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A Search for Solar Axions via the Resonant Absorption by Atomic Nuclei

Abstract

An axion is the hypothetical particle that was introduced in attempt to solve the long-standing problem of CP non-violation in strong interactions. After the initial hypothesis of "standard" axion was experimentally disproved, some modifications of theoretical model were performed, allowing these particles to have smaller mass, but at the same time significantly suppressed the intensity of axion interaction with ordinary matter. Such properties of these new "invisible axions" made them a viable dark matter candidate, igniting an additional interest for the experimental axion searches.

Being a pesudo-scalar particle, an axion can undergo resonant absorption/emission in nuclear transitions of magnetic type. The low-energy nuclear levels of particular nuclides (57Fe, 169Tm, 83Kr) can be used for detection of solar axions via the resonant absorption by atomic nucleus. The resonant nature of the process provides relatively high cross-section and allows one to achieve reasonable sensitivity to the solar axion flux even a small scale.

A series of experiments with Fe and Tm targets were performed at PNPI (St. Petersburg, Russia) in the ground level setup, and the most recent measurement was carried out with Kr target at the Baksan Neutrino Observatory (INR, RAS) underground setup, setting new limits on the axion coupling constants and mass.

September 27, 2018 - h 2:30 pm

LNGS - "B. Rossi" room

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