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Unconventional Metallic Phase of the Quasi Two-Dimensional Organic Superconductors EDDY YUSUF, B.J. POWELL, R.H. MCKENZIE, Physics Department, University of Queensland, Brisbane 4072, QLD, Australia — We show, by analyzing previously published nuclear magnetic resonance (NMR) data, that there are large antiferromagnetic fluctuations above $T_{\rm NMR} \sim 50$ K in the metallic phase of κ-$(ET)_2X$ family of organic charge transfer salts. The proximity of the metallic phase to the antiferromagnetic Mott insulating phase and the d-wave superconductivity are thought to be the origin of the large antiferromagnetic fluctuations. The antiferromagnetic correlation lengths are estimated to be several lattice constants at $T_{\rm NMR}$ which place the materials between the isotropic triangular lattice and the square lattice. For materials close to the Mott insulating phase the nuclear spin relaxation rate per unit temperature, Knight shift and Korringa ratio all decrease significantly with decreasing temperature below $T_{\rm NMR}$, inconsistent with the renormalized Fermi liquid picture previously thought to be the correct description of the low temperature metallic phase in these materials. One plaussible explanation is that a pseudogap, similar to that observed in the underdoped cuprate superconductors, opens up in the density of states below $T_{\rm NMR}$. Such a pseudogap has recently been predicted to occur in the dimerised organic charge transfer salts materials by the resonating valence bond (RVB) theory.

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