TT 17: Charge Density Wave Materials

Time: Thursday 10:00–11:00 Location: H6

TT 17.1 Thu 10:00 H6

Condensation signatures of photogenerated interlayer excitons in a van der Waals heterostack — •Johannes Figueiredo[1], Lukas Sigl[1], Florian Sigger[1], Jonas Kiemle[2], Ursula Wurstbauer[1], and Alexander Holleitner[1] — [1]Walter Schottky Institut, Technical University of Munich — [2]Institute of Physics, Westfälische Wilhelms-Universität Münster

Due to large exciton binding energies and long lifetimes, atomistic van der Waals heterostacks of TMDCs present an ideal platform for studying high-temperature condensation of excitons. At cryogenic temperatures, optically generated interlayer excitons in such heterostructures yield several signatures regarding the condensation of the photogenerated excitons. The transition into this state is consistent with the predicted critical condensation temperature above 10K. Our studies provide a first phase-diagram of the achieved quantum degenerate interlayer exciton ensemble. [1]

[1] L. Sigl *et. al*, Phys. Rev. Research 2, 042044(R) (2020)

TT 17.2 Thu 10:15 H6

Doping fingerprints of spin and lattice fluctuations in moiré superlattice systems — •Niklas Witt[1], José Pizarro[1], Takuya Nomoto[2], Ryotaro Arita[2], and Tim Wehling[1] — [1]Universität Bremen — [2]University of Tokyo

Twisted van der Waals materials open up novel avenues to control electronic correlation and topological effects. These systems contain the unprecedented possibility to precisely tune strong correlations, topology, magnetism, nematicity, and superconductivity with an external non-invasive electrostatic doping. By doing so, rich phase diagrams featuring an interplay of different states of correlated quantum matter can be unveiled. The nature of the superconducting order presents a recurring overarching open question in this context.

In this work, we quantitatively assess the case of spin-fluctuation-mediated pairing for Γ-valley twisted transition metal dichalcogenide homobilayers. We construct a low-energy honeycomb model on which basis we self-consistently and dynamically calculate a doping dependent phase diagram for the superconducting transition temperature T_c. A superconducting dome emerges with a maximal $T_c \approx$ 0.1-1 K depending on twist angle. We qualitatively compare our results with conventional phonon-mediated superconductivity and discern clear fingerprints which are detectable in doping-dependent measurements of the superconducting transition temperature, providing direct access to probing the superconducting pairing mechanism in twisted Van der Waals materials.

TT 17.3 Thu 10:30 H6

Electronic transformations in the semi-metallic transitional oxide Mo_8O_{23} — Venera Nasretdinova[1], •Yaroslav Gerasimenko[2,3], Jernej Mravlje[3], Gianmarco Gatti[4], Petra Sutar[3], Damjan Svetin[3], Anton Meden[5], Viktor Kabanov[3], Alexander Kuntsevich[6,7], Marco Grioni[4], and Dragan Mihailovic[1,3,5] — [1]CENN Nanocenter, Ljubljana, Slovenia — [2]University of Regensburg, Germany — [3]JSI, Ljubljana, Slovenia — [4]EPFL, Lausanne, Switzerland — [5]University of Ljubljana, Slovenia — [6]LPI RAS, Moscow, Russia — [7]HSE, Moscow, Russia

Mo_8O_{23} is a low-dimensional stoichiometric transitional metal oxide from MoO_{3-x} family. Its room-temperature phase associated with charge density wave (CDW) is accompanied by non-monotonic resistivity at low temperatures well below structural transitions. Using tunneling and angle-resolved spectroscopy, transport measurements and density functional calculations we reveal electronic transformations leading to a multi-band correlated ground state [1,2]. We observe the metal-to-insulator transition at 343K in resistivity, consistent with CDW onset. At low temperatures, the picture with the only CDW order parameter is broken by the onset of the correlated ground state visible both in transport and spectroscopic probes. Spatially-resolved tunneling spectroscopy studies reveal the emergent electronic texture. We discuss the possible origins of the electronic order that emerge in the absence of any structural or magnetic transitions [3].

[1] V. Nasretdinova et al. PRB 99, 085101
[2] V. Nasretdinova et al., Sci.Rep. 9, 15959 (2019)
[3] V. Nasretdinova et al., in preparation

TT 17.4 Thu 10:45 H6

Field tuning beyond the heat death of a charge-density-wave chain — •Manuel Weber[1,2] and James Freericks[2] — [1]Max-Planck-Institut für Physik komplexer Systeme, Nöthnitzer Str. 38, 01187 Dresden, Germany — [2]Department of Physics, Georgetown University, Washington, DC 20057, USA

Time-dependent driving of quantum systems has emerged as a powerful tool to engineer exotic phases far from thermal equilibrium; when the drive is periodic this is called Floquet engineering. The presence of many-body interactions can lead to runaway heating, so that generic systems are believed to heat up until they reach a featureless infinite-temperature state. Finding mechanisms to slow down or even avoid this heat death is a major goal—one such mechanism is to drive toward an even distribution of electrons in momentum space. Here we show how such a mechanism avoids the heat death for a charge-density-wave chain in a strong dc electric field; minibands with nontrivial distribution functions develop as the current is prematurely driven to zero. We also show how the field strength tunes between positive, negative, or close-to-infinite effective temperatures for each miniband. These results suggest that nontrivial metastable distribution functions should be realized in the prethermal regime of quantum systems coupled to slow bosonic modes.