Contribution ID: **230** Type: **Oral presentation (young scientists)**

remoTES: A new design for the cryogenic NaI detectors of the COSINUS experiment

Thursday 21 July 2022 16:20 (10 minutes)

With its increasing statistical significance the DAMA/LIBRA annual modulation signal is a cause for tension in the field of dark matter direct detection. A dark matter explanation for this signal is under standard assumptions incompatible with numerous null-results of other experiments. The COSINUS experiment aims at a model-independent cross check of the DAMA/Libra signal claim.
In order for such a model-independent cross check to be meaningful, the same detector material as used by DAMA has to be employed. Thus COSINUS will use NaI crystals operated as cryogenic scintillating calorimeters at mili-Kelvin temperatures. Such a setup enables independent measurement of both temperature and scintillation light signals via transition edge sensors (TESs). This dual-channel readout allows particle discrimination on an event-by-event basis, as the amount of light produced depends on the particle type (light quenching).
However, the non-standard physical and chemical properties of NaI cause an obstacle when attaching such a TES directly onto the surface of the crystal. This problem can be overcome with the so called "remoTES" design, where the TES itself is attached to an external wafer crystal. Phonons from an interaction in the NaI crystal are then collected in a gold pad coupled to the absorber which is connected to the TES via a gold bonding wire. We present the results from a first successful operation of NaI and other crystals as cryogenic calorimeters with the remoTES design.

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Session Classification: Parallel 3A - Direct detection (calibration and new approaches)