Canadian Association of Physicists
Association canadienne des physiciens et physiciennes

Contribution ID: **2758** Type: **Invited Speaker / Conférencier(ère) invité(e)**

Atomic-scale dynamics of collective charge and spin excitations

Monday 3 June 2019 10:45 (30 minutes)

Spin and charge correlations are particularly pronounced in low-dimensional materials and enable new technologies that harness quantum behavior. Accessing these correlations on their intrinsic length and time scales is an important step towards a microscopic understanding of correlated-electron physics.
We combine scanning tunneling microscopy with pump probe schemes to achieve ultrafast spectroscopy of spin and charge dynamics with atomic spatial resolution. Using electronic pulse generation [1] and optical excitation with THz pulses [2] it is possible to achieve time resolution between milliseconds and femtoseconds thereby matching the instrument to the dynamics of the investigated system. At nanosecond time resolution, we can track the spin dynamics of magnetic atoms on surfaces and identify miniscule magnetic interactions between few-atom spin chains [3]. At femtosecond time resolution, we can detect electron dynamics and follow the evolution of collective modes in a correlated-electron state at individual atomic defects.
These experiments access the microscopic dynamics of quantum materials and highlight pathways to design and control matter at the single atom level.
[1] S. Loth, M. Etzkorn, C. P. Lutz, D. M. Eigler, A. J. Heinrich, Science 329, 1628 (2010).
[2] T. L. Cocker, V. Jelic, M. Gupta, S. J. Molesky, J. A. J. Burgess, G. de los Reyes, L. V. Titova, Y. Y. Tsui, M. R. Freeman, F: A. Hegmann, Nature Photon. 7 620 (2013).
[3] S. Yan, L. Malavolti, J. A. J. Burgess, S. Loth, Science Adv. 3 e1603137 (2017).

Author: LOTH, Sebastian (Institute for Functional Matter and Quantum Technologies, University of Stuttgart and Max Planck Institute for Solid State Research, Stuttgart)

Presenter: LOTH, Sebastian (Institute for Functional Matter and Quantum Technologies, University of Stuttgart and Max Planck Institute for Solid State Research, Stuttgart)

Session Classification: M1-11 Probing and controlling matter with light I (DCMMP) | Sonder et contrôler la matière avec de la lumière I (DPMCM)

Track Classification: Condensed Matter and Materials Physics / Physique de la matière condensée et matériaux (DCMMP-DPMCM)