

WINTER QUARTER 2007 COURSE ANNOUNCEMENT!!

“Organic Electronic, Photonic, and Magnetic Materials”

Physics 880K20
Call Number 16895-8
(Grade A-E)

or

Chemistry 693
Call Number 04776-1
(Grade S/U)

Instructor: *Arthur J. Epstein*

Monday and Wednesday
12:30 to 2:18 pm
CE 0110

Course content: This course introduces the physics, chemistry, and applications of organic- and polymer-based electronic, photonic, and magnetic materials and their phenomena and applications. This includes the electronic structure of molecules, polymers and solids, and the relation to their electrical conductivity, photonic response, and magnetism of conventional metals and materials.

Tentative Course Outline:

- Introduction to classes of magnetic and electronic organic- and polymer-based materials and properties
- Introduction to electronic structure of molecules, polymers, and band structure of solids
- Introduction to role of electron-phonon (vibration) interaction and electron-electron (Coulomb) interaction
- Introduction to exotic "particles" including solitons, polarons, bipolarons, excitons, etc.
- Introduction to SSH Hamiltonian.
- Introduction to electrical conductivity of conventional metals (such as sodium or copper) and semiconductors (such as silicon or GaAs)
- Introduction to quasi-one-dimensional conducting organic electron transfer materials (metal-insulator transition of TTF-TCNQ; superconductivity in BEDT-TTF-TCNQ)
- Metallic polymers (doped polyacetylene, polythiophene, polypyrrole, polyaniline) - why and how do they conduct electricity
- Applications of conducting polymers (EMI shielding, ...)

- Semiconducting polymer and molecular materials
- Device physics of semiconducting polymers and molecules (LEDs, transistors, photovoltaics, sensors, ...)
- Nanostructures based on electronic polymers and their properties
- Bioimplications of electronic polymers
- Introduction to magnetism in conventional materials
- Introduction to organic and polymer-based magnets
- Phenomena unique to organic and polymer-based magnets (fractal behavior, photoinduced magnetism, spintronics, ...)

Requirements: There will be two documents due: (a) at the end of the 5th week there is a one-half to one page description of a topic a student plans to explore in a later 8 page double spaced paper. The 8-page paper is a qualitative introduction to, or a survey of a topical sub-area, and is based on several published articles. This is to be written in the style of a journal article (Phys. Rev. Lett., Applied Physics Letter, JACS) addressing a particular organic-based electronic material or phenomenon. The papers of students registered under the Chemistry call number are to reflect the student's chemistry background. Students may submit a more device oriented paper to reflect their background. Also, during finals week there will be an oral presentation by the students based on their 8-page paper. Additional information will be provided in the course syllabus.

Note: There will be no classes the week before finals (March 5-9, 2007) as this coincides with the American Physical Society Meeting. The hours have been integrated into the regular class sessions (12:30-2:18 Mon./Wed.).

Registration: Registration is open to graduate students in the Physics, Chemistry, and Engineering departments. With permission of the instructor, advanced undergraduate students may also register for this course.

Additional information: Please contact Dr. Arthur J. Epstein (epstein@mps.ohio-state.edu).