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Dark Matter Search with SuperCDMS eV-resolution Device

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We report the final dark matter (DM) search results and background spectrum measurement from a 1.2 g·day exposure of an upgraded SuperCDMS high-voltage eV-resolution (HVeV) detector. The 1×1×0.4 cm³ (0.93 g) HVeV detector is able to detect single electron-hole pair production by sensing phonons produced by the Neganov-Trofimov-Luke effect at a voltage bias of 100 V. Relative to the first run of a HVeV detector, a revised phonon sensor design improves the phonon energy resolution from 14 eV to 3 eV, achieving 3% energy resolution for detection of one electron-hole pair. Furthermore, the laser energy calibration scheme now accounts for photons directly absorbed in the phonon sensor, and the detector response model was improved by incorporating charge carrier trapping and impact ionization. We use data division to blind our DM search. We report constraints on DM-electron scattering for 0.5-10⁴ MeV DM mass, dark photon absorption for 0.3-50 eV mass, and, for the first time, constraints on galactic axion-like particle absorption for 0.3-50 eV mass.

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