Model-Independent Neutrino Oscillation Diagram

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L-E diagram

Although the Neutrino Standard Model (νSM), three massive neutrino oscillations with the Standard Model, successfully describes most of the current oscillation data, the question remains about short-baseline anomalies, including LSND signal, MiniBooNE excesses, and reactor anomaly [1]. If these signals are hints of new physics, there is a chance that they will not exhibit the standard L/E oscillatory dependence. The world neutrino oscillation data are usually mapped on the $\Delta m^2 - \sin^2 2\theta$ space (so called "MS-diagram"). However, this model-dependent diagram might mislead if neutrino oscillation signals are not based on neutrino masses.

The L-E diagram is a model-independent plot to map oscillation signals from different experiments. Here, massive neutrino oscillation solutions (=L/E oscillatory dependence) are represented by the line $L \propto E$. Data are consistent with two L/E neutrino oscillations, $\bar{\nu}_e$ disappearance measurement at the KamLAND experiment (2 to 8 MeV), and ν_μ and $\bar{\nu}_\mu$ disappearance measurements at the long-baseline and atmospheric neutrino experiments (300 to 2,000 MeV). Therefore, we know **there are at least two segments with $\mathbf{L \propto E}$ on the L-E diagram**. Nevertheless, our knowledge outside of these segments is limited. There are proposed models [2] which have L/E oscillatory dependences in these energy ranges so that models are consistent with current data, but have completely different dependences at the outside of them. These alternative models are interesting because they have a chance to reproduce short-baseline anomalies.

In conclusion, new experiments mapped on L-E diagram not previously explored are generally interesting.

References

[1] A. Aguilar *et al.*, Phys. Rev. D **64**, 112007 (2001); A. A. Aguilar-Arevalo *et al.*, Phys. Rev. Lett. **102**, 101802 (2009); Phys. Rev. Lett. **105**, 181801 (2010); G. Mention *et al.*, Phys. Rev. D **83**, 073006 (2011).

[2] J. S. Díaz and V. A. Kostelecký, Phys. Lett. B **700**, 700 25 (2011); arXiv:1108.1799 [hep-ph].

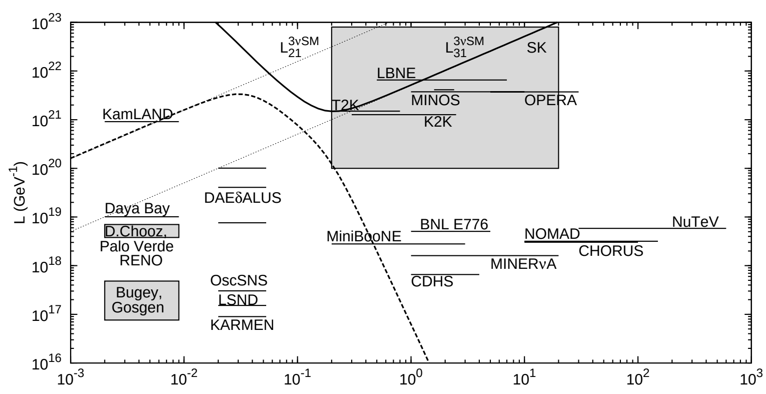

Figure 1: L-E diagram with νSM (two straight lines) and Puma model [1] (two curves).