

## Exploring spin of ultralight dark matter with gravitational wave detectors

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In this study, we propose a novel method for distinguishing spin of ultralight dark matter (ULDM) through the ULDM search with interferometric gravitational wave detectors. ULDM, presenting potential spin states of 0, 1, and 2, induces distinctive signatures in GW signals. We found that the finite-time light-traveling effect dominates for spin-0 and spin-1 ULDM, resulting in unique overlap reduction functions (ORF) distinct from those of spin-2 ULDM. This allows us to distinguish spins of ULDM. Furthermore, our results suggest that the current constraint on the coupling constant of spin-1 ULDM to baryons becomes 30 times weaker.

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