Seminaires du LPTM , Universite de Cergy Pontoise

Mardi 22 Janvier 2019, 11 :00
LPTM, 4.13 St Martin II
Domaines : math-ph

Titre : *Collective behavior of networked phase oscillators : explosive synchronization, dynamically interdependent networks and Bellerophon states*

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Résumé : *I will discuss the spontaneous emergence of some complex collective dynamics in networked phase oscillators.*

As a first step, I will discuss how synchronization can be set in the system. Synchronization is a process in which dynamical systems adjust some properties of their trajectories (due to their interactions, or to a driving force) so that they eventually operate in a collective and macroscopically coherent way. A common result is that the vast majority of transitions to synchronization are of the second-order type, continuous and reversible. However, as soon as networked units with complex architectures of interaction are taken into consideration, abrupt and irreversible phenomena may emerge, namely explosive synchronization, which rather remind first-order like transitions.

In the second part of my talk, I will try to concentrate on a novel coherent state, the Bellerophon state, which is generically observed in the proximity of explosive synchronization at intermediate values of the coupling strength. Bellerophon states are multi-clustered states emerging in symmetric pairs. In these states, oscillators belonging to a given cluster are not locked in their instantaneous phases or frequencies, rather they display the same long-time average frequency (a sort of effective global frequency). Moreover, Bellerophon states feature quantum traits, in that such average frequencies are all odd multiples of a fundamental frequency.

Finally, I will show a way to generalize the concept of interdependence of graphs when dynamical systems are considered to be the constituents of the networks, and in relationship to the setting of collective dynamics.