华侨大学系统科学研究所
Institute of Systems Science, Huaqiao University

# Seminar

## Collective dynamics in two populations of noisy oscillators with asymmetric interactions

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**Abstract:**
We study two intertwined coupled networks of noisy Kuramoto phase oscillators that have the same natural frequency, but differ in their perception of the mean field and their contribution to it. Such a give-and-take mechanism is given by asymmetric in- and out-coupling strengths which can be both positive and negative. We uncover in this minimal network of networks intriguing patterns of discordance, where the ensemble splits into two clusters separated by a constant phase lag. If it differs from π, then traveling wave solutions emerge. Despite its simplicity, the model exhibits a rich dynamical behavior which includes a new route to traveling waves via one-cluster configurations, and bistable regions between all accessible states. This bistability is shown to give rise to abrupt transitions not only between incoherent and partially synchronized states, but also between π- and traveling waves states. These findings provide evidences that different mechanisms other than large frequency mismatches are able to induce such transitions in networks. Analytical results and bifurcation diagrams are derived with a reduced system. In addition, networks of Rössler oscillators under asymmetric attractive-repulsive couplings are explored. Traveling waves are also observed when the phase dynamics coexists with chaotic amplitudes; however, in this case, we show that phase waves are possible even in the absence of global coherence and cluster separation.

**Biography**:
Thomas Peron is a postdoc researcher at the Institute of Mathematics and Computer Science in the University of São Paulo. He holds a PhD on applied physics from the São Carlos Institute of Physics at the University of São Paulo on the theme of collective dynamics of Kuramoto oscillators on complex networks. During one year, he was a visiting PhD student in the group of Prof. Jürgen Kurths at the Potsdam Institute of Climate Impact Research, Germany. His contributions have been published in Physics Reports, Physical Review Letters and other journals.

**时间：3:00-4:00 pm, May. 4, 2018 (Friday)**
**地点：Room B430, Mechatronics Building**
**（机电信息实验大楼B430会议室）**