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ANAIS-112: the most sensitive experiment to test the DAMA/LIBRA signal in a model independent way

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The ANAIS (Annual modulation with NaI(Tl) Scintillators) experiment is intended to search for dark matter annual modulation with ultrapure NaI(Tl) scintillators in order to provide a model independent confirmation or refutation of the long-standing DAMA/LIBRA positive annual modulation signal in the low energy detection rate, using the same target and technique. Other experiments exclude the region of parameters singled out by DAMA/LIBRA. However, these experiments use different target materials, so the comparison of their results depends on the models assumed for the dark matter particle and its velocity distribution in the galactic halo. ANAIS-112, consisting of nine 12.5 kg NaI(Tl) modules produced by Alpha Spectra Inc., disposed in a 3×3 matrix configuration, is taking data smoothly with excellent performance at the Canfranc Underground Laboratory, Spain, since August, 2017. Last results corresponding to the reanalysis of the first 3 years data using new filtering protocols based on machine-learning techniques lead international efforts in testing the DAMA/LIBRA signal, and are compatible with the absence of modulation and incompatible with DAMA/LIBRA for a sensitivity of almost 3σ C.L., with the potential to reach a 5σ level by the end of 2025. These results will be reported in this talk. The scintillation quenching factors constitute the main systematics in the comparison between the DAMA/LIBRA result and other experiments using NaI(Tl). The impact of different scintillation quenching factors in the comparison between ANAIS-112 and DAMA/LIBRA will also be addressed. Finally, the present status of the experiment and prospects for the upcoming 6-years unblinding will be discussed.

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