Reaching a consistent picture for organic $TMTSF_2X$ superconductors

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A wealth of new experimental results obtained recently is supporting a consistent picture for the generic *P-T* phase diagram of TM_2X conductors and the mechanism leading to superconducting coupling for some of them.

The low pressure domain is governed by one dimensional physics with an interplay between 1D Mott localization and three dimensional charge ordering depending on the existence or the absence of a stack dimerization [1].

High pressure enables the establishment of transverse coherence in the a-b planes while transport along the least coupled c-direction remains incoherent down to low temperature. The c-axis incoherent-coherent transition has been investigated through systematic measurements of transport along c and a under pressure in the prototype system $TMTSF_2PF_6$ [2].

The transition between the insulating spin density wave phase and superconductivity is characterized by an inhomogenous coexistence domain which appears to be quite a general feature even for other series of materials including inorganics [3]. A systematic study of transport along a and c in $TMTSF_2ClO_4$ and $TMTSF_2PF_6$ performed under pressure [4] has revealed a clear link between the *T*-linear dependence of the resistivity close to the superconducting transition and the transition temperature itself leading in turn to a close connection between antiferromagnetic fluctuations seen by NMR relaxation and the anomalous temperature dependence of the transport on the one hand and on the existence of superconductivity on the other hand.

All new experimental data (NMR [5], doping [6]) support the existence of superconductivity being spin singlet with nodes in the gap (d-wave state). The study of the superconducting phase under magnetic field [7] has shown the existence of a cross over between a low field homogenous singlet and a high field inhomogenous phase.

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