



Astronomy 418/518 (ATMO 518, PTYS 518)

Instrumentation and Statistics

Mon/Wed/Fri 9:00 – 9:50 AM, Steward 204

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. *In addition to these, ASTR 300A/B, 302, and PHYS 305 are highly recommended.*

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

Dr. Ewan Douglas, SO N402, 520-621-1624, douglass@email.arizona.edu

Office Hours (Zoom): Bender: Wed @ 2pm & other times as needed; Douglas: MW 10-11am

Zoom Channel for Lecture: <https://arizona.zoom.us/j/98291823054>

Course Website (D2L): <https://d2l.arizona.edu/d2l/home/944473>

Slack Channel: <https://astr518fall2020.slack.com>

Course Format and Teaching Methods

The course will be comprised of lectures, homework assignments, a semester project carried out in small groups (518 only), a midterm, and a final exam.

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.

Fall 2020 Covid-19 Policies

This course will be taught in the Flex In-Person modality. Lectures will be delivered live, but will also be available synchronously in zoom and recorded for asynchronous viewing. Students participating on zoom will not be required to use cameras. Please respect the privacy and intellectual property of your fellow students and the instructors and do not post or link outside of D2L to course material, including recorded lectures.

Students who cannot or choose not to attend in person will be accommodated. If you are unable to synchronously attend (either in person or via zoom) please contact the instructors so that we can ensure your needs are being met.

The semester projects should not be affected by Covid-19. Astronomers routinely develop proposals with physically distant teams working asynchronously. Students are encouraged to utilize private slack channels to communicate amongst themselves and with the instructors.

If technology issues are impeding your participation and progress in the class, please alert the instructions as soon as possible. This might include, but is not limited to, insufficient bandwidth, insufficient computing resources, insufficient monitor/screen size, inability to view recorded lectures, etc.

The University of Arizona requires that face coverings without a vent be worn at all times when in shared spaces such as classrooms, hallways, restrooms, etc. The university policy can be found here: <https://covid19.arizona.edu/face-coverings>.

Required Texts or Readings:

For statistics part of course: "Practical Statistics for Astronomers," 2nd Ed. J. V. Wall & C. R. Jenkins, Cambridge University Press

For instrumentation part of course: "Measuring the Universe," G. H. Rieke, Cambridge University Press
"Electronic Imaging in Astronomy", 2nd Ed. I. S. McLean, Springer

Required Assignments and Examinations:

Homework: Approximately six homework sets will be assigned throughout the semester

Semester Project: 518 includes a semester project that 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.

Midterm Exam: October 12 – Will be take home

Final Exam: December 17, 10:30am – 12:30pm – Will be take home

<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.

The grading scale will be A: >85%; B: 70 – 85%; C: 60-70%; D: 50-60%; E: <50%

Grading for 518 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%).

Grading for 418 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, and homework and class participation (50%).

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.