Dark Matter Search with PICO-LON

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Abstract

Dark matter problem is one of the most important subjects in both astrophysics and particle physics. The most promising candidate is weakly interacting massive particles (WIMPs) that is proposed by the particle theory beyond the standard theory. The interaction cross section between nucleus is expected to be smaller than 10^{-5}pb so that high sensitive detector is needed to search for WIMPs [1,2].

A thin and wide area NaI(Tl) scintillator has been applied to search for dark matter search[3]. The thickness of the crystal was optimized to make a coincidence measurement of a recoil nucleus and a gamma ray from excited nucleus. The gamma ray whose energy is 57.6keV is emitted immediately after the excitation of ^{127}I. The gamma ray escapes from the original crystal and detected by the neighboring crystal. The multilayer NaI(Tl) detector system named PICO-LON (Planar Inorganic Crystal Observatory for LOw background Neutr(al)ino) has been developed[3].

The test modules has been tested for WIMPs search. The performances, energy threshold and energy resolution were enough good to search for WIMPs[4]

Future high sensitive project was approved. The PICO-LON system will be installed into KamLAND detector. The sensitivity is expected to reach the interesting range of cross section.

[1] N.J.Spooner, J. Phys. Soc. Jpn. 76 (2007) 111016 and references therein.
[2] P.Toivanen et al., Phys. Rev. C79 (2009) 044302.
[3] K.Fushimi et al., J. Phys. Soc. Jpn. 74 (2004) 3117.
[4] K Harada, et al., arXiv: 1203.4872.