



## **Astronomy 418/518 (ATMO 518, PTYS 518)**

### **Instrumentation and Statistics**

**Tues/Thurs 9:30 – 10:45 AM, Steward 202**

#### **Description of Course**

Astronomy 418/518 is a course on astronomical instrumentation and statistics given at the advanced undergraduate (418) or graduate (518) level. It is one of the required courses for the graduate astronomy program but has also proven relevant for students in planetary sciences and optical sciences, among other areas. The course is intended for scientists and engineers who will be future users of astronomical instrumentation, as well as those interested in building operating such systems.

#### **Course Prerequisites or Co-requisites**

The course assumes a minimum preparation of Math 122B or 125 (Calculus I), Math 129 (Calculus II), Math 223 (Vector Calculus), Math 254 (Differential Equations), Physics 141/161 (Intro. Mechanics), and Physics 142/162 (Intro Thermal and Optical Phys.) or admission into the astronomy graduate program. Potential students who are unsure of their level of preparation should consult the instructors.

#### **Instructor and Contact Information**

Dr. Chad Bender, SO N508, 520-626-8795, [cbender@email.arizona.edu](mailto:cbender@email.arizona.edu)

Prof. Philip Hinz, SO N412B, 520-205-0576, [phinz@as.arizona.edu](mailto:phinz@as.arizona.edu)

Office Hours: Wed 2-4 PM (Bender), Mon. 10-12 (Hinz), or by appt.

Course Website (D2L): <https://d2l.arizona.edu/d2l/home/714457>

#### **Course Format and Teaching Methods**

The course will be comprised of lectures, homework assignments, a semester project, and exams. The project for 518 will be completed in small groups and will involve writing a proposal for a new astronomical instrument that is equivalent to a NSF Major Research Instrumentation proposal. The instrument concept needs to be agreed upon with one of the instructors. In general, it should apply the material in the course. The project is not required for 418, and the homework and exams will be modified to make the level appropriate for an advanced undergraduate course.

#### **Course Objectives and Expected Learning Outcomes**

Students will gain a practical understanding of traditional and modern statistical analyses and techniques, sufficient for interpreting astronomical datasets and investigating astronomical phenomenon.

Students will understand the interplay between radiation, photon detection, and detector design

Students will gain an advanced understanding of X-Ray, Optical, Infrared, and Radio instrumentation used in astronomy sufficient to:

1. Plan and execute sophisticated observing programs and data analysis
2. Understand strengths and limitations of various instruments used in modern astronomy
3. Understand the design processes involved in creation of a new astronomical instrument

Students in 518 will develop expertise with communicating fundamental astronomical concepts in a written format

#### **Absence and Class Participation Policy**

The UA's policy concerning Class Attendance, Participation, and Administrative Drops is available at: <http://catalog.arizona.edu/policy/class-attendance-participation-and-administrative-drop>

The UA policy regarding absences for any sincerely held religious belief, observance or practice will be accommodated

where reasonable, <http://policy.arizona.edu/human-resources/religious-accommodation-policy>.

Absences pre-approved by the UA Dean of Students (or Dean Designee) will be honored. See: <https://deanofstudents.arizona.edu/absences>

Participating in the course and attending lectures and other course events are vital to the learning process. Students who will miss a lecture due to a pre-known academic activity (e.g. observing run, academic conference, etc.) should discuss the absence with the instructors as soon as the absence is known, and as far in advance as possible.

### **Required Texts or Readings:**

For statistics part of course: "Practical Statistics for Astronomers," J. V. Wall & C. R. Jenkins, Cambridge University Press

For instrumentation part of course: "Measuring the Universe," G. H. Rieke, Cambridge University Press

### **Assignments and Examinations:**

Midterm Exam: October 9

Semester Project: November 20

### **Final Examination or Project**

December 11, 8:00 – 10:00 AM

<https://www.registrar.arizona.edu/courses/final-examination-regulations-and-information>

<http://www.registrar.arizona.edu/schedules/finals.htm>

### **Grading Scale and Policies**

The course is normally given for standard (ABCDE) grades, but 418 can also be taken as pass/fail.

Grading will be based on a mid-term exam (20%); a final exam (30%) that will be divided roughly 2/3 on the material since the mid-term and 1/3 comprehensive for the course; a semester project (30%), and homework and class participation (20%).

University policy regarding grades and grading systems is available at:

<http://catalog.arizona.edu/policy/grades-and-grading-system>

**Requests for incomplete (I) or withdrawal (W)** must be made in accordance with University policies, which are available at <http://catalog.arizona.edu/policy/grades-and-grading-system#incomplete> and <http://catalog.arizona.edu/policy/grades-and-grading-system#Withdrawal> respectively.

### **Classroom Behavior Policy**

Students are asked to refrain from disruptive conversations with people sitting around them during lecture, or other activities that are disruptive to the class environment. Students observed engaging in disruptive activity will be asked to cease this behavior. Those who continue to disrupt the class will be asked to leave lecture or discussion and may be reported to the Dean of Students.

### **Threatening Behavior Policy**

The UA Threatening Behavior by Students Policy prohibits threats of physical harm to any member of the University community, including to oneself.

See <http://policy.arizona.edu/education-and-student-affairs/threatening-behavior-students>.

### **Students with Disabilities:**

If you anticipate barriers related to the format or requirements of this course, please meet with me so that we can discuss ways to ensure your full participation in the course. If you determine that disability-related accommodations are necessary, please register with Disability Resources (621-3268; <https://drc.arizona.edu/>) and notify me of your eligibility for reasonable accommodations. We can then plan how best to coordinate your accommodations.

### **Code of Academic Integrity**

Students are encouraged to share intellectual views and discuss freely the principles and applications of course materials. However, graded work/exercises must be the product of independent effort unless otherwise instructed. Students are expected to adhere to the UA Code of Academic Integrity as described in the UA General Catalog. See: <http://deanofstudents.arizona.edu/academic-integrity/students/academic-integrity>.

The University Libraries have some excellent tips for avoiding plagiarism, available at <http://www.library.arizona.edu/help/tutorials/plagiarism/index.html>.

### **UA Nondiscrimination and Anti-harassment Policy**

The University is committed to creating and maintaining an environment free of discrimination; see <http://policy.arizona.edu/human-resources/nondiscrimination-and-anti-harassment-policy>

### **Confidentiality of Student Records**

<http://www.registrar.arizona.edu/personal-information/family-educational-rights-and-privacy-act-1974-ferpa?topic=ferpa>

### **Subject to Change Statement**

Information contained in the course syllabus, other than the grade and absence policy, may be subject to change with advance notice, as deemed appropriate by the instructor.