ABSTRACT CONTRIBUTION

Emergence of multifrequency activity in a multi-population neural mass model

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Non-invasive measurements of brain activity such as EEG and LFP frequently capture the collective dynamics of thousands of neurons. One of the characteristic features of these measurements is the presence of oscillations at multiple frequency bands. Understanding how rhythmic patterns emerge and change can not only shed light on how the brain functions but also provide insights into spectral anomalies that are characteristic of conditions such as Alzheimer's disease, Parkinson's disease, and epilepsy [1, 2].

Neural mass models (NMM) aim to trace the principles underlying such macroscopic neural activity from the intricate and multi-scale structure of the brain [3]. Recently, Sanchez-Todo et al. proposed a Laminar NMM (LaNMM) capable of displaying coupled slow and fast oscillations [4], resulting from the interaction between different cortical layers. This simultaneous oscillatory activity allows for studying mechanistically different disease-related spectral dysfunctions.

Here, we analyze how oscillations emerge in the LaNMM through an extensive bifurcation analysis of its parameter space [5]. Our results show that the model is capable of displaying periodic, quasi-periodic, and chaotic oscillations at alpha and gamma frequency ranges. This study enhances our understanding of the LaNMM and holds promise for advancing more accurate whole-brain computational models and effective neuromodulation therapies for neurological disorders.

References

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