Turbulence-Induced Rogue Waves in Kerr Resonators

Coulibaly, Saliya

Taki, Majid

Bendahmane, Abdelkrim

Millot, Guy

Kibler, Bertrand

Clerc, Marcel Gabriel

Spontaneous emergence of self-organized patterns and their bifurcations towards a regime of complex dynamics in nonequilibrium dissipative systems is a paradigm of phase transition. Indeed, the behavior of these patterns in the highly nonlinear regime remains less explored, even in recent high-quality-factor resonators such as Kerr-nonlinear optical ones. Here, we investigate theoretically and experimentally the alteration of the resulting Kerr frequency combs from the weakly to the highly nonlinear regime, in the frameworks of spatiotemporal chaos, and dissipative phase transitions. We reveal the existence of a striking and easily accessible scenario of spatiotemporal chaos, free of cavity solitons, in a monostable operating regime, wherein a transition to amplitude turbulence via spatiotemporal intermittency is evidenced. Moreover, statistics of the light bursts in the resulting turbulent regime unveils the existence of rogue