Noise spectroscopy of charge glasses and the Mott transition

Tim Thyzel, Florian Spitzfaden, Jens Müller, Takahiko Sasaki

1 Institute of Physics, Goethe University, Max-von-Laue-Str. 1, 60438 Frankfurt am Main, Germany, e-mail: thyzel@physik.uni-frankfurt.de
2 Institute of Materials Research, Tohoku University, Sendai, Japan

Organic charge transfer salts based on the BEDT-TTF (ET) molecule are low-dimensional model systems for various electronic correlation phenomena in solid-state physics. In particular, the θ-(ET)₂X family of compounds exhibits a charge-ordering metal-insulator transition which can be suppressed kinetically and through geometrical frustration. Recently, it has been debated [1] whether the resulting glass-like state is primarily of electronic or structural origin.

In the κ-(ET)₂X series, a bandwidth-controlled Mott transition is accessible at Helium temperatures and low hydrostatic pressure, in the vicinity of anti-ferromagnetism and superconductivity. Of particular interest is the critical region around the Mott endpoint, where a breakdown of Hooke’s law of elasticity has been observed [2], suggesting an enhanced electron-lattice coupling.

We study the phase diagrams of these systems by means of conductance fluctuation spectroscopy, a powerful method to detect phase transitions and other slow dynamics through changes in the low-frequency charge transport noise.

θ-(ET)₂X with X=CsCo,RbZn is examined in a state of static disorder introduced by X-ray irradiation, quantifying the impact of the degree of disorder on the proposed charge glass. We also present for the first time fluctuation spectroscopy data mapping the temperature-pressure phase diagram of κ-(ET)₂Cu[N(CN)₂]Cl near the metal-insulator transition, searching for signatures of glass-like ethylene-endgroup ordering and of Mott criticality.

References