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Search for light dark matter with the CRESST-III experiment

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CRESST (Cryogenic Rare Events Search with Superconducting Thermometers) is a long-standing experiment with cryogenic detectors located at the underground facility Laboratori Nazionali del Gran Sasso in Italy. CRESST-III, the third CRESST experiment generation, is designed to probe the spin-independent Dark Matter(DM)-nucleus cross-section with a world leading sensitivity for low DM particle mass (less than $2\text{GeV}/c^2$).

Despite many well motivated theoretical models for light dark matter, a large part of the parameter space for spin-independent scattering off nuclei remains untested for dark matter particles with masses below few GeV/c^2 . CRESST experimental approach is the direct detection, which looks for scattering off nuclei of hypothetical dark matter particles inside a target of ordinary matter.

The CRESST-III experiment adopted scintillating CaWO_4 crystals of $\sim 25\text{g}$ as target material for dark matter interactions. Each detector module is constituted by a CaWO_4 crystal paired with a plate made of Silicon-On-Sapphire for the detection of the scintillation light. Both crystals are equipped with Transition Edge Sensors (TES) and operated as cryogenic calorimeters at a temperature of $\sim 10\text{mK}$. The double channel read-out of scintillation light and total energy deposition is foreseen for event-by-event particle identification, a crucial feature for background suppression. In addition, a fully scintillating instrumented holder allows for identification of background events originated on the surrounding surfaces.

CRESST-III Phase 1 was successfully completed in 2018, achieving an unprecedented energy threshold for nuclear recoils. This result extended the present sensitivity to DM particles as light as $\sim 160\text{MeV}/c^2$.

In this contribution, a complete overview of the CRESST-III detectors will be presented, emphasizing the latest DM results and the perspectives of future stages of the CRESST experiment.

Less than 5 years of experience since completion of Ph.D

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