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Towards Low Energy Threshold and Large Area Superconducting Nanowire Single Photon Detectors for HEP Science

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We present the latest results in superconducting nanowire single photon detectors (SNSPDs) towards large active areas at the $1 \times 1 \text{ mm}^2$ level and beyond. These large active areas sensors are key to enable HEP experiment looking for axion dark matter candidates in proposed experiments such as BREAD.

We will present the initial characterization of these devices and show in depth characterization of the dark count rate of these new devices and its dependence on operating temperature. The dark count rate is a key detector parameter for expected low-signal experiments such as those searching for dark matter and special care has been put to develop a characterization system at Fermilab to extensively characterize these devices. We will discuss possibilities for enabling SNSPDs with lower energy threshold and further area scalability by using frequency domain multiplexing readout schemes. These developments have a unique physics case towards detecting axion masses below the in the 0.01 - 1 eV range which currently remains largely unexplored.

Early Career

Yes

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