

ASTR 302

Cosmology

Fall 2021, Section 001

Instructor Information

Instructor	Contact	Lectures
<p>Dr. Rob Parks (He/Him)</p> <p>Office Hours MWF 11:00 AM - 12:00 PM</p> <p>Appointments also possible</p> <p>Office Location Research Hall, Room 216</p>	<p>Email jparks23@lsu.edu</p> <p>Office # (703) 993-1276</p> <p>Cell # (404) 840-8361</p>	<p>Lectures TR 1:30 - 2:45 PM Online (synchronous)</p> <p>Discord https://discord.gg/gG7gb4x8</p>

General Information

Course Goals

The following objectives will be pursued in basically a non-mathematical way. However, a qualitative understanding of the physical basis of modern cosmology will be used in the presentation of the material. Although examinations do not involve problem solving, lectures will use quantitative material.

1. To familiarize students with the historical, philosophical, and scientific background of cosmological thought as it pertains to the modern science of cosmology
2. To familiarize students with the physical concepts and terms used in modern physics, mathematics, astronomy, and cosmology, so as to contribute to a student's understanding of the physical nature of human existence in the Universe
3. To expose students to the practices, methodology, and the conceptual basis of a modern physical science, such as cosmology
4. To provide an exposure to one of the important areas in the history and philosophy of science

Course Description and General Education Course Statement

The Mason Core natural sciences courses engage students in scientific exploration, foster their curiosity, enhance their enthusiasm for science, and enable them to apply scientific knowledge and reasoning to personal, professional and public decision-making.

The Learning Outcomes of Astronomy 302: “Cosmology” are:

1. Understand how scientific inquiry is based on investigation of evidence from the natural world, and that scientific knowledge and understanding:
 - evolves based on new evidence
 - differs from personal and cultural beliefs.
2. Recognize the scope and limits of science.
3. Recognize and articulate the relationship between the natural sciences and society and the application of science to societal changes (e.g. health, conservation, sustainability, energy, natural disasters, etc.)
4. Evaluate scientific information (e.g. distinguish primary and secondary sources, assess credibility and validity of information).
5. Participate in scientific inquiry and communicate the elements of the process, including:
 - making careful and systematic observations
 - developing and testing a hypothesis
 - analyzing evidence
 - interpreting results.

Research has shown most students only learn a limited amount of information from lecture alone regardless of how clear or engaging the material. Therefore, lectures are used to introduce you to the topic while classroom activities are designed to help better understand the material. The in-class activities include, but are not limited to, interactive questions and exercises. It cannot be understated regular reading of the textbook immensely aids providing context to the material presented in class.

Cosmology 302 is a Mason Core Course in Natural Sciences Overview. *Note:* ASTR 302 with ASTR 112 or ASTR 114 can be used to fulfill a 4-credit lab science requirement. Not for physics majors.

George Mason University promotes a living and learning environment for outstanding growth and productivity among its students, faculty, and staff. Through its curriculum, programs, policies, procedures, services, and resources, Mason strives to maintain a quality environment for work, study, and personal growth.

Course Diversity Statement

An emphasis upon diversity and inclusion throughout the campus community is essential to achieve these goals. Diversity is broadly defined to include such characteristics as, but not limited to, race, ethnicity, gender, religion, age, disability, and sexual orientation. Diversity also entails different viewpoints, philosophies, and perspectives. Attention to these aspects of diversity will help promote

a culture of inclusion and belonging, and an environment where diverse opinions, backgrounds, and practices have the opportunity to be voiced, heard, and respected.

The reflection of Mason's commitment to diversity and inclusion goes beyond policies and procedures to focus on behavior at the individual group and organizational level. The implementation of this commitment to diversity and inclusion is found in all settings, including individual work units and groups, student organizations and groups, and classroom settings; it is also found with the delivery of services and activities, including, but not limited to, curriculum, teaching, events, advising, research, service, and community outreach.

Acknowledging that the attainment of diversity and inclusion are dynamic and continuous processes and that the larger societal setting has an evolving socio-cultural understanding of diversity and inclusion, Mason seeks to continuously improve its environment. To this end, the University promotes continuous monitoring and self-assessment regarding diversity. The aim is to incorporate diversity and inclusion within the philosophies and actions of the individual, group and organization, and to make improvements as needed.

Course Information

Credit Hours: 3

Main Textbook: *Foundations of Modern Cosmology*, 2nd Edition, Hawley, J. and Holcomb, K.

