Mass Eigenstate Composition of $^8$B Solar Neutrinos

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Abstract. 91±2% of $^8$Boronsolar neutrinos observed by SNO are $\nu_2$ mass eigenstates.

Around the MSW “triangle”, where $\langle P(\nu_e \rightarrow \nu_e) \rangle = 0.35$, the composition of $^8$Boronsolar neutrinos is either 65% or 100% $\nu_2$ except at the top and bottom right hand corners of this triangle. Nature’s choice for the solar oscillation parameters is at the top right hand corner, the LMA corner, where the fraction of $\nu_2$ is 91±2%, see Fig. 1. Details of this two flavor calculation can be found in [1] using the analytical formulation of [2] and the global solar analysis of SNO, [3]. For non-vanishing $\theta_{13}$, the $\nu_2$ fraction is reduced by $\sin^2\theta_{13}$, see Ref. [1].

Figure 1. Left panel: The mass eigenstate composition of $^8$Boron solar neutrinos in $\delta m^2 \nu \sin^2 \theta_\odot$ plane showing the MSW triangle (red) dotted line. Middle panel: Focusing in on the current allowed region. Right panel: The normalized $^8$Boron spectrum broken into its $\nu_1$ and $\nu_2$ components both unweighted, left, and weighted, right, by the charge current cross section using a 5.5 MeV threshold on the kinetic energy of the recoil electron and the best fit point for the solar oscillation parameters given in [3]. These weighted mass eigenstate fractions are the fractions that SNO is sensitive to. All panels of this figure are for vanishing $\sin^2 \theta_{13}$.


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