

Ultrahigh-energy Gamma Rays and Gravitational Waves from Primordial Exotic Stellar Bubbles

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We put forward a novel class of exotic celestial objects that can be produced through phase transitions occurred in the primordial Universe. These objects appear as bubbles of stellar sizes and can be dominated by primordial black holes (PBHs). We report that, due to the processes of Hawking radiation and binary evolution of PBHs inside these stellar bubbles, both electromagnetic and gravitational radiations can be emitted that are featured on the gamma-ray spectra and stochastic gravitational waves (GWs). Our results reveal that, depending on the mass distribution, the exotic stellar bubbles consisting of PBHs provide not only a decent fit for the ultrahigh-energy gamma-ray spectrum reported by the recent LHAASO experiment, but also predict GW signals that are expected to be tested by the forthcoming GW surveys.

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