Abstract Submitted
for the MAR14 Meeting of
The American Physical Society

Modeling criticality in networks of neurons SHANE SQUIRES, ANDREW POMERANCE, EDWARD OTT, MICHELLE GIRVAN, University of Maryland - College Park — A recent series of experiments have suggested that networks of biological neurons operate near a critical point, separating two phases in which firing activity either decays or grows exponentially. In this talk, we propose and analyze a simple model of this behavior. Neurons may be connected via arbitrary networks of activating and inhibiting links, and they fire when their membrane voltage exceeds a threshold value. The main advantage of our model is that we can analyze the effects of network structure on the criticality of the system, while preserving realistic features of neurons, such as threshold-based firing behavior. At the critical point, we reproduce the empirically measured critical exponents for firing avalanches, and we discuss how changes to the network affect the tuning parameter for the phase transition.

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Date submitted: 14 Nov 2013 Electronic form version 1.4