**Syllabus: Galactic, Extra-Galactic Astronomy & Cosmology**
**ASTR 400B Spring 2023**

**Instructor**: Prof. Gurtina Besla
**Email**: gbesla@arizona.edu You must include ASTR 400B in the subject line of all emails
**Office**: Steward Observatory N312
**Office Hours:** Wednesdays 2-3 PM N312

**TA**: Hayden Foote
**Email**: haydenfoote@arizona.edu You must include ASTR 400B in the subject line of all emails
**Office Hours:** Wednesdays 3-5 PM in Steward 3rd floor Library

**Course Website**: All handouts, homework/in class worksheets and solutions will be posted on GitHub: https://github.com/gurtina/ASTR400B_2023

**Classes**: Tuesday & Thursday 2:00-3:15 PM SO 204

**Recommended Textbooks:**

**Introduction to Cosmology. 2nd Edition.** Barbara Ryden

**Galaxies in the Universe 2nd Edition** L.S. Sparke & J.S. Gallagher, III
Errata for the book: http://www.astro.wisc.edu/~sparke/book/errata.html

**Course Prerequisites:**
Students must have taken or are currently taking Phys 305 OR already have proficiency in coding in some language.

**Description of the Course**:
This course will teach you about the structure of our Milky Way Galaxy and how it compares to the zoo of galaxies that exist in our Universe. We will also discuss the very early stages of the universe and how galaxies evolve over time. This course involves a computational research project, where you will develop code to analyze an aspect of a simulation of the future fate of our Local Group, wherein the Milky Way and Andromeda galaxies collide and merge.

**Lecture Topics Covered:**
1) The Milky Way (~Jan)
2) Our Local Group of Galaxies (~Jan/Feb)
3) Galaxy Types and Profiles of Light and Dark Matter (~March)
4) Processes that Govern Galaxy Evolution: Mergers, AGN, Black Holes (~March)
5) Cosmology and the Early Universe (~April)

**Course Goals and Objectives:**
Class lectures will provide an overview of the equations and processes that describe galaxy evolution over cosmic time. Computational homework is designed to illustrate how those equations are used to study galaxy structure and evolution in practice, using code and industry standard practices (Github, version control, code documentation).

**Course Learning Outcomes:**

1. Demonstrate the ability to meaningfully analyze, apply and integrate the principle findings, common applications, current problems, fundamental techniques, and underlying theory of the astronomy discipline.

2. Employ discipline skills related to the computational methods and theoretical approaches used to investigate modern astrophysical phenomena and problems.

3. Develop proficiency with communicating, translating and interpreting fundamental astronomical concepts and research results in written formats.

4. Conduct guided research and/or develop mastery-knowledge of a specific area of the discipline of astronomy.

5. Participate in the scholarly, ethical, and discipline specific practices of the field at an emergent level.

**Course Evaluation:**

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| Computational Homeworks | 40% | ~ Weekly |
| In-Class Computational Labs | 10% | ~ Weekly |
| Project Proposal | 20% | March 16th 2023 |
| Final Report (3-5 pgs. LaTex) | 30% | May 5th 2023 |

You are required to submit all code on Github. Grades will be emailed to you by the TA or will appear on D2L. It is your responsibility to notify the TA of any grading errors within 72 hrs of the grades being posted.

**Late Assignment Policy:** All homeworks and labs are due by 5 PM the date marked on the assignment. Late assignments will be accepted until midnight of the due date, with a -2 penalty. If extensions are needed these must be communicated to Prof. Besla and the TA in advance of the deadline.

**Course Communications:**

All information about this course is communicated through a combination of the Syllabus, announcements/pdfs posted on the classroom Github repository, information provided in class, Powerpoint slides, and announcements made in-class.

**Absence and Class Participation Policy:**

As outlined in the Course Format and Teaching Methods section above, a significant amount of the course content and course work will be presented and done in-class. **If you know you will be missing a class, you are required to communicate the date and circumstances for your absence via an email to the professor at least one week in advance.**

**Classroom Behavior**

- **Academic Integrity**: All students in this course are expected to abide by the University of Arizona's Code of Academic Integrity http://dos.web.arizona.edu/uapolicies/

- **Cheating is not tolerated in any form.** If a student is caught cheating on any assignment or presentation the penalty will be failure in the course. In all cases a letter will be sent to the Dean of Students describing the incident. If you are aware that someone else is cheating, it is your obligation to inform the instructor.

- We allow, even encourage, collaboration on assignments. However, **you must always write the final version of an assignment yourself** and use your own words to describe what you have concluded. If we receive verbatim answers from more than one person we will divide the credit received among all those with identical answers. You must indicate anyone you worked closely with in the code documentation. Note, however, that the final research project is expected to be done **independently.**

- It is fine to make use of reference books or websites. But if you do so, make sure to add appropriate citations and put text taken verbatim in quotes, otherwise make sure to rewrite things in your own words. In all cases you must list the source of your information. **Plagiarism is strictly prohibited**. If you are uncertain as to what constitutes plagiarism see: http://deanofstudents.arizona.edu/codeofacademicintegrity Plagiarized code or writing for the final project will result in a Fail for the entire course.

  **Note: Working in teams for homeworks is allowed** – but please make a note of the names of everyone you worked with at the top of your code. All code documentation must be your own.

- **Cell Phones:** The use of cell phones is not allowed in the class.

**Students with Disabilities:**

If you anticipate barriers related to the format or requirements of this course, please meet with me so that we can discuss ways to ensure your full participation in the course. If you determine that disability-related accommodations are necessary, please register with Disability Resources (621-3268; drc.arizona.edu) and notify me of your eligibility for reasonable accommodations. We can then plan how best to coordinate your accommodations.

**Additional Resources for Students:**

UA Academic policies and procedures are available at:
http://archive.catalog.arizona.edu/2015-16/policies/aaindex.html

Student Assistance and Advocacy information is available at:
http://deanofstudents.arizona.edu/student-assistance/students/student-assistance

The TIMESTEP website https://lavinia.as.arizona.edu/~timestep/

The University of Arizona provides a wide variety of resources to help you feel more at home in the UA environment. Examples of student resource/cultural centers include:

- The African-American Student Center

- The Asian & Pacific American Student Center
- The Guerrero Student Center
- The Immigrant Student Resource Center
- The LGBTQ+ Student Center
- The Native American Student Center
- The Transfer Student Center
- The Veterans Education and Transition Services Center
- The Women & Gender Resource Center

We encourage you to take advantage of the community, support, and learning opportunities afforded by these centers, and to encourage your friends and colleagues to do the same.