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Ergodic properties of spiking neuronal networks with delayed interactions. AGOSTINA PALMIGIANO, FRED WOLF, Max Planck Institute for Dynamics and Self-Organization — The dynamical stability of neuronal networks, and the possibility of chaotic dynamics in the brain pose profound questions to the mechanisms underlying perception. Here we advance on the tractability of large neuronal networks of exactly solvable neuronal models with delayed pulse-coupled interactions. Pulse coupled delayed systems with an infinite dimensional phase space can be studied in equivalent systems of fixed and finite degrees of freedom by introducing a delayer variable for each neuron. A Jacobian of the equivalent system can be analytically obtained, and numerically evaluated. We find that depending on the action potential onset rapidness and the level of heterogeneities, the asynchronous irregular regime characteristic of balanced state networks loses stability with increasing delays to either a slow synchronous irregular or a fast synchronous irregular state. In networks of neurons with slow action potential onset, the transition to collective oscillations leads to an increase of the exponential rate of divergence of nearby trajectories and of the entropy production rate of the chaotic dynamics. The attractor dimension, instead of increasing linearly with increasing delay as reported in many other studies, decreases until eventually the network reaches full synchrony

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