Colloquium Notice

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Full transmission and reflection of waves propagating through complex media

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Multiple scattering of waves in disordered media is often seen as a nightmare whether it be for communication, imaging or focusing purposes. The ability to control wave propagation through scattering media is thus of fundamental interest in many domains of wave physics, ranging from optics or acoustics to medical imaging or electromagnetism. Thirty years ago, it was shown theoretically that a properly designed combination of incident waves could be fully transmitted through (or reflected by) a disordered medium. Although this remarkable prediction has attracted a great deal of attention, open and closed channels have never been accessed experimentally.

Here, we study the propagation of elastic waves through a disordered elastic waveguide. Thereby, we present experimental measurements of the full S-matrix across a disordered elastic wave guide. To that aim, laser-ultrasonic techniques have been used in order to obtain a satisfying spatial sampling of the field at the input and output of the scattering medium. The unitarity of the S−matrix is investigated and the eigenvalues of the transmission matrix are shown to follow the expected bimodal distribution. Full transmission and reflection of waves propagating through disorder are obtained for the first time experimentally. The wave-fields associated to these open and closed channels are imaged within the scattering medium to highlight the interference effects operating in each case.

In the second part of the talk, we study beam-like states which can be seen as spatio-temporal open / closed channels. To that aim, the eigenstates of the Wigner-Smith time-delay matrix are considered in a regular cavity and a weakly disordered medium. The propagation of the wave-packets associated to these transmitted trajectory-like states is investigated.

Monday
August 3, 2015
Starts at 12:15 PM
Coffee at 12:00 PM
SB B141