MICHIGAN STATE
UNIVERSITY

December 3, 2003

Biocomplexity Search Committee
Prof. Rob de Ruyter van Stevenick
Indiana University
Biocomplexity Institute
Swain Hall West 117
Bloomington, IN 47405-7105

Dear Prof. de Ruyter van Stevenick:

This is a letter of recommendation for Radu Dobrin who has applied for a tenure track position at your university. Radu was a Ph.D. student in my group during the period August 1998 – August 2002. He already had a Masters in Physics from Romania and so was able to begin research immediately on arrival here. While here he has also completed a Masters in Computer Engineering, though his goal is an academic career in physics.

Radu was an important member of my group and of our department. He established a nice connection with other strong Romanian students, which has improved our graduate recruiting efforts. He is bright, affable, energetic and personable. He has good physical insight and is keen to interact with his peers.

Radu has learned about and analyzed several model systems during the course of his Ph.D. research. He has also learned many of the central algorithms in computer science and has applied them to physics problems. His first publication in this area (Physica A – 1999) noted that the shortest path problem in computer science is like the directed polymer problem in physics, except that the shortest path problem allows overhangs. Surprisingly even the problem with overhangs is easy to solve using the Dijkstra algorithm from computer science. Dijkstra's algorithm is an invasion algorithm whose growth surface is in the KPZ universality class, provided the disorder is not strong. A second algorithm from computer science, Prim's algorithm, is designed to find the minimum spanning tree in a random system. Radu studied the minimum spanning tree from a physics perspective and showed that it has fractal branches (PRL – 2001). In that paper we also proved that the fractal dimension of the minimum spanning tree is universal. This is one of the few disordered systems in which universality can actually be proven.

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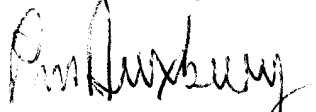
There is also a mapping between the ground state of the random field ising model (RFIM) and a problem in computer science, the minimum cut problem. The minimum cut is in turn related to a flow problem, called the maximum flow problem. Another student of mine (Jan Meinke) is using the maximum flow algorithm to study the equilibrium ground states of the RFIM. Radu is using the algorithms of Dahmen and Sethna et al, to study the non-equilibrium behavior of the RFIM and to compare avalanches at equilibrium and away from equilibrium. Our motivation for studying the RFIM is that Angles d'Auriac and Sourlas recently suggested that the RFIM is non-universal, based on numerical work using the maximum flow algorithm. To check their work, we analytically studied the mean-field RFIM and found that the ground state can have a continuously varying order parameter exponent. In contrast, Rau showed that on Bethe lattices, universality is restored and the order parameter exponent returns to ½. In addition he showed that the non-equilibrium and equilibrium models on Bethe lattices are trivially related (Preprint).

Most recently Radu has become interested in self-similar networks, like those introduced by Barabasi. He has found a way to grow self-similar networks using a combination of algorithm ideas from physics and computer science. In this effort Radu is leading the collaboration and is demonstrating that he is ready to strike out on his own. Radu's postdoctoral work is in this area, in particular on the application of these networks to biophysics. I am looking forward to hearing about his discoveries in this fascinating area.

Radu is an excellent physicist who has developed a broad knowledge and deep insight into modern topics in disordered systems. I recommend him to you without reservation.

Yours Sincerely,



Phillip M. Duxbury
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