INFN

LNGS SEMINARS

Maxim Gromov
SINP Moscow, Russia

Updated results of the geo-neutrino observation with the Borexino detector

Abstract

The observation of geo-neutrinos is a powerful method to investigate interior of the Earth. But for the moment only two detectors, namely Borexino and KamLAND, have registered these particles. Another problem is large errors of the measurements in both cases that are about a few dozens of percent. This precision is not sufficient in order to choose the correct Earth's model, accurately determine the geo-neutrino signal and the value of the radiogenic heat, convincingly demonstrate the presence of the geo-neutrino flux from the mantle and constrain or measure the thermal power of the hypothetical georeactor at last. Overcoming the problem is partly possible thanks to increasing the statistics and optimization of the selection criteria. The continuation of the measurement with Borexino and applying well-tuned cuts to its data have led to more than double exposure that is equal to $(1.29 \pm 0.05) \times 10^{32}$ protons × year. The new results are compatible with different Earth's models but slightly (~2.4σ) disfavor the geological predictions of the lowest concentration of heat-producing elements in the mantle. The measured geo-neutrino signal is $47.0^{+8.4}_{-7.7}$ (stat) $^{+2.4}_{-1.9}$ (sys) TNU with $^{+18.3}_{-17.2}$% total precision, the full radiogenic heat is $38.2^{+13.6}_{-12.7}$ TW. It was also found that there is the mantle signal of $21.2^{+9.5}_{-9.0}$ (stat) $^{+1.1}_{-0.9}$ (sys) TNU excluding the null-hypothesis at 99.0% C.L. or 2.3σ significance. The georeactor power is constrained to 2.4 TW at 95% C.L. for the location in the Earth's center.

December 5, 2019 - h 2:30 pm

LNGS - Room "B. Pontecorvo"

https://agenda.infn.it/e/gromov_2019