

ASTR 301: OBSERVATIONAL PROJECTS

COURSE SYLLABUS

Instructor: Richard Wainscoat

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Hours: Mon. 12:30 PM – 1:30 PM;

Wed. 12:30 PM – 1:30 PM

Assistant: TBD

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Office: Watanabe hall, room 403

Hours: TBD

The general Astronomy TA pool staffs Watanabe room 403. A link to their hours will be posted on the Laulima site for this course (laulima.hawaii.edu).

Class Details

Semester: Spring, 2016

Meeting Time: TR, 3:00 – 4:20

CRN: XX

Room: Watanabe hall, room 113

Dates: Jan 11 - May 13

Final: May 12, 2:15 pm

Course goals

The primary goals of this course are for you to be able to:

- (1) plan and effectively propose observations to answer scientific questions
- (2) collect, reduce, and analyze data from astronomical observations
- (3) effectively present findings

Materials

- *Class website at* <http://laulima.hawaii.edu> (class notes, announcements, grades)
- **Textbook:** *To Measure the Sky* To Measure the Sky, Chromey
- computer access with the following software
 - Python
 - writing and presentation software (Office, Pages, OpenOffice, LaTeX, etc.)
 - DS9
 - Astrometrica
 - FindOrb

Important dates

- January 11 - first day of instruction
- January 18 - MLK Jr. Day
- February 15 - Presidents' Day
- March 21 – 25 - Spring break
- May 4 - last day of instruction
- May 12, 2:15 - 4:15 - final exam

Approximate Course Calendar

This **approximate** course calendar is subject to change, based on class pacing.

- Week 1, Jan 12, 14:** Review: imaging and spectroscopy. Select first science cases.
- Week 2, Jan 19, 21:** Using expected effect size and frequency to determine needed signal-to-noise and number of targets. Introduction to archival data for data selection and case studies.
- Week 3, Jan 26, 28:** estimating the integration time needed per target; what calibrations are needed?
- Week 4, Feb. 2, 4:** **Lecture on making a compelling science case, and demo talk with practice critique.** Target availability.
- Week 5, Feb. 9, 11:** **Oral presentation and critique of first proposal.** Submit written proposals.
- Week 6, Feb. 16, 18:** Internal telescope time allocation committee.
- Week 7, Feb. 23, 25:** Observations and imaging data reduction (in case of poor weather, find similar data in archives). Using archives to complement your observations.
- Week 8, Mar. 1, 3:** Basic data analysis. Select second science case (with option of extending first)
- Week 9, Mar. 8, 10:** **Lectures: clearly communicating results, with demo talk and practice critique**
- Week 10, Mar. 15, 17:** **Oral reports and feedback on first project.** Submit written reports on project 1.
- Week 11, Mar. 29, 31:** **Oral presentation and critique of second proposal.** Submit written proposals.
- Week 12, Apr. 5, 7:** Internal telescope time allocation committee.
- Week 13, Apr. 12, 14:** Observations; spectroscopic data reduction
- Week 14, Apr. 19, 21:** Data analysis - model comparisons and model fitting
- Week 15, Apr. 26, 28:** Adapting these skills to other types of observing (radio, interferometry, etc.). **Discussion of lessons learned, class generates a presentation checklist.**
- Week 16, May 3:** Submit written reports
- Final, May 12:** **Oral presentation of science results**

Learning Goals

The following outlines the concepts and skills that you will learn in this course.

- science case → observational requirements
 - effect size → necessary signal-to-noise and number of targets
 - point sources vs. extended sources
 - signal-to-noise, telescope size, & instrument → integration time per target
- observation planning
 - target availability
 - solar system targets
 - things to work around: twilight, the moon
- Effective proposal writing
 - Putting science in context
 - Clear presentation of technical requirements
 - Evaluating proposals
- Data reduction and analysis
 - Imaging data reduction (review from ASTR 300/L)
 - Aperture photometry (review from ASTR 300/L)

- Trends in data
- Model comparisons
- Effective communication of results
 - Concise speaking
 - Effective figures
 - Written reports (review from ASTR 300L)

Institutional Learning Objectives. The course outcomes are aligned with the University of Hawaii's Institutional Learning Objectives for Undergraduate Students (<http://manoa.hawaii.edu/ovcaa/ilo/>). This course:

- teaches an understanding of how astronomers answer questions about the universe (objective 1b),
- provides continuous practice with critical and creative thinking: solving challenging and complex problems, applying questioning and reasoning, generating and exploring new questions, information literacy, and mathematical reasoning (objective 2a),
- is structured around the process of conducting research: conceptualizing problems and asking research questions, analyzing data, applying research designs, engaging in self-directed inquiry, and using library and information systems (objective 2b),
- integrates in-class collaborative work and critiques to practice and extend the concepts covered in class (objective 2c), and
- trains students in specific habits of scholarly inquiry (objective 3a).

Oral communications focus. Students must adequately complete all oral communication assignments to pass the course with a D grade or better. Students who do not complete all oral communication assignments will not earn O Focus credit.

Evaluation

Traditional ABCDF scale (90%, 80%, 70%, 60%, less than 60%)

Homework— 20%

Oral presentation of research plans — 20%

Oral presentation of research results — 20%

Written observation proposal — 20%

Written results reports — 20%

Homework. Each week, there will be a homework assignment. These are meant to serve as focused practice of specific skills taught in the class. **Late assignments lose 10 percentage points for each day after the due date, to a maximum reduction of 50%.**

Oral presentation of research plans. Students will plan two observations over the course of the semester, and give presentations as if part of a research group doing internal vetting. Effective presentation includes successful completion of science practice skills. Part of the student grade will be based on quality evaluation of other students' work.

Oral presentation of research results. Students will give presentations on research results mid-way and at the end of the semester. Effective presentation includes successful completion of science practice skills. Part of the student grade will be based on quality evaluation of other students' work. The final presentation will be given to an audience including lower division Astrophysics and Astronomy students.

Written observation proposal. Following oral presentations, students will submit written observation proposals and conduct an internal Time Allocation Committee for the available telescope resources. Effective presentation includes successful completion of science practice skills. Part of the student grade will be based on quality evaluation of other students' work.

Written results report. Prior to oral presentations, students will submit written reports and carry out round-robin critiques. Effective presentation includes successful completion of science practice skills. Part of the student grade will be based on quality evaluation of other students' work.