PHS 564: Light and electron optics
(cross-listed with BIO 594 in summer 2004)

ASU Main Campus, Physical Sciences Center, room H-563
Instructor: David Smith, Regents Prof. of Physics, ASU

Course Objectives:
Study basic principles of light and electron optics, and explore applications to very large objects (astronomical scale) and very small objects (atomic scale).

Topics:
1. Introduction and overview: Many objects are invisible to the naked eye but become accessible to observation using light or electron-optical instruments. Telescopes allow exploration of the far-flung corners of the universe, and microscopes permit exploration of the atomic structure of matter. Simple physical concepts of reflection, refraction and diffraction can be equally well applied to light and electrons, and they will be used to explain the basic operating principles of optical and electron-optical instruments. These topics will be outlined, and applications will be described. Students will get practical experience using optical and electron microscopes, and modules that might be suitable for high-school classrooms will be explored and developed.

2. Reflection, refraction and diffraction: these physical phenomena form the basis for all optical and electron-optical instruments and observations. Similarities and differences between light and electrons will be discussed

3. Microscopy, spectroscopy and holography: these techniques all rely on reflection, refraction and/or diffraction of light or electrons, but important distinctions need to be made because of the differences in wavelength and energy.

4. Instrument design: microscopes, telescopes, and spectrometers utilize light or electrons to provide observation of objects that are not visible to the unaided eye.

5. Applications using light.
6. Applications using electrons.

Type of Work and level
Class activities will include lectures, open discussions, demonstrations and student presentations, as well as tours of campus research facilities and hands-on practical experience. Basic knowledge of geometry, algebra, and trigonometry is expected, & a course in algebra-based physics.

[Note from Jane Jackson: This course received excellent evaluations from teachers in summer 2001 -- it was the top-rated course. David Smith loves his research, loves to teach, and loves to make this subject understandable. He says with great energy, "EVERYONE should take this course!"]