ASTR 421 Teaching Exercise

Each of you will select a topic related to the course, and prepare a short presentation. This is an opportunity to learn how to read, think, write and talk about science. You will do a review of both background and the currently published research on a selected topic (using refereed astrophysical journals and other sources) and then make a presentation to the class. The presentation should be relevant to the subject material of this class, i.e. stars and stellar remnants for the most part, although pulsars and black holes are of such interest that you might consider them too. The topic should not be one that was covered extensively in class (e.g. the basic physics of stellar atmospheres), and you should avoid reviewing material we saw in class. Rather, what we study in class should be a departure point for your own exposition.

Decide on your topic (a title or a sentence will do) by Sept 2. In case we have many people choosing the same topic, come up with two backup topics that you want to do, and we'll resolve any conflicts.

Teaching topic outlines are due Oct 7. These should be just one page, any format, with a list of topics and subtopics to be covered. Basically a list of powerpoint slides. I will give you comments on these to make sure your topic and the content/amount of material you want to cover are appropriate.

Draft topic slides are due on Nov 6. Presentations should be given in powerpoint. I will review a draft of your powerpoint slides to provide guidance and ensure that the level of discussion is appropriate to the class.

Your presentation should start with an outline and then an introduction, including what the topic is about, and end with a summary. You should provide motivation for the research being done in the area. What question(s) is (are) being addressed by the research? Then it should go on to describe the research. You should incorporate figures and plots in your presentation and give proper attribution. Finally, what are the broader implications of the findings you have presented (for example, if you are studying a kind of star, what can it tell us about the Milky Way and its structure and history)? You need to convey to your audience (think of the audience as other phys/astro majors), but also to me, that you understand what you are talking about. The level should be that of the physics and math we use in this class. If you run into a concept too advanced for this class, don't be afraid to say so, and try to convey a partial understanding if you can. Very important: do not plagiarize! Create your own slides, in your own words and do not use AI.

Other tips: avoid quoting passages from papers – instead describe their results in your own words and then cite their work. When you present material from a reference, quote the reference on the slide (as you will have seen done in class). Make a slide at the end with a list of references. When quoting references, use the style you'll see in the first four journals listed below, e.g. quote them in the text as (Einstein 1905, Einstein & Brown 1905, Einstein et al. 1905 for >2 authors, etc), and include the list of references at the end using these journals' styles (e.g. Einstein, A. & Brown, I. 1905, Journal, Volume, Page).

Presentations. Attendance is required at all presentations. Everybody will be required to ask at least one question on each of the two talk days.

One of the main ideas of the teaching exercise is to give you your (possibly) first experience in reading research papers. Your sources of information should include papers from professional journals. The main ones are:

The Astrophysical Journal (known as "ApJ")
The Astronomical Journal ("AJ")
Astronomy and Astrophysics ("A&A")
Monthly Notices of the Royal Astronomical Society ("MNRAS")
Nature
Science
Physics Today

There is also the very useful Annual Reviews of Astronomy and Astrophysics, which contains a dozen or so articles in each edition, each reviewing a particular subject in astronomy. Articles here can be excellent references for you if there happens to be one related to your topic, but they are very long and you may wish to concentrate on only sections of them. You are also free to read more popular articles and web pages to gain a general idea of your subject, but don't use, e.g., Wikipedia pages as references as they are not vetted (although Wikipedia may be a starting point). The first five journals above and the Annual Reviews are the most challenging to understand. I'm happy if most of your references are from easier to understand sources, but please discuss at least one or two papers from these journals.

Possible topics:

The Sun – solar activity, constraints on past long term evolution, solar oscillations
Stars – special types, e.g. variable stars, carbon stars, hot evolved low mass stars, winds, white dwarfs, brown dwarfs, binary star systems, etc.
Supernovae – different types, SN 1987a, clues to progenitors, details of explosions, etc.
Stellar black hole remnants – constraints on masses, the accretion process, jets, etc.
Neutron stars and pulsars – pulsar searches, binary pulsars and general relativity, ablating winds, the Crab pulsar, pulsars in globular clusters, etc.
Transients sources - Gamma ray bursts, Fast Radio bursts, others

Resources:

Starting points. Search around on the Web to find out current issues of interest in your topic, or talk to me. This should lead to an initial list of the names of some of the researchers working on the topic, some of the relevant papers, and the journals they appear in.

When you need to find a research paper, there are probably three good ways to do it.

1) The ADS service at https://ui.adsabs.harvard.edu/classic-form. This allows you to search for electronic versions of papers in the astronomy research journals listed above, as well as some books from conferences (these can give you up to date information on a topic, but often only the abstracts are available, not the whole article), and read these papers on the publishers' websites. I will show you how to use it in class. If you are on campus you should have full access to the journals because UNM has a subscription. If you are off campus, you should still have full access by going through this link: https://login.libproxy.unm.edu/login?qurl=http%3a%2f%2fads.harvard.edu%2f This will ask you to login with your UNM Net ID and then take you to the ADS page. Then click on "highly customizable query forms" and then "Astronomy and Astrophysics Search". Warning: this interface can be pretty slow.

2) Before publication (but usually after the paper has been accepted for publication), most authors post their papers on the Astro-ph archive (https://arxiv.org/archive/astro-ph). So this is where you can find recent papers that will soon be published, but papers stay there after they are published too. You can reach these versions with your search on ADS. If you are off campus, you probably won't be able to access papers published in the last year at the actual publishers' websites but you can at least get the versions posted on the archive after you do a search with ADS. Some papers from conferences may also be on here that are otherwise impossible to get without paying (because UNM doesn't subscribe to certain conference publication services) if you went through ADS.

3) Hardcopies of all the above journals exist at Centennial library.

Reading research papers:

Typical sections

Abstract - summary of the main findings.
Introduction - background and motivation on subject of paper for astronomers who don't work on the particular area
Observations - technical details of observations \
Results - description of what was found | most difficult sections
Discussion - implications of the results /
Conclusions or Summary - restating of the main findings of the paper.

Given that this may be your first exposure to research papers, it is most important to understand the abstract, introduction, discussion and conclusions sections. However, you may find relevant details in the other sections as well. Please see me if you are having trouble with a paper.

Tips for Presentations

As we have to fit six talks into one 75-minute period on most days, plan on a 10 minute talk with about 3-4 minutes for questions. Your slides should not have too much text – otherwise your audience spends too much time reading the words and not enough time listening. The text should be bullet points or short descriptions of what you are talking about. Use figures and images to illustrate points when possible. There should at the start be a clear motivation as to why your topic is important and interesting.

Most importantly, practice, practice, practice. Do not assume that because everything is clear in your head that you will be able to convey it clearly when speaking out loud. Go through your entire talk a few times, possibly with a friend present, to make sure that you make your points the way you want to, and that everything sounds coherent. This is also the best way to make sure your talk is the right length. If you don't practice it out loud, you may find that what you planned to say is much shorter or much longer than your allotted time.

It is also good to anticipate questions other students may have. There is not enough time in the talk to discuss everything you have studied for your topic, but keep in mind what the most important things are that you are leaving out that likely might come up as questions.