

Avishek Kumar: Wally Stoelzel Physics Fellowship

Personal Statement

I would like to be a professor of physics because I find research and teaching consuming, exciting and rewarding. It has become increasingly clear to me that a regular “nine-to-five” job would be very unsatisfying; I prefer to have a challenging job that allows me to critically think and take pride in my professional accomplishments. Specifically, I would investigate problems in biological physics and material science while teaching students physics. I first became interested in biological physics as an undergraduate because I have always been in awe of nature’s ingenious design. Upon entering graduate school, I began working on problems in material science to add variety to my knowledge base and find the field intellectually stimulating. Education is an invaluable component in any person’s life, and I find it rewarding to stimulate others toward high levels of achievement.

Even as a child I have always wanted to accomplish something, to have a career and to make a contribution to society: I was drawn to science in high school as a way to achieve my goals. My first exposure to physics was in high school. Initially I struggled with physics concepts and mathematics. But I found the subject fascinating and endured, developing a penchant for working in the late hours of the night and rising to the top of my class. By the end of high school, I was the top student in physics and mathematics.

I attended Carnegie Mellon University as an undergraduate and majored in physics. At CMU, my blossoming interest in science was refined into a set of technical skills. I took numerous courses in biology, chemistry and physics, giving me an, unusually, interdisciplinary background. I learned that I enjoyed teaching physics as a teaching assistant, and I held multiple leadership positions in student organizations (including president of the Society of Physics Students). My undergraduate years were also my first exposure to scientific research. I investigated problems in biological physics relating to lipid membranes and lipid-coated gold nanoparticles for use in Surface Enhanced Raman Scattering—the latter was published in the Biophysical Journal. By the end of my time as an undergraduate, it was clear that I could be passionate about a career in research. Instead of following the normal course after undergraduate, getting the “nine-to-five” job, I choose to pursue my PhD studies at Arizona State University because of its interdisciplinary environment and strong research interest in biophysics.

Upon entering ASU, I was awarded a GAANN (Graduate Assistance in Areas of National Need) fellowship (\$30,000) in my first year, allowing me to waste no time pursuing my research interests. While many of my former undergraduate classmates reported their hate for their jobs, I found that graduate school was definitely the correct choice for me. I began working with Professor Michael Thorpe to computer-generate structures of amorphous graphene. I choose this particular project in condensed matter theory in order to diversify my skills and background. My work in amorphous graphene allowed me to travel to Oxford University in the summer following my first year and I will return to Oxford again this coming summer. The amorphous graphene networks I have designed have engendered further studies by other researchers outside of ASU. Professor David Drabold (Ohio University) is currently investigating the band gap structure and rippling effect of amorphous regions of graphene, and Professor Mark Wilson (Oxford University) is investigating alternative means of creating amorphous

graphene by freezing a liquid form of carbon. The second thrust of my PhD research is in protein science. I use rigidity theory to study the pathways proteins explore to travel from one conformational state to another. In addition to my research, I completed my coursework with a 4.0 GPA, and serve as a member of the graduate seminar committee (Next year I will be the chair of the committee and intend to create a journal club for graduate students of the Center for Biological Physics.) For my time at ASU, I plan on developing my computational, mathematical, communication and leadership skills. My PhD will consist of problems in materials science and biological physics. After graduate school I will pursue an academic position.

Publications

- Stephan M. Woods, Katrice E. King, **Avishek Kumar**, Roberta E. Redfern, Alonzo Ross, Arne Gericke, *Lipid Bilayer Covered Gold Nanoparticles Provide Insight into Proteins' Conformational Changes*, Biophys J.96 (2009).
- Vitaliy Kapko, **Avishek Kumar**, David Drabold, Michael Thorpe, *Electronic Structure of a realistic model of amorphous graphene*, APS March Meeting Abstract (2011).