# Non-metallic conduction in layered metals

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Transport in many layered materials–cuprates, perovskites, graphite, etc.–shows a puzzling anomaly. Whereas the temperature dependence of the in-plane resistivity is metallic, that of the out-of-plane (c-axis) resistivity is insulating or even non-monotonic. We show that, contrary to the commonly accepted paradigm of coherent-incoherent crossover, the Boltzmann equation is robust with respect to either elastic or inelastic scattering, as long as $E_F\tau \gg 1$. Hence this anomaly cannot be explained within a model containing only usual (potential) impurities and inelastic degrees of freedom. A model of phonon-assisted tunneling via resonant states located in between the layers is shown to explain a non-monotonic temperature dependence of the c-axis resistivity observed in the experiment. As a competing mechanism, we also consider electron-assisted tunneling when an on-site electron exchanges energy with itinerant electrons.

References :

[1] D. B. Gutman and D. L. Maslov, Phys. Rev. Lett. v. 99, 196602 (2007).

[2] D. B. Gutman and D. L. Maslov, arXiv :0710.0087.