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Distinct criticality of phase and amplitude dynamics in the resting brain

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Abstract

Converging research suggests that the resting brain operates at the cusp of dynamic instability, as signified by scale-free temporal correlations. We asked whether the scaling properties of these correlations differ between amplitude and phase fluctuations, which may reflect different aspects of cortical functioning. Using source-reconstructed magneto-encephalographic signals, we found power-law scaling for the collective amplitude and for phase synchronization, both capturing whole-brain activity. The temporal changes of the amplitude comprise slow, persistent memory processes, whereas phase synchronization exhibits less temporally structured and more complex correlations, indicating a fast and flexible coding. This distinct temporal scaling supports the idea of different roles of amplitude and phase fluctuations in cortical functioning.

Keywords: Power laws, Criticality, DFA, Amplitude, Phase

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