

The COSINUS project: development of new NaI-based cryogenic detectors for direct dark matter search

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Many astrophysical observations can be explained by the existence of cold dark matter. Although nowadays its contribution to the energy density of the universe is known precisely, its particle nature remains still unknown. Clarifying the nature and origin of dark matter is one of the big challenges for modern particle physics.

Direct dark matter searches aim at the observation of dark matter particles interacting with the material of their earthbound detectors. Since many years there is a tension between the DAMA/LIBRA experiment observing an annual modulation signal, as expected for dark matter particles, and several other experiments with null results.

COSINUS, an R&D project recently initiated by INFN and located at Laboratori Nazionali del Gran Sasso (LNGS), offers the unique possibility to investigate and clarify the above discrepancy. In particular, COSINUS is designed to combine the DAMA/LIBRA detector material NaI with the well established phonon/light technique for particle identification and background rejection. We will present first results using CsI (undoped), which has similar crystal properties as NaI, as a cryogenic scintillating calorimeter. Furthermore, we will describe our current plans to develop and operate such cryogenic calorimeter based on NaI (undoped). The dedicated detector design for the first NaI-based proof-of-principle detector, including a cryogenic light detector as well as the objectives for the COSINUS project are reported.

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