Contribution ID: **134** Type: **oral**

CUPID-0: a cryogenic calorimeter with particle identification for double beta decay search.

Thursday, May 25, 2017 9:54 AM (18 minutes)

With their excellent energy resolution, efficiency, and intrinsic radio-purity, cryogenic calorimeters are primed for the search of neutrino-less double beta decay (0nDBD). The sensitivity of these devices could be further increased by discriminating the dominant alpha background from the expected beta-like signal. The CUPID-0 collaboration aims at demonstrating that the measurement of the scintillation light produced by the absorber crystals allows for particle identification and, thus, for a complete rejection of the alpha background. The CUPID-0 detector, assembled in 2016 and now in commissioning, consists of 26 $Zn^{82}Se$ scintillating calorimeters for about $2x10^{25}$ 0nDBD emitters. In this contribution we present the preliminary results obtained with the detector and the perspectives for a next generation project.

Summary

The neutrinoless double beta decay (0nDBD) is a hypothesized nuclear transition that violates the conservation of the total lepton number. Its prized observation would have important implications in the explanation of the asymmetry matter/anti-matter, and it would demonstrate that neutrinos have a Majorana mass component.

The CUORE collaboration is now completing the commissioning of a ton-scale detector based on cryogenic calorimeters, which is expected to become soon one of the most sensitive detectors searching for 0nDBD.

Next generation projects aim at increasing the sensitivity on 0nDBD by at least an order of magnitude with respect to CUORE. The sensitivity of this experiment is limited by an intrinsic background due to alpha particles, that are produced by contaminations of the material that constitute the detector itself.

We present an upgrade of the calorimetric technique, based on the simultaneous read-out of heat and scintillation light, that will allow to perform particle identification and disentangle electrons (possible signal) from the dominant alpha background. We assembled a first medium-scale prototype of this technology, which is now being commissioned in the underground Laboratori Nazionali del Gran Sasso (Italy). Given the high number of 0nDBD emitter and the low expected background, this prototype has also an interesting physics potential in the search for 0nDBD.

In this contribution we describe the detector, we present our preliminary results, and we discuss the perspectives in view of a next generation experiment.

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Session Classification: R1-Particle identification(2)

Track Classification: Neutrino Detectors