Abstract Submitted
for the MAR15 Meeting of
The American Physical Society

Violation of the Wiedemann-Franz law in clean graphene layers[1]

ALESSANDRO PRINCIPI, GIOVANNI VIGNALE, Department of Physics and Astronomy, University of Missouri, Columbia, Missouri 65211, USA — The Wiedemann-Franz law, connecting the electronic thermal conductivity to the electrical conductivity of a disordered metal, is generally found to be well satisfied even when electron-electron (e-e) interactions are strong. In ultra-clean conductors, however, large deviations from the standard form of the law are expected, due to the fact that e-e interactions affect the two conductivities in radically different ways. Thus, the standard Wiedemann-Franz ratio between the thermal and the electric conductivity is reduced by a factor $1 + \tau/\tau_{\rm th}^{\rm ee}$, where $1/\tau$ is the momentum relaxation rate, and $1/\tau_{\rm th}^{\rm ee}$ is the relaxation time of the thermal current due to e-e collisions. Here we study the density and temperature dependence of $1/\tau_{\rm th}^{\rm ee}$ in the important case of doped, clean single layers of graphene, which exhibit record-high thermal conductivities. We show that at low temperature $1/\tau_{\rm th}^{\rm ee}$ is 8/5 of the quasiparticle decay rate. We also show that the many-body renormalization of the thermal Drude weight coincides with that of the Fermi velocity.

[1]This work was supported in part by DOE grant DE-FG02-05ER46203 and by a Research Board Grant at the University of Missouri.

Alessandro Principi
Department of Physics and Astronomy,
University of Missouri, Columbia, Missouri 65211, USA

Date submitted: 08 Nov 2014 Electronic form version 1.4