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Measurement of low-energy Compton and neutron scattering in Si CCDs for dark matter searches

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For optimal sensitivity to low-mass dark matter candidates experiments like DAMIC-M employ skipper charged-coupled devices (CCDs) with detection threshold of just a few ionization charges. Ionization signals from small-angle Compton scatters of environmental gamma-rays - an important component of the background in dark matter searches - must thus be characterized down to $O(10 \text{ eV})$ energy. Using a Am-241 gamma-ray source, we report a precise measurement of scattering on silicon atomic shell electrons in a skipper CCD with single-electron resolution. Notable differences are observed between data and theoretical expectations in the L-shell energy region ($<150 \text{ eV}$). We also present preliminary data from a skipper CCD exposed to low-energy neutrons ($<24 \text{ keV}$) from a SbBe photoneutron source, demonstrating a measurement of the nuclear recoil ionization efficiency in Si down to few ionization charges.

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