

# Conduction in graphene: the low-temperature anomaly

Viera Skakalova<sup>1</sup>, Alan B. Kaiser<sup>2</sup>, Jai Seung Yoo<sup>3</sup>, and Siegmur Roth<sup>1</sup>.

<sup>1</sup>*Max Planck Institute for Solid State Research, Stuttgart*

<sup>2</sup>*MacDiarmid Institute for Advanced Materials and Nanotechnology, SCPS, Victoria  
University of Wellington, P O Box 600, Wellington, New Zealand*

<sup>3</sup>*Department of Physics and Astronomy, Seoul National University, Seoul 151-747, Korea*

The resistance  $R(T)$  of graphene often shows a monotonic increase or decrease as temperature increases from 4.2 K to around 70 K. We find this anomaly can change sign for even very small changes in gate voltage, indicating that it is not a systematic effect. Using the field effect transistor configuration, we have conclusively determined the cause of this anomaly as arising from the decay of mesoscopic resistance fluctuations (MRFs) due to progressive dephasing of the interfering scattered electron waves as  $T$  increases. Our measurements of  $R(T)$  at different constant gate voltages  $V_g$  tuned to different features of the MRFs observed in  $R(V_g)$  at constant temperature reveal some surprising features not well understood by current theory, for example the exponential rather than power law decay of MRFs with temperature, and the variation of MRF properties as  $V_g$  changes [1].

[1] V. Skákálová, A.B. Kaiser, J.S.Yoo, D. Obergfell and S. Roth, Phys. Rev. B 74, 153404 (2009).