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Initial Dark Matter Results from the SuperCDMS Single-Charge Sensitive Detectors

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Astronomical evidence over the past several decades points to a Universe composed primarily of Dark Matter. There are several competing hypotheses about the composition and the interaction mechanisms of Dark Matter. Several groups have assembled instruments to test these ideas by searching for the hypothesized interaction, but despite their best efforts no direct detection has been confirmed to date. The Super Cryogenic Dark Matter Search (SuperCDMS) SNOLAB experiment is the successor to SuperCDMS Soudan and CDMS II experiments, which for the past two decades focused on the direct detection of dark matter particles. Currently, the next generation of high-resolution SuperCDMS HV detectors are being developed and recently a 0.93 g prototype with a charge resolution of 0.1 electron-hole pairs (CDMS HVeV) was produced. A 0.49-gram day exposure with minimal overburden was taken using the CDMS HVeV detector. The first limits on inelastic electron scattering dark matter and dark photon absorption are presented. The limits for the dark matter-standard model particle interaction significantly improve experimental constraints on dark matter particles with masses as low as 1 MeV. These results demonstrate the scientific potential of phonon-mediated semiconductor detectors that are sensitive to single electronic excitations.

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