Multilayer Graphene as an Endoreversible Otto Engine

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Summary

Graphene is perhaps the most prominent "Dirac material," a class of systems whose electronic structure gives rise to charge carriers that behave as relativistic massless fermions. This emergence of relativistic behavior at laboratory scale energies makes graphene an ideal environment for probing the thermodynamics of relativistic quantum systems. For multilayer graphene structures, subject to an external magnetic field, the energy spectrum strongly depends on the number of layers, and we examine the performance of a finite-time endoreversible Otto cycle with multilayer graphene systems as working mediums. We show that there exists a simple relationship between the engine efficiency and the number of layers, and that the efficiency at maximum power can exceed that of a classical working medium.

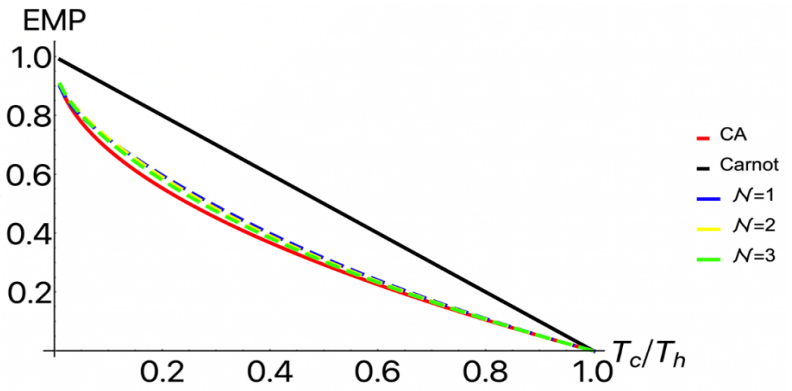

Figure 1: Efficiency at maximum power (EMP) as a function of temperature ratio (cold/hot) for multilayer graphene with different number of layers (blue, yellow, and green respectively) compared to Carnot efficiency (black curve) and Curzon-Ahlborn (red curve) efficiency.

Acknowledgments

P.V. acknowledges support from ANID Fondecyt grant No. 1210312 and to ANID PIA/Basal grant No. AFB180001. F.J.P. acknowledges support from ANID Fondecyt grant No. 11200032, ANID Fondecyt grant No. 1210312, Millennium Science Initiative Program - NNBP grant NCN2021_021 and USM-DGIIE. N.C. acknowledges support from ANID Fondecyt grant No. 11221088.

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