

Coherent Brain Rhythms Emerging from Complex Neural Firings

Recently much attention has been paid to rhythms of the brain. Coherence of neural oscillations may be used for efficient sensory and cognitive processing (e.g., feature integration, selective attention, working memory, and decision making). This kind of neural coherence is also correlated with pathological rhythms associated with neural diseases (e.g., epileptic seizures and tremors in the Parkinson's disease). I will give a general talk on these coherent brain rhythms. Particularly, we are interested in coherent cortical rhythms in cognition with irregular and sparse neural discharges. We note that this kind of sparsely synchronized neural oscillation emerges from complex individual neural spiking activities. Noise is inevitable in a real biological environment. Hence, such sparse synchronization is investigated in a population of subthreshold neurons (which cannot fire without help of noise). Stochastic spiking coherence (i.e. collective coherence between noise-induced spiking) with stochastic individual spiking at a lower rate than the population frequency is shown to occur at some intermediate range of noise intensity. Finally, we emphasize that these noise-induced brain rhythms (occurring due to a constructive role of noise) show emergent properties that cannot be reduced to individual behaviors.