Abstract Submitted
for the MAR06 Meeting of
The American Physical Society

Scaling Properties of Topological Neural Nets[1] ALFRED HUBLER, Department of Physics, University of Illinois at Urbana-Champaign, JOSEPH JUN, Department of Physics, Penn State University — We study the agglomeration of metallic particles in an electric field. Earlier it has been shown that this system is a hardware implementation of a neural net [1]. In this paper we study the growth and topological properties of the emerging networks. In contrast to other networks the conductivity of the connections has a fixed value, but the completeness and number of connections depends on the training patterns. We find that the patterns grow in three stages: growth of shooters, ramification, and expansion [2]. The emerging patterns are hierarchical. For the limiting patterns certain properties are highly reproducible, such as the number of end points and the number of branching points, while other properties are not well reproducible, such as the number of tree structures. Further there are power law relations between the mass and the number of branching points and the number of end points. [1] M. Sperl, A. Chang, N. Weber, and A. Hubler, *Hebbian Learning in the Agglomeration of Conducting Particles*, Phys.Rev.E. **59**, 3165-3168 (1999). [2] J. K. Jun and A. Hubler, *Formation and structure of ramified charge transportation networks in an electromechanical system*, PNAS 102, 536–540 (2005).

[1]Supported by by the National Science Foundation Grant No. NSF PHY 01-40179, NSF DMS 03-25939 ITR, and NSF DGE 03-38215

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Date submitted: 25 Nov 2005 Electronic form version 1.4