High-frequency cavity modes: efficient computation and applications

Alex Barnett
New York University

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B03 Moore Hall, 4:10 pm
(Tea 3:30 pm Math Lounge)

Abstract

The 'drum problem'—finding the modes (eigenfunctions) of the Laplacian in a cavity—is a classical problem of mathematics and physics with a 150-year history, and a wealth of applications. Modern applications can involve complex geometries, and high frequencies, where the multiscale nature of the problem makes it computationally challenging. I will present a variant of the Method of Particular Solutions which overcomes a normalization problem inherent in the original method. Rigorous perturbation analysis then leads to tighter new inclusion bounds on cavity eigenvalues. Another variant, the 'scaling method', finds clusters of modes simultaneously, thus can be orders of magnitude faster than the MPS or any other known methods for this problem. I will present applications to i) high-frequency asymptotics of chaotic modes (involving 'quantum chaos' and 'scars'), and ii) modeling of dielectric micro-cavity lasers.

This talk should be accessible to graduate students.