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Unconventional Metallic States of the Superconducting Layered Organic Charge Transfer Salts EDDY YUSUF, B. J. POWELL, R. H. MCKENZIE, Physics Department, University of Queensland — We show, by analyzing previously published nuclear magnetic resonance data, that there are large antiferromagnetic (AF) fluctuations above 50 K and a pseudogap below 50 K in the metallic state of $\kappa-(ET)_2Cu[N(CN)_2]Br$. We discuss the relationships between the metallic state, the AF Mott insulating state, and the unconventional superconducting state. The AF correlation length is found to be 3.5 ± 2.5 lattice constants at $T = 50$ K; this places the material between the isotropic triangular lattice and the square lattice We show that the low temperature regime of the metallic state of $\kappa-(ET)_2Cu[N(CN)_2]Br$ is not a renormalized Fermi liquid, as has been previously thought. We argue that a pseudogap is responsible for the loss of the density of states in the spin degrees of freedom, seen in NMR data, while that probes of the charge degrees of freedom have a Fermi liquid character in these materials. We compare and contrast our phenomenological description with the predictions of dynamical mean field theory (DMFT) and the resonating valence bond (RVB) theory. Similar spin fluctuations and pseudogap are also found in κ-$(ET)_2Cu[N(CN)_2]Cl$, fully deuteratred κ-$(ET)_2Cu[N(CN)_2]Br$, and κ-$(ET)_2Cu(NCS)_2$ suggesting common physics in these salts.

Eddy Yusuf
Physics Department, University of Queensland

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