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Compact Dynamical Equations for Brain Activity JONG WON KIM, PETER A. ROBINSON, School of Physics, University of Sydney, Australia. Brain Dynamics Center, Westmead Hospital and University of Sydney, Australia —
A continuum model of brain dynamics has recently been developed to reproduce and unify many features of electroencephalographic (EEG) signals. We further investigate the model and propose a new, more compact, model based on a single delay differential equation which captures the essential features, such as rapid corticocortical feedbacks and delayed feedbacks from extra cortical pathways. Experimentally observed frequency spectra of EEGs, including resonances, are reproduced in relevant regions of parameter space. In the nonlinear regime, onsets of seizures, which often show limit cycles, are explained by the instabilities of resonances at the boundary of a stability zone in the parameter space. This compact model also shows several other points of agreement with previous models and experiments, and thus provides a theoretical basis for analyzing complex brain activities, especially when they exhibit low-dimensional dynamics.

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