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Spinon Fermi sea state as a candidate spin liquid in κ-$(ET)_2Cu_2(CN)_3$

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Experimental studies of the quasi-two-dimensional organic compound κ-$(ET)_2Cu_2(CN)_3$ strongly suggest a spin liquid state in the insulating phase at ambient pressure. This material is modelled as a half-filled triangular lattice Hubbard system close to the Mott transition. By applying trial wave function approach to an effective spin Hamiltonian with significant ring exchanges, it is proposed that a spin liquid state with spinon Fermi surface is realized in this system. Properties of this state are reviewed and compared with experiments. Further experiments find that an inhomogeneous spin state is induced by strong magnetic field. It is argued that the origin of this anomalous response is magneto-orbital effects, whereby spinons see significant orbital field and have strong back action on the internal gauge field. The spin liquid ground state itself is readjusting in the magnetic field, possibly in a discontinuous manner in an ideal system; this persists in a broad temperature range and may be responsible for the inhomogenuous state in the real system.