

Probing the population of pop III remnants using gravitational wave observations

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The properties of the first stars in the Universe, known as Population III (Pop III) stars, and their remnants are still poorly understood. However, the increased sensitivity of next-generation gravitational wave observatories offers the potential to detect mergers of these early compact binaries at redshifts greater than 15. A fraction of these detections will be loud enough, that is, the signal-to-noise ratio greater than 20 in the third-generation gravitational wave detector network, and are suitable for accurately understanding the astrophysical processes behind the formation and evolution of these very first compact binaries in the Universe. Using parametric population models, we explore the detectability and parameter inference accuracy of the early Universe binary black hole populations and determine the astrophysical population properties, such as the mass, spin and redshift distributions. Furthermore, we assess the gravitational wave network requirements necessary to differentiate the properties of compact binary populations in the early Universe from those in the present-day Universe.

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