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Diamond cryogenic detector for low-mass Dark Matter searches

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Despite the multiple and convincing evidences of the existence of Dark Matter (DM) in our Universe, its identification is one of the most pressing questions in particle physics. As of today there is no unambiguous hint which could clarify its particle nature. For these reasons, a huge experimental effort is ongoing, trying to realise experiments which can probe different DM properties. In particular, direct searches experiments are trying to cover the widest possible mass range, from a few MeV up to TeVs.
Particularly suited for sub-GeV sensitivity are detectors made of light nuclei, which are sensitive to the scattering-off of light DM candidates. Among them, carbon-based materials used as detection medium would be able to probe value of low-mass DM masses, down to the MeV range.
Thanks to their cryogenic properties (high Debye temperature and long-lived phonon modes), carbon-based materials operated as low temperature calorimeters could reach an energy threshold in the eV range, and would allow for the exploration of new parameters of the DM- nucleus cross section.
Despite several proposals, the possibility of operating a carbon-based cryogenic detector has not been demonstrated yet. In this contribution the preliminary results obtained with a diamond absorber operated with a TES temperature sensor will be reported. The potential of such a detector in the current landscape of dark matter searches will be also illustrated.

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

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