Geometrical and Orbital Effects in a Quasi-One Dimensional Conductor

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Introduction

The organic conductor, $(Per)_2Au(mnt)_2$ undergoes a charge density wave (CDW) phase transition when cooled below 12K. With a strong enough magnetic field [1] and applied pressure, the CDW is suppressed and the Fermi surface is observed through the appearance of quantum interference oscillations [2] between the Q1D sheets predicted from band structure calculations [3].

Experimental

Small single crystals were mounted in a double-clamped BeCu pressure cell for conventional four terminal transport measurements. The magnetic field was held constant as the pressure cell was rotated with the conducting chain of the sample (*b*-axis) parallel to the rotation axis. Temperatures as low as 300 mK were achieved while using the NHMFL mK facility (SCM2) and dc fields (31T resistive magnet) for these measurements.

Results and Discussion

The angular dependent magnetoresistance (ADMR) is shown in Fig. 1a, where alignment between the field and *a* and *c* crystallographic axes are indicated. Black arrows show the features which do not change angular location with different magnetic fields. Fig. 1b shows these features in greater detail from the second derivative of the ADMR data. The red arrows show features which shift angle location when a different magnetic field is applied (i.e. orbital effects).

Conclusions

The observed angular dependent phenomenon may be explained within the context of carrier coherence. When a strong magnetic field is applied along one of the directions indicated in Fig. 1c, the real space width of the carrier trajectory can be limited such that the carriers as confined within "layers". [4] Away from these "magic angle" orientations, scattering and MR become larger as the coherence decreases. The MR background is more complex than with the $(TMTSF)_2X$ compounds, most likely due to a residual CDW state, even under pressure.

Acknowledgements

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References

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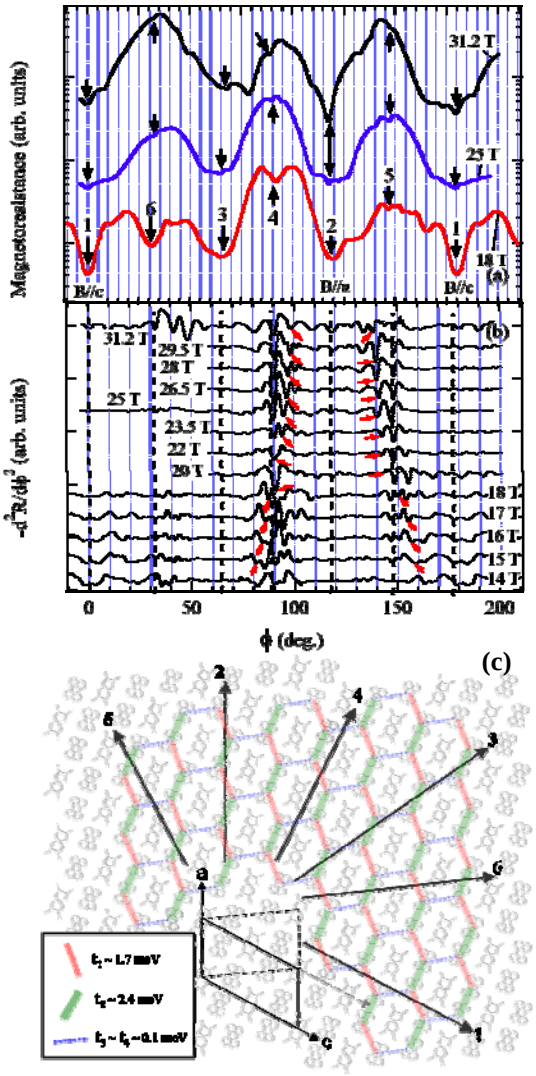

Fig. 1. (a) Magnetoresistance (MR) measurements at constant fields with the rotation axis parallel to the conducting chains and P ~ 6.0 kbar. Black arrows note minima. (b) $-d^2R/d\phi^2$ for MR data between 14 and 31.2 T. Dashed lines show minima occurring at constant angles. Red arrows show data which shifting with different magnitude of applied field. (c) The *ac*-plane of $(Per)_2Au(mnt)_2$ with different lines to distinguish the strength of the transfer integrals in each direction. The black, numbered arrows correspond to the orientation of the sample and applied magnetic fields from Fig. 1a.