Time-evolution of random laser spectra reflect underlying scattering dynamics

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Kymographs Show Shot to Shot Variation in Random Laser Intensity



Turbid media are found throughout oil exploration, extraction and transportation. Non-invasive methods are required to quantify the microscale structure and dynamics of turbid media. We are exploring a new approach to the optical spectroscopy of turbid media based on random lasing. When multiply scattering media with gain are pumped with a laser pulse, they emit coherent radiation in many spectral lines.

We are characterizing the statistics of random lasing spectra from samples that are nearly identical optically, which have different scatterer dynamics.

We have shown that the shot to shot variation in random laser spectra depend sensitively on the underlying dynamics of scatterers. As shown on the left, the emission spectrum of a gel is effectively stationary, while the emission spectrum of scatterers in a liquid phase vary dramatically from shot to shot.