Measures of Casimir force and of near-field radiative heat transfer

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Near-field force and energy exchange between two objects due to quantum and thermal induced electrodynamic fluctuations give rise to interesting phenomena such as Casimir and van der Waals forces and thermal radiative transfer exceeding Plancks theory of blackbody radiation.
A theoretical explanation, in the framework of stochastic electrodynamics introduced by Rytov [1] in the late sixties, accounts for quantum and thermodynamic fluctuations and has been successfully applied to model Casimir forces [2] and radiative heat transfer [3]. While quantum fluctuations, related to zero point energy, yelds to the formulation of the Casimir force, near-field radiative heat transfer is only due to classical thermodynamics fluctuations.

Although significant progress has been made in the past of the precise measurement of the Casimir force [4,5], a detailed quantitative comparison between theory and experiments in the nanometer regime is still lacking when speaking about heat transfer. After description of our quantitative measurement of the Casimir force and comparison with theory, we report experimental data on the thermal flux spatial dependence. Theory based on the Derjaguin approximation, successfully used here for the first time to describe radiative heat transfer from the far field to the near field regimes, reproduces the measured dependence.

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