Abstract Submitted
for the MAR09 Meeting of
The American Physical Society

Burst switching between incoherence and synchrony NATHAN CROSBY, JOSEPH TRANQUILLO, Bucknell University — Studies of coupled oscillators often use diffusive connections to ensure that the coupled quantity is conserved. Signals between neurons, however, are not diffusive and may propagate unattenuated throughout a network. We compare diffusive and synapse-like coupling of Hindmarsh-Rose (HMR) oscillators through numerical simulations. HMR parameters are tuned to either oscillate continuously or alternate bursts of oscillations and periods of quiescence. In diffusive coupling, two HMR units synchronize bursts and individual oscillations within a burst at nearly the same coupling strength. Synapse-like coupling, however, shows a new behavior, called burst switching, between incoherence and synchrony. For example, a bursting unit can entrain an oscillating unit of a different frequency during the burst but then force the oscillator into quiescence. Burst switching in various network topologies synchronizes inhomogeneous units for the duration of the burst, followed by a period of network quiescence and a return to incoherence. The summed activity resembles the progression of an epileptic seizure including the "spike and wave" at the transition from synchrony to quiescence.

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Date submitted: 24 Nov 2008 Electronic form version 1.4