

Probing the Origin of Primordial Black Holes using Gravitational Waves

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In this article we investigate the cumulative stochastic gravitational wave spectra as a tool to gain insight on the creation mechanism of primordial black holes. We consider gravitational waves from the production mechanism of primordial black holes and from the gravitational interactions of those primordial black holes among themselves and other astrophysical black holes. We specifically focus on asynchronous bubble nucleation during a first order phase transition as the creation mechanism. We have used two benchmark phase transitions through which the primordial black holes and the primary gravitational wave spectra have been generated. We have considered binary systems and close hyperbolic interactions of primordial black holes with other primordial and astrophysical black holes as the source of the secondary part of the spectra. We have shown that this unique cumulative spectra have features which directly and indirectly depend on the specifics of the production mechanism.

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