SEARCH FOR LOW-MASS DARK MATTER WITH THE CRESST EXPERIMENT

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The CRESST (Cryogenic Rare Event Search with Superconducting Thermometers) experiment aims at the direct detection of dark matter particles [1]. As target material it uses scintillating $CaWO_4$ crystals which are operated as cryogenic particle detectors. A dark matter run was recently finished after a successful 2-years operation with a total target mass of 5 kg. With respect to previous measuring campaigns the intrinsic radiopurity of $CaWO_4$ crystals and the capability to reject recoil events from alpha surface contamination have been improved significantly [2]. The data acquired by two $CaWO_4$ detectors were analysed which combine an unprecedented background level with a trigger threshold as low as 300 eV. With these detectors, all events observed in the region-of-interest for dark matter search are compatible with background. No indications for an excess signal are observed. Therefore, limits on the spin-independent dark matter particle-nucleon scattering cross sections are derived [1][3]. The new data disfavour a dark matter interpretation of earlier CRESST-II results [4] and currently provide the best sensitivity for particle masses below $\sim 2\,\mathrm{GeV/c^2}$.

These results demonstrate the high potential of the phonon-light detector technology, in particular for low-mass dark matter search. To further improve the sensitivity and expand it to even lower dark matter particle masses the energy threshold is crucial, since the expected exponential recoil spectra extend only up to energies of $\mathcal{O}(1\,\mathrm{keV})$ for particle masses of $\mathcal{O}(1\,\mathrm{GeV/c^2})$.

For the next generation experiment, CRESST-III, which will be dedicated to low-mass dark matter search, a novel detector design has been developed. It aims at an energy threshold as low as 100 eV and an improved background discrimination technique. We present the CRESST-III detector module in detail, report about first measurements with a prototype detector and outline the future experimental strategy. Further we give projections for the sensitivity: with a moderate target mass of $\mathcal{O}(3\,\mathrm{kg})$ and a measuring time of ~ 2 years most of the dark matter particle parameter space below $10\,\mathrm{GeV/c^2}$ can be probed [5]. CRESST-III might reach sensitivities close to coherent neutrino-nucleus scattering cross sections [6]. First data from phase 1 of CRESST-III is expected in 2016.

[1] G. Angloher et al., EPJ-C **74**, 3184 (2014).
[2] R. Strauss et al., EPJ-C **75**, 352 (2014).
[3] G. Angloher et al., arXiv:1509.01515 (2015) submitted to EPJ-C.
[4] G. Angloher et al., EPJ-C **72**, 1971 (2012).
[5] G. Angloher et al., arXiv:1503.08065 (2015).
[6] A. Gütlein et al., Astropart. Phys. **69**, 44 (2015).