T_CSUH Bi-Weekly Seminar

Texas Center for Superconductivity
University of Houston

Prof. John H. Miller, Jr.

Department of Physics and T_CSUH
University of Houston

Mechanisms and Detection of Biological Molecular Motors

Friday, October 31, 2008
Room 102, University of Houston Science Center
12:00 Noon – 1:00 p.m.

Abstract

Rotary motors, including ATP synthase and the bacterial flagellar motor, play critical roles in living organisms. ATP synthase produces ATP, life's chemical currency of energy, in all three domains of life – bacteria, archaea, and eukarya. In humans, ATP synthase operates in the inner membranes of mitochondria. I will describe our recently developed electric field driven torque model of ion-driven rotary motors. The model predicts a scaling law that relates torque to the number of ion-carrying subunits in the rotor, the number of stators, and the ion motive force across the membrane. When the F0 complex of ATP synthase is coupled to F1, the model predicts a critical proton motive force below which ATP production drops to zero. In a human, such a drop in ATP would lead to unconsciousness and, eventually, death. We have also been measuring electromagnetic properties, such as impedance and harmonic responses, of live cells, mitochondria, and chloroplasts, in an effort to detect activity of active enzymes and changes in membrane potential. Dysfunction of mitochondrial enzymes has been implicated in type-2 diabetes, cancer, heart disease, Alzheimer's disease, and numerous specific mitochondrial disorders. Therefore, improved understanding of ATP synthase and other enzymes of mitochondrial respiratory chain is broadly significant to human health.

Bio

Prof. Miller received his Ph.D. at the University of Illinois in 1985, where he studied the dynamics of charge density waves under the direction of John Tucker and two-time Nobel laureate John Bardeen. He was a faculty member in the Department of Physics and Astronomy at the University of North Carolina - Chapel Hill from 1986-1989, receiving the prestigious Alfred P. Sloan Research Fellowship in 1987. In 1989, he joined the University of Houston as a faculty member in the Department of Physics and the Texas Center for Superconductivity. Prof. Miller's research has included experiments probing the pairing state symmetry of high-T_c superconductors, applications of superconducting quantum interference devices, and noninvasive biosensors and their use to probe the electromagnetic properties of live cells and complex biological macromolecules.

Persons with disabilities who require special accommodations in attending this lecture should call (713) 743-8210 as soon as possible.

T_CSUH
TEXAS CENTER FOR SUPERCONDUCTIVITY