Interplay between Localization and Absorption in Disordered Waveguides

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Anderson localization, which manifests itself through vanishing of the diffusion coefficient in infinite medium, originates from a constructive interference of loop trajectories – pairs of time-reversed paths returning to the same point. In systems of finite size, the probability of such paths is smaller near a boundary where wave can escape. Self-consistent theory of localization predicts that diffusion coefficient varies spatially and depends on geometry of the system. We will present numerical and experimental evidence for these effects. We will also show that diffusion coefficient depends on absorption because it limits the size of the loop trajectories that contribute to its renormalization. As a consequence, the true limit of zero diffusion coefficient is never reached in an absorbing random medium – diffusion coefficient saturates at some finite value. We will demonstrate how this effect can be used to control light transport in photonic nanostructures.