ABSTRACT
The transmission eigenvalue problem is a new class of eigenvalue problems that has recently appeared in inverse scattering theory for inhomogeneous media. Such eigenvalues provide information about material properties of the scattering object and can be determined from scattering data, hence can play an important role in a variety of problems in target identification. The transmission eigenvalue problem is non-selfadjoint and nonlinear which make its mathematical investigation very interesting.

In this lecture we will describe how the transmission eigenvalue problem arises in scattering theory, how transmission eigenvalues can be computed from scattering data and what is known mathematically about these eigenvalues. The investigation of transmission eigenvalue problem for anisotropic media will be discussed and Faber-Krahn type inequalities for the first real transmission eigenvalue will be presented. We conclude our presentation with some recent preliminary results on transmission eigenvalues for absorbing and dispersive media, i.e. with complex valued index of refraction, as well as for anisotropic media with contrast that changes sign.

Our presentation contains a collection of results obtained with several collaborators, in particular with David Colton, Drossos Gintides, Houssem Haddar and Andreas Kirsch.