NMR and the quasi-one dimensional superconductors $(TMTSF)_2X$

Stuart Brown[1]

[1] *UCLA*

The quasi-one dimensional Bechgaard salts $(TMTSF)_2X$ were the first discovered of the molecular superconductors, and although the transition temperature is low, the systems remain of interest for a number of reasons, including the survival of superconductivity to very high magnetic fields [1,2], and novel normal state properties. Both likely result from spin fluctuations in association with the low dimensionality.

Superconductivity is observed in $(TMTSF)_2PF_6$ under pressure $P >$ 0.6GPa for $T \sim 1$K. At lower pressures, correlations are manifested in the stabilization of a spin-density wave (SDW) ground state. The antiferromagnetic fluctuations persist in the high-conductivity regime, as evidenced by enhanced nuclear spin-lattice relaxation rates. $1/T_1(T,P)$ is quite unusual, and was recently interpreted [3] as a consequence of the nature of the quasiparticles in a quasi-one dimensional system with imperfect nesting.

Superconductivity surviving to fields exceeding the paramagnetic limit H_P is well-known in molecular superconductors. In the case of the quasi-two dimensional materials such as κ-$(BEDT\text{-}TTF)_2Cu(NCS)_2$, it is sometimes attributed to the stabilization of inhomogeneous (FFLO) superconductivity for fields aligned with the conducting layers. The situation in $(TMTSF)_2X$ may be different, and we discuss the possibility of a field-inducted transition from singlet to triplet superconductivity.

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