

# Development of qubit-based light dark matter detector on sapphire substrate

One of the challenges in exploring target materials for dark matter searches is the detection of sub-eV energy excitations from light dark matter interaction with a target material. Dark matter interaction can excite sub-eV optical phonon modes in polar materials like sapphire. Furthermore, the anisotropy of sapphire crystal could provide a signature of daily modulation of the dark matter scattering rate, making it a promising target material. We plan to utilize superconducting qubits on a sapphire substrate to detect the scattering events by taking advantage of the excitation of phonons, which scatter and further down-convert to lower-energy phonons. A good fraction of these phonons are expected to reach the qubit superconductor on the substrate and break Cooper pairs. Such a process can cause qubit decoherence, which can be measured using standard qubit readout protocol. This poster describes our ongoing development of a prototype detector.

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