Quantum Sensor for detection of Dark Matter

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Introduction

The observable universe is composed of 26% dark matter. So, it is essential to understand dark matter to get a comprehensive description of the universe.

Searching for Dark Matter

It is very difficult to detect such matter since it only reacts through weakest known force. There has been numerous attempt to directly observe dark matter particle but the theoretical bounds for the supposed mass of dark matter is very large.

MKID (Microwave Kinetic Inductance Detector)

MKID, a kind of quantum sensor, work on the principle that incident energy changes the surface impedance of a superconductor through the kinetic inductance effect. This project aims to deploy the property of MKID to attempt to detect low-energy dark matter particles. It is expected that when dark matter collides with silicon crystal substrate, it will deposit some fraction of its kinetic energy. Sometimes this is enough to create an electron-hole pair and shower of phonons. MKIDs can be used to detect these low-energy phonons.

Results and Future Works

The resulting program of this internship project can be used to simulate the collection of phonon generated due to interaction with dark matter. This would allow to create database for varying configuration (energy deposition, position, initial direction) of interaction with dark matter, the results of which can be analyzed to make better decision on design of the detector.

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