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Thermodynamic Analysis for Near-field Thermal Radiation: Energy and Entropy Transfer[1] YI ZHENG, ARVIND NARAYANASWAMY, Columbia University — It can be argued that what is fundamental to Planck's theory of blackbody radiation is not the concept of the quanta but the concept of entropy of electromagnetic waves. Planck's work relies on the thermodynamic analysis of thermal radiation in a cavity, which requires knowledge of energy, entropy and momentum of photons. Planck's analysis, though, is restricted to the case when near-field effects such as diffraction and tunneling of evanescent waves are absent. We proposed a method to evaluate the entropy density and entropy flux in vacuum between two half-spaces that takes into account near-field effects. It is used to determine the maximum work that can be extracted through near-field radiative transfer between two objects at different temperatures.

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