Seminar

Measuring the transmission matrix for controlling wave propagation in random media

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Time: 4:00pm, Sept. 18, 2014(Thursday)
时间： 2014年9月18日 （周四）下午4:00
Venue: Conference Room 607, Science Building 5
地点： 理科五号楼607会议室

Abstract

I will discuss recent measurements of the transmission matrix (TM) for microwave radiation propagation through a random multichannel copper waveguide. I will show that, even though the sample is opaque since it is much longer than the transport mean free path, it is possible to obtain nearly complete transmission through “open” eigenchannels of the TM. We are able to focus monochromatic transmission through the strongly scattering sample via phase conjugation of the TM so that the strongly scattering medium acts as a focusing lens. We can also control pulse transmission through the media by exploiting the spatial degrees of freedom of the scattering sample. In addition, measuring the TM allows us to explore the statistics of the transmittance *T*, known as “optical” conductance. We find a transition to a Gaussian distribution with variance equals to -<ln*T*>, in accord with the single parameter scaling (SPS) theory of localization for one-dimensional random system. On the way to SPS, we observe a highly asymmetric distribution of ln*T*. This is explained with the aid of an intuitive charge model. In the end, I will discuss the average spatial intensity profiles of the transmission eigenchannels ***inside*** the sample obtained in computer simulations. The integral of the intensity profiles over the space yields the contribution of each eigenchannel to the density of states (EDOS). The sum of the EDOS over all eigenchannels is equal to the density of states (DOS) of the sample. Results are in good agreement with the DOS determined independently by counting the quasi-normal modes within the sample.

About the Speaker

Zhou Shi got his Bachelor degree in Physics from the Univeristy of Science and Technology of China in 2007 and his Ph.D in the Graduate Center of CUNY in 2014. Now he is the Postdoc Research Associate, Queens College of CUNY.