NEUTRINO2010, XXIV International Conference on Neutrino Physics and Astrophysics, Athens, GREECE

Contribution ID : **149** Type : **not specified**

Status and new data of the geochemical determination pp-neutrino flux by LOREX

Abstract content

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LOREX, the acronym of LORandite EXperiment, is the only long-time solar neutrino experiment still actively pursued. It addresses the long-time detection of the solar neutrino flux with the thallium-bearing mineral lorandite, TlAsS2 from the mine of Allchar, FYR Mazedonia, via the neutrino-capture reaction 205Tl + ν(e) → 205Pb + e(-). The final step of LOREX would be the extraction of lorandite samples and the quantitative determination of the ratio of 205Pb / 205Tl atoms, thus providing the product of solar neutrino flux and neutrino-capture cross section, integrated over the age of lorandite 4.31 • 10ˆ6 yr. The detector offers the low threshold of only 52 keV for solar pp-neutrinos, to be compared with the next lowest 232 keV in the GALLEX and SAGE experiments. Moreover, LOREX would be unique in view of providing the mean luminosity of the sun over the last 4.3 million years. This paper presents new data on accurate geological age of the minerals at Allchar, and in particular the erosion rate in two with thallium enriched locations: ore body Crven Dol 33 – 35 m/10ˆ6 y and Central Part of 66 - 67 m/10ˆ6 y. This determination based on Accelerator Mass Spectrometry (AMS) of three independent investigation of 10Be, 26Al and 53Mn and GMI i.e. Geo-morphologic investigation. Reliable erosion rate is indispensable for proper determination of the background of 205Pb induced by cosmic radiation. Provided that this erosion rate is corroborated by more measurements of additional probes, the experiment is expected to reach an acceptable signal-to-background ratio. Finally, it is discussed how to get the still unknown capture probability of solar pp-neutrinos from 205Tl into 205Pb, in particular into its first excited state at E* = 2.3 keV, as well as how to count the extremely small number of 205Pb atoms found within the few kilograms of the mineral, needed to attain the estimated accuracy low as 30% of the final result.

Summary

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