

20 December 2003

Biocomplexity Faculty Search Committee
c/o Rob de Ruyter van Steveninck
Biocomplexity Institute
Indiana University, Swain Hall West 117
Bloomington, IN 47405-7105

Dear Colleagues:

This letter is written in support of Mukesh Dhamala, who has applied for a faculty position in your department. I have known Mukesh since March 2001, when he came to interview for a postdoctoral position in my nonlinear dynamics group. Mukesh had just the mix of experience I was looking for, and he was offered the position. In Atlanta, he was engaged predominantly in our collaboration with an experimental neurobiology group at the Emory School of Medicine. This project combined elements from neurobiology and computational dynamical systems theory. He also did a bit of physics research with me on the theory of coupled nonlinear oscillators, specifically as it applies to superconducting electronics.

The combination of Mukesh's experience makes him well suited for a career in computational biology or computational dynamical systems theory. He is experienced in applying techniques and algorithms; he is not likely to prove theorems. His productivity during his time in Atlanta might seem a bit low, but that is deceptive because both projects (neurobiology and coupled oscillators) were entirely new topics for him. As he explained to me during his interview, he hoped to use his postdoctoral training to increase his breadth as much as he could. I think this was a mature strategy in preparation for a job in academia. And with his choice of postdoctoral positions, first in Atlanta and then in Tallahassee, he has certainly branched out in new directions. The tools that he learned in graduate school are highly portable, namely methods (largely numerical) for analyzing chaotic dynamics and complex systems. This gives him the flexibility to do research over a very broad range of topics.

Our neurobiology project in Atlanta is an attempt to marry modern methods of time series analysis to experimental data of brain activity. Our approach is very new and somewhat speculative, though recognized as promising enough that the NIH agreed to fund it. The spatiotemporal brain data from fMRI measurements presumably reflect the (human) mental state while doing simple physical or cognitive tasks. The big question is: how does one reduce the enormous spatiotemporal data sets to identify the underlying correlations? The standard approach in neuroscience has (we argue) a number of drawbacks and virtually ignores the techniques developed over the past two decades by nonlinear dynamicists studying other complex systems. While in Atlanta, Mukesh was the main force behind the effort to locate suitable dynamical measures.

In the coupled oscillator work, Mukesh and I focused on superconducting circuits known as Josephson arrays. Our goal was to get analytic and physical insight into the conditions under which these oscillators which mutually and spontaneously synchronize.

Spontaneous synchronization occurs in many many different contexts, including mechanical, electrical, chemical, biological, neurological, ecological, and even social systems. We focused on Josephson arrays because in addition these have technological significance. Our progress was very gratifying to me. We discovered a general stability condition for synchronization -- really, a major achievement in such a well-studied subject. The new idea behind the discovery was not his, but Mukesh executed both the analytic and numerical calculations with care and precision. The breakthrough achieved when he was here has been important in my group's work since Mukesh left for his current job, namely investigation of the related problem of superconducting transmission lines, which represent the state of the art in ultra-high frequency superconducting oscillators.

Mukesh is an extremely pleasant individual, and would be a very helpful colleague. I doubt he will be a leader in your department, but he would certainly be an excellent team player. His English skills are good; he is a fluent speaker of English. His technical oral presentations are good, though not outstanding. Two years ago, when Mukesh first applied for faculty positions, I was not confident that he was ready to be successful as an assistant professor: although I felt he could handle the teaching side of the job very well, I wasn't sure that he was ready to run his own research program nor to guide students in their research. Now, with another 18 months under his belt, I feel much better about his preparation for a tenure track faculty position.

If you think I can be of any further assistance, please feel free to contact me.

Sincerely,

A handwritten signature in black ink that reads "Kurt Wiesenfeld". The signature is written in a cursive style with a large, stylized initial "K".

Kurt Wiesenfeld
Professor of physics