Tentative Syllabus for Physics 524: Physical Optics and Experimental Spectroscopy  
Spring 2007  
M, W  6:00 – 7:15PM  
W  7:30 – 9:20PM  Lab  
Instructor:  Mark F. Masters, Ph.D.  
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Office Hours:  M 13:00 – 15:00, W 11:00-13:00 but you guys know where you can find me!  
Initial text: Optics by Hecht (I hate this book but you all have it).  This will be supplemented as we proceed.  

Archaic Course Description: Theory and applications of spectroscopic instruments including Fourier spectrometer, scanning and photographic interferometer, grating and prism spectrometers, and spectrographs. Emphasis on the analysis of the instruments and their fundamental and practical limitations. Theory and structure of spectra and their regularities and the Zeeman effect.  

Improved course description: The course will involve the consideration of light as a wave and concentrate initially upon interference and diffraction effects. The focus of the course will be the theory and application of spectroscopic instruments in particular interferometry including wave front splitting and amplitude splitting interferometers such as Fourier transform spectrometer, and Fabry-Perot interferometer, Fiber gyroscope, optical testing. Also to be considered will be grating and prism spectrometers, and spectrographs. The emphasis will be on the analysis of the instruments and their fundamental and practical limitations. We will consider the theory and structure of spectra and their regularities.  

The gist of this course is one on spectroscopy and spectroscopic instruments. This in effect means a study of physical optics. When we talk about physical optics we talk about interferometry. Immediately, you might say, “what about spectrometers?” We will only concern ourselves with grating spectrometers and the diffraction grating, which is the heart of any spectrometer functions through interference. Therefore we will be considering these early on when we consider multiple source interference.  

The other aspect that we will consider will be experimental methods. This means that we need to consider physical instruments and their limitations and abilities. Why should you choose one instrument over another?  

One thing we will have to decide is whether to expand our definition of the course to include laser spectroscopy techniques.  

Physical optics arises from the interference and diffraction of light and is based on the wave model of light. As such, we will consider light as a wave throughout the course and waves will be our starting point.
Scope of class: We will decide on the scope of the class (i.e. if there are any special topics you want to discuss) on the first day of the semester.

Grading
The class will be graded entirely on homework and laboratories. There will one homework assignment per topic.

Topics
- Wave nature of light: What is the meaning of amplitude, wavelength and frequency? What is the wave equation? What is the mathematical form of plane, cylindrical and spherical waves?
- Interference of two free beams: heterodyning
- Wavefront and Amplitude splitting interferometers
- Interference developed through a preliminary, idealized Michelson interferometer
- Single slit diffraction/interference. Why is there diffraction?
- Double slit interference in all its glory.
- Multiple slit interference
- Grating spectrometers
- Fabry-Perot Interferometer
- Michelson interferometer complete
- Mach-Zender interferometer
- Sagnac interferometer
- Fourier Transform interferometry
- Wedge interferometer
- Holographic interferometry
- Topics to be added based on requests and interest.