Dipartimento di Fisica
Università di Cagliari
INFN, Sezione di Cagliari

High Energy Physics Colloquia

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The Role of Neutrino Backgrounds on Next Generation Dark-Matter Direct Detection Experiments

Abstract

The scientist who first detected the neutrino called this strange new particle "the most tiny quantity of reality ever imagined by a human being". Indeed, they are absurdly small and interact with other matter incredibly weakly. Despite that, upcoming direct dark matter detection experiments will be so sensitive to start to detect neutrinos from several astrophysical sources, including the Sun, atmosphere, and diffuse supernovæ. For experiments that do not distinguish the direction of an event, coherent neutrino scattering represents an important background to understand, as it can almost perfectly mimic an authentic weakly interacting massive particle (WIMP) dark matter signal. The effect of neutrino background is to reduce the discovery potential of WIMPs. It's a phenomenon some physicists are calling the "neutrino floor", which represents the hard limit after which the neutrino scattering starts to compete with dark matter interactions. This limit has been determined for two different targets, namely xenon and argon. Since neutrino-nucleus scattering has never been observed, different contributions to the differential cross section have been tested in order to evaluate the implications on the neutrino floor. In particular, the effects on the latter due to modifications of the nuclear form factor and of the coherence hypothesis will be discussed. Finally, the implications of such neutrino background for the DarkSide-20k experiment, a 20 tonnes liquid argon TPC to be built at LNGS, has been analysed and the importance of the RED (REcoil Directionality) project will be highlighted.

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