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Novel techniques for thermal detectors and applications for rare events physics

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The current technology of thermal detectors for rare events physics is based on large cryogenic calorimeters read with NTD thermistors. Measuring the total energy deposition via the heat release in the crystal lattice allows for optimal energy resolutions when the detectors are operated at 10mK. In case the crystals are made of a scintillating material, a double readout of heat and scintillation light could allow for an improved discrimination between alpha and beta/gamma events.
Cryogenic detectors read with NTD are generally characterised by a slow time response, limited by the several thermal factors playing a role in the signal formation. For example, the traditional glue coupling between the NTD and the absorber could introduce spurious and variable thermalisation time constants to the signal. A new technique for coupling the NTD to the absorber crystal would be the silicate bonding, applied already in several fields of satellite and optical physics. We will be showing the first results of NTD coupled on LMO crystal with the silicate bonding technique, when these are operated as cryogenic calorimeters at 10 mK.
A second fundamental aspect for these detectors is the improvement in the collection of scintillation light. In general, the light detectors are Ge or Si wafers, operated also as thermal detectors, absorbing the scintillation photons and converting them into heat. We are now proposing to use instead a plastic film with high absorbance for optical photons, wrapped around the scintillating calorimeter. In particular, we will be showing the results obtained with a thermal light detector made in KAPTON® film, operated in the Milano Cryogenic Lab.

Collaboration

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