Chimeras in a Network of Three Oscillator Populations with Varying Network Topology

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We study a network of three populations of coupled phase oscillators with identical frequencies. The populations interact nonlocally, in the sense that all oscillators are coupled to one another, but more weakly to those in neighboring populations than to those in their own population. Using this system as a model system, we discuss the influence of network topology on the existence of so called chimera states for the first time. In this context, the network with three populations represents an interesting case because the populations may either be connected as a triangle, or as a chain, thereby representing the simplest discrete network of either a ring or a line segment of oscillator populations. We introduce a special parameter that allows us to study the effect of breaking the triangular network structure, and to vary the network symmetry continuously such that it becomes more and more chain-like. By showing that chimera states only exist for a bounded set of parameter values we demonstrate that their existence depends strongly on the underlying network structures. We conclude that chimeras exist on networks with a chain-like character, which indicates that it might be possible to observe chimeras on a continuous line segment of oscillators.

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