Contribution ID: **32** Type: **not specified**

New Neutrino Interactions and Direct-Detection Experiments

Tuesday, 22 September 2020 11:50 (10 minutes)

We find that a magnetic transition dipole moment between tau and sterile neutrinos can account for the XENON1T excess events. Unlike the ordinary neutrino dipole moment, the introduction of the new sterile mass scale allows for astrophysical bounds to be suppressed. Interestingly, the best-fit regions that are compatible with the SN1987A imply either boron-8 or CNO neutrinos as the source flux. We find that sterile neutrinos of either ~ 260 keV or in the ~(500 - 800) keV mass range are capable of evading astrophysical constraints while being able to successfully explain the XENON1T event rate. The sterile neutrino in the best fit parameter space could have significant effects on big bang nucleosynthesis (BBN) and Cosmic microwave background (CMB) depending on the reheat temperature of the Universe.

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Session Classification: Contributed 06