O 41: Poster Session III: Poster to Mini-Symposium: Ultrafast surface dynamics at the space-time limit I

Time: Tuesday 10:30–12:30 Location: P

O 41.1 Tue 10:30 P

Microscopic theory for the real-time magnetization dynamics in bilayer-surfaces driven by ultrafast laser pulses — •Hanan Hamamera[1], Filipe Souza Mendes Guimaraes[2], Manuel dos Santos Dias[1], and Samir Lounis[1,3] — [1]Peter Grünberg Institut and Institute for Advanced Simulation, Forschungszentrum Jülich & JARA, 52425 Jülich, Germany — [2]Jülich Supercomputing Centre, Forschungszentrum Jülich & JARA, 52425 Jülich, Germany — [3]Faculty of Physics, University of Duisburg-Essen, 47053 Duisburg, Germany

We study the ultrafast magnetic reversal of spin moments by a single laser pulse [1] from a microscopic point of view. This is done by employing a realistic tight-binding Hamiltonian parameterized from density functional theory calculations to describe the real-time evolution of the electronic states. We map the parameter space characterizing the magnetic reversal of bulk Ni by the applied laser pulse, explaining the underlying physics and dissecting various intertwined spin-dynamics regimes. The knowledge gained on Ni is then utilized to explore the case of bilayer surfaces such as Co/Pt(001), where the non-magnetic heavy-metal substrate provides additional channels for angular momentum dissipation via spin and orbital pumping mechanisms, as well as stronger spin-orbital conversion.

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[1] J. Gorchon *et al.*, Appl. Phys. Lett. **111**, 042401 (2017)

O 41.2 Tue 10:30 P

Exchange-striction driven ultrafast nonthermal lattice dynamics in NiO — •Yoav William Windsor[1], Daniela Zahn[1], Robin Kamrla[2], Johannes Feldl[3], Helene Seiler[1], Cheng-Tien Chiang[2], Manfred Rammsteiner[3], Wolf Widdra[2], Ralph Ernstorfer[1], and Laurenz Rettig[1] — [1]Fritz Haber Institute def MPG, Berlin — [2]Martin-Luther-Universität Halle-Wittenberg — [3]Paul-Drude-Institut für Festkörperelektronik, Berlin

We use femtosecond electron diffraction to study ultrafast lattice dynamics in the highly correlated antiferromagnetic (AF) semiconductor NiO. Using the scattering vector (Q) dependence of Bragg diffraction, we introduce a Q-resolved ensemble of temperatures describing the lattice, and identify a nonthermal lattice state with preferential displacement of O compared to Ni ions, which occurs within ~0.3 ps and persists for 25 ps. We associate this with transient changes to the AF exchange striction-induced lattice distortion, supported by the observation of a transient Q-asymmetry of Friedel pairs. Our observation highlights the role of spin-lattice coupling in routes towards ultrafast control of spin order.

O 41.3 Tue 10:30 P

Heavy fermion dynamics in semimetallic and insulating phases — •Chul-hee Min[1], Michael Heber[2], Simon Müller[3], Lukas Wenthaus[2], Steffen Palutke[2], Dmytro Kutnyakhov[2], Federico Pressacco[2], Lenart Dudy[4], Matthieu Silly[4], Hendrik Bentmann[3], Kiana Baumgärtner[3], Woojae Choi[5], Yong Seung Kwon[5], Markus Scholz[6], Friedrich Reinert[3], and Kai Rossnagel[1,2] — [1]IEAP, CAU Kiel, Germany — [2]DESY, Hamburg, Germany — [3]EP7 and ct.qmat, University of Würzburg, Germany — [4]Synchrotron-SOLEIL, Saint-Aubin, France — [5]Dep. of EMS, DGIST, South Korea — [6]EuXFEL, Schenefeld, Germany

Due to time–energy correlation, heavy fermion systems with hard-to-detect meV energy scales are expected to show relatively slow dynamics on ps time scales, which are relatively easy to measure. Using the free-electron laser FLASH, we have performed time-resolved pump-probe photoemission spectroscopy (PES) of mixed valent $TmSe_{1-x}Te_x$ at a probe photon energy where the photoionization cross-section of the localized $4f$ states is two orders of magnitude higher than the ones of the other states. The system consists of two magnetic $4f^{12}$ and $4f^{13}$ configurations in the ground state and can be tuned from a semimetallic to an insulating phase via x without destroying the periodicity of the Tm ions. Here, we present and discuss the transient dynamics of the $4f$ states near E_F showing a remarkably strong dependence on x. Particularly, we identify a renormalized $4f$ peak whose time-domain signature is distinct from all other $4f$ multiplet peaks.

O 41.4 Tue 10:30 P

Direct Access to Auger Recombination in Graphene — •Marius Keunecke[1], David Schmitt[1], Marcel Reutzel[1], Marius Weber[2], Christina Möller[1], G. S. Matthijs Jansen[1], Tridev A. Mishra[3], Alexander Osterkorn[3], Wiebke Bennecke[1], Klaus Pierz[4], Hans Werner Schumacher[4], Davood Momeni Pakdehi[4], Daniel Steil[1], Salvatore R. Manmana[1], Sabine Steil[3], Stefan Kehrein[2], Hans Christian Schneider[1], and Stefan Mathias[1] — [1]1. Physikalisches Institut, Georg-August-Universität Göttingen, Göttingen, Germany — [2]TU Kaiserslautern, Kaiserslautern, Germany — [3]Institut für Theoretische Physik, Georg-August-Universität Göttingen, Göttingen, Germany — [4]Physikalisch-Technische Bundesanstalt, Braunschweig, Germany

The Auger scattering channels are of fundamental importance in the non-thermal charge-carrier dynamics of graphene and govern processes of technological relevance like carrier-multiplication and population inversion. These band-crossing scattering events can be separated into impact excitation (IE) and Auger recombination (AR) events which increase (IE) or decrease (AR) the charge-carriers in the conduction band. In this contribution, we apply time-resolved momentum-microscopy to study the non-thermal charge carrier dynamics in n-doped graphene with energy and full in-plane momentum resolution. We report on direct experimental evidence and quantification of AR in graphene and support our conclusions by model calculations.