TECHNISCHE UNIVERSITÄT WIEN

INSTITUT FÜR FESTKÖRPERPHYSIK
Institute of Solid State Physics

Wiedner Hauptstr. 8-10/138, 1040 Wien
www.ifp.tuwien.ac.at

EINLADUNG zum IFP-SEMINAR

Bandwidth-Tuning and Strain Effects in Mott Insulators, Correlated Metals and Superconductors Unveiled by Optical and NMR Spectroscopies

Andrej Pustogow

UCLA Physics & Astronomy, Los Angeles, USA

Host:	Silke Bühler-Paschen
Termin:	Mittwoch, 2. Oktober 2019, 16:00 Uhr
Ort:	Institut für Festkörperphysik, TU Wien
	Wiedner Hauptstraße 8-10, 1040 Wien
	Seminarraum DC rot 07 (roter Bereich, 7. OG)
Funding:	EMP

Abstract:

The physics of competing orders and insulator-metal transitions (IMT) is commonly explored by spectroscopic probes combined with pressure and chemical substitution. Recent success in determining the electronic correlation strength in half-filled Mott insulators by means of optical spectroscopy [1,2] enables a quantitative comparison among (i) rather different materials and (ii) between experiment and theory. This finally allows us to systematically explore the unified phase diagram and to identify exotic excitations, such as spinons deep within the Mott state in absence of magnetic order [3]. As correlations diminish, finite-frequency quantum fluctuations emerge in the Mott insulator as a precursor of the Fermi liquid [1]. At the IMT we observe a colossal peak in the dielectric permittivity that originates from metal-insulator coexistence [4], thus our macroscopic experiments provide deep insight into the microscopic details of the transition – otherwise only accessible to scanning probes [5]. In the correlated metal we identify the spectral features of resilient quasiparticles and bad-metallic transport at finite frequency, the latter involving a 'displaced' Drude peak.
While hydrostatic pressure primarily tunes the bandwidth, uniaxial stress distorts the Fermi surface. In Sr_2RuO_4, for instance, correlation effects become enhanced when approaching a van Hove singularity [6], resulting in a boost of T_C. By probing the superconducting state of strain-tuned Sr_2RuO_4, we uncover a finite drop of the NMR Knight shift below T_C that even persists at zero strain, in contradiction with the most prevalent theoretical interpretation of the order parameter as a chiral *p*-wave state [7].

[1] A. Pustogow, M. Bories, A. Löhle, R. Rösslhuber, E. Zhukova, B. Gorshunov, S. Tomić, J. A. Schlueter, R. Hübner, T. Hiramatsu, Y. Yoshida, G. Saito, R. Kato, T.-H. Lee, V. Dobrosavljević, S. Fratini and M. Dressel, *Nat. Mater.* **17**, 773–777 (2018)
[2] M. Dressel and A. Pustogow, *J. Phys. Condens. Matter* **30**, 203001 (2018)
[3] A. Pustogow, Y. Saito, E. Zhukova, B. Gorshunov, R. Kato, T.-H. Lee, S. Fratini, V. Dobrosavljević, and M. Dressel, *Phys. Rev. Lett.* **121**, 056402 (2018)
[4] A. Pustogow, R. Rösslhuber, Y. Tan, E. Uykur, A. Böhme, A. Löhle, R. Hübner, J. A. Schlueter, M. Dressel, and V. Dobrosavljević, arXiv:1907.04437
[5] A. Pustogow, A. S. McLeod, Y. Saito, D. N. Basov, M. Dressel, *Sci. Adv.* **4**, eaau9123 (2018)
[6] Y. Luo, A. Pustogow, P. Guzman, A. P. Dioguardi, S. M. Thomas, F. Ronning, N. Kikugawa, D. A. Sokolov, F. Jerzembeck, A. P. Mackenzie, C.W. Hicks, E. D. Bauer, I. I. Mazin, and S. E. Brown, *Phys. Rev. X* **9**, 021044 (2019)
[7] A. Pustogow, Y. Luo, A. Chronister, Y.-S. Su, D. A. Sokolov, F. Jerzembeck, A. P. Mackenzie, C. W. Hicks, N. Kikugawa, S. Raghu, E. D. Bauer and S. E. Brown, *in production at Nature*, arXiv:1904.00047