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Cryogenic light detectors for background suppression: the CALDER project.

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Background rejection plays a key role for experiments searching for rare events, like neutrino-less double beta decay and dark matter interactions.
Among the several detection technologies that were proposed to study these processes, cryogenic calorimeters stand out for the excellent energy resolution, the ease in achieving large source mass, and the intrinsic radio-purity. Moreover, they can be coupled to a light detector that measures the scintillation or Cherenkov light emitted by interactions in the calorimeter, enabling the identification of the interacting particle by exploiting the different light emission. This feature allows to disentangle signal events from background produced by all the other interactions (mainly alpha particles) that, otherwise, would dominare the region of interest, preventing the achievement of a high sensitivity.

The technology for light detection must ensure an RMS noise resolution lower than 20 eV, a wide active surface (several square cm), a fast time response and a high intrinsic radio-purity. Furthermore, the detectors have to be multiplexable, in order to reduce the number of electronics channels for the read-out, as well as the heat load for the cryogenic apparatus. Finally they must be characterized by a robust and reproducible behavior, as next generation detectors will need hundreds of devices. None of the existing light detectors satisfies all these requests.
In this contribution I will present the CALDER (Cryogenic wide-Area Light Detectors with Excellent Resolution) project, a recently proposed technology for light detection which aim to realize a device with all the described features. CALDER will take advantage from the superb energy resolution and natural multiplexed read-out provided by Kinetic Inductance Detectors (KIDs).

In this contribution I will present the achievements of the CALDER R&D activities and the last results obtained with the final 5x5 square cm light detector.

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

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