Abstract

Localization and Diffusion of Transient Waves in Random Media

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Frequency coherence of classical waves in random media is studied by means of the path integral technique. The technique allows the investigation of the two-frequency mutual coherence function to be made in a most general way without regard to the dimensionality of the medium or to the explicit form of the power spectrum of fluctuations. Based on this results the propagation of narrow-band signals is studied on the "microscopic" level, i.e., starting from the wave equation for fields, not from the "macroscopic" diffusion or transport equations for intensities. This enables us to account for the coherent interference of scattered fields, which is disregarded in the diffusion approximation. It is shown that a pulse radiated by a point source in both one- and two-dimensional random media is strongly localized. Explicit expressions for the corresponding localization lengths are obtained. In three dimensions the results interpolate between the ballistic propagation of pulsed waves in forward scattering media and a diffusive regime in strongly disordered systems. For the lowest-order temporal moments of pulse a universal scaling is shown to be held in both regimes: the excess delay time increases with the distance, L, as L^2, while the pulse width grows proportionally to $L^{3/2}$.

¶Presenter