Abstract Submitted
for the NWS12 Meeting of
The American Physical Society

Statistical mechanics of graph models and their implications for emergent manifolds SI CHEN, STEVEN PLOTKIN, University of British Columbia — Inspired by "quantum graphity" models for spacetime, a statistical model of graphs is proposed to explore possible realizations of emergent manifolds. Graphs with a given number of vertices and edges are considered, with a Hamiltonian that favors graphs with near-constant valency and local rotational symmetry. The ratio of vertices to edges controls the dimensionality of the emergent manifold. The model is simulated numerically in the canonical ensemble for a given vertex to edge ratio, where it is found that the low energy states are almost triangulations of two dimensional manifolds. The resulting manifold shows intricate topological structures in a higher dimensional embedding space. The transition is first order, underlying the difficulty of graph models in describing criticality that is independent of the details of the underlying graph. A further perplexing phenomenon is that the entropy of the graphs are super-extensive, a fact known since Erdös, which results in a transition temperature of zero in the limit of infinite system size. Aside from a finite-universe as a possible solution, long-range interactions between vertices also resolve the problem and restore a non-zero transition temperature.

Si Chen
Unversity of British Columbia

Date submitted: 17 Sep 2012 Electronic form version 1.4