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Ballistic Thermal Conductance of a Graphene Ribbon ENRIQUE MUNOZ, JIANXIN LU, BORIS YAKOBSON, Rice University — Recent experiments on thermal transport in graphene suggest that the phonon mean free path may exceed 500 nm,[1] with thermal conductivities in the range 3000 – 5000 (W/m/K). In this scenario, it is expected that thermal transport is dominated by a ballistic rather than diffusive mechanism. We present an analytical theory to calculate the thermal conductance of a graphene ribbon in the ballistic regime. For that purpose, we analyze the vibrational modes of a continuum thin plate with isotropic elastic properties. To address the effect of nanoscale dimensions, we consider a finite width w in the model. At low temperatures, our analytical theory shows a power law dependence of the thermal conductance per unit width, were the exponent β is a function of the ribbon width, ranging from $\beta = 1$ for thin graphene ribbons, towards $\beta = 1.5$ in the limit of a large graphene sheet. Quantitative predictions of our theory at room temperature are in good agreement with experiments.[2]

[1]S. Ghosh, et al., "Extremely high thermal conductivity of graphene: Prospects for thermal management applications in nanoelectronic circuits" Applied Physics Letters, 2008. **92**: p. 151911.
[2]Ibid.

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