January 16, 2004

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

Dear Prof. Glazier:

It is a pleasure to write in behalf of RAHUL KULKARNI, whom you are considering for a faculty position.

Rahul was my Ph. D. student between 1996 and early 2000. He did important and highly original work in at least two distinct areas, and also made some significant contributions to a third. Considering this work, and his subsequent contributions, I certainly rank Rahul as one the most outstanding young scientists I have seen.

Rahul's first project was to calculate the diffusion coefficients in liquid Ge and its alloys. This challenging problem came up as part of a NASA microgravity program. My role was to provide the theoretical input to an experiment to be carried out on the space shuttle by Prof. David Matthiesen of Case Western Reserve University.

Rahul brilliantly solved this problem. Since liquid Ge is actually a metal, but still with some residue angle-dependent forces characteristic of the semiconducting solid, I suggested to Rahul that he could use the *ab initio* molecular dynamics method. In this approach, the forces on the atoms are calculated from first principles, using the Hellmann-Feynman theorem. Rahul took the initiative of traveling to Berlin to learn how to use a code which accomplishes this. Later, he adapted the more powerful VASP code for the same purpose. He then calculated, not only the atomic diffusion coefficient, but the electrical conductivity, structure factor, and electronic density of states, all in excellent agreement with available experiment. He also went further and computed the properties of several liquid alloys.

It is safe to say that Rahul was crucial to my NASA project. Rahul's work was recognized by an invited talk at the Centennial meeting of the American Physical Society in March, 1999. This work alone would have been quite sufficient for a Ph. D.

In 1999, Rahul jumped into the exciting subject of Small World Networks, which had just been invented. These network, which interpolate between and ordered and a random system, have been shown to apply to many biological systems (e. g. biochemical networks). Rahul produced the first scaling hypotheses for both the structure and dynamics of these networks, and confirmed both hypotheses numerically. I was greatly impressed that Rahul (i) had the insight to see the importance of this type of system, before almost anyone else, (ii) thought of several original applications and extensions, and (iii) carried out these extensions and did several complete pieces of work in a short time. This work immediately attracted widespread attention, and led to another invited talk at the 2003 APS March meeting. I feel that this work showed an originality far beyond that of most graduate students.

Rahul's third Ph. D. project is on fractional vortices in Josephson junction arrays. Once again, the impetus for this project was Rahul. He has added to this project recently with another paper on fractional vortices in Josephson ladders, which I think may be a physically achievable geometry.

Rahul's more recent work at Davis and Princeton shows that he has become an important and widely recognized contributor in modeling of biological systems. I understand that this work has also led to several invited talks at prominent conferences. It is clear that he will be producing many original ideas in the future, and that he is already a leader in these fields.

In short, I certainly believe that Rahul is of the quality you would want for a faculty member in a major research university, and that he has already made substantial contributions. I expect he will continue to make significant contributions, and will become an important and recognized figure in biology and biological physics. I recommend him to you with great enthusiasm.

Yours sincerely,

David G. Stroud
Professor of Physics