Minimum Viscosity in Graphene: Insights into Thermal and Coulomb Screening Effects

Alexey Ermakov
Alessandro Principi
University of Manchester, Oxford Road, Manchester, United Kingdom
Alexey.Ermakov@manchester.ac.uk

Abstract

We present a theoretical study of Fermi-liquid viscosity in both monolayer and bilayer graphene, focusing on the role of electron-electron interactions. We employ kinetic equation approach to compute the shear and kinematic viscosities in both screened and unscreened regimes. Our calculations reveal that the temperature dependence of the viscosities features a pronounced minimum, consistent with generic liquid behaviour. We further analyze how varying the carrier density influences hydrodynamic transport in these two-dimensional systems, providing the tools to tune experimental studies to regions of lower or higher viscosity. Our results contribute to a deeper understanding of many-body effects and guide experimental efforts to explore novel fluid-like transport phenomena in graphene.

References

[1] Müller, M., Schmalian, J., & Fritz, L. (2009). Phys. Rev. Lett., 103, 025301.
[2] Principi, A., Vignale, G., Carbone, F., & Polini, M. (2016). Phys. Rev. B, 93(12), 125410.

Figures

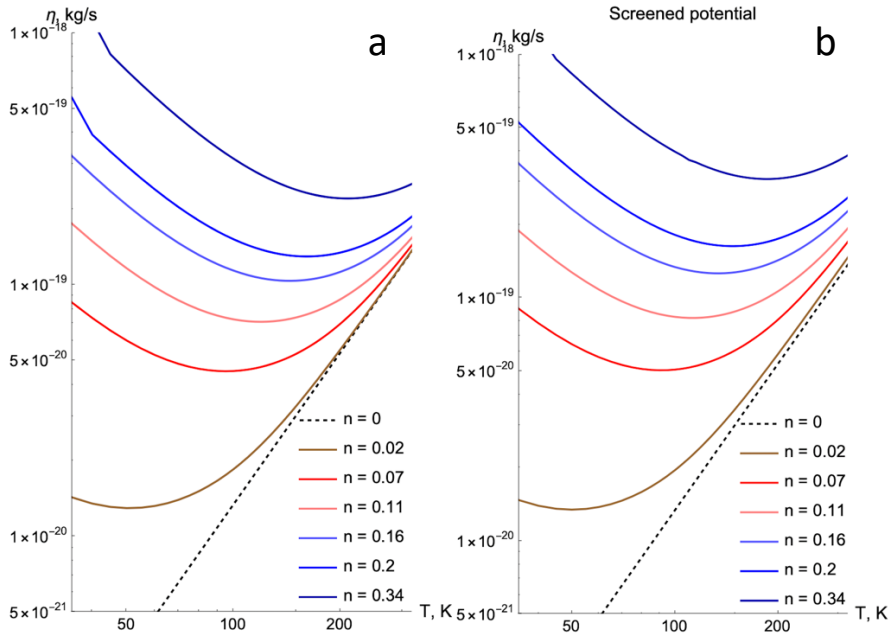

Figure 1: Shear viscosity in graphene without (a) and with (b) static screening as function of temperature for for different carrier densities.