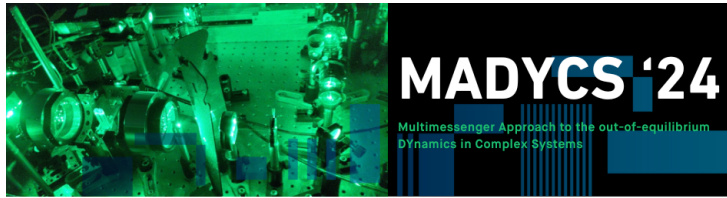


Multimessenger Approach to out-of-equilibrium Dynamics in Complex Systems (MADYCS)



Trieste, 17-19 April 2024



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Ultrafast Coherent THz Lattice Dynamics Coupled to Spins in the van der Waals Antiferromagnet FePS₃

Friday, April 19, 2024 11:15 AM (30 minutes)

We employed the time-resolved magneto-optical setup described in [1] to study the optically driven lattice and spin dynamics of a 380 nm thick exfoliated flake of the antiferromagnetic van der Waals semiconductor FePS₃ as a function of excitation photon energy, sample temperature and external magnetic field [2]. We found evidence of a coherent optical lattice mode with a frequency of 3.2 THz.

The amplitude of the coherent signal vanishes as the phase transition to the paramagnetic phase occurs, revealing its close connection to the long-range magnetic order. The observed phonon mode is known to hybridize with a magnon mode in the presence of an external magnetic field [3], which we utilize to excite the hybridized phonon-magnon mode optically. These findings open a pathway towards the generation of coherent THz photomagnonic dynamics in a van der Waals antiferromagnet, possibly scalable down to thinner flakes. The talk will discuss the properties of the tabletop setup as well as the investigation of the phonon and phonon-magnon dynamics in FePS₃.

[1] F. Mertens et al., Review of Scientific Instruments 91 (2020)

[2] F. Mertens et al., Adv. Mater. 35 (2023)

[3] S. Liu et al., Phys. Rev. Lett. 127 (2021)

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