Colloquium # 238

Institute for Plasma Research

Title :   Chimera freed from the constraints
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Date :   25th September 2014 (Thursday)
Time :   11:00 AM
Venue :   Seminar Hall, IPR

Abstract:

A chimera state is a novel and surprising collective state of a system of identical oscillators that are identically coupled. Named after the mythical Greek creature it displays the simultaneous existence of coherent and incoherent behavior within the system. Ever since its discovery about a decade ago the chimera state has aroused a great deal of scientific interest and study across various disciplines of physical and life sciences. Since an ensemble of coupled oscillators is a popular paradigm for studying collective behaviour in many natural systems the chimera state has also raised interesting possibilities. Can it, for example, be used as a model to depict such phenomena as unihemispheric sleep observed in many mammals and birds where one half of their brain is in a synchronous state (sleeping) while the other half is in an asynchronous state (awake). The simultaneous existence of laminar and turbulent behavior in Couette flow is another instance where the chimera state may offer a useful model representation. The restrictions of weak coupling and non-locality of the interaction have limited the applicability of these states towards gaining a more fundamental understanding of their origin.

In our recent work we show that neither the weak-coupling approximation nor non-local coupling are essential conditions for the existence of chimera states. We obtain for the first time amplitude-mediated chimera states in a system of globally coupled complex Ginzburg-Landau oscillators. Our results therefore not only open up a much broader framework for the emergence of chimera states with significant implications for practical applications but also provide fundamental new insights that could aid in the investigation of many open questions on this topic.

The talk will be based on the following two publications:

1. Gautam C Sethia, Abhijit Sen, and George L Johnston, *Amplitude-mediated chimera states,* Phys. Rev. E **88**, 042917 (2013).

2. Gautam C Sethia, and Abhijit Sen, *Chimera* states: the existence criteria revisited*,* Phys. Rev. Lett. **112**, 144101 (2014).