

PHYSICS & ASTRONOMY COLLOQUIUM UNIVERSITY OF WISCONSIN – STEVENS POINT

FRIDAY, November 21, 2014 at 2:00 P.M. (Room A-109 SCI)

Refreshments will be served beginning at 1:50 p.m.

Physics at the Intersection of Biology: The Mechanics of Cellular Filaments

Dr. Taviare Hawkins – Assistant Professor of Physics, University of Wisconsin-La Crosse

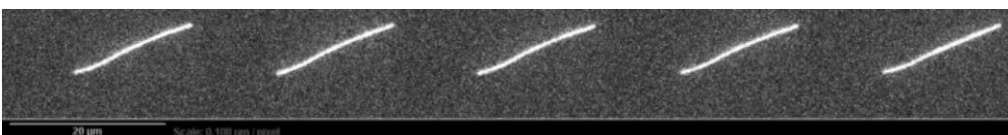
About the Speaker:



I attended the University of Iowa in Iowa City, Iowa, where I received my BS in Physics and a minor in African American Studies. I left the world of academia for three years and became a Real Estate Asset Manager for the Resolution Trust Corporation in Manhattan. I then entered graduate school at Syracuse University where I completed a MS degree in Computer Science, as well as a MS and a PhD in Physics. I went onto postdoc at the University of Massachusetts-Amherst. I have taught physics at Syracuse University, Xavier University of Louisiana, Mount Holyoke College, and now at the University of Wisconsin-La Crosse. My research involves working on problems that lie at the intersections of physics, mathematics, engineering, biology and chemistry. I am a biophysicist who uses the quantitative skills and methods I learned in physics to gain a better understand how living cells do what they do. Understanding the mechanical and dynamical properties of microtubules, in addition to, how microtubule associated proteins work to fine-tune these properties within cells is where my research is currently focused.

ABSTRACT:

Some of the most interesting science lies at the intersection of biology and physics. Filament mechanics has been an active branch of research for statistical and soft matter physicists for many years. Nano- and bio- engineers are attracted to this topic of research for use as scaffolding in nano-scale structures in new materials and for use as containers for targeted delivery of medicine in the cell. Microtubules, the largest filaments in the cytoskeleton, show great promise for developing research in this area. Microtubules play an important role in cellular division, intracellular transport and defining the structural shape to the cell. Each of these functions requires that microtubules be stiff when forming the scaffolding for the cell and flexible when the cell needs to divide. Measuring the mechanical properties of microtubules has been an active branch of research for more than 30 years, however a consensus has not been reached regarding their measured stiffness. We are interested in the mechanical properties of microtubules and how this property may be altered by purification, labeling, age, or the presence of microtubule-associated proteins (MAPs) that are typically found in the cell. We used the freely fluctuating method to probe the mechanics of microtubules. Confined inside a 2-dimensional thin chamber ($<3 \mu\text{m}$), fluorescently labeled microtubules were imaged. To improve the accuracy over previous determinations of the rigidity, we used Fourier mode analysis and bootstrapping statistics. We determined that the purification process and the age of the microtubules do have an effect on the stiffness of microtubules but the rhodamine labeling process used to image the microtubules does not.



Fluorescent labeled microtubules undergoing fluctuations due to thermal interactions.