Synchronization of stochastic mean field networks of Hodgkin?Huxley neurons with noisy channels

Bossy, Mireille

Fontbona, Joaquín

Olivero, Héctor

In this work we are interested in a mathematical model of the collective behavior of a fully connected network of finitely many neurons, when their number and when time go to infinity. We assume that every neuron follows a stochastic version of the Hodgkin?Huxley model, and that pairs of neurons interact through both electrical and chemical synapses, the global connectivity being of mean field type. When the leak conductance is strictly positive, we prove that if the initial voltages are uniformly bounded and the electrical interaction between neurons is strong enough, then, uniformly in the number of neurons, the whole system synchronizes exponentially fast as time goes to infinity, up to some error controlled by (and vanishing with) the channels noise level. Moreover, we prove that if the random initial condition is exchangeable, on every bounded time interval the propagation of chaos property for this system holds (regar