

Probing Ultralight Dark Matter with Gravitational Waves

Ultralight bosons are promising dark matter candidates that can leave observable imprints in gravitational waves. In this talk, I will discuss several complementary ways to probe ultralight scalar fields with gravitational wave observations. I will focus on black hole superradiance and the resulting stochastic gravitational wave background, including the impact of higher modes, current LIGO–Virgo constraints, and the prospects for next-generation detectors. I will also discuss how self-interactions modify these signals, and how extreme-mass-ratio inspirals in scalar-cloud environments can develop resonant features that may be detectable by future space-based detectors. These results show that gravitational waves provide a powerful multi-band probe of ultralight dark matter.

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