Correlated electrons on triangular lattice near Mott transition
-- from spin liquid to superconductivity ---

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The family of layered organic conductors, \( \kappa-(ET)_2X \), are model systems of interacting half-filled-band electrons on anisotropic triangular lattice. The bandwidth and the Coulomb repulsive energy are comparable in this family, which is situated around Mott transition [1]. In particular, the Mott insulator, \( \kappa-(ET)_2Cu_2(CN)_3 \), has nearly isotropic triangular-lattice network of transfer integral and therefore is a model system of frustrated quantum spins. At ambient pressure, there is no indication of magnetic ordering in either NMR spectra or relaxation rate, \( 1/T_1 \), down to 30 mK. The spins are likely in the quantum liquid state. NMR, \( \mu \)SR and thermodynamic measurements suggest low-lying spin excitation at low temperatures with a signature of some kind of crossover or hidden order around 5K. This spin state is icontrasting with that of the commensurate antiferromagnet, \( \kappa-(ET)_2Cu[N(CN)_2]Cl \), with more anisotropic triangular lattice.

Under pressure, the antiferromagnet and the spin liquid both undergo Mott transition to the Fermi liquid, which shows superconductivity. The remarkable difference of the pressure-temperature phase diagrams of the spin liquid, \( \kappa-(ET)_2Cu_2(CN)_3 \), and the antiferromagnet, \( \kappa-(ET)_2Cu[N(CN)_2]Cl \), indicates an interplay between the charge and spin degrees of freedom around the Mott transition. In this workshop, I also discuss similarities and dissimilarities in the superconductivity-related properties of the two systems, highlighting the role of the spin frustration in the emergence of superconductivity.

I also mention the doped triangular-lattice systems, \( \kappa-(ET)_4Hg_{3-\delta}X_8 \) [X=Br, Cl]

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