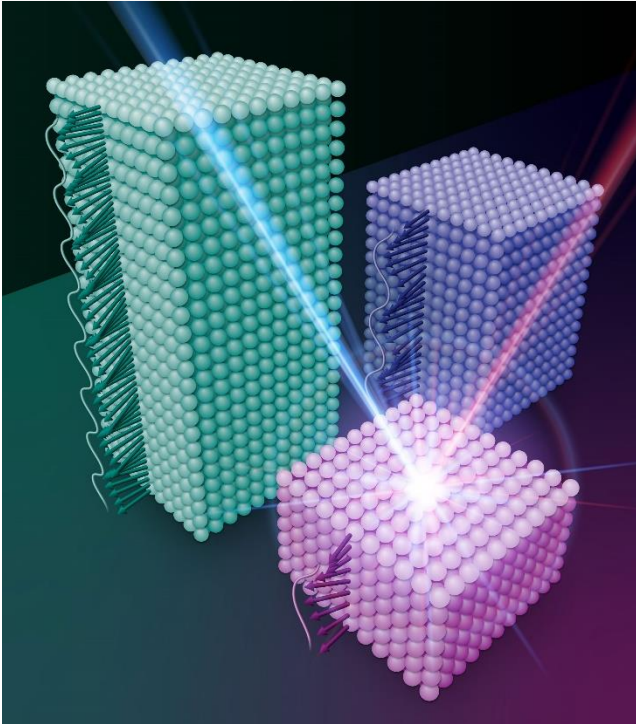


Tuning spin excitations in magnetic films by confinement



An artist's interpretation of measuring the evolution of the spin dynamics as a function of thickness using resonant inelastic x-ray scattering.

J. Pellicciari, S. Lee, K. Gilmore, J. Li, Y. Gu, A. Barbour, I. Jarrige, C. H. Ahn, F. J. Walker, V. Bisogni. *Nat. Mat.* 20 (2), 188-193 (2021).

Work was performed in part at Brookhaven National Laboratory

Scientific Achievement

Scientists controlled spin dynamics in magnetic films by tuning their thickness.

Significance and Impact

Spin excitations play an important role in novel electronic materials; but their behavior in thin films is less known due to experimental limitations. This work revealed new insights about spin dynamics by using resonant inelastic x-ray scattering (RIXS).

Research Details

- Grew high-quality, ferromagnetic iron (Fe) films with various thickness from 100 to 3 unit cells.
- Used RIXS at the SIX beamline at NSLS-II to investigate the change of spin excitations when they become confined in thinner films.
- Discovered the origin for the dependence to be the change in out-of-plane spin excitations.
- Explained this through the loss of Fe bonds at surface with an isotropic Heisenberg model.
- Theoretical predictions may be used for other materials.