

APPLIED MATHEMATICS COLLOQUIUM

Waves from Nothing: Modeling Fluctuation Interactions

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Abstract:

Although most modeling of wave phenomena concerns itself with waves that are created intentionally by an external source, important problems in physics stem from waves that arise whether you want them or not, due to thermal or even quantum fluctuations in the underlying fields. The results, from thermal radiation to van der Waals forces, are increasingly important as experimental devices enter submicron scales, both for basic physics and for applications such as micromechanical or thermophotovoltaic devices. The mathematical challenge, however, has been that modeling these phenomena is surprisingly difficult, with numerical solutions for simple two-sphere geometries representing state-of-the-art advances even in the last few years. This colloquium will give a basic introduction to fluctuation phenomena in quantum electromagnetism, introducing some of the simpler mathematical formulations and explaining where the difficulty arises in evaluating them. We will describe recent advances in relating these phenomena to standard techniques from classical computational wave mechanics, with a few unusual wrinkles such as a need for imaginary frequencies (Laplace domain rather than Fourier). In particular, we will focus on fluctuation-induced forces in micromechanical and microfluidic devices, where the goal is to use geometry and materials choices to radically alter the nature of the interactions.

Monday October 4th 2010

4:30 PM

Building 2, Room 105

*Refreshments are available in Building 2, Room 290
(Math Common Room) between 3:30 – 4:30 PM*

Applied Math Colloquium: <http://www-math.mit.edu/amc/fall10>

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