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Direct Detection With Magnons

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To directly detect dark matter significantly lighter than a GeV, experiments must utilize the sub-eV energy excitations in condensed matter systems. Phonons, collective excitations of lattice vibrations, naturally have energies in the 1-100 meV range and are promising targets for spin-independent dark matter interactions. However, their response is generally suppressed for spin-dependent dark matter couplings. In such cases, magnons, collective excitations of spin waves, offer a more favorable detection pathway, exhibiting similar kinematic properties to phonons but enhanced sensitivity to spin-dependent interactions. In this talk we'll discuss calculating the dark matter-magnon scattering rate from both a first-principles approach and a data-driven approach using neutron scattering data collected with the MAPS spectrometer at the ISIS Neutron and Muon Source. Additionally, we'll explore how magnons can also be used to search for electron-coupled axion dark matter.

Presenter: TRICKLE, Tanner