数学与系统科学研究院

计算数学所学术报告

报告人：Prof. Douglas Zhou

（ School of Mathematical Sciences & Institute of Natural Sciences, Shanghai Jiao Tong University ）

报告题目：

Balanced state in heterogeneous neuronal networks

邀请人： 于海军 副研究员

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上午 9:00-10:00

报告地点： 科技综合楼三层

301 报告厅

Abstract:

The balance between excitation and inhibition is crucial for neuronal computation. It is observed that the balanced state of neuronal networks exists in many experiments, yet its underlying mechanism remains to be fully clarified. Theoretical studies of the balanced state mainly focus on the analysis of the homogeneous Erdos-Renyi network. However, neuronal networks have been found to be inhomogeneous in many cortical areas. In particular, the connectivity of neuronal networks can be of the type of scale-free, small-world, or even with specific motifs. In this work, we examine the questions of whether the balanced state is universal with respect to network topology and what characteristics the balanced state possesses in inhomogeneous networks such as scale-free and small-world networks. We discover that, for a sparsely but strongly connected inhomogeneous network, despite that the whole network receives external inputs, there is a small active subnetwork (active core) inherently embedded within it. The neurons in this active core have relatively high firing rates while the neurons in the rest of the network are quiescent. The dynamics of the active core can be well predicted using the Fokker-Planck equation with the mean-field assumption. Our results suggest that, in the presence of inhomogeneous network connectivity, the balanced state may be ubiquitous in the brain and the existence of the small active core embedded in a large network may provide a potential dynamical scenario underlying sparse coding in neuronal networks.

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