Abstract Submitted
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A discrete structure of the brain waves.[1] YURI DABAGHIAN, Rice University, Baylor College of Medicine, LUCA PEROTTI, Texas Southern University, OSCILLONS IN BIOLOGICAL RHYTHMS COLLABORATION, PHYSICS OF BIOLOGICAL RHYTHMS TEAM — A physiological interpretation of the biological rhythms, e.g., of the local field potentials (LFP) depends on the mathematical approaches used for the analysis. Most existing mathematical methods are based on decomposing the signal into a set of "primitives," e.g., sinusoidal harmonics, and correlating them with different cognitive and behavioral phenomena. A common feature of all these methods is that the decomposition semantics is presumed from the onset, and the goal of the subsequent analysis reduces merely to identifying the combination that best reproduces the original signal. We propose a fundamentally new method in which the decomposition components are discovered empirically, and demonstrate that it is more flexible and more sensitive to the signal's structure than the standard Fourier method. Applying this method to the rodent LFP signals reveals a fundamentally new structure of these "brain waves." In particular, our results suggest that the LFP oscillations consist of a superposition of a small, discrete set of frequency modulated oscillatory processes, which we call "oscillons". Since these structures are discovered empirically, we hypothesize that they may capture the signal's actual physical structure, i.e., the pattern of synchronous activity in neuronal ensembles. Proving this hypothesis will help to advance our principal understanding of the neuronal synchronization mechanisms and reveal new structure within the LFPs and other biological oscillations.

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