

Wave Statistics in Scattering by Weak Correlated Disorder

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Waves propagating through a medium characterized by weak correlated disorder exhibit intricate branching patterns of fractal appearance. Such branching patterns may be quantitatively understood in terms of caustics or singularities in the corresponding classical flow, and the resulting density variations survive averaging over wavelength and wave propagation directions. We show that the statistical properties of the wave patterns may be obtained analytically as a function of the disorder parameters (disorder strength and correlation length) and the properties of the incoming wave (specifically, the mean frequency, frequency spread, and angular spread). Applications range from 2DEG electron flow to ocean waves refracted by currents and to microwaves in a disordered cavity.