# INQ 250: Astronomy Controversies of the Modern Era F2025

**Instructor:** Dr. Truong Le
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**Lectures Room:** Trexler Hall, 263
**Lectures Time:** TTH 10:10-11:40 am
**Office Hrs:** MW (10-12:00 pm), and by appointment

**Course Description:** Introduces the methodologies of the natural sciences through an inquiry-focused approach to a topic. Students will explore the types of questions that science asks and how it attempts to answer them by defining and classifying information, developing models, identifying patterns, and drawing conclusions based upon data (**Credit cannot be received for both HNRS-250 and INQ-250 from the same discipline**).

**Course Material:** Required and recommended

- **Calculator (required):** A scientific calculator.
- **Text (required):** Astronomy by Fraknoi, Morrison, and Wolff (on Inquire).
- **Text (required):** College Physics by Urone and Hinrichs (on Inquire).

**Laboratory:** You must be enrolled in the laboratory portion INQ 250L of this course. Although INQ 250L operates as a separate course, it counts as 20% of the course grade for INQ 250. Please refer to the lab course syllabus for important information about the lab specifics and final grade.

**Goals & Objectives:** All sections of INQ 250 share a common set of learning outcomes related to the skills students will develop in this course. These outcomes are:

- Students will be able to describe and apply scientific methodologies appropriate for the course's discipline and topic, including the ability to design and conduct simple experiments and to draw conclusions based upon data.
- Students will be able to write about course topics clearly and effectively.
- Students will be able to interpret quantitative information related to the course topic.

Our course covers a broad range of topics, primarily focusing on physics and astronomy. We will also incorporate elements of history, philosophy, and mathematics. A set of course-specific secondary learning outcomes which enhance and support those outlined above, have also been developed and are presented below.

- Understand fundamental historical, philosophical, and physical concepts, principles, and ideas.
- Understand major ideas and concepts that have shaped and are shaping 21st century scientific thought and discoveries.
- Understand connections between past, present, and future scientific developments and discoveries that have come to shape our conceptions of the universe.
- Understand and identify the major contributions of individual philosophers, scientists, astronomers, mathematicians, who have played a role in helping to develop our understanding of the universe.
- Appreciate science and the fundamental ideas and laws that govern the Universe.

**Methods of Instruction** You will learn astronomy from a variety of sources, including:

- textbook readings
- brief in-class lectures
- tutorials/homeworks
- laboratories in INQ 250L
- discussions with instructor or subject tutor
- quizzes and tests

**What You Can Do:** Here are ways to get the most out of this course:

- Attend each class meeting (lecture and lab) and arrive on time.
- Read the relevant sections of the textbook before or after class.
- Participate in class by working with your group to complete the tutorial worksheets
- Complete all group tutorial/homework assignments on time.
- Talk to me in office hours if you are having trouble with any aspect of the course.

**Final Grade:** Final course grades will be assigned using the following scale:

| | | | | | |
|---|---|---|---|---|---|
| A | 93% or more | A- | 90-92.9% | | |
| B+ | 87-89.9% | B | 83-86.9% | B- | 80-82.9% |
| C+ | 77-79.9% | C | 73-76.9% | C- | 70-72.9% |
| D | 60-69.9% | F | below 60% | | |

**Grading:** Your grade in this class will be determined by a combination of project, exams, homework, laboratory, and class participation. The separate weightings will be:

**Class Participation (tutorial, quiz):** 10%
**Homework:** 20%
**Laboratory:** 20%
**Midterm:** 20%
**Project:** 10%
**Final:** 20%

**Collaborative Work:** Groups of four students (in some cases, three students) will be formed to develop problem-solving skills/strategies. Tutorials and quizzes will be worked in groups. Exams will have both group portions and individual portions.

**Show your work:** Your solutions on tutorials, quizzes, and exams should be neat, clear, and organized.

**Tutorial:** You will work on a tutorial worksheet with your group during every class. One person in your group (that person will rotate alphabetically by last name) will need to submit a tutorial solution to me by the end of the class for the group to potentially receive full credit. If the tutorial solution is not submitted by the end of class, the tutorial becomes group homework, and the designated person in the group must submit a solution before 3 pm of that day for potential full credit. Late submissions for up to half credit can be accepted until 3 pm before the next class.

**Quiz:** Quiz will occur almost in every lectures. Only one quiz solution need be submitted to me per group. The aim is to provide you feedback on how well you and your group have understood the tutorials.

**Homework:** Homework will be **assigned after each class and is due by midnight after the next class.** Each assignment will consist of 15-20 multiple-choice questions, and you should plan to spend about 2 hour on each homework. If you find yourself spending more than 2 hours, please meet with me for assistance. **Homework will be posted on Inquire.** Discuss and understand the material with others in your group, but focus on learning rather than copying answers. Understand the homework, as similar problems will be on exams. **Submit all assignments on time for full credit.**

**Exams:** There will be two exams in this course (a midterm and a final) that each contain group and individual parts. Each group will turn in one group part of the exam, and each student will turn in their own individual part of the exam. Note that the final exam covers only the last half of the course, i.e. it is not a cumulative exam.

