

Note on an Entropy Marker for DUNE Neutrino Oscillations

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In a two-flavor reduction of $\nu_\mu \rightarrow \nu_e$ oscillations, the linear entropy of the reduced density matrix is:

$$S_L = 1 - \text{Tr } \rho^2.$$

A possible empirical marker is:

$$E_{\min S_L} \approx E_{\max P(\nu_\mu \rightarrow \nu_e)}.$$

How it can be tested: DUNE's broadband beam covers a wide energy range. By reconstructing both appearance probabilities and effective entropies, one can test whether the energy of minimal entropy aligns with the energy of maximal appearance probability.

Why it may be important: If valid, this relation could provide a new handle on analyzing CP violation effects and coherence in long-baseline oscillations.