

# **Special Topics in Observational Astrophysics**

Syllabus for Fall 2018

**Organizer: Xuening Bai (IASTU & THCA)**

Email: xbai@tsinghua.edu.cn

Office: THCA — Mong Man-wai Building (蒙民伟科技楼) S-617

IASTU — Science Hall (科学馆) 312

**Instructors: THCA faculty members**

**Time: Fridays, 3:00-4:30 pm**

**Location: Mong Man-wai Building (蒙民伟科技楼) S-727**

**Office Hours:** Walk-in or by appointment.

## **General Rationale**

This course is offered to THCA graduate students as well as interested undergraduate students. The goals are three-fold:

- Learn astrophysical topics beyond your own area of research.
- Improve your English, especially reading and speaking English.
- Develop and improve your skills for scientific presentation.

Through this course, we hope to expose students to a wide range of topics to develop both breadth and depth in astrophysical knowledge. Moreover, it trains students in aspects that are not normally covered by standard courses and research, but the corresponding skills are crucial for your future careers, regardless of whether you stay in academia or not.

This course is offered every year in the Fall semester, focusing on topics in observational astrophysics. Its sister course, "Special Topics in Theoretical Astrophysics", will be offered in Spring semesters. It runs in identical format and will focus on topics in theoretical astrophysics.

## **Format**

The organizer (a THCA faculty member) will decide on the general theme, and divide the theme into a list of topics. For each topic, a few references are suggested as the starting point based on which the students will construct their talks. There is a faculty contact to help with preparation.

At the beginning of the semester, students are provided a list of topics and select a few topics of their interest. We stress that students should

**select topics that are different from their current areas of research.** Afterwards, the organizer will assign individual students with a topic and a date considering the overall preferences. **We expect 2 to 3 student talks per week** in general.

Students are expected to read the references associated with their assigned topics, and are encouraged to explore other relevant literature as needed. **A good practice is to start preparing the talk at least two weeks ahead of time.** During the preparation, students should feel free to consult with the faculty contact and/or other faculty members. **At least two days before the talk, the student must get ready and discuss with the faculty contact for approval.** If approved (see "Evaluation" section for details), the faculty contact will further comment and help improve the presentation, and the student should further practice and polish the talk. **If not approved, the talk will be cancelled.** For graduate students, this not only means that you lose the opportunity to improve your presentation skills, but also, you will no longer be eligible for THCA scholarships.

Each presentation is expected to be 25 minutes for the talk, plus 5 minutes for questions. The talk is expected to cover standard ingredients such as motivation/background, methodology, main results, implications, and a summary. We require every presenter to **give the talk in English.** English is also strongly encouraged during the question session, but it is OK to switch to Chinese if necessary.

## **Participation and Enrollment Policy**

This course is part of the standard astrophysics curriculum at THCA. We require all THCA graduate students to *participate* in the course unless this is the year for graduation. However, the online system only allows one to enroll a course once. To avoid conflict, we ask graduate students to **enroll only when it is the last time he/she is going to participate in this course.** On the other hand, we do record the performance of all students, and grading will also be based on previous performance.

Graduate students are excused for not participating in this course when he/she is on leave (e.g., attending exchange programs abroad for extended period), or this is his/her final semester (for thesis defense).

Senior undergraduate students are strongly encouraged to participate and give presentations, but we welcome anyone interested to attend the talks.

You are also welcome to enroll in the course if you are **NOT** planning to enter THCA for graduate school.

Student talks from this course will be advertised to all members of THCA, and we anticipate a good fraction of faculty and post doc to attend as well. They will also offer feedback to the presenters.

## **Evaluation and Grading**

The faculty contact will judge the overall quality of the talk based on the level of understandings the student possesses on the topic, and how well the talk is prepared. **The bottom line is that an audience with no background on the topic should be able to learn something useful from talk.** Please note that the fact you think you understand the topic does not necessarily mean that you can give a good talk. In fact, it is the other way round in general: only when you manage to clearly talk about the subject and are ready to address any questions that may arise, it best demonstrates your understanding of the topic.

Some guiding principles include:

- 1). The content of the talk is reasonably well organized and joined in a logical way. It should contain introduction, method, results, and summary sections, and please also pay attention to the transition between slides.
- 2). Be confident about all the information you show in each slide. Don't simply read the slides, but rather explain the content, discuss the implications, and highlight the key results.
- 3). Be able to answer basic questions that may arise from anywhere in your slides and/or your words.

For approved talks, everyone in the audience will be provided an evaluation sheet prior to the presentation. Students in the audience should carefully evaluate the overall quality of the talk by answering the questions provided in the sheet. The sheets are anonymous (but you are welcome to put your name as well) and will be collected at the end of the class. The presenter, upon receiving the evaluation, should talk to the faculty contact to discuss his/her performance.

The nature of this course means that students themselves are primarily responsible for their performances: the more you invest in preparing your talk, the more you will learn and grow. While grading will be judged according to the history of performances on a P/F basis, we do not easily fail anyone unless his/her performance is exceptionally unacceptable.

## **Theme of the Semester: Major Astronomical Projects (II)**

Astronomy has entered an era where substantial major progress is made through coordinated efforts from large groups of scientists. We choose the theme of the semester to be "Major Astronomical Projects", aiming at offering a broad overview of such major efforts in astronomy. To a large extent, these projects outline the major pathways astronomer take along the lines of history from the past to the future.

The listed topics are largely instrumental and observational oriented. Due to the overwhelming number of choices, we decide to spend two semesters under this theme. In 2018 Spring (last semester), we have focused on topics in radio astronomy, high-energy astrophysics, and time-domain astrophysics. This semester will serve to cover the remaining topics, e.g., planet-hunting/exploration missions, optical/IR instruments, cosmology related projects, etc. Because almost all such major projects have their own dedicated websites, we simply list these websites and encourage the students to explore the contents and references.

Being major projects, it is of crucial importance that you clearly explain the scientific motivation and background, major science goals, as well as new developments (e.g., technological, software engineering) that make the projects feasible and unique. For future projects, we ask you to elaborate these aspects in more detail, emphasizing future vision. For current and past projects, we also expect you to discuss main scientific achievements, and how they revolutionized our view of the universe.

Note that each of such major projects may address several different science applications. Given the time limit of your presentation, a good strategy would be to first provide an overview of these applications, and then focus on one or two most important ones to elaborate in detail.

While preparing and attending the talks throughout the semester, you may try to construct a big picture on the overall movement of the astronomy field. Where does your current research project(s) stand in this big picture? Which direction do you want to commit your time and energy towards making significant contributions in the foreseeable future?