Turbulent chimeras in large semiconductor laser arrays

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Semiconductor laser arrays have been investigated experimentally and theoretically from the viewpoint of temporal and spatial coherence for the past forty years. In this work, we are focusing on a rather novel complex collective behavior, namely chimera states, where synchronized clusters of emitters coexist with unsynchronized ones. For the first time, we find such states exist in large diode arrays based on quantum well gain media with nearest-neighbor interactions. The crucial parameters are the evanescent coupling strength and the relative optical frequency detuning between the emitters of the array. By employing a recently proposed figure of merit for classifying chimera states, we provide quantitative and qualitative evidence for the observed dynamics. The corresponding chimeras are identified as turbulent according to the irregular temporal behavior of the classification measure.