

Probing Solar Heavy Neutrinos with Heliospheric Electrons

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We search for an excess of electrons and positrons in the interplanetary space from the decays of heavy neutrinos produced in nuclear reactions in the Sun. Using measurements of the electron spectra in the MeV range from the Ulysses and SOHO satellites, we report the strongest direct upper bound to date on the mixing between heavy neutral leptons with MeV masses and electron neutrinos, reaching $U_e^2 10^{-6}$ at $M_N = 10\text{MeV}$. Our sensitivity is predominantly constrained by the uncertainties in the propagation of electrons and positrons, particularly the diffusion coefficient in the inner Solar System, as well as the uncertainties in the astrophysical background. Enhancing our understanding of either of these factors could lead to a significant improvement in sensitivity.

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