

Solar Neutrinos as a Probe of Dark Matter-Neutrino Interactions

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Sterile neutrinos at the eV scale have long been studied in the context of anomalies in short baseline neutrino experiments. Their cosmology can be made compatible with our understanding of the early Universe provided the sterile neutrino sector enjoys a nontrivial dynamics with exotic interactions, possibly providing a link to the Dark Matter (DM) puzzle. Interactions between DM and neutrinos have also been proposed to address the long-standing “missing satellites” problem in the field of large scale structure formation. Motivated by these considerations, in this paper we discuss realistic scenarios with light steriles coupled to DM. We point out that within this framework active neutrinos acquire an effective coupling to DM that manifests itself as a new matter potential in the propagation within a medium of asymmetric DM. Assuming that at least a small fraction of DM has been captured by the Sun, we show that a sizable fraction of the parameter space of these scenarios can be probed by solar neutrino experiments, especially in the regime of small couplings and light mediators where all other probes become inefficient. In the latter regime these scenarios behave as familiar 3+1 models in all channels except for solar data, where a Dark MSW effect takes place. Solar Dark MSW is characterized by sizable modifications of the most energetic 8B and CNO neutrinos, whereas the other fluxes remain largely unaffected.

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