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中山大学物理学院学术报告

Fractional diffusion theory of neural circuits

Speaker：Pulin Gong (Sydney University)

Host：Haiping Huang

Abstract：

Interactions of large numbers of neurons give rise to complex neural dynamics with fluctuations occurring at multiple scales. Conventionally, fluctuating neural dynamics are formulated as balanced, uncorrelated excitatory and inhibitory inputs with Gaussian properties. This theoretical framework, however, is at odds with heterogeneous, non-Gaussian properties widely observed in both neural connections and neural dynamics. In this talk, I will first present a theory called fractional diffusion theory we have recently developed. I will illustrate that this theory and its neural circuit implementation explain and reconcile a diversity of experimental findings on rich, complex dynamics ranging from the synaptic to the circuit level. I will then demonstrate how such complex dynamics emerging from a biologically plausible, spatially extended neural circuit can carry out a type of powerful probabilistic neural computation. Finally, I will demonstrate that applying our theoretical approach to deep neural networks results in a unique understanding of why they work.

About speaker：

Dr Pulin Gong is an Associate Professor at The University of Sydney (USyd). He is the Head of the Theoretical and Computational Neuroscience Group. Before joining USyd, he was a staff scientist at RIKEN Brain Science Institute in Japan. Dr Gong is interested in better understanding the self-organizing mechanisms of brain spatiotemporal dynamics and the principles underlying how these dynamics implement neural computations.

Time: 14:00-15:30, Oct 12, 2021

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