Lecture Presentation Service: *Top Hat*, <https://tophat.com>

The course syllabus and all other course information can be found on both Blackboard and Top Hat course websites. This information can be accessed this by logging directly onto Blackboard (<https://blackboard.gmu.edu>) or by:

1. Logging onto the Top Hat website and finding the class using the Join Code 408499
2. By directly going to the course Top Hat website (<https://app.tophat.com/e/408499>).

It is your responsibility to check either web site regularly to prepare for class this and future information. You will also need to check your university email account regularly for course information updates.

Course Format - Lectures

The course adopts an inverted class structure – lectures will be videos watched before class. Videos will be hosted on the following channel: https://www.youtube.com/channel/UCqPt-mMHr1Bq-XxI7iyah_g. The following virtual class session will begin with quiz questions hosted on Top Hat that relate to the previous day's lecture. Please arrive to class on time so as not to miss these questions.

The remaining virtual class time will consist of a lecture review followed by work on class projects. These projects will include specific assignments or preparation for your debates, presentations, and final paper.

Technology Basic Requirements

Activities and assignments in this course will regularly use the Top Hat (<https://app.tophat.com/e/408499>) and Blackboard learning system (<https://mymason.gmu.edu>). Students are required to have regular, reliable access to a computer with an updated operating system (recommended: Windows 10 or Mac OSX 10.13 or higher) and a stable broadband Internet connection (cable modem, DSL, satellite broadband, etc., with a consistent 1.5 Mbps [megabits per second] download speed or higher. You can check your speed test on this website.)

Activities and assignments in this course will regularly use the Zoom web-conferencing software. In addition to the requirements above, students are required to have a device with a functional camera and microphone. In an emergency, students can connect through a telephone call, but video connection is the expected norm.

Assignments

Lecture Quizzes

Starting on the second week of class, quiz questions will be asked at the beginning of each session on Top Hat. You will have two minutes to answer the question using any laptop, tablet, smartphone, or through text messaging. You are encouraged to discuss the answer to the question with your neighbor. Given the online nature of the course, collaboration can be done through chat with other students. **Please do not discuss answers with the class as a whole.** The total quiz grade accounts for 15% of your final grade. Each question is worth two points. Answering the question will award a participation point contributing to your final grade. Answering the question correctly will award an extra credit point.

Class Exercises

As discussed above, this course will practice an inverted design where lectures will be available online to be viewed outside of class. The “lecture” time will be spent reviewing the topics from the appropriate online lectures and working problems within class. The exact exercises are listed in course schedule. The total grade will comprise 30% of your final grade and will represent the average grade of all assigned exercises.

The Great Debate

One of the course goals is to improve communication and intergroup cooperation skills. A principal way to work on both, particularly the latter, is to participate in a “Great Debate”. The name is taken from the debate between Shapley and Curtis near the beginning of the 20th century as to the size of the Universe and Earth’s location within it. Students will be broken into one of six groups and assigned a side on one of the following three debates:

- Geocentric vs. Heliocentric Universe
- Steady-State vs. Big Bang Cosmology
- Low Luminosity vs. Weakly Interacting Dark Matter

Groups will be assigned **Friday, August 27th** and will consist of no more than 6 people. If you wish to be partnered with certain people, please let me know prior to this date or you will randomly designed teammates. Topics and positions will be randomly assigned to groups once they have been finalized and will also be announced that Friday.

Term Paper

Students will write a research paper in APA format (most recent edition) unless otherwise approved by the instructor. The topic of the paper must be on one of the following topics:

1. The Age of the Universe; a description of the history behind how this fundamental parameter was determined and the various methods the parameter is currently determined. Include any discrepancies present in the age of the Universe using modern methods.
2. Dark Energy; a description of why cosmologists included this concept into the current model and the prevailing theories as to the nature of dark energy.
3. Dark Matter; a description of the history of the observations supporting the existence of dark matter; possible explanations of the nature of dark matter (e.g. what is it?); implications to the fate of the Universe through the inclusion of dark matter.
4. Inflation; a discussion of the nature of the inflationary model and what problems in the Big Bang theory it attempts to solve.
5. The Big Bang Theory; a description of the state of cosmology prior to the adoption of the Big Bang theory; a discussion of what observed phenomena promoted the need for its adoption; an overview of the theory and the observational evidence that supports it.
6. The Shapley-Curtis Great Debate; a discussion of the salient points of the fundamental debate; how did Shapley view the Universe and what was his evidence; how did Curtis view the Universe and what was his evidence; who decided the matter and who won
7. Additional topics are possible at the discretion of the instructor.

