Abstract Submitted
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Temperature Dependent Behavior of Near Field Radiative Heat Transfer[1] ROBERT JOACHIM, University of California, Irvine — We have designed and implemented an apparatus capable of measuring near field radiative heat transfer (NFRT) from room temperature down to cryogenic temperatures in vacuum. Utilizing a bimaterial cantilever with a 20 μm glass sphere attached to the end in the pendulum geometry as a thermal detector and an optical fiber interferometer as a displacement detector we were able to measure the heat flux between a substrate and the glass sphere. The apparatus was sensitive enough to measure displacements of 1 nm and heat fluxes of 50 pW. NFRT was observed at temperatures ranging from 300K to 100K and at displacements down to 100nm. These measurements were performed for various combinations of Si, SiO_2 and sapphire. The thermodynamic formulation of Lifshitz's theory for attraction between dielectrics [1] predicts that NFRT will scale as T^2 while far field radiative transfer will scale as T^4 and that the crossover between these two regimes will occur at a distance given by $(1/2\pi)(\hbar c/k_b T)$. Our data confirms these predictions.

[1] J. Loomis and H. Maris. Phys Rev. B. 50, 18517 (1994).

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