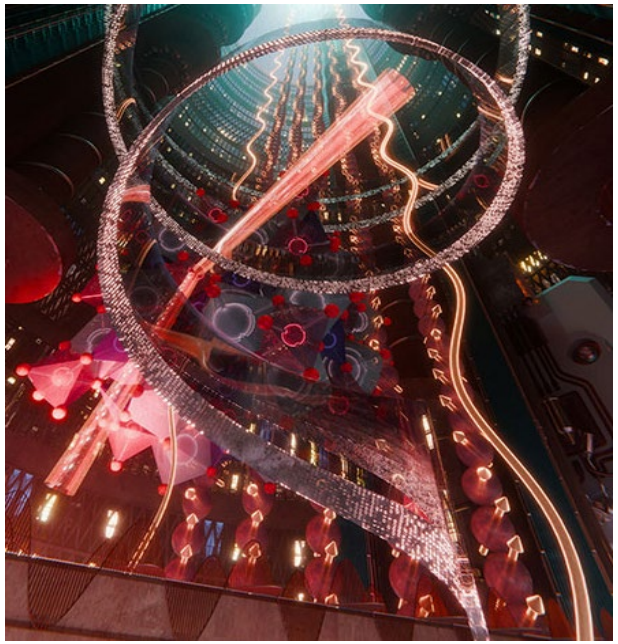
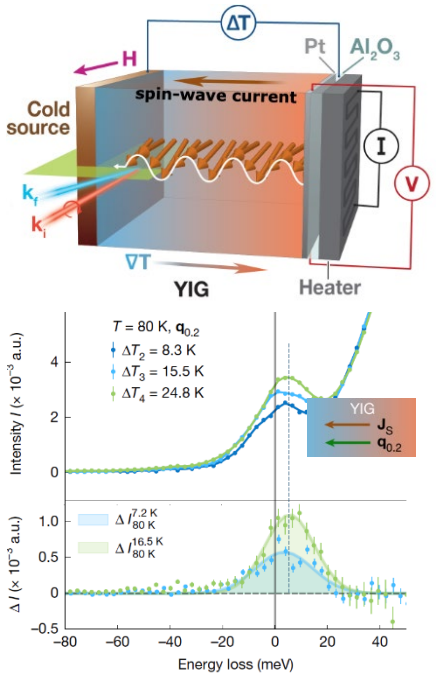
Observing Elusive Carriers of Angular Momentum with X-rays





Left: An artist's representation of the spin current generated in YIG by the spin Seebeck effect and probed with RIXS at the SIX beamline at NSLS-II. **Right:** *(Top)* Schematic of the device used for the RIXS experiment. *(Bottom)* RIXS spectra measured at q=[0.2,0.2,0.2]r.l.u. for increasing thermal gradient ΔT or magnon current J_S.

Y. Gu, J. Barker, J. Li, T. Kikkawa, F. Camino, K. Kisslinger, J. Sinsheimer, L. Lienhard, J. J. Bauer, C. A. Ross, Dmitri N. Basov, E. Saitoh, J. Pelliciari, G. E. W. Bauer & V. Bisogni, Observing differential spin currents by resonant inelastic X-ray scattering. *Nature* (2025). https://doi.org/10.1038/s41586-025-09488-9

Work was performed at NSLS-II and CFN

Scientific Achievement

First Momentum- and energy-resolved observation of magnon spin current by resonant inelastic x-ray scattering (RIXS).

Significance and Impact

Microscopic measurement of magnon spin current reveals the magnon mode responsible for the flow of information. This approach allows access to otherwise inaccessible momentum-dependent parameters.

Research Details

- A magnon spin current device based on Yttrium Iron Garnet (YIG) driven by a thermal gradient, exploiting the spin Seebeck effect, was measured by RIXS.
- The RIXS spectra of YIG displayed a linear relationship between magnon current and the acoustic magnon intensity at ~10meV, illuminating the physics of magnon transport in this material.