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Measurement of Near-Field Thermal Radiation through a Nanometer-Sized Gap ANASTASSIOS MAVROKEFALOS, POETRO SAMBEGORO, GANG CHEN, Massachusetts Institute of Technology — Radiation heat transfer in nanostructures can differ significantly from that in macrostructures due to wave effects. Theory has predicted that thermal radiation heat transfer between two surfaces separated by tens of nanometers can exceed that of Planck's blackbody radiation law by several orders of magnitude. Our AFM-inspired heat flux sensor, comprising of a sphere attached to the tip of a bimetallic cantilever, can measure the radiation exchange across nanometer-scale gaps between a sphere and a flat surface. The objective of this work is to experimentally study thermal radiative transfer at very small separation gaps. In previous experiment, our group has successfully measured near-field radiative heat transfer through gap as small as 30 nm. In this work, we extend this technique to decrease the gap down to a few nanometers and show that existing fluctuating electrodynamics theory cannot predict experimental results in the extreme limit of small separation between two surfaces. Our experiments raise interesting question on the convergence of radiation heat transfer mechanism and interfacial heat conduction mechanism. Theoretical approaches bridging these two regimes will be discussed.

Anastassios Mavrokefalos
Massachusetts Institute of Technology

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