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Recent progress in theories of thermal transport

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要旨

We will report the results of our recent research on the unification of near-field radiation with phonon conduction using a lattice dynamics model. We can derive electromagnetic force constants across the vacuum gap between two ionic compounds. From this lattice dynamics model, the transmission and thermal conductance are computed using the Green's function method and the Landauer formula. The formalism has the advantage of producing the heat transfer coefficient continuously from contact to the near-field limit. While the results are in good agreement with radiation theory of Rytov beyond 1nm gap separation, at lower distances they differ.

We will also report on our recent modeling of thermionic transport in layered materials. We show the potential of suitably chosen van der Waals layers in displaying large figures of merit, and coefficients of performance.