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How the CNO neutrinos detection can unravel the solar metallicity problem?

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The "solar metallicity problem"is one of the most long-standing puzzles in solar physics. It consists in the discrepancy between several Sun physical properties predicted by solar models using updated metal abundances from spectroscopy (low-metallicity scenario, LZ-SSM), and those inferred from helioseismology, which favours a higher metal content (high-metallicity scenario, HZ-SSM). The solar neutrino fluxes depend on the chemical composition of the Sun: their precise measurements can be used to test the solar models, and to discriminate the between the two scenarios. A considerable progress in solar neutrino physics comes by the Borexino experiment, which recently claimed the first detection of neutrinos emitted from the CNO cycle. In this sequence, the hydrogen fusion is catalysed by carbon, nitrogen and oxygen, and so the flux of CNO neutrinos depends directly on the abundance of these elements in the solar core. For this reason, the CNO neutrinos flux strongly depend on the metallicity scenario, leading to a ~30% difference between the HZ-SSM and LZ-SSM predictions. In this talk, the implications of the CNO detection by Borexino for solar physics are discussed, combining this latest result with the previous measurement of 7Be and 8B neutrino fluxes. In this way, a mild preference for HZ scenario is found, disfavouring LZ hypothesis at a level of 2.1σ significance. Moreover, the impact of future experimental improvements for the CNO neutrino flux determination will be addressed. This work is presented on behalf of the Borexino Collaboration.

Collaboration name

Borexino collaboration

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