

Testing DAMA/LIBRA result with ANAIS-112 experiment

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Detecting the elusive WIMPs (Weakly Interacting Massive Particles) proposed to explain the dark matter has shown to be a very challenging effort. The study of distinctive features in the WIMP signal allowing disentangling it from other backgrounds is an important asset in this search. The motion of the Earth around the Sun will produce a modulation in the dark matter interaction rate along the year, because of the change in relative velocity between WIMPs and target nuclei. DAMA/LIBRA experiment, in the Laboratory of Gran Sasso, Italy, has observed such a modulation, having all the features expected for WIMPs distributed in an isotropic and spherical halo, with a high statistical significance. Neither considered systematics are able to explain such a modulation, nor are compatible with this result other very sensitive experiments in most of the considered dark matter scenarios.

The ANAIS (Annual modulation with NaI(Tl) Scintillators) experiment aims at the confirmation or refutation of the DAMA/LIBRA signal using the same target and technique at the Canfranc Underground Laboratory (LSC). Several 12.5 kg NaI(Tl) modules produced by Alpha Spectra Inc. have been operated in Canfranc during the last years in various set-ups. All of them have shown an outstanding light collection at the level of 15 photoelectrons per keV, which allows triggering at 1 keV of visible energy, and their background has been fully characterized. The ANAIS-112 set-up consisting of nine detectors in a 3x3 matrix configuration with a total mass of 112.5 kg has been commissioned at LSC in the first semester of 2017, starting the dark matter run on August, the 3rd.

ANAIS-112 present sensitivity will allow exploring the DAMA/LIBRA singled-out WIMP parameter region at 3 sigma in 5 years of data taking. Discovery potential of ANAIS-112 in present conditions is very high if WIMPs are responsible of the DAMA/LIBRA annual modulation signal. The ANAIS-112 experimental plan is to take data for two years and in parallel, to explore possible experiment upgrading: using the same crystals but replacing the photomultiplier (PM) tubes by SiPMs or adding a liquid scintillator veto. The additional three years of data taking would require new funding.

Moreover, ANAIS will work in the next two years in the understanding of the behaviour at low energy of the scintillation quenching factor for NaI(Tl) crystals of different quality and providers, in collaboration with other international partners.

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