Unconventional Magnetism
Seminars

Thursday 22 November, 2pm

Magneto-elastic waves in quantum magnets and the full elasticity tensor from thermal diffuse scattering

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In the first part of my presentation I will focus on the triangular lattice Heisenberg antiferromagnet $LiCrO_2$ which exhibits a surprisingly strong magnon-phonon coupling. Using inelastic x-ray scattering we show that phonon dispersion contain so-far undetected magnetic correlations that can be probed throughout the Brillouin zone, see Figure 1a.
Our study reveals intrinsic details of the magnetoelastic excitation spectrum. We found single particle excitations with momentum dependent lifetime and continuum scattering at low temperature. Moreover, we observed over-damped modes, para-electromagnons, above the Néel temperature [1].

The second part of my presentation addresses a novel and fully quantitative analysis of thermal diffuse x-ray scattering. I will show that high-precision measurements of diffuse scattering intensities together with a rigorous data analysis allow the determination of the full elasticity tensor in a single crystal diffraction experiment [2]. This approach enables a reliable and model-free determination of the elastic properties and can be performed together with crystal structure investigation in the same experiment, see Figure 1b.

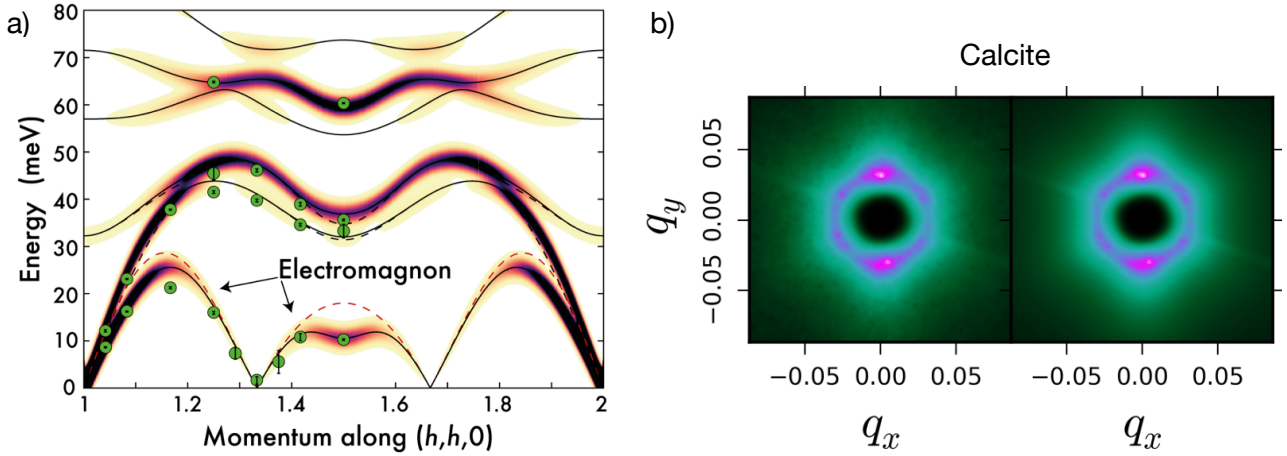

Figure 1: a) Phonon and electromagnon dispersion in $LiCrO_2$ measured by IXS. b) TDS in Calcite, measurement (left) and fit (right) for the determination of the full elasticity tensor.

[1] Sándor Tóth, Björn Wehinger, Katharina Rolfs, Turan Birol, Uwe Stuhr, Hiroshi Takatsu, Kenta Kimura, Tsuyoshi Kimura, Henrik M. Rønnow and Christian Rüegg, Electromagnon dispersion probed by inelastic X-ray scattering in $LiCrO_2$, Nat. Comm. 7, 13547 (2016).
[2] Björn Wehinger, Alessandro Mirone, Michael Krisch and Alexeï Bosak, Full Elasticity Tensor from Thermal Diffuse Scattering, Phys. Rev. Lett. 118, 035502 (2017).