ID de Contribution: **198**

Type: **Non spécifié**

Recent results and status of the SNO+ experiment on its journey towards Neutrinoless Double Beta Decay

SNO+ is a large, multi-purpose neutrino detector located 2 km underground at SNOLAB, Canada, with the main goal of searching for the neutrinoless double beta decay ($0\nu\beta\beta$) of ^{130}Te. The detector is currently operating with 780 tonnes of liquid scintillator as its active target mass. The combination of high light yield, low intrinsic background levels, and steadily increasing livetime enables the SNO+ collaboration to pursue a broad physics program. This includes measurements of solar neutrinos, detection of antineutrinos from nuclear reactors and from the Earth, as well as searches for other rare processes.

SNO+ performed the first observation of the charged-current interaction of solar neutrinos with ^{13}C, marking a significant milestone in low-energy neutrino detection and demonstrating the detector's sensitivity to rare interaction channels. In parallel, the spectral analysis of reactor antineutrino oscillation led SNO+ to obtain the second-most precise determination of Δm^2_{21} and to perform the first measurement of the flux of geoneutrinos in the Western Hemisphere.

The scintillator data is also being used to quantify backgrounds and understand the detector response in preparation for the search of neutrinoless double beta decay. In a first phase, SNO+ will perform this search with 0.5% of natural tellurium by weight, targeting a predicted half-life sensitivity of 2×10^{26} years (90% CL) with 3 years of livetime, followed by higher tellurium loadings, up to 3%, for sensitivities above 10^{27} years. In this talk I will present the most recent physics results from the analysis of the SNO+ scintillator data, and will discuss the status and prospects for the neutrinoless double beta decay search.

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