

# **Syllabus: AST 483: Cosmology Capstone**

Course Title: AST 483: Cosmology Capstone

Semester: Fall 2024

Instructor: Dr. Robert Williams

Email: [rwilliams@asu.edu](mailto:rwilliams@asu.edu)

Office: SANCA 390D, The Polytechnic School, ASU

Office Phone: (480) 727-7100

Office Hours: Thursdays 2:00-4:30 PM OR by appointment

Class Time & Place: Monday or Wednesday 3:00-4:15 PM in SANCA 395

## **Course Description:**

This capstone course focuses on the study of large-scale structures and the evolution of the universe. Students will analyze data from cosmic microwave background observations, galaxy surveys, and simulations, culminating in a presentation of their findings at the Innovation Showcase. The course includes the development of a project proposal, data collection, modeling, and a final report.

## **Course Objectives:**

- Study the large-scale structure and evolution of the universe.
- Analyze observational data and develop cosmological models.
- Compare data with theoretical predictions and test hypotheses.
- Effectively present the project at the Innovation Showcase.

## **Learning Outcomes:**

- Gain expertise in cosmology and data analysis.
- Develop practical skills in modeling and hypothesis testing.
- Improve communication skills through written reports and presentations.
- Enhance the ability to manage astronomy projects from conception to completion.

## **Group Project and Required Subtasks:**

The group project for this course will involve the study and analysis of large-scale structure and the evolution of the universe. The project will be broken down into the following subtasks:

### 1. **Project Proposal (Week 3):**

- Create a proposal outlining the cosmological phenomena being studied, the research objectives, and the anticipated outcomes. Include a timeline and assign roles to team members.

### 2. **Data Collection and Analysis (Weeks 4-6):**

- Collect data from cosmic microwave background observations, galaxy surveys, and other sources. Analyze the data to study the distribution of matter and energy in the universe.

### 3. **Modeling and Simulation (Weeks 7-10):**

- Develop models and simulations to understand the formation and evolution of cosmic structures. Compare the models with observational data.

### 4. **Hypothesis Testing and Interpretation (Weeks 11-12):**

- Test hypotheses about the origin and evolution of the universe. Interpret the results in the context of current cosmological theories.

### 5. **Final Report and Presentation (Weeks 13-15):**

- Document the entire research process, including challenges, solutions, and outcomes in a final report.
- Prepare a presentation and poster for the Innovation Showcase that highlights the key aspects of the project.

Groups are expected to collaborate closely, meeting regularly to discuss progress and resolve any

issues. Instructor check-ins will be scheduled to provide guidance and feedback.

**Evaluation:**

Class meetings (5): 20 points

Individual meetings (3): 12 points

Project Proposal: 10 points

Data Collection and Analysis: 15 points

Modeling and Simulation: 18 points

Hypothesis Testing and Interpretation: 10 points

Final Report: 10 points

Presentation: 5 points

Poster: 10 points

Total: 100 points

**Course Policies:**

**Attendance and Participation:** Regular attendance and active participation are crucial for success in this course. Students are expected to attend all scheduled class meetings and individual sessions. If a student is unable to attend a class, they should inform the instructor in advance and arrange to complete any missed work.

**Academic Integrity:** All students must adhere to ASU's academic integrity policy. Any form of academic dishonesty, including plagiarism, will be reported and may result in severe penalties, including a failing grade for the course.

**Accommodations:** Students with disabilities or special needs should contact the ASU Disability Resource Center to arrange appropriate accommodations and notify the instructor as soon as possible.

**Important Dates:**

Class Week 1: Introductions & Project Brainstorming (Aug 26)

Individual Meeting #1: Discuss Ideas and Readings (Sep 4)

Class Week 2: Proposal Presentation & Group Feedback (Sep 18)

Individual Meeting #2: Proposal Feedback & Methods Discussion (Oct 2)

Class Week 3: Revised Proposal Presentation & CERTT Tour (Oct 23)

Individual Meeting #3: Data Analysis & Progress Review (Nov 13)

Class Week 4: Professional Development & Project Discussion (Nov 27)

Innovation Showcase: Final Presentations & Poster Display (Dec 6)