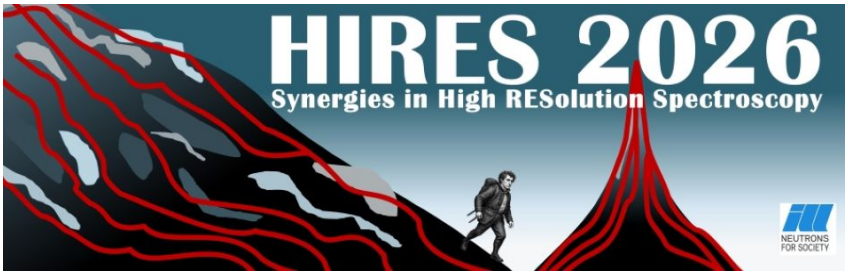

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Exploiting polarised neutron and ultrafast X-ray pump-probe synergies to reveal the spin and heat dynamics in spin caloritronics

Spin caloritronics are currently a science highight due to their potential exploitation in the next generation of spintronics applications. A prominent example are devices exploiting the spin Seebeck effect (SSE), where thermoelectric generation is achieved by a thermally induced spin-current, which is then converted into an electric charge current by the inverse spin Hall effect within the HM layer. At low temperatures the generation of a net spin current in the MI can be understood in terms of thermal excitation of chiral magnons [1]. Therefore, the development of emerging technologies based on spin caloritronic physics, requires a high resolution microscopic understanding of their magnetic and heat dynamics. We present new insights into the dynamics of spin caloritronic materials, by exploiting the synergies of polarised neutron inelastic scattering at IN20 of the ILL and ultrafast X-ray pump-probe techniques using the LCLS XFEL. These studies were applied to prototype spin caloritronic materials, based on the rare-earth iron garnets of Tb3Fe5O12 and Gd3Fe5O12 (TbIG and GdIG). Polarised neutron inelastic scattering studies of single crystal TbIG can be correlated with the low energy chiral magnon modes responsible for the SSE in this material. In addition, our theoretical calculations highlight the Femtosecond X-ray pump-probe techniques were used to study the thermal [3] and magnetic dynamics induced in GdIG thin epitaxial films, using resonant X-ray magnetic scattering techniques. These results open new routes to investigate acoustic wave induced magnetic excitations with photon energy resolution beyond the current limits of RIXS.

Session

Magnetism

Primary author: MANNIX, Dan

Presenter: MANNIX, Dan

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