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Crystal Defect Creation by Nuclear Recoils in Cryogenic Calorimeters

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Mineral detectors look for signals of new and interesting physics by studying defects in the crystal lattice of natural minerals caused by recoiling nuclei. As the measurement happens sometimes Gyr after the searched-for interaction, this can be understood as the extreme case of a "long-lived"signal. In contrast, cryogenic calorimeters are used to study the temperature increase caused by the nuclear recoil in the laboratory –a very "short-lived"signal. For cryogenic calorimeters, crystal defects are a source of systematic uncertainty, as their creation energy is missing from the temperature signal. Although the detection methods are different, nuclear recoils and crystal defect creation are of common interest for mineral detectors and cryogenic calorimeters alike.
In this contribution, I will discuss crystal defects from the perspective of cryogenic calorimetry. After briefly introducing rare-event searches with cryogenic calorimeters, I will present the simulation of crystal defect creation by nuclear recoils using the Molecular Dynamics program LAMMPS. The possibility of comparing simulation and measurement will be discussed based on direct measurements of the thermal signal caused by single, monoenergetic nuclear recoils by the CRESST and CRAB & NUCLEUS experiments. Finally, I give an outlook on the CRAB facility at TU Wien, which aims at precision measurements of nuclear recoils in cryogenic detectors using thermal neutron capture.

Do you plan to give the talk in person?

Yes

Author: KLUCK, Holger (Marietta Blau Institute for Particle Physics of the Austrian Academy of Sciences)

Co-author: BURKHART, Jens (Marietta Blau Institute for Particle Physics of the Austrian Academy of Sciences)

Presenter: KLUCK, Holger (Marietta Blau Institute for Particle Physics of the Austrian Academy of Sciences)