universität innsbruck

FWF Der Wissenschaftsfonds

Innsbruck Physics Colloquium

Light-wave driven charge- and spin dynamics

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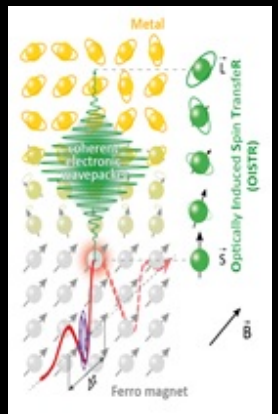
The enormous electric field strength of ultrafast laser waveforms allows to steer electronic motion and control electronic excitation so fast, that secondary processes disrupting coherence and striving for an equilibrium have hard time catching up – even in condensed phase systems. We investigate the opportunities this temporal segregation offers to transfer coherent control ideas as pioneered in Innsbruck in atomic and molecular ensembles to solids. I will discuss two experiments demonstrating that single cycle optical fields allow manipulating electronic and spin degrees of freedom in solid state systems at optical clock rates faster than de-coherence. Ultrafast bidirectional energy transfer between a light-field and the band-structure of silica proves the early times reversibility of electronic excitations and holds promise of novel ultrafast, coherent optoelectronic applications[1]. As a corollary of this ultrafast coherent modification of the electronic system, in suitably chosen heterostructures also the spin system can be manipulated coherently. Optically induced spin transfer is demonstrated as a route to the direct, all-optical manipulation of macroscopic magnetic moments on previously inaccessible attosecond timescales[2]. I will also give an outlook on our attempts to control molecular fragmentation with light fields and arrange magnetic domain patterns with light.

1.Attosecond nonlinear polarization and light–matter energy transfer in solids. Nature 534, 86–90 (2016).

2.Light-wave dynamic control of magnetism. Nature 571, 240–244 (2019).



Colloquium: Tuesday, 22.03.2022
17:15 h, lecture hall A

DK-ALM Pre-Talk: 16:30 h, lecture hall A
Matthias Englbrecht
Party-local Clifford transformations of stabilizer states

LAND TIROL

Innsbruck Physics Colloquium, Organisation: M. Beyer, H.-C. Nägerl, A. Reimer