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Modelling the electric field in SuperCDMS High Voltage Detectors

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The Super Cryogenic Dark Matter Search (SuperCDMS) collaboration uses cryogenic silicon and germanium detectors to search for evidence of dark matter. The collaboration utilises Monte Carlo simulations to examine the predicted response of these detectors to energy depositions by dark matter particles via nuclear recoil. The detectors produce signals through creation of electron-hole pairs within the detector bulk which are then accelerated by the voltage difference applied on the faces of the detector. Thus an accurate Monte Carlo simulation requires an accurate model of the electric field within the detector. The E-field modelling was first done for the SuperCDMS HVeV gram-scale prototype detectors, which at a smaller scale allowed for the establishment of a framework that was then generalised to the full-scale SuperCDMS HV100mm detectors. The E-field models were then used in Monte Carlo simulations based on Geant4 and G4CMP to study particle transport within the bulk of the detectors. This talk will cover the simulation framework created in COMSOL Multiphysics simulation software to implement QET designs for accurate E-field modeling alongside the challenges and approximations required in extending individual detector models to a full-scale detector tower model consisting of 6 detectors that represents the SuperCDMS as-built geometry at SNOLAB. Ultimately I present the simulation data extracted by the Monte Carlo simulation using the E-field models of the detectors.

Keyword-1

Dark Matter

Keyword-2

SuperCDMS

Keyword-3

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