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Scalar Non-Standard Interactions of Neutrinos in Earth, Sun, Supernovae and Early Universe[1] GARV CHAUHAN, Washington University, St. Louis, K. S. BABU, Oklahoma State University, BHUPAL DEV, Washington University, St. Louis — Non-standard interactions (NSI) of neutrinos with matter mediated by a scalar field would induce medium-dependent neutrino masses which can modify oscillation probabilities. Generating observable effects requires an ultra-light scalar mediator. We derive a general expression for the scalar NSI using techniques of quantum field theory at finite density and temperature and discuss various limiting cases applicable to the neutrino propagation in different media, such as the Earth, Sun, supernovae and early universe. We also analyze various terrestrial and space-based experimental constraints, as well as astrophysical and cosmological constraints on these NSI parameters, applicable to either Dirac or Majorana neutrinos. By combining all these constraints, we show that observable scalar NSI effects, although precluded in terrestrial experiments, are still possible in future solar and supernovae neutrino data, and in cosmological observations such as cosmic microwave background and big bang nucleosynthesis data.

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