Emergent states of interacting electrons in triangular-lattice organics: quantum spin liquid, charge glass, and unconventional superconductivity

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Abstract:
Coulomb interactions among electrons have huge impacts on their behavior through competition of charge localization/delocalization and spin order/disorder. Layered organic compounds host flexible lattice geometries and appreciable Coulomb interactions, both of which are varied by pressure or chemical substitution to display diverse emergent phenomena like a showcase of correlation physics. In this colloquium, I review a variety of electron correlation-derived phenomena that show up on the molecular triangular lattices, which exert geometrical frustration on the spins and charges of interacting electrons. These include quantum-critical Mott metal-insulator transition [1], quantum spin liquid [2], BEC-like superconductivity in a doped spin liquid [3], charge glass [4], and massless Dirac electrons with dynamic mass generation [5]. Some of these phenomena have links to soft-matter physics and particle physics beyond the conventional discipline of solid-state physics.