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Faculty Search Committee
Department of Physics
Indiana University
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Bloomington, IN 47405-7105

Letter of Recommendation for Dr. Maria Gracheva

Dear Sir or Madam:

I am writing with regard to Dr. Maria (Masha) Gracheva, who is applying for a faculty position in your department. Masha worked for me for about two years as a postdoc and I have a very high regard for her. She is a talented, well educated and exceedingly hardworking scientist whom I expect will have an excellent scientific career. She has a very good background in theoretical physics gained during her education in Moscow and also possesses very strong computational skills. Her research experience has been quite broad. She worked on vortex dynamics in high temperature superconductivity for her PhD, which yielded results in agreement with experimental observations and resulted in several publications. She was also involved in a substantial project with Professor J. Rickman (Materials Science, Lehigh) and myself aimed at determining the Ginzburg-Landau free energy function for Lennard-Jones systems for two phase coexistence. This function is the starting point for the field theoretic approach to the kinetics of first order phase transitions (nucleation and growth, spinodal decomposition and coarsening, ...), but (except for the Ising model) has never been calculated starting from a microscopic model. We were able to calculate this function for liquid-gas coexistence, using Monte Carlo simulations together with finite size scaling theory. We have subsequently been trying to extend this calculation to liquid-solid coexistence. The latter project is still ongoing and has proved to be very difficult. Masha was quite clever at applying various biasing techniques to sample infrequent events (necessary to obtaining the free energy function in two phase coexistence) and has mastered most of the techniques in the literature. She also became an expert at Monte Carlo and molecular dynamics simulations during this time. I have been impressed with her ability to see her way through complex problems as well as with her persistence in these matters.

She also played the lead role in a collaboration with myself and Professor Raul Toral (Spain) in studying stochastic effects in cell-cell signaling, with our particular interest being intercellular calcium oscillations. She learned this new subject quite quickly and readily mastered the numerical techniques necessary to extend and solve current models in the field. We published two papers on this topic, plus a short article in a conference proceeding.

Masha has recently worked with Professor Hans Othmer at the University of Minnesota, where she has been involved in modeling various aspects of cell motion. This is a very difficult, important topic and Masha has clearly mastered the literature and computational techniques used in the field. Although Professor Othmer is more able to judge her role in this collaboration, it is my impression that their work is thorough, interesting and, perhaps, groundbreaking in terms of their continuum formulation. At this point Masha now has a thorough understanding of many aspects of theoretical/ mathematical biology and is well equipped to have a successful career in this field. Her combination of theoretical and computational skills is a wonderful asset.

She also has considerable teaching experience. She taught our first year physics labs for physics and engineering students and received good evaluations from both the students and the professor in the course. In addition, she substituted for me on several occasions in upper division physics courses and was well received by the students. She has subsequently taught undergraduate mathematics courses at the University of Minnesota, so she has considerable breadth in her teaching.

Masha is also a delightful person, with a good sense of humor. She is somewhat reserved, so that it takes a bit of time to get to know her, but she is a person of high integrity and intelligence. Her spoken English is fine (although she doesn't believe this!), and her writing skills have become quite reasonable. I have thoroughly enjoyed working with her and believe that she will have an outstanding academic career.

Sincerely yours,

Jim Gunton

Jim Gunton
Professor of Physics