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Ultrafast manipulation of the structure and topological properties of layered materials

Tuesday, 26 June 2018 14:30 (30 minutes)

I will describe recent experiments using ultrafast electron diffraction and x-ray free electron lasers to probe light-induced structural dynamics in layered transition metal dichalcogenide materials. In particular the focus of this talk will be terahertz-driven atomic-scale responses in WTe2 and related materials. We show, via the measurement of structure factor changes in >200 Bragg reflections, that terahertz light pulses drive interlayer shear phonon excitations with strains >1% that occur along the transition state separating the orthorhombic and monoclinic phases of the material. Theoretical estimates indicate that this is consistent with a photo-doping-driven stabilization of the monoclinic (1T') phase of the material, a metastable phase not found in equilibrium. A theoretical model also shows that these shear displacements represent a novel ultrafast and energy efficient means to control the topological phase of the material, including both the possibility for inducing a more robust topological structure or as a means to annihilate all Weyl points of opposite chirality.

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