Noise spectroscopy of charge glasses and the Mott transition

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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

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[2] E. Gati et al., *Science Advances* **2**, e1601646 (2016).