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Poster presentation

A survey of dynamical complexity in a mean-field nonlinear model of human EEG

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A recently proposed mean-field mesoscopic theory of mammalian cortex dynamics describes the salient features of rhytmic electrical activity in the cerebral macrocolumn, with the use of inhibitory and excitatory neuronal populations [1]. This model is capable of producing a range of important human EEG (electroencephalogram) features such as the alpha rhythm, the 40 Hz activity thought to be associated with conscious awareness [2] and the changes in EEG spectral power associated with general anesthetic effect (e.g. the so-called "biphasic" response) [3]. From the point of view of nonlinear dynamics, the model entails a vast parameter space within which multistability, pseudoperiodic regimes, different routes to chaos, fat fractals and resonances occur for a range of physiologically relevant parameter values, giving rise to a multitude of rich and elaborate bifurcation scenarios. Examples of these are the Shilnikov saddle-node bifurcation (see Figure 1 and [4]), the homoclinic doubling cascade and different kinds of resonances. The origin and the character of these complex behaviors and their relevance for EEG activity are illustrated.

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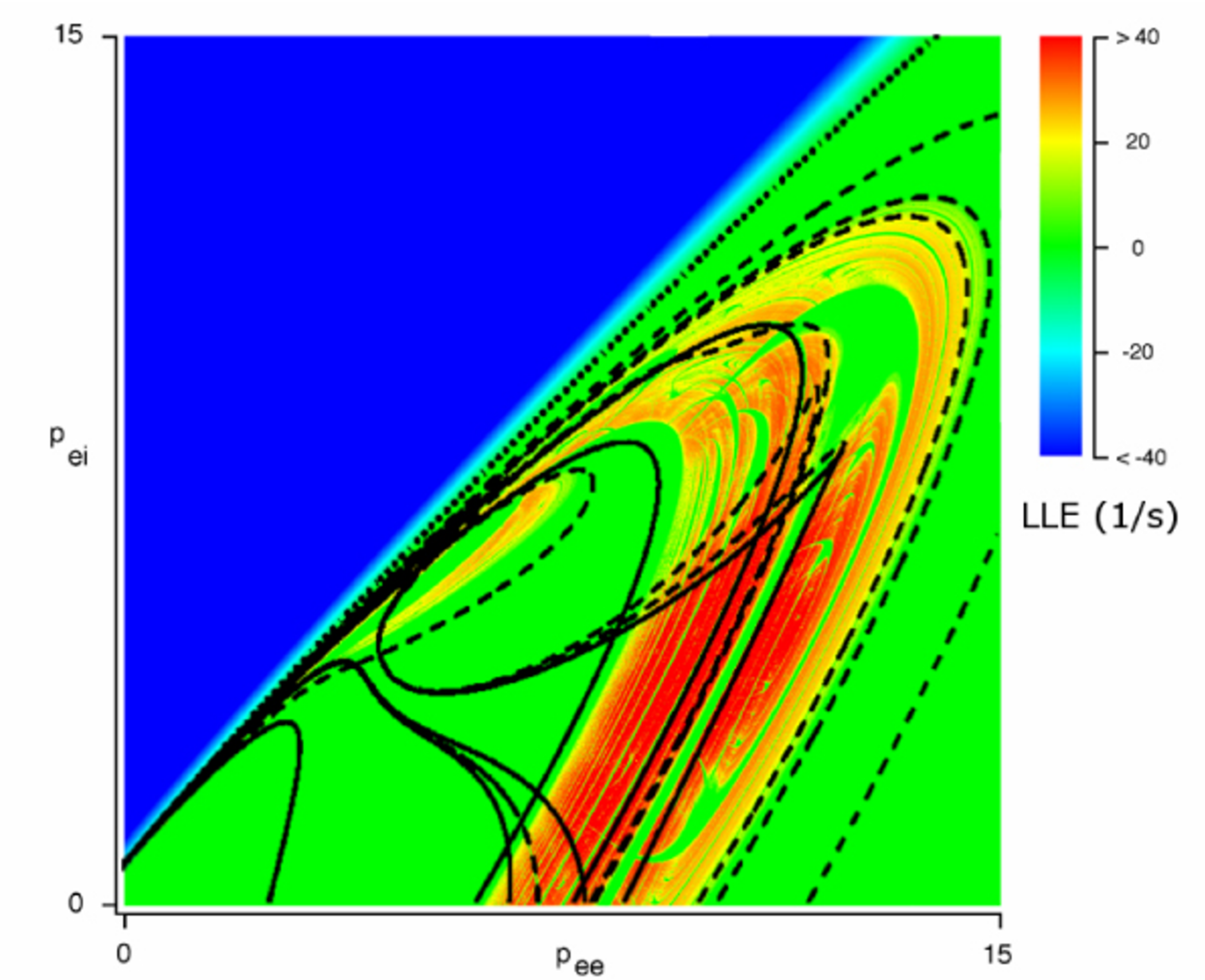

Figure 1

The largest Lyapunov exponent in color reproduced from [4], **with superimposed two-parameter continuation of saddle-node and period-doubling bifurcations for periodic orbits of a mesoscopic mean field EEG model**. The leftmost wedge of chaos terminates for negative values of the exterior forcings p_{ee} and p_{ei}.