As this is a writing intensive course, all papers need to meet the following criteria:

1. Papers need to include a minimum of 10 references, unless the instructor determines the paper is adequately supported with fewer references. Typically, students will exceed this requirement.
2. Papers need to be a minimum of 2500 words (double spaced: *excluding* title page, references, tables, and figures). More important than length is presentation of an adequate rationale through concise language and thorough support from cited sources.

The final paper will consist of **30%** of your final grade.

Project Presentation

Students will be required to present the principle points of their term paper at the end of the semester. The minimum length of the PowerPoint presentation is 10 minutes with a maximum length of 15 minutes. The presentation is to be recorded and uploaded to Blackboard on or before **Wednesday, December 8th**. The presentations are to be viewed and graded by each student (except for the presentation's author) prior to **Friday, December 10th**. The grading will be done through a rubric that will be uploaded to Blackboard and Top Hat. The grade for the presentation will be an aggregate of the student evaluations and that of the instructor. The grade will comprise **15%** of the course grade.

Grade Distribution

Assignment	Percentage
Top Hat Lecture Quizzes	10%
Class Exercises	30%
The Great Debate	15%
Final Paper	30%
Final Presentation	15%

Grade Scale

Letter Grade	Numerical Scale	Letter Grade	Numerical Scale
A+	96 - 100%	C+	72 - 75.99%
A	92 - 95.99%	C	68 - 71.99%
A-	88 - 91.99%	C-	64 - 67.99%
B+	84 - 87.99%	D	60 - 69.99%
B	80 - 83.99%	F	BELOW 60%
B-	76 - 79.99%		

Course Policies and Services

- Course Materials and Student Privacy

- All course materials posted to Blackboard or other course site are private to this class; by federal law, any materials that identify specific students (via their name, voice, or image) must not be shared with anyone not enrolled in this class.
 - Video recordings – whether made by instructors or students – of class meetings that include audio, visual, or textual information from other students are private and must not be shared outside the class.
 - Live video conference meetings (e.g. Zoom) that include audio, textual, or visual information from other students must be viewed privately and not shared with others in your household or recorded and shared outside the class.
 - **All of our synchronous meetings in this class will be recorded to provide necessary information for students in this class.** Recordings will be stored on Blackboard and Top Hat and will only be accessible to students taking this course during this semester.
- **Disability Services**
 - George Mason University is committed to providing equitable access to learning opportunities for all students by upholding the laws that ensure equal treatment of people with disabilities. If you are seeking accommodations for this class, please first visit <http://ds.gmu.edu/> for detailed information about the Disability Services registration process. The please discuss your approved accommodations with the professor. Disability Services is located in Student Union Building (SUB I), Suite 2500. Email: ods@gmu.edu | Phone: (703) 993-2474
- **Interpersonal Violence**
 - As a faculty member and designated “Responsible Employee”, I am required to report all disclosures of sexual assault, interpersonal violence, and stalking to Mason’s *Title IX Coordinator per university policy 1412*. If you wish to speak with someone confidentially, please contact the *Student Support and Advocacy Center (730-380-1434) or Counseling and Psychological Services (703-993-2380)*. You may also seek assistance from *Mason’s Title IX Coordinator (703-993-8730 | titleix@gmu.edu)*
- **Email and Communication**
 - Students must use their MasonLive email account to receive important University information, including communications related to this class. I will not respond to messages from or send messages to a non-Mason email address.
 - It is your responsibility to stay current with all information either communicated through email or posted to either the Top Hat or Blackboard page. Please check your LSU email and the course pages regularly.
 - Email sent to the instructor is normally checked during business hours and a response sent out within one business day. If you do not receive a reply within that timeframe, please follow-up with a reminder email. Instantaneous responses, responses to emails past 10 PM, or during the weekends should not be expected.
 - All emails need to include your name and the course in which you are enrolled. Additionally, the email needs to include a greeting and be written in a professional

manner. Emails that do not conform to these requirements may be ignored at the instructor's discretion.

