Spontaneous formation of chimera states under global coupling: theory and experiment

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An ensemble of Stuart-Landau oscillators interacting via a nonlinear global coupling may split into two groups, one being synchronized and one being desynchronized. For this so called chimera state a nonlocal coupling was believed to be indispensable, in contrast to our findings. The surprising result can be generalized further by adding diffusional coupling to the ensemble of oscillators. This yields a modified complex Ginzburg-Landau equation being capable of explaining experimental patterns observed during the oscillatory electrooxidation of silicon in flouride containing electrolytes [1,2]. We obtain the spontaneous formation of two-dimensional chimera states in both theory and experiment and conclude that also in this case the global coupling is solely responsible for the symmetry breaking. Thus, we found a new and robust mechanism for the formation of chimera states. As a global coupling is much more frequently encountered than a nonlocal coupling, the occurence of chimera states is considerably more likely than previously anticipated.

1. I. Miethe, V. García-Morales and K. Krischer, *Phys. Rev. Lett.*, **102**, 194101 (2009).
2. V. García-Morales, A. Orlov and K. Krischer, *Phys. Rev. E*, **82**, 065202(R) (2010).