ASTR 504: Course Outline and Syllabus

Welcome to ASTR 504. Normally this graduate course has between 2 and 5 students. The number varies from year to year. Over the years, I have experimented with a number of different approaches and in due course, settled on a scheme that seems to work well. Here's how it works — and how the grades will be assigned. I will spend about 20-30 minutes during our first class going through this. If you have suggestions for improvement or special requests, I am happy to mull it over and make the appropriate adjustments.

VENUE AND TIME

Given that this is a small class, I prefer to conduct the class in an informal "discussion session" style format, with lots of questions and discussions. I have historically conducted this class in mixed formation because online discussions work just as well as in-person discussion. This year (2021), we will start fully online and see how things evolve.

This year, the class will be held on **Wednesdays from 12pm to 3pm** (Note: I appreciate that the timetable says this class runs from 11:30am to 2:30pm and if anyone has objections to the 12-3 timeslot, I am happy to start at 11:30).[1]

In addition to our weekly meeting time, members of this class are expected to attend all Dept. colloquia and Astronomy seminars that address "extra-galactic" topics. I will send you the circulars for these as they come up.

FORMAL REFERENCE BOOK + READING LIST

For three years prior to 2015, I have used ***Galaxy Formation and Evolution by Houjun Mo, Frank van den Bosch , Simon White*** as a basis for readings and classroom discussions. The book offers a fairly thorough coverage of subject. It is, however, much too detailed for an introduction to the subject. Most students who are not working on galaxy formation find it difficult to distinguish between key concepts and "specialist-oriented" details. However, if you are working on anything related to galaxy formation, I do recommend this monograph as a reference or as a starting point.

In 2015, I experimented with using recent reviews for readings and discussion. These, I have found, are written more clearly, tend to focus much more on the concepts and essential elements, which I think is more important for an introductory course. In addition, this approach gives me more flexibility; I can add and remove reviews depending on issues that are more/less topical at any given time.

I list below some of the reviews we have worked through previously. We will definitely work through the first two. Thereafter, I am flexible. If some of you have a subject of interest, do let me know. Alternatively, there are topics that I want to brush up. So let's talk and see if we can come up with an interesting list of readings:

[1] Historically, this class has run from 12-3. It was changed to 11:30 a couple of years ago because our colloquium start time was changed to 3:00pm, from 3:30pm. It has since reverted to 3:30.

- Andrew Benson, Galaxy Formation Theory -- 55 pages (arXiv:1006.5394)
- Somerville and Dave, Physical Models of Galaxy Formation in a Cosmological Framework (arXiv:1412.2712) — 67 pages
- Reality and Myths of AGN Feedback (https://arxiv.org/pdf/1802.10304.pdf) — 3 pages
  Naab & Ostrikier 2017 – 50 pages,
  http://www.annualreviews.org/doi/abs/10.1146/annurev-astro-081913-040019
- Raffaella Morganti 2017 paper. The Many Routes to AGN Feedback - 10 pages (observational overview)
- Harrison et al. 2018 paper AGN outflows and feedback twenty years on (https://www.nature.com/articles/s41550-018-0403-6) — 6 pages

The total reading load is quite reasonable. Typically, it amounts to about 220 pages in total. I expect that we will cover abut 20-30 pages per week. This deliberate. In keeping the readings down to ~25 pages/week, I am expecting that you will be able to think about the underlying ideas and concepts, etc.

Everybody will read the assigned pages. During class, each of you will take turn summarizing the text. Everyone is expected to chime in with questions, comments and insights. I will do the same too.

I should note that the readings will get less onerous with time because some of the topics are repeated from one article to the next. This is not a bad thing. It is useful to see the same topic covered from different perspectives. And even straight repetition is good. It reinforces learnt concepts and it highlights what the community considers to be among the more important issues.

CLASS SESSIONS

The discussion lead should regard the task as an informal presentation, where he/she will give an oral summary/presentation using only his/her notes. Please do not *any powerpoint slides;* you may however use the annotation/white board (or blackboard, if in persion) to draw illustrative sketches, etc.

During this oral presentation, I expect everyone else to step in with questions and comments, and relevant supplementary material that you may have come across earlier. I too will add additional information. I also encourage everyone to ask questions about the subject and your readings, which I will try my best to answer.

This exercise is all about reading and learning about the current state of affairs in Galaxy Formation modeling, about the terminology used, concepts that inform the topic, etc. I expect you to have questions and by asking and discussing, we will get to learn more about the topic than is covered in the Review papers.

GRADING

40% of your final mark will come from both the quantity and quality of your classroom contributions over the semester. This includes your level of preparedness; how well you summarise and highlight; questions you pose; and effort/thought that goes into answering my questions and generally generating discussion.

At seminars or colloquia on relevant topics, I'd like to see you draw on your readings - and improving understanding of the subject - to ask the speakers interesting and even challenging questions. To encourage you,

20% of your final mark will come from the quality of questions you pose during the seminars/colloquia.

FINAL PROJECT/PRESENTATION

In previous years, I have asked the students to do an actual research project. These have ranged from working with Galacticus, a semi-analytic code that Andrew Benson developed, to working with outputs from numerical simulations. I have several simulation boxes.

If you are interested in doing this, let me know.

The alternative, and the option most students opt for, is a 45 minutes long formal presentation on a pre-approved journal/arXiv paper. In this class, my expectation is that when you choose a paper, you own it. You "become" one of the authors. I will discuss what this means at our first (introductory) meeting

40% of your final mark will come from this "final project" component. The presentations will occur over the exam period.

I will send more details, including grading scheme for the Presentations in due course.