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Dear Colleague,

My previous graduate student Dr. Yohannes Shiferaw has asked me to write a letter of recommendation on his behalf and I am glad to abide. Yohannes has worked with me from May 1998 until August 2001 when he received his Ph.D. in Physics.
At the outset I would like to point out that Yohannes was an excellent student, among the very top graduate students in condensed matter theory that we had in the last decade.

Yohannes' Ph.D. work and subsequent collaboration with me resulted in four published papers in refereed journals plus a book chapter that is scheduled to be published in 2005. In all of these papers he was an equal collaborator and contributed significantly to the results. Let me summarize this work briefly.

In his first project I asked him to try and solve exactly a model for a polymer in a random potential with long-range, quadratic correlations. As opposed to directed polymers, the potential depends only on position in space and is independent of 'time' which in this case is the monomer label along the polymer. Yohannes solved the problem using path integrals and quickly realized the different behaviors of a chain with both ends free to move versus a tethered chain with one end fixed. He also suggested checking the results obtained by using the replica method by solving the imaginary time Schrödinger equation in one dimension in the presence of a long range correlated random potential.

This project led to his second project, involving a polymer chain in a short-ranged correlated potential. In the previous year I corrected the variational treatment of Edwards and Muthukumar and obtained for the first time a 1-step replica-symmetry-breaking solution of the problem that had all the desired behaviors, and predicted the subtle logarithmic dependence on the volume of the system as previously conjectured by Cates and Ball using heuristic arguments. Yohannes had in mind to give the replica solution a physical interpretation along the lines used by Mezard and Parisi for directed polymers. This interpretation connects the problem directly to the problem of an electron or another type of quantum particle in a random medium. The connection was noticed before by Nattermann and Renz but a detailed investigation was not carried out. In particular the replica solution showed how to obtain the localization length of a chain that is free to move from the density of states of electrons in a random potential. Yohannes used solutions of the Schrödinger equation to check for consistency of the mapping in the polymer language and to tie up all the loose ends together.

After finishing his dissertation we proceeded to work on two other important problems related to polymers in random media. In the first we considered a polymer in a sea of hard obstacles situated at random. We have found that depending on the volume of the system the size of the polymer behaves differently as a function of the concentration of obstacles. Several regimes were identified and it was shown the problem is quite different from a random potential with a Gaussian distribution. In particular the limit of large volume is totally different.
In another paper we considered a chain with self-avoiding interaction as opposed to a Gaussian chain considered in earlier papers. A new conformation of blobs and connecting lines occurs and we have identified a delocalization transition as a function of the strength of the self-avoiding interaction compared to the strength of the random potential. Our work on polymers will appear soon as a book chapter in "Statistics of Linear Polymers in Disordered Media", edited by B.K. Chakrabarti, Elsevier 2005

Yohannes surprised me several times by his willingness to read very difficult and formal papers on spin-glasses that had bearings on our problem in order to extract the elements necessary for applying it in the current context. His analytical skills are outstanding. His numerical skills are also excellent and he used with ease the new cluster of parallel processors built in our department. I could always trust his numerical results. He is also a gifted teacher and he was a awarded the Best Teacher award for teaching assistants based on student evaluations of his teaching in recitation sections.

After finishing working with me, Yohannes decided to go in the direction of biological physics where his numerical and analytical skills can play an important role. He had postdoctoral appointments at Northeastern University and subsequently at UCLA. You can learn from them about his accomplishments in this field.
Yohannes is comparable to Pik-Yin Lai, a former graduate student of mine, who is now a full professor at the National Central University in Taiwan.
He has a pleasant personality, and he is fun to work with. I recommend him very strongly for a faculty position in the areas of condensed matter physics/ biological physics/ mathematical modeling of complex systems.

Sincerely yours,

Y. Goldschmidt

Yadin Y. Goldschmidt
Professor of Physics