Physics
AT QUEENS COLLEGE

Colloquium Notice

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Disorder-induced coherence in transmission eigenchannels

Illuminating disordered samples with waveforms matched to the eigenchannels of the transmission matrix produces striking variations in transmission, from complete to vanishing, and in internal energy density. These waveforms are experimentally accessible for classical waves and provide a theoretical framework for electronic transport. This opens new avenues for communications, imaging, sensing, and energy delivery. Yet the origin of these departures from diffusive transport has remained elusive: they can arise only through interference, but coherence between incident and internal waveguide modes is rapidly lost as waves scatter. We show through microwave measurements and numerical simulations that, nonetheless, phase coherence builds among the modes within the medium and governs the flux, energy density, and velocity in each mode of each transmission eigenchannel throughout the sample. Interference among contributions to a given eigenchannel seeded by incident modes is either constructive or destructive depending on whether the flux in the eigenchannel is larger or smaller than the average. The modal composition of each eigenchannel at all depths is determined by the interplay of the fixed incident modal weights, the depth-dependent growth of coherence, and the diminishing internal modal flux amplitudes. This establishes a foundation for controlling transport in complex media.

Monday
December 1, 2025
Starts at 12:15 PM
Coffee at 12:00 PM
Physics Conference Room, SB B326