

Black Hole Superradiance and Gravitational Wave Beats

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Ultralight bosons can extract energy and angular momentum from a Kerr black hole (BH) due to superradiant instability, resulting in the formation of a BH-condensate system. We carefully investigate the evolution of this system numerically with multiple superradiant modes. We find the BH still evolves along the Regge trajectory of the $n = 0$ modes even with the presence of the $n > 0$ modes. On the other hand, the BH-condensate system emits monochromatic gravitational waves (GWs) with a unique beat signature, which could be directly observed by GW detectors.

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