Resonant Inelastic X-ray Scattering to probe spin excitations and their dynamics in spintronic materials

Valentina Bisogni
Brookhaven National Laboratory, Upton, NY 11973, USA

Spin excitations in quantum materials provide a revolutionary alternative for devices with improved performances and energy-efficiency, as they permit the transfer of information without any movement of charge, thus eliminating the dominant source of energy dissipation. Understanding how to manipulate such spin excitations would provide a foundation for the next generation of energy-efficient electronic devices. A promising direction is to undertake the study of the microscopic spin dynamics in technologically relevant quantum materials under device-operating conditions.

Resonant Inelastic X-ray Scattering (RIXS) is an emergent technique for the study of spin excitations and their momentum dependence and can achieve an unprecedented insight into the material properties, even at the presence of small samples or ultra-thin films down to the single-unit-cell limit. Additionally, RIXS is fully compatible with the application of device-relevant perturbations such as applied current, electric-field, and temperature gradient.

In this talk, we will present RIXS results on ultra-thin films of Fe and on $LiCuVO_4$ crystal measured at the world-record-resolution beamline SIX of NSLS II (BNL). The very first measurement of spin-excitations under the application of electric field will be also discussed. This experiment has been realized thanks to the new *Opera* sample environment installed at SIX, uniquely enabling the study of spin dynamics under device-operating conditions. This research is supported by DOE through the “Early Career Research Program” funds.