PAUL SCHERRER INSTITUT

Condensed Matter Theory Seminar

Shaken, Not Strained: How to Control Magnetic Order with Lattice Vibrations

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DATE: **Thursday, January 21, 2021**
SEMINAR: **2.30 p.m.**
PLACE: **zoom**
https://psich.zoom.us/j/92453287057?pwd=d1VjdDljSHlZV1g2WWpNbFUyemFjZz09
Meeting ID: 924 5328 7057
Passcode: 564377

We know that the structure and symmetry of the crystal lattice are closely connected to magnetism. We try to adjust these factors in order to change the alignment of spins in conventional ways; for instance, by applying pressure or strain. However, these effects can only be achieved statically, and many materials may break under the load required to make significant changes in the magnetic order. In this talk, I will show how coherent collective vibrations of atoms, known as optical phonons, provide an intriguing alternative. The development of powerful terahertz sources in recent years has enabled resonant driving of optical phonons, yielding vibrational amplitudes so large that the dynamics are governed by nonlinear interactions between phonons and other degrees of freedom. I will lay out the steps that lead to the prediction of phono-magnetic effects, the nonlinear phononic phenomena that can be regarded as the lattice analogs of opto-magnetic effects in nonlinear optics. In this process, I will show how optical phonons can be used not just to control spin waves coherently and induce spin polarization, but also to produce magnetic responses in otherwise entirely nonmagnetic materials.