

# ASTR 5760

## *Astrophysical Instrumentation*

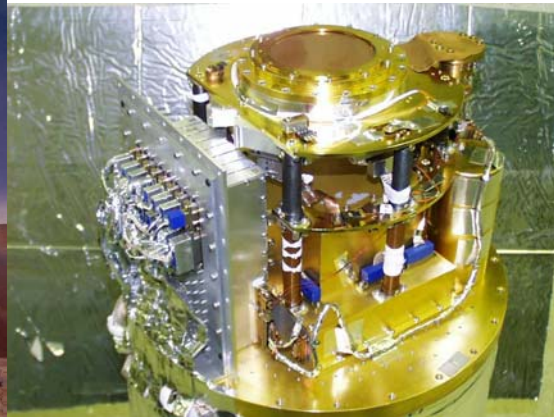
T-Th 2:00-3:15; Room E126

Professor Jason Glenn

Office: Room F913 & ARL 175E, (303) 735-5904, [jglenn@casa.colorado.edu](mailto:jglenn@casa.colorado.edu)

Office Hours: By appointment

Examples of innovative astronomical instruments:



The 10.4-m Caltech Submillimeter Observatory    The Bolocam millimeter-wave camera

### **Course Prerequisites:**

Undergraduate degree in physics, astronomy, electrical engineering, or special permission.

### **Course Goal**

My goal is to convey a physical understanding of modern astronomical instrumentation, from telescopes to detectors, across the electromagnetic spectrum.

### **Course Content**

- Fundamental optics, telescopes
- Electromagnetics: diffraction, Gaussian beams
- Spectroscopy and polarimetry
- Detectors from the X-ray to the radio

### **Class Format**

The class will consist of standard lectures, a couple of guest lectures by world experts, and student presentations.

### **Text**

For the first half of the course, there is no required text, however, there will be recommended reading from various sources. For the second half of the course, the text

(required) will be the 2<sup>nd</sup> edition of Detection of Light From the Ultraviolet to the Submillimeter by G.H. Rieke.

## **Coursework and Grading**

- Homework: 40%
- Group talk and paper: 20%
- Midterm: 20%
- Final Exam: 20%

## **Attendance & Additional Policies**

You are expected to attend lectures. The exam materials will be drawn from the lectures and the reading. You are encouraged to work together on homework, however, copying and cheating will result in a minimum penalty of zero credit. If you work together, write on your homework who you have worked with so that it is clear when I grade it.

## **Students with Disabilities**

If you have specific physical, psychiatric or learning disabilities and require accommodations, please let me know early in the semester so that your learning needs may be met. You will need to provide documentation of your disability to the Disability Services Department (303-492-8671) at the beginning of the semester.

## ***Preliminary List of Course Topics***

- Fundamentals of Optics  
Snell's law, reflection and refraction, the thin lens equation, sign conventions, Fermat's principle, stops
- Fundamentals of Telescopes  
Types of telescopes, aberrations
- Diffraction Theory  
Single slit, double slit, circular aperture
- Spectrometers  
Diffraction gratings, other types of spectrometers
- Introduction to Gaussian Beam (Diffraction-Limited) Optics
- Fundamentals of Radio Astronomy
- Polarimetry
- Photoconductors
- Photodiodes
- Amplifiers and Readouts
- CCDs
- Bolometers
- Heterodyne Receivers
- Cryogenics