SAPIENZA



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## Observation of a nuclear recoil peak in Sapphire and molecular dynamics simulation of the Al recoil

The current generation of cryogenic solid state detectors used in direct dark matter and CE $\nu$ NS searches typically reach energy thresholds of  $\mathcal{O}(10 \text{ eV})$  for nuclear recoils. The energy calibration of these detectors is usually done via X-ray sources with energies in the  $\mathcal{O}(\text{keV})$  region, requiring an extrapolation to the low-energy regime. Ideally, these detectors should be calibrated via mono-energetic nuclear recoils in the relevant energy range. To achieve this, a new method has been proposed which is based on the radiative capture of thermal neutrons on nuclei, which may be followed by a de-excitation via single  $\gamma$ -emission leading to a low-energetic nuclear recoil. The first experimental observations of this effect were accomplished with  $_4$  crystals. In this work we report on the observation of a peak around 1.1 keV in the data of an Al<sub>2</sub>O<sub>3</sub> crystal in CRESST-III, which was irradiated with neutrons from an AmBe calibration source. We attribute this mono-energetic peak to the radiative capture of thermal neutrons on  $^{27}$ Al and the subsequent de-excitation via single  $\gamma$ -emission.

To investigate the impact of crystal defect creation on the observable energy, the INCIDENCE project is performing molecular dynamics simulation of the Al recoil within the crystal lattice of  $Al_2O_3$ . We will present first results that predict an energy loss of  $\mathcal{O}(10 \text{ eV})$  for nuclear recoils at around 1.1 keV.

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