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To,  
Prof. James A. Glazier  
Director, Biocomplexity Institute  
Department of Physics  
Swain Hall West 159  
727 East Third Street  
Indiana University, Bloomington  
Bloomington, IN 47405-7105  
USA

Dear Professor Glazier,

I am writing in support of Dr. Rahul Kulkarni's application for a faculty position in your department. I have known Rahul as a postdoc in Professor Cox's group at the University of California at Davis. We have collaborated on the study of 'prion diseases' and I have had many discussions with him on other physics topics. I think he is an excellent candidate for a junior faculty position, with a very thorough preparation in mathematical methods and an extremely broad interest in physics and biology.

What clearly stands out about his research training and record so far, is the diversity of topics he has worked on and the number of theoretical techniques he has mastered. Rahul has worked on molecular dynamics and ab initio density functional calculations. He has applied many-body methods to study thermally driven volume-collapse transitions in valence tautomers. He has obtained a number of exact results in statistical mechanical studies of fractional vortices in XY models and architecture of small world networks. All of the studies are supported by extensive numerical simulations of various kinds. It would be very difficult to find another candidate with such a broad range of expertise ranging all the way from density-functional methods to rigorous statistical mechanics.

The one subject, we have collaborated on, is the statistical mechanical studies of prion diseases. This is a fascinating topic, which challenges the conventional view of diseases in biology, and thus opens a new window into an important aspect of life processes— protein folding versus their misfolding and aggregation. As we are learning more about these things, we are finding that misfolding and aggregation of proteins is a very widespread problem, that needs to be understood in many contexts.

For prion diseases, we have developed a simple statistical mechanical model for the autocatalytic misfolding and aggregation of prion proteins. Our study focusses on the long disease incubation-times as well as incubation time distributions, and allows us to address several aspects of the laboratory and epidemiological data. In our collaboration, Rahul made two key contributions: (i) He played a major role in developing the analytic theory, *i.e.* in carrying out calculations of distribution functions in analytically tractable limits, and (ii) He developed almost encyclopedic knowledge of the phenomenology of ‘prion-diseases’, including details of epidemiological and pathological issues, which have been crucial in shaping our research on the problem.

In our department, Rahul gave excellent talks on two different subjects, (i) Fractional vortices in XY models and (ii) Small world networks. His talks were very clear and well organized. He was in complete command of both the ‘exact’ and ‘numerical’ aspects of the problem. I have no doubt that he can communicate his ideas very well and would turn into an excellent teacher, when the opportunity arises.

Since moving to NEC, I believe Rahul has done some very interesting work relating to bioinformatics. I am not familiar enough to comment on that work. You would surely hear about them from his other letter writers.

In short, I have the highest regard for Rahul’s scientific capabilities. He is clearly one of the strongest postdoctoral researchers I have seen in our department. The combined strength of wide ranging technical expertise and broad interests make him an outstanding candidate for a junior faculty position.

Yours sincerely,

Rajiv R P Singh  
Professor of Physics