# Probing lattice effects in κ-(BEDT-TTF)$_2$X spin-liquid-candidate systems

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κ-phase (BEDT-TTF)$_2$X salts, characterized by a layered structure where (BEDT-TTF)$_2^{1+}$ dimers form a distorted triangular lattice, show a variety of intriguing phase transitions and ground states including the Mott metal-insulator transition, quantum disordered potentially quantum-spin-liquid (QSL) phases, local moment antiferromagnetic and charge-ordered states as well as superconductivity. Important parameters, determining the actual ground state, are the relative strength of onsite-, intersite- and intradimer Coulomb interactions, the degree of frustration and the coupling of the electronic degrees of freedom to the lattice.

Here we will address the QSL-candidate systems κ-(BEDT-TTF)$_2$X with X = $Cu_2(CN)_3$ and $Ag_2(CN)_3$, both of which reveal a high degree of frustration and lack long-range magnetic order down to mK temperatures. In particular, we will address the mysterious 6 K anomaly for the X = $Cu_2(CN)_3$ salt where thermal expansion measurements [1,2] reveal clear evidence for a second-order phase transition with strong involvement of the lattice, which was recently assigned to the formation of valence-bond singlets [3]. These observations will be complemented by recent results of an inelastic-neutron-scattering study on deuterated specimens of X = $Cu_2(CN)_3$ [4], probing the same intra-dimer breathing/shearing mode where pronounced renormalization effects accompanying ordering phenomena in the spin- and charge-channels, were revealed for the dimer-Mott insulator X = Cu[N(CN)$_2$]Cl [5]. In contrast, for the X = $Ag_2(CN)_3$ system, the thermal expansion lacks any indication for a phase transition down to 1.5 K, consistent with a QSL ground state. For this system broad and strongly anisotropic anomalies are observed around 20 K which can be assigned to the strongly correlated π-electron system on a triangular lattice [6,7].

## References

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