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**Thursday, March 27, 2025, RUN auditorium**

**10:00 AM**

## **Optical control of nonequilibrium phases: from hammers to tweezers**

Ultrafast pump-probe spectroscopy has not only provided remarkable insights into electronic and structural dynamics on atomic length and femtosecond time scales but has also enabled the optical control of nonequilibrium states. Over the past decade, a dominant trend in the field has been the shift from strong, unselective optical stimuli towards the selective excitation of few key degrees of freedom—in other words, from hammers to tweezers. This approach promises more energy-efficient switching and access to entirely new states of matter.

In this talk, I will present three examples of optical control over nonequilibrium states with increasing selectivity. The spectrum ranges from laser-induced thermal quenching of a multiferroic domain pattern to the all-optical amplification of a key phonon mode in a van der Waals ferroelectric, and finally to the ultrafast manipulation of metal-insulator nanotextures. Furthermore, I will provide an outlook on a novel approach for the investigation and control of structural dynamics based on non-resonant excitation of phonons via transient Raman forces.



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