Discovery of Multimagnon Bound States in FeI_2

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Magnons, or spin waves, are quasiparticles describing collective spin excitations of ordered magnets. When magnon-magnon interactions are strong, new multi-magnon excitations and bound states can emerge.

Here, magnetic THz spectroscopy of the layered magnet FeI_2 revealed a complex series of excitations beyond the one-magnon picture.

These 4- and 6- magnon bound states emerge due to strong hybridization of individual states and thus represent discovery of new and novel type of magnetic excitation.

This demonstrates the utility of THz spectroscopy in probing magnetic ground states and demonstrates that layered magnets are a route to novel (and potentially useful) forms of quantum magnetism. It also provides a unique platform to study decay and renormalization, reminiscent of the few-body problems found in cold-atom, nuclear, and particle physics.

Large single crystals were grown at PARADIM's Bulk Crystal Growth Facility by an external user (Mourigal), and then distributed to their collaborator (Armitage) with theory collaborations to interpret the results (Batista).

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