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Geoneutrinos and reactor antineutrinos expected in SNO+ and JUNO

Geoneutrinos , i.e. neutrinos produced by beta decays occurring in natural 238U and 232Th decay chains, are a unique direct probe of our planet's interior. They instantaneously bring to the Earth's surface information on the total amount and distribution of U and Th in the crust and in the mantle, which are thought to be the main reservoirs of these elements.

Geoneutrinos are presently detected in KamLAND and Borexino experiments. New measurements are highly awaited from SNO+ and from future experiments,as JUNO (Jiangmen Underground Neutrino Observatory). The main background in geoneutrino measurements is due to the electron antineutrinos produced by nuclear power plants. The energy spectrum of reactor antineutrinos extends beyond the end point of the geoneutrino one. As a consequence, in the geoneutrino energy window (1.8 – 3.3 MeV) we observe an overlap between geoneutrino and reactor antineutrino signals. Therefore, a careful analysis of the expected reactor antineutrino event rate at a given experimental site is mandatory.

In this framework, we estimate the expected reactor antineutrino signals all over the world, with a particular focus on SNOLab and on the site candidate for hosting the JUNO experiment.In our calculation we take into account the three neutrino oscillation mechanisms in vacuum, the most updated reactor antineutrino spectra and standard fuel compositions. According to the International Atomic Energy Agency (IAEA) database, we use detailed information on the locations and on the monthly time profiles of the thermal power for each nuclear core.
In particular, by using the 2012 IAEA database, we find that the ratio between the expected reactor antineutrino signal in the geoneutrino energy window (RG) and the expected geoneutrino signal (G) is 0.9 for SNO+ and 0.7 for JUNO. We also calculate the ratio RG/G all over the world in order to produce a RG/G map.

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