DEPARTMENT OF PHYSICS AND ASTRONOMY

(Special Seminar)

Probing non-equilibrium dynamics in complex materials using ab-initio-based approaches

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The interplay between charge, spin, and lattice degrees of freedom in complex materials under external stimuli gives rise to several fascinating phenomena, such as photo-induced phase transitions, non-linear optical effects, and transient 'hidden' phases. Theoretically, studying these processes is a challenging task that requires methods that can cover timescales of various active degrees of freedom. The complex interactions and correlated processes in materials add further complication. In this talk, I will discuss the microscopic modeling of the relaxation dynamics of complex oxides exhibiting long-range charge and orbital orders. The photo-induced dynamics in these systems are highly selective depending on the light-pulse intensity and polarization. I will provide insight into possible spin- and lattice-assisted relaxation mechanisms. Additionally, I will present simulation results demonstrating how optical excitations can serve as a powerful tool to control spin-splitting gaps in the newly discovered class of magnetic materials known as altermagnets. In the second part, I will discuss the impact of interactions and quasiparticle dynamics on non-linear optical properties. I will present real-time dynamics of photocurrent generation in ferroelectrics, emphasizing the role of spin- and phonon-driven ballistic photocurrents alongside the shift current.

Monday, February 3, at 10:30 AM,
CSP Conference Room 322, Physics Building

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