# Magnetism and Mott Transition in Molecular Conductors with Triangular Lattice

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The molecular conductors, $\kappa$-$(ET)_2X$ and $Z[Pd(dmit)_2]_2$, are model materials for the research of frustrated quantum spins and Mott transition on triangular lattice. In particular, the almost perfect triangular lattice is realized in $\kappa$-$(ET)_2Cu_2(CN)_3$ and $EtMe_3P[Pd(dmit)_2]_2$.

$\kappa$-$(ET)_2Cu_2(CN)_3$ shows no indication of magnetic order down to 20 mK in NMR measurements despite the antiferromagnetic exchange energy of 250 K evaluated from the magnetic susceptibility. The $^{13}C$ NMR reveals that small staggered moments is induced in a magnetic field [1]. By applying pressure, the bandwidth-controlled Mott transition occurs from the spin liquid state to the Fermi liquid state, followed by a superconducting transition at 3.8 K. The pressure-temperature phase diagram and the superconductivity are revealed to have unique features owing to the spin frustration.

On the other hand, the magnetic ground state of $EtMe_3P[Pd(dmit)_2]_2$ becomes the valence-bond-solid (VBS) state with a spin gap due to a structural phase transition at 25 K [2]. Under a hydrostatic pressure applied on the verge of Mott boundary, the insulator-to-metal transition and the reentrant metal-to-insulator transition are observed as the resistance jump at low temperatures. Finally, it undergoes the insulator-superconductor transition at 5.2 K. The reentrant insulating phase is suppressed with increasing a magnetic field. The result indicates that the Zeeman energy reduces the spin gap in the Mott insulating state and stabilizes the metal, which proves that the VBS phase neighbors to the superconducting state.

[1] Y. Shimizu *et al*., Phys. Rev. Lett. **93**, 107001 (2003); Phys. Rev. B **73**, R140407 (2006).
[2] M. Tamura, *et al*., J. Phys. Soc. Jpn. in press; R. Kato, *et al*., J. Am. Chem. Soc. in press.