Spin-orbit-lattice entangled state in A_2MgReO_6 (A = Ca, Sr, Ba) revealed by resonant inelastic X-ray scattering

SEMINAIRE

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The $5d_1$ ordered double perovskites have recently drawn significant interest as a fertile ground for the realization of novel multipolar physics. However, while these materials are theoretically described to have a net zero dipole magnetic moment due to large spin-orbit coupling, real materials manifest with a suppressed but non-zero dipole magnetic moment. Though this phenomenon has typically been attributed to orbital hybridization between the transition metal ions and ligand oxygens, recent studies have shown that coupling to lattice degrees of freedom via the dynamic Jahn-Teller (DJT) effect can have a significant impact on the magnetic moment size in $5d_1$ systems. I will present Re L_3-edge resonant inelastic X-ray scattering (RIXS) results
that demonstrate the presence and impact of the DJT effect in the A_2MgReO_6 (A = Ca, Sr, Ba) family of $5d_1$ double perovskites. The spin-orbit excitations in these materials show a strongly asymmetric lineshape indicative of dressing by lattice vibrations and, curiously, these excitations broaden and shift to higher energy with temperature. These results are explained quantitatively by a *vibronic* DJT RIXS model that yields an electronic ground state in which spin, orbit, and lattice degrees of freedom become entangled. Consequently, the energy scales of spin-orbit and lattice coupling are not directly resolvable. We find that this spin-orbit lattice entangled state is robust against magnetic and structural phase transitions as well as against significant static JahnTeller distortions.

Ce séminaire sera suivi d'une pause café

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