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Recent advancements and future of Solar Neutrino Physics

Abstract Text: Solar neutrinos have been fundamental since ever in creating a link between elementary particle physics and astrophysics. Ten years after the \annus mirabilis" 2002, in which the long standng Solar Neutrino Puzzle was denitly solved, we revise the main results of solar neutrino physics and discuss the main open questions. In this decade the date obtained by dierent solar neutrino experiments and KamLAND made possible a more and more accurate determination of the oscillation parameters and of the medium and high energy part of the solar neutrino spectrum. Meanwhile, we could nally start attaching the study of the low energy part of the spectrum and Borexino measured the 7Be monochromatic line and the important pep component and put a limit on the CNO neutrino
ux. The mass and mixing pattern emerging from all
these data and from the parallel phenomenological analyses and the comparison with the solar models oer a generally coherent picture, conrmed by the recent discovery of a non zero mixing between the rst and the third
generations. However, some points still need to be claried. The anomalies that seem to emerge in the \vacuum to matter transition region" clearly indicates the need of a more detailed analysis of the low energy part of the
spectrum. We discuss the potentialities of dierent present and future experiments (already approved or under discussion), like Borexino, SNO+ and various future experiments that will use liquid scintillators of dierent kind and will try also to measure the lower energy components of the pp cycle (better determination of pep and
possibly measurement of pp neutrinos) and to combine these data with the study of the CNO neutrinos, with the hope to discriminate between high Z and low Z solar models and solve the metallicity problem.

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