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Inhibitory Synaptic Coupling and Spatiotemporal Synchrony in a Neural Model ROXANA CONTRERAS, University of Missouri-Saint Louis, SONYA BAHAR, University of Missouri-Saint Louis — We study the behavior of an array of neurons, connected by excitatory and inhibitory synapses, when the relative proportion of such connections is varied. The cells, described by the Huber-Braun model [1], exhibit different bursting states as parameters such as temperature and coupling strength are tuned. In a recent paper [2], stochastic phase synchronization was studied in this model, using gap-junction type connections. Here, we extend this work to more realistic synaptic connectivities, to investigate the connection between bursting and synchronization, which has been implicated in the triggering of pathological processes such as epilepsy, since synchronous firing in neuronal populations is viewed as a hallmark of seizures. We also present evidence suggesting that noise could be responsible for transitions between various types of field potential oscillations, reminiscent of the transitions between spike-and-wave firing and low voltage fast activity observed in the epileptic cortex. [1] H. A. Braun, M. T. Huber, M. Dewald, K. Schäfer, and K. Voigt. Computer simulations of neuronal signal transduction: the role of nonlinear dynamics and noise. Intl. J. Bifurcation and Chaos 8(5): 881-889, 1998. [2] S. Bahar. Burst-enhanced synchronization in an array of noisy coupled neurons. Fluctuation and Noise Letters 4(1):L87-L96, 2004.

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