Astronomy 660: Course Project  
Professor Douglas Leonard

- **Assignment:** Read a current article in the astronomical literature on any area of interest related to “extragalactic astronomy” (includes galaxies as well as cosmology), and write a thorough report on it.

- **Due Dates:**
  
  - *Paper Choice:* Email your prospective paper choice to me by 3 PM Friday, April 12. (The sooner you email me your choice and get it approved, the more time you’ll have to work on the project!)
  
  - *Course Project:* Turned in by 5 PM Thursday, May 9. (Note that this is a later due date than was announced in the Course Syllabus.)

**Details of the Assignment**

Got a particular area of extragalactic research that fascinates you? This is your chance to learn *in depth* about it. In the course, our study of extragalactic astronomy encompassed a very broad range of astrophysical topics in a short amount of time, and one of the primary goals is to provide a basic familiarity with the astronomical literature. However, the limitations of the course permit only a brief introduction to many of the active areas of research to be made. For this project, you will identify a recent article in the astronomical literature about extragalactic astronomy that piques your interest. Then, you will research the topic addressed by the article (generally by reading several of the articles cited by the paper itself) and provide a general scholarly review of the field investigated by the article, a summary of the article itself, and point out future directions of research in this area. Here’s how to go about this project.

1. **Find a current research article.** All fields that are related to extragalactic research are open to investigation. To find recent articles, go to the Smithsonian/NASA ADS Astronomy Query Form at: http://adsabs.harvard.edu/abstract_service.html. To find potential articles in areas of interest, enter words or phrases into the “Title” or “Abstract Words” sections, and then click on the “Send Query” button. For instance, entering “elliptical galaxy formation” (with quotes) into the “Abstract Words” section brings up the titles of 1,503 articles, with the most recent ones shown at the top. To see the complete abstract of a particular article, click on the “A” field next to the article; to download the PDF version of the complete article, click on the “F” field; you can then print out the article if you wish.

Try to find an article that both interests you and challenges you. The only limitation is that it must be a specific research contribution to the literature, and *not a review article* itself. An easy way to tell this is to see what journal the article is published in; if it’s a professional journal (e.g., ApJ (Astrophysical Journal), AJ (Astronomical Journal), A&A (Astronomy & Astrophysics), MNRAS (Monthly Notices of the Royal Astronomical Society), or PASP (Publications of the Astronomical Society of the Pacific)), odds are it represents a specific research contribution rather than a review. Contributions to *conference proceedings*, in general, are reviews of fields, and will not make an appropriate choice for this project – exceptions do exist, so if you are unsure, just email me the prospective article and I’ll let you know. Note that articles that have been submitted to a journal but have not yet been accepted (e.g., they’re posted on astro-PH) are also acceptable. Try to find an article published (or submitted) within the last two years.

2. **Carefully read the article,** and determine that it, indeed, represents a field in which you would like to know more. The article should push well beyond what was covered in class in the field. Note, though, that some research articles are quite technical, and will make for a difficult review. Try to find one in which you can follow the main lines of reasoning on your first read-through; a few unfamiliar terms are fine, but the basic gist of the article should be understandable.
3. *Email me a pdf file of your prospective article, as well as its title and article information (Journal volume, number, by 3 PM Friday, April 12.* I will have a look at the article to see if it is appropriate, and will email you back, telling you to go ahead with it or to ask you to find a different article. I may also give you some suggestions as to how to best go about researching the topic.

4. *Identify at least five earlier sources of additional primary reference material to read.* A significant part of your report will consist of an Introduction to the general field studied by your article (see below). To this end, it will be important to track down several earlier references; usually, your main paper will cite dozens of existing articles. The idea here is to identify a few of these articles as being of particular importance to establishing the fundamental principles of the general field being studied; these are often (but not always) the most ancient papers that are referenced (i.e., those published the longest ago). They may include review articles as well as research articles.

5. *Prepare your written review of the article.* As stated in the course syllabus, your written review of the article will be worth 25% of the course grade. Details on the form and content of the review are given below.

**Written Review**

Your written review must include the following three sections:

1. **Introduction.** *This is the most important part of your review,* and may well be the longest section. Here, provide a thorough summary of your understanding of the field being studied. Introduce the general field of study to the reader, who may be assumed to have basic astronomical knowledge (i.e., the reader knows what a galaxy is, and what the Big Bang is, in a general sense, but *is not* particularly knowledgeable about the specific field studied by the paper). Be complete, and don’t be afraid to write a lot! This introduction should establish the fundamental principles that underlie the specific field investigated in the paper.

   A good way to think about this introduction is this: Write it as though you are writing it to yourself *prior to having taken this course.* Pretend that, before taking Astronomy 660, you would have been handed this introduction, and then told to read the article itself and be able to discuss it thoroughly. Note that many articles themselves include an introduction; usually, these provide some introduction to the field but are not as *comprehensive* in nature as the introduction that you will write. It is in this section that you will be aided by having familiarized yourself with the earlier articles that you have identified.

   As part of this introduction, it is particularly important to thoroughly describe all of the key prior work that has been done in the field, so that the current study that you are reviewing is firmly placed in its proper historical context.

2. **A Recent Study: [Name of Your Article Here].** Summarize the article in this section. Frequent reference to your Introduction is fine, as you point out the specific contributions to the field made by this particular research. Be sure to point out the limitations of the research as well as the advances. You may also include some personal commentary here about the nature of the research (e.g., do you think it represents a valuable contribution? Could it have been done better?) Note that there should be no “new” terms presented in this section that were not first introduced and described thoroughly in your Introduction.

3. **Future Directions.** In this final section, sketch out how you think this field will develop in the future: What are the current open questions? What are the most exciting areas of research? How close are we to answering the basic questions? How much further along do you think the field will be in, say, 10 years?
Grading

When the course project is graded, you will receive detailed comments on your written work. It will be evaluated based on my assessment of your achievement in the following areas four separate areas: Quality of introduction; recent paper analysis; future directions; and clarity of writing. Each will be assessed on a sliding scale ranging from “Poor” to “Excellent”, e.g. ('X' indicates location!):

<----X---->
Poor Average Excellent

An “overall assessment” will also be given, and a numerical score assigned (out of 100 possible points).

Sample Course Project

To provide an example of what I am looking for, I have placed an example written report from a former Astronomy 660 student that I felt was particularly well done in the “Course Documents” section of the Blackboard Web Page for this class.