Quantum Interference and Weak Localization Effects in the Interlayer Magnetoresistance of Layered Metals

Malcolm P. Kennett[1] and Ross H. McKenzie[2]
[1]*Physics Department, Simon Fraser University, Canada*
[2]*Physics Department, University of Queensland, Australia*

Email: malcolmk@sfu.ca

Studies of angle-dependent magnetoresistance oscillations (AMRO) in the interlayer conductivity of layered metals have generally considered semi-classical electron transport. We consider a quantum correction to the semi-classical conductivity that arises from what can be described as an interlayer Cooperon. This correction depends on both the disorder potential within a layer and the correlations of the disorder potential between layers. We compare our results with existing experimental data on organic charge transfer salts that are not explained within the standard semi-classical transport picture. In particular, our results may be applicable to effects that have been seen when the applied magnetic field is almost parallel to the conducting layers. We predict the presence of a peak in the resistivity as the field direction approaches the plane of the layers. The peak can occur even when there is weakly incoherent transport between layers.

*This work was supported by NSERC and the Australian Research Council.
[1] M. P. Kennett and R. H. McKenzie, Phys. Rev. B 78 (2008) 024506.