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Time Reversal Experiments in Chaotic Cavities BO XIAO, JEN-HAO YEH, THOMAS ANTONSEN, EDWARD OTT, STEVEN ANLAGE, Univ of Maryland-College Park — Wave focusing through a strongly scattering medium has been an intriguing topic in the fields of optics, acoustics and electromagnetics. By introducing the time reversal technique, prior knowledge about each transmission channel is no longer needed since the step of sending waves through the medium measures this information. Many approaches have been explored to achieve better focusing quality, which is influenced by several factors, such as the propagation loss. We present a method to focus electromagnetic wave at an arbitrary location in ray-chaotic billiards or cavities using the time reversal technique. First, a ray-tracing algorithm calculates orbit information from knowledge of the cavity geometry. We use this information to generate a synthetic signal, which is then sent into the cavity as if it's the time reversed signal in the traditional time-reversal scheme. This method tries to obtain channel information numerically but has limited accuracy due to the loss, the coupling, the mode density, and the existence of chaotic. We discuss the effects of these factors by presenting experimental results on a low-loss superconducting cavity, changing the ports(to modify coupling) and frequency range(to vary the mode density), and modifying the cavity to obtain smaller Lyapunov exponents and thus longer Ehrenfest times to vary the time over which the semi-classical approximation is valid.

Bo Xiao
Univ of Maryland-College Park

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