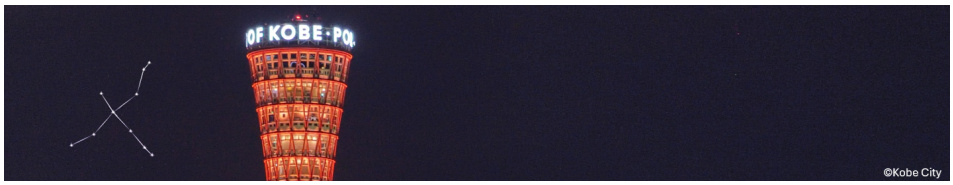


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# Directional Search for Light Dark Matter Using Quantum Sensor Technologies

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The search for light dark matter requires detectors capable of sensing extremely small energy deposits while also providing information about the direction of the incoming particles. Quantum sensors offer a promising path toward this goal due to their exceptional sensitivity, low noise characteristics, and ability to measure minute spatial or temporal signals. In this study, we explore a quantum-sensor-based framework for directional dark-matter detection that integrates precision readout, coherent signal amplification, and noise-suppression techniques. We discuss potential detector concepts that can register sub-keV interactions, evaluate directional signatures at low momentum transfer, and operate with scalable arrays for improved sensitivity. Early simulations indicate that quantum-enhanced measurements may enable access to previously unreachable regions of light-dark-matter parameter space. This approach highlights the growing role of quantum technologies in next-generation astroparticle experiments.

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