

# T<sub>c</sub>SAM Bi-Weekly Brown Bag Seminar

Texas Center for Superconductivity and Advanced Materials



**Prof. John H. Miller, Jr.**  
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University of Houston

## “Electromagnetic Properties of Live Cells and Proteins”

**Friday, September 17, 2004**

Room 102, Houston Science Center

University of Houston

12:00 noon – 1:00 p.m.

### Abstract

A live cell in an electrolyte or other extracellular medium has a finite membrane potential due to a net negative charge in the interior, and can thus be polarized by an applied electric field. In addition, most proteins in their native (folded) state are either electrically charged (e.g. actin, which self assembles into 8-nm diameter filaments) or have a net electrical dipole moment (e.g. the *a-b* tubulin heterodimer). These properties lead to enormous dielectric responses at low frequencies, which can be probed non-invasively at various length scales. We observe changes with time in the dielectric properties of *a-b* tubulin heterodimers as they self assemble to form 25-nm diameter microtubules, a major component of the cellular cytoskeleton. In addition, we have been studying live cells, and, for example, have observed substantial reductions in the dielectric response of eucaryotic cells when exposed to respiratory inhibitors, such as cyanide, that attack the mitochondria. This is significant because it shows the technique can non-invasively probe the metabolic states of these internal organelles. More recently, our group has found possible evidence for novel phase transitions in the temperature-dependent dielectric responses of some biological systems, such as *E. coli*.

### Brief 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 Dept. 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<sub>c</sub> 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.*

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