

Axion dark matter search using quantum sensing of magnons: Estimation of sensitivity for Kittel mode – superconducting qubit hybrid

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Axions can be probed through the interaction between axions and electron spins. By detecting magnons (quantum of collective spin excitation) induced by axions inside a ferromagnetic crystal such as YIG, we can explore the parameter space of axions in the GHz regime. To improve the sensitivity of axion detectors, we must (1) increase the signal (magnons) excited by axions and (2) suppress detector noise. Using a dilution refrigerator, thermal noise can be suppressed to below 50 mK. The noise of conventional axion detectors is limited by the Standard Quantum Limit. This Standard Quantum Limit can be overcome by quantum sensing of magnons using superconducting qubits. I will present the sensitivity evaluation along with our R&D toward an axion dark matter detector using a superconducting qubit-Kittel mode hybrid system.

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