Physical properties of a quantum spin liquid candidate κ-$(ET)_2Cu[Au(CN)_2]Cl$ at low temperatures and high pressures

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Quantum spin liquids (QSLs) have attracted much attention because they are exotic quantum phases of matter where long-range magnetic ordering is suppressed even at low temperature. QSL is thought to be realized by the strong spin frustration in triangular lattice. Actually, several QSL candidates with triangular lattice have been reported in organic conductors so far [1, 2]. In particular, κ-$(ET)_2X$ and $Y[Pd(dmit)_2]_2$ (X= $Cu_2(CN)_3^-$, $Ag_2(CN)_3^-$ etc., Y= $EtMe_3Sb^+$ etc.) are typical examples having nearly regular triangular lattices, while some organic QSL candidates have anisotropic triangular lattices. The latter suggests the presence of other factors besides spin frustration for the realization of QSL.

All the reported organic QSL candidates have some disorders in their crystal structures. Such structural disorders have been discussed as one of the key factors for realizing QSL. To evaluate the role of spin frustration in QSL, disorder-free QSL candidates are greatly desired.

κ-$(ET)_2Cu[Au(CN)_2]Cl$ (ET = bis(ethylenedithio)tetrathiafulvalene) is the first triangular-lattice organic QSL candidate with disorder-free polyanion layers.[3] This salt has a layered structure composed of alternating ET and polyanion $\{Cu[Au(CN)_2]Cl^-\}_\infty$ layers stacking along *a* axis (Fig.). This new QSL candidate provides an ideal research platform to investigate a genuine QSL state.

In this study, we have performed transport measurements of κ-$(ET)_2Cu[Au(CN)_2]Cl$ at high pressures up to 7 kbar and low temperatures down to 0.5 K and investigated the pressure–temperature phase diagram in the vicinity of the QSL state.

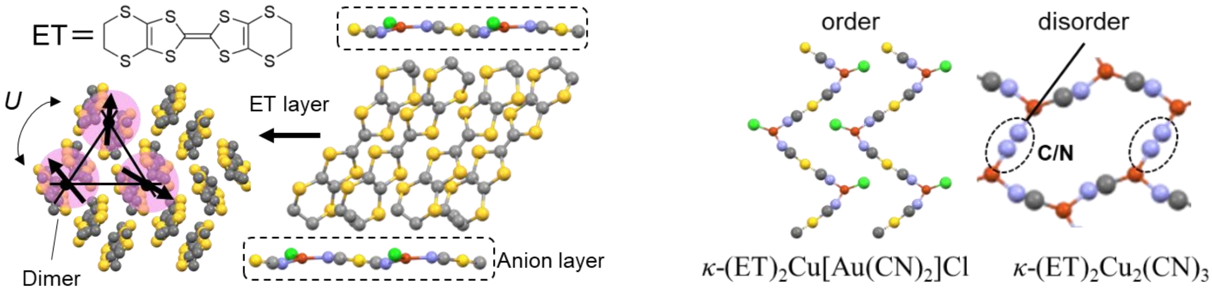

Fig. Crystal structure of κ-$(ET)_2Cu[Au(CN)_2]Cl$ (left) and comparison of anion layer (right)

References

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