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Theory of out-of-equilibrium electron and lattice dynamics in laser-excited solids

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The fundamental interactions between electrons, the crystalline lattice and spins are in recent years being probed on ultrafast timescales, which has led to discoveries of unexpected phenomena, such as e.g. ultrafast demagnetization, breaking of exchange interactions, ultrafast spin currents and all-optical switching. A characteristic feature of these discoveries is that an ultrashort excitation initiates highly correlated, out-of-equilibrium interactions between the three reservoirs of electrons, spins, and ions.

A basic understanding of fast processes involving laser-heated electrons, phonons and spins is provided by the three temperature model. It has recently become evident that the two- or three temperature model fails in several respects. Our aim is to go beyond a phenomenological picture and achieve first-principles based theory. In this context I shall address electron-phonon spin dissipation in the context of ultrafast laser-induced demagnetization. A second emerging area concerns ultrafast nonequilibrium energy flow between hot electrons and phonons; our recent investigations emphasize that this flow proceeds in a manner different from the commonly used two-temperature model, and that new theoretical modeling is required to capture the nonequilibrium electron-spin-lattice interplay.

Für diese Zeit steht eine Kinderbetreuung nach vorheriger Anmeldung zur Verfügung.

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