Spectral characterization of mutually coupled random lasers

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Abstract

Random lasers are very attractive devices both for photonics applications, due to their ease of fabrication, and for basic research on the physics of light-matter interaction [1]. So far, theoretical and experimental approaches have focused on a single resonator, where the cavity is defined by the ensemble of scattering centers or by the pump spatial extension. However, as for standard lasers, random resonators can be coupled together by mutual injection of light. By shaping the spatial beam of the pump source [2, 3] we succeeded in exciting two random resonators simultaneously, thus inducing strong mutual coupling. Surprisingly, we observe that the same frequencies are activated in different resonators [4]. This is in contrast to what would be expected because, given the pumping conditions, the spectral signature of a random laser is intrinsically unique, as it is related to the random spatial distribution of the scattering centers in its cavity. We perform spectral measurements and spatial characterization of the emission from a coupled pair of random resonators and observe strong mode competition as a function of the pumping conditions and coupling strength. Extending the reported results to a network of coupled random lasers could open the way to a complete new field of applications.

References

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Figures