TRANSMISSION EIGENVALUES, NON-SCATTERING PHENOMENA AND THE INVERSE PROBLEM

FIORALBA CAKONI

Abstract. Transmission eigenvalues are inherent to the scattering theory for inhomogeneous media. They are related to frequencies at which there exist time harmonic incoming waves that are not scattered by a given inhomogeneity; in other words, the inhomogeneity is invisible to probing by such waves. The transmission eigenvalue problem is non-selfadjoint with a challenging and interesting mathematical structure, which has prompted a significant amount of recent research [**?**]. Existence of infinitely many real transmission eigenvalues is proven for a large class of inhomogeneities. It is also shown that real transmission eigenvalues can be determined from scattering data, hence they are important for the inverse problem. In this talk we discus the role of transmission eigenvalues in understanding essential properties of the relative scattering operator, and as a fundamental building block of methods for solving the inverse scattering problem. We show some recent theoretical results on transmission eigenvalues and non-scattering phenomena [**?**, **?**] as well as a general approach for introducing new interior eigenvalue problems in a similar framework of nonscattering [**?**]. We present several applications which clearly indicate the versatile potential of these measurable eigenvalues as target signatures for the identification of changes and faults in the interrogating media and their unexpected imaging capabilities [**?**, **?**]. The talk highlights some open theoretical and computational questions related to this active research area in inverse scattering.

Keywords: inverse scattering, transmission eigenvalues, non-scattering phenomenon, scattering theory, inhomogeneous media

Mathematics Subject Classifications (2010): 35A01, 35A15, 78A25, 78A46

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Department of Mathematics, Rutgers University, New Brunswick, New Jersey, USA
Email address: fc292@math.rutgers.edu