- **Additional Services and Support**

- George Mason has a wide variety of support services for students. Please visit the following website for information about on-campus resources:
<https://stearnscenter.gmu.edu/knowledge-center/knowning-mason-students/student-resources-on-campus/>

- **Attendance and Absences**

- From LSU Policy Statement 22: "Class attendance is the responsibility of the student. The student is expected to attend all classes. A student who finds it necessary to miss class assumes responsibility for making up examinations, obtaining lecture notes, and otherwise compensating for what may have been missed. The course instructor will determine the validity of a student's reason(s) for absences and will assist those students who have valid reasons."
- Attendance will be taken each class as a way to ensure in-class activities are completed in the classroom.
- If you miss a graded assignment and believe that you qualify for an excused absence, contact the instructor within 48 hours and provide a copy of the absence excuse within one week, unless physically unable to do so. Failure to follow these deadlines will result in the absence being considered unexcused.
- Note: if a class is missed, attendance of another section of the same course is not permitted.

- **Limit on Course Repeats**

- There is a limit of three graded attempts for this course. A *W* does not count as a graded attempt. Please see AP. 1.3.4 in the University Catalog and consult with your academic adviser if you have any questions.

- **GMU Code of Student Conduct**

- Students are expected to follow the George Mason University rules of student honor. As noted in the catalog: "George Mason University shares in the tradition of an honor system that has existed in Virginia since 1842. The Honor Code is an integral part of university life. On the application for admission, students sign a statement agreeing to conform to and uphold the Honor Code. Therefore, students are responsible for understanding the provisions of the code. In the spirit of the code, a student's word is a declaration of good faith acceptable as truth in all academic matters. Therefore, cheating and attempted cheating, plagiarism, lying, and stealing of academic work and related materials constitute Honor Code violations. To maintain an academic community according to these standards, students and faculty must report all alleged violations of the Honor Code to the Honor Committee. Any student who has knowledge of, but does not report, an Honor Code violation may be accused of lying under the Honor Code." (Source: <http://www.gmu.edu/catalog/apolicies/index.html>)

- **Instructor's Intended Purpose**

- The student's work must match the instructor's intended purpose for an assignment. While the instructor will establish the intent of an assignment, each student must clarify outstanding questions of that intent for a given assignment.
- **Unauthorized/Excessive Assistance**
 - The student may not give or get any unauthorized or excessive assistance in the preparation of any work.
- **Authorship**
 - The student must clearly establish authorship of a work. Referenced work must be clearly documented, cited, and attributed, regardless of media or distribution. Even in the case of work licensed as public domain or Copyleft (See: <https://creativecommons.org/>) the student must provide attribution to that work in order to uphold the standards of intent and authorship.
- **Declaration**
 - Online submission of, or placing one's name on an exam, assignment, or any course document is a statement of academic honor that the student has not received or given inappropriate assistance in completing it and that the student has complied with the Academic Honesty Policy in that work.
- **Consequences**
 - An instructor may impose a sanction on the student that varies depending upon the instructor's evaluation of the nature and gravity of the offense. Possible sanctions include but are not limited to, the following: (1) Require the student to redo the assignment; (2) Require the student to complete another assignment; (3) Assign a grade of zero to the assignment; (4) Assign a final grade of "F" for the course. A student may appeal these decisions according to the Academic Grievance Procedure (See the relevant section in the LSU Code of Student Conduct.). Multiple violations of this policy will result in a referral to the Conduct Review Board for possible additional sanctions.
- **Academic Dates and Deadlines**
 - Students must be aware of important dates during the semester. These dates are available at https://registrar.gmu.edu/calendars/fall_2020/
- **Smoking and Tobacco Products**
 - George Mason University is committed to providing a safe, healthful, and pleasant learning and working environment for Mason students, faculty, and staff. The purpose of this policy is to address the use of all tobacco products and electronic cigarettes, as well as ensure compliance with the Virginia Indoor Clean Air Act and Virginia Executive Order 41. Virginia Executive Order 41 states that smoking is not permitted within buildings, facilities, enclosed structures, or vehicles owned, leased or rented by the University.
 1. Executive Order 41 applies to parking garages, covered walkways, temporary enclosed structures, trailers, and tents, as well as structures placed on state-owned property by contractors or vendors.
 2. Smoking is not permitted outdoors within 25' of any building or facility entrance/exit (including parking garages, loading docks, etc.), outdoor air

- intake, operable window, or covered walkway. Smokers are requested to use ash urns to dispose of their smoking material waste and should not litter on state-owned property with smoking material waste.
3. Smoking locations should not impede traffic flow in or out of buildings and should be in a location where smoke cannot drift into office, class or living spaces.
 4. Faculty, staff, student and visitor smokers are required to comply with Office of Housing and Residence Life policies and guidelines as they relate to smoking.
- The use of electronic cigarettes (e-cigs) also known as vaping will follow the same guidelines as the use of all tobacco products.