Instabilities of Heavy Magnons in an Anisotropic Magnet

M. Mourigal (Georgia Tech), Cristian D. Batista (Oak Ridge)

The concept of quasiparticles is central to understanding and predicting the properties of condensed matter. For example, magnons describe the excitations of fully-ordered magnetic systems. Interactions between magnons can yield to spontaneous decay into multi-magnon states, resulting in incoherent excitation bands. Although magnon instabilities are expected for a broad class of models, their experimental observation is rare and so far, limited to a handful of examples.

Here, **users from Georgia Tech** continue their work on single crystals of iron iodide (FeI_2) **grown by them at the PARADIM Bulk Crystal Facility**. In collaboration with Oak Ridge National Lab, they demonstrate that strong quantum interactions exist between three flavors of quasiparticles in the uniaxial spin-one magnet FeI_2 through neutron scattering measurements in a transverse magnetic field.

The figure shows a comparison between experiment and simulation for various applied magnetic fields—labeled Data and GLSW respectively—demonstrating the fidelity to which experimental data enables models of magnetic properties to be constructed.

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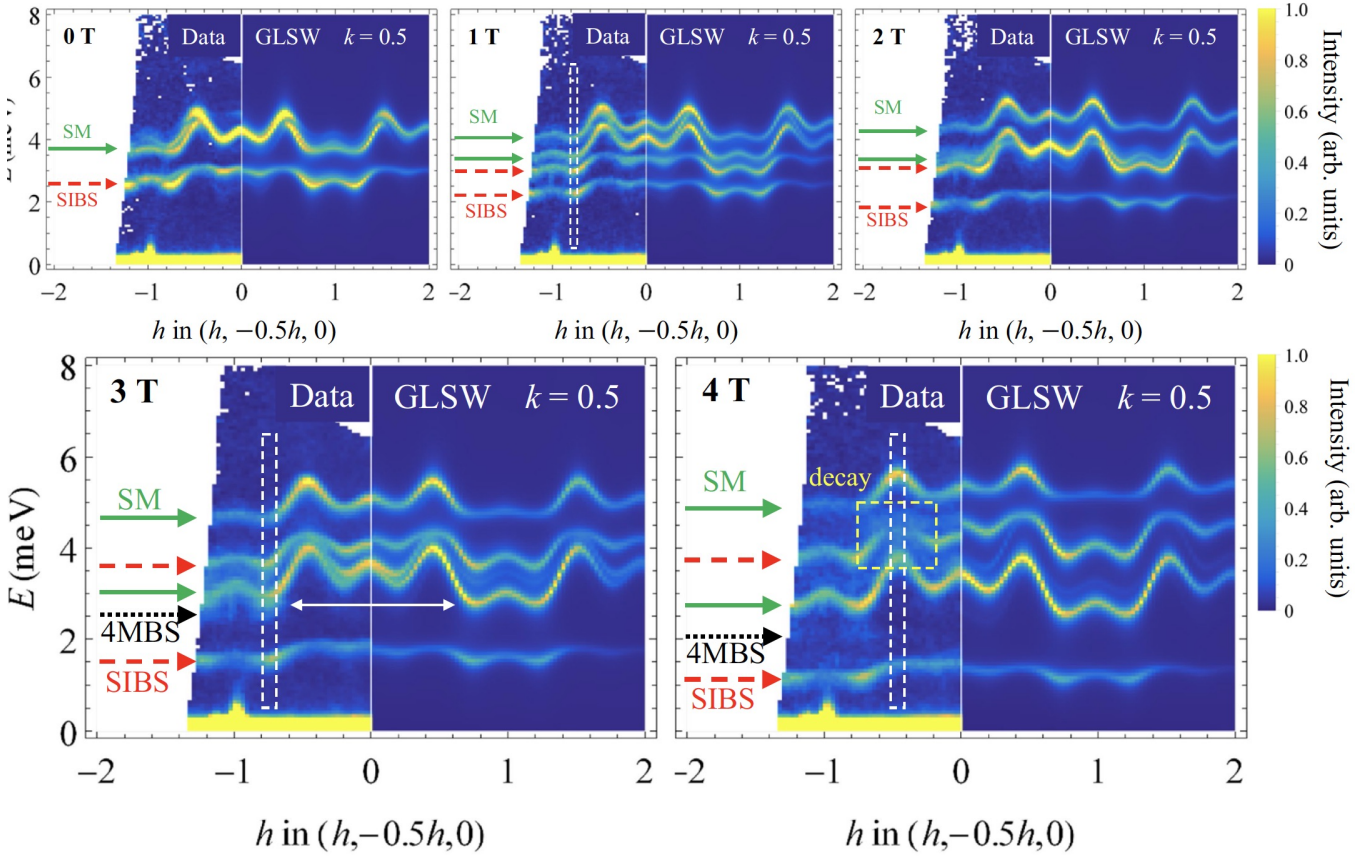

Fig.: Momentum and energy-resolved neutron scattering spectra of FeI_2 at 1.8 K and applied magnetic fields (Data, 0 – 4Tesla) compared to prediction (GLSW—generalized linear spin wave). SM—single magnon, SIBS—single ion-bound states, 4MBS—4 magnon-bound state.