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Charge and spin dynamics of atoms studied with ultrafast scanning tunneling microscopy

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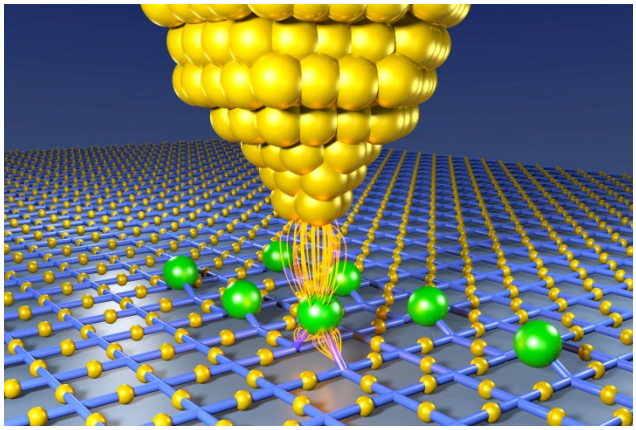

Spin and charge correlations are particularly pronounced in nanoscale materials enabling new technological applications that harness quantum behavior. Accessing these correlations on their intrinsic length and time scales is an important step towards a microscopic understanding of correlated-electron physics.

We combine scanning tunneling microscopy with electronic pump probe schemes [1] to achieve ultrafast spectroscopy of spin and charge dynamics with atomic spatial resolution. Using pulse shaping techniques we surpass the bandwidth limitations of the STM apparatus more than tenfold and achieve sub-nanosecond time resolution. In this talk I will focus on two recent experiments: one in which we probed the fast charging dynamics of individual dopants in silicon through highly localized field effect gating [2] and one in which we fabricated a few-atom spin sensor capable of measuring micro-electronvolt magnetic interaction with nearby magnetic atoms [3].

These experiments shed light onto the impact of correlations and coherences in quantum materials and highlight pathways to design and control magnetism at the single atom level.

[1] S. Loth, M. Etzkorn, C. P. Lutz, D. M. Eigler, A. J. Heinrich, Science 329, 1628 (2010).
[2] M. Rashidi, J. Burgess, M. Taucer, R. Achal, J. Pitters, S. Loth, R. Wolkow, arXiv: 1512.01101 (2015).
[3] S. Yan, L. Malavolti, J. Burgess, S. Loth, arXiv: 1601.02723 (2016).

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

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