

AST424H: Introduction to Astrophysical Research

AST425H: Research Topics in Astronomy & Astrophysics

Syllabus 2019-2020

Instructor:

Prof. Roberto Abraham

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Classes:

Time: Fridays 3:00-4:30pm Place: AB88. The cadence of these will be roughly weekly to begin with, then once every two weeks once things settle down and your projects are well underway.

In addition to the classes, students are *required* to attend DAA/Dunlap Colloquia. These are one-hour talks by (mostly) visiting scientists at Cody Hall (AB107), Wed 3pm.

For more information on upcoming talks, go to:

<http://www.astro.utoronto.ca/daa-events/upcoming-colloquium-talks/>

AST424 and AST425 are very similar. The classes will meet together and presentations will be given together.

AST424

Course Description

This course for senior undergraduate students in the Astronomy and Astrophysics Major Program is a literature study that develops methods and skills applicable to research in the physical sciences, with an emphasis on communication, including writing proposals and reports, and delivering presentations. With the help of an advisor, the student identifies a subject area in astronomy or astrophysics, and conducts a literature study, becoming familiar with existing work and current state and progress in the field. In some instances, short practical work related to the field may also be included to obtain some hands-on experience on how research is conducted.

Some specific goals are:

- Get acquainted with scientific research results as presented in the primary literature.
- Acquire literature comprehension and time-management skills.
- Learn to write scientific proposals and reports.
- Practice delivering scientific presentations.

The student needs to provide reports based on their literature reading (and practical exercises) throughout the year, both written and oral. An important part of the course is the opportunity it provides to discuss your ideas and findings with your fellow students. We will meet once a week at the beginning, and then once every 2-3 weeks once your projects have settled down. During these meetings, the students will discuss the progress in their projects, the colloquia/talks attended, and any other issues of interest. Also, the instructor and invited faculty members will make presentations on topics such as: how to do a literature search, how to apply to graduate schools, how to give a scientific talk, how to prepare a scientific paper, etc.

AST425

Course Description

This course is an introduction to research for senior undergraduate students in the Specialist program with the centre-piece being an independent research project under the supervision and guidance of a faculty member. With the help of the supervisor, the student identifies a promising problem, becomes familiar with existing work in the field, formulates an approach to investigating an unresolved issue, and undertakes research.

Some specific goals are:

- Get acquainted with doing real research (i.e., *a priori* unknown outcome).
- Acquire research, collaboration, and time-management skills.
- Learn to write scientific proposals, reports, and papers.
- Practice delivering scientific presentations.

The student needs to provide short reports throughout the year, both written and oral, and a final report and presentation which describe the entire project and its conclusions. An important part of the course is the opportunity to discuss your ideas and problems with your fellow students. Although our projects are focussed on astronomical problems, learning about approaches to solving novel problems has wide utility. We will meet approximately once a week at the beginning, before meeting once every 2-3 weeks once your research projects have settled down. During these meetings, students will discuss the progress in their projects, the colloquia/talks attended, and any other issues of interest. From time to time I will provide informal presentations on topics such as: how to do a literature search, applying to graduate schools, how to give a scientific talk, and how to prepare a scientific paper.

Details

Advisors

Guided independent study forms the heart of these two classes.

Students are required to have a research advisor selected by mid October at the latest, though it would be best if you had an advisor by the end of September. Any research member of the Department of Astronomy & Astrophysics (DAA), Canadian Institute for Theoretical Astrophysics (CITA), Dunlap Institute for Astronomy & Astrophysics (DI), Center for Planetary Sciences (CPS), or members of the Graduate Department of Astronomy and Astrophysics can serve as an adviser. In case a postdoctoral fellow or CITA visitor is an adviser, a faculty member from DAA, CITA or Dunlap must be added as a co-adviser. The most effective strategy is to meet in-person with potential advisers after preliminary e-mail contacts (even when these meetings do not lead to research projects, they will acquaint you with knowledgeable and experienced people who may be able to help you later).

A very useful source of information is Prof. Chris Matzner's links (<http://www.cita.utoronto.ca/~matzner/svc/resources.html>) for undergraduate and graduate researchers.

The following are good places to see/meet advisers:

- In their offices: write professors whose work you are interested in to arrange for a meeting. For brief descriptions of faculty research, see: <http://www.astro.utoronto.ca/people/faculty>
- DAA Coffee, everyday (some days there will also be an astro-ph discussion), starting usually around 10:30 AM (AB, 2nd floor lounge).
- Post-colloquium snack (Wed starting at around 4, I the AB 2nd floor lounge); Also, at CITA dessert (Fridays at 4pm, MP 14th floor lounge).

Course Information (in **bold**: used for evaluation)

1. Find an adviser and a project. Ideally, the project should be useful and interesting to both the student and the adviser. In the case of AST425, the goal should be to produce a publishable research contribution, either as a separate publication or as part of adviser's publication. In the case of AST424, the goal is to produce a comprehensive literature review.

2. You must inform me of your advisor's name and the topic of your project by email **no later than noon, October 15, 2019** (preferably much earlier). It should be a true new research contribution. The student will make a **brief (10 min) presentation (10%** of the final mark) describing the subject area of and plans for the project, in consultation with the adviser, during the class meetings in late October (specific dates TBD).
3. Discuss goals and expectations for the project with your adviser(s) and develop a research plan for the whole year. Plan to meet with the adviser on a weekly basis; see item 4 below.
4. **Write up a project proposal (15%** of the final mark) by Nov 13, 2019 (-50%/day for lateness, i.e., zero for reports two or more days late). Unless it is a giant hassle for you, the proposal should be formatted in LaTeX as this will give some practice for the final report. (It may be easiest to use the [AASTeX](#) package). The proposal should explain the background and motivations for the project, as well as the plan for executing the project, in a compelling and persuasive manner. Please put in an anticipated schedule (though of course I know this will be pretty notional). *Pease email the proposals to me as PDF files* (no hardcopy needed or even wanted).
5. Meet with your adviser(s) regularly; I recommend you meet at least once per week. Good communication is the key to good research. Both you and your adviser will enjoy these meetings a lot more if you arrive with *new results* and new questions each time.
6. **Four short progress reports (10%** of the final mark in total), starting at the end of November 2019 but skipping the end of year (the December report). These should be e-mailed, with CC to the adviser, and are due at the end of the month. The reports should contain a paragraph or two describing your activities and progress. No points are given for reports that are late.
7. **Class participation (10%)** for discussions after colloquium talks, presentations by classmates, and lectures by the instructor and invited faculty members, and attendance of classes and colloquia.
8. **Summary talk (~10 minutes, 20%)** in the AST 425 Jamborees, in late March/early April (exact dates to be confirmed). These will be public events, with the advisers expected to attend, and other DAA/CITA/Dunlap members/students invited. Evaluation will be made jointly by the advisor and course instructor.
9. **Final report (10 -15 pages, 35%)** by the last days of classes (10%/day penalty for lateness). The report should be composed using LaTeX using one of the

journal templates. Evaluation will be made jointly by the adviser and course instructor.

10. **Notwithstanding anything above, I reserve the right to (and intend to) award an A to any project that results in an accepted article in a mainstream (i.e. high impact) professional journal (such as the ApJ or MNRAS) by the last day of class. Submitted but not yet accepted articles may also qualify for grade upgrades (I will use my discretion based on my perceived likelihood of acceptance).**