Universität Konstanz

Seminar
des Centrums für Angewandte Photonik –
CAP

Deterministic and glassy randomness in lasers, a replica symmetry breaking characterization

Abstract: Ultrafast Random lasers are diverse compounds in which multiple scattering provides the feedback mechanism for light amplification under stimulated emission. A large collection of random lasers have been investigated in the recent literature, varying in the microscopic structure, in the mechanisms establishing standing modes, and in the optical properties. In particular, the spectral behaviour of optically active random media above the laser pumping threshold turns out to be either deterministic or glassy.
By deterministic optical randomness we mean that a given random molecular structure yields equal random optical spectra in different experiments.
Whereas, glassy randomness appears when a given piece of random medium yields substantially different spectral patterns under different pumping shots.
We quantitatively characterize what 'different' and 'equal' stay for, in terms of shot-to-shot spectral fluctuations. Inspired by spin-glass replica theory, a method is introduced to discriminate deterministic and glassy randomness by means of breaking of the so-called replica symmetry in the overlap between intensity fluctuations in different shots.

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