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

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The family of layered organic conductors, κ-$(ET)_2X$, 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, κ-$(ET)_2Cu_2(CN)_3$, 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, μSR 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 antiferromaget, κ-$(ET)_2Cu[N(CN)_2]Cl$, with more anisotropic triangular lattice.

Under pressure, the aniferromagnet 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, κ-$(ET)_2Cu_2(CN)_3$, and the anitiferromagnet, κ-$(ET)_2Cu[N(CN)_2]Cl$, 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, κ-$(ET)_4Hg_{3-\delta}X_8$ [X=Br, Cl]

This work has been done in collaboration with Y. Shimizu, F. Kagawa, Y. Kurosaki, H. Kasahara, K. Kobashi, K. Miyagawa, S. Yamashita, Y. Nakazawa. M. Maesato, G. Saito, I. Kezsmarki and Y. Tokura.