primordial black holes and non-Gaussianity in the gravitational-wave era

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Recently, Pulsar Timing Array collaborations have discovered strong evidence of the nanohertz gravitational wave background. This has sparked extensive discussions in the academic community regarding the sources of gravitational waves, with strong interest in cosmological sources in addition to supermassive black holes. This report will focus on the progress of scalar-induced gravitational wave research. We will explore the significant contribution of primordial non-Gaussianity to scalar-induced gravitational waves and analyze the detection data of nanohertz gravitational waves in an attempt to address the issue of overproduction of primordial black holes. Furthermore, we propose that the angular power spectrum, which characterizes the anisotropy of scalar-induced gravitational waves, can serve as a powerful probe of primordial non-Gaussianity. We will also introduce the stochastic gravitational-wave background produced by binary black hole mergers and discuss the theoretical criteria for cross-validation using multi-band gravitational wave probes, as well as using the angular power spectrum to distinguish the population of black holes. We anticipate that gravitational wave probes will play a significant role in the study of primordial black holes and the origin of the universe.

Collaboration (if any)

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