

# The Neutrino Magnetic Moment Portal: Cosmology, Astrophysics, and Direct Detection

*Thursday 15 October 2020 10:15 (45 minutes)*

We revisit the physics of neutrino magnetic moments, focusing in particular on the case where the right-handed, or sterile, neutrinos are heavier (up to several MeV) than the left-handed Standard Model neutrinos. The discussion is centered around the idea of detecting an upscattering event mediated by a transition magnetic moment in a neutrino or dark matter experiment. Considering neutrinos from all known sources, as well as including all available data from XENON1T and Borexino, we derive the strongest up-to-date exclusion limits on the active-to-sterile neutrino transition magnetic moment. We then study complementary constraints from astrophysics and cosmology, performing, in particular, a thorough analysis of BBN. We find that these data sets scrutinize most of the relevant parameter space. Explaining the XENON1T excess with transition magnetic moments is marginally possible if conservative assumptions are adopted regarding the supernova 1987A and CMB constraints. Finally, we discuss model-building challenges that arise in scenarios that feature large magnetic moments while keeping neutrino masses well below 1 eV. We present a successful ultraviolet-complete model of this type based on TeV-scale leptoquarks, establishing links with muon magnetic moment, B physics anomalies, and collider searches at the LHC.

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**Session Classification:** Tuesday/Thursday seminars