**Note:** Quizzes and exams will be open notes. Any missed quiz or exam will receive a zero unless it is an excused absence (illness, participation in a scheduled College event, etc.), which should be cleared with me before the quiz or exam. The missed quiz or exam may be made up in a way decided by the instructor.

**Project:** This is a group project, and this assignment is different from your homework and exams. This project allows you to creatively demonstrate your understanding of a topic related to our course themes. You can choose a topic from readings, lectures, discussions, or video segments. Your project must include a written commentary. In this commentary, explain your project, its significance, and how it connects to one or more historical cosmological models. Possible topics for your creative projects include (but are not limited to):

- The creation of a piece of artwork (e.g. a collage, drawing, painting, sculpture, a particular model of the universe, etc.).
- A musical expression of some type (e.g. writing a song, creating an interpretive dance).
- A creative literary piece (e.g. a piece of poetry, a short story, a piece of science journalism such as an interview with a scientist, cosmologist, astronomer, etc.).
- The creation and performance of a short skit or play.
- You might also create a video that might serve as a stand-alone piece or that might accompany your project.

To get approval for your creative project, submit a brief proposal detailing how your topic connects to historical cosmologies and their original sources. Include at least two cited sources in your proposal. Further details will be provided in class. At the end of the semester, your group will give a 10 to 15-minute presentation of your project.

**Academic Integrity:** Your learning and integrity are at the core of your RC education. For this reason, you must follow the College's Academic Integrity policies: you can find the policies and resources online at https://www.roanoke.edu/inside/academic_affairs/academic_integrity (⟵ clickable link).

Collaboration is an important skill, and you are encouraged to collaborate on assignments. Specifically, you will collaborate with your group on tutorial/homeworks and on quizzes, and on the group portion of exams. You may also collaborate with other students on tutorial/homeworks, but you should note the names of those students in your work. The individual portions of exams must be completed individually without collaboration.

Quizzes and exams are open-notes. Electronic devices (other than calculators) are NOT permitted during quizzes and exams. If you choose to take notes electronically, you will need to print out your notes ahead of time. Communication between students regarding quiz or exam content is prohibited until all students have completed the quiz or exam.

If I become aware of a possible violation of these guidelines, I am contractually obligated to report it to the Academic Integrity committee.

**Subject Tutoring:** This is located on the lower level of Fintel Library (Room 5), is open 4-9 PM, Sunday-Thursday. Subject Tutors are highly trained, current students who offer free, one-on-one (and small group) tutorials in over 80 courses taught at Roanoke College, including: Business, Economics, Mathematics, INQ 240, Modern Languages, Lab Sciences, and Social Sciences. Check out all available subjects and schedule 30- or 60- minute appointments at www.roanoke.edu/tutoring (⟵ clickable link). If you have a question, feel free to stop by, or contact us at subject_tutoring@roanoke.edu or 540-375-2590. See you soon!

**Accessible Education Services (AES):** Located in the Goode-Pasfield Center for Learning and Teaching in Fintel Library. AES provides reasonable accommodations to students with documented disabilities. To register for services, students must self-identify to AES, complete the registration process, and provide current documentation of a disability along with recommendations from the qualified specialist. Please contact Becky Harman, Assistant Director of Academic Services for Accessible Education, at 540-375-2247 or by e-mail at aes@roanoke.edu to schedule an appointment.

**Course Schedule:** This may be adjusted by the instructor if necessary, but students will be notified of any changes, and there will be no changes to exam dates. I will inform you the reading material at the beginning of every class:

| **Dates** | **Topic** | **Lab** |
|---|---|---|
| | **Is the Earth at the center of the universe?** | |
| W1: Aug 28 | Welcome and Course Introduction | no lab first week |
| W2: Sep 2,4 | Tour of the universe: Estimating, orders of magnitude, factors of 1000<br>Angular Size & Field of Views (FoV) | 1: Scale the solar system |
| W3: Sep 9,11 | Early civilization, Greek civilization<br>Retrograde motions & Motion of the Sun | 2. Angular Size-FoV |
| W4: Sep 16,18 | Scientific Rev. I: Copernicus, Galileo<br>Tycho, Kepler's Laws | 3. Outdoor/Telescope |
| W5: Sep 23,25 | Scientific Rev. II: Newton, velocity, acceleration, force, circular motion, and gravity | 4. Night Observation |
| | **Are there planets beyond our solar system?** | |
| W6: Sep 30, Oct 2 | Properties of the solar system<br>Early hypotheses of the solar system &<br>Exoplanets | 5. Kepler Laws |
| W7: Oct 7,9 | Escape Velocity and the Earth's Atmosphere<br>Review for Midterm | 6. Exoplanets |
| | **Midterm** (Oct 9) | |
| W8: Oct 11-19 | Fall Break | |
| | **Are there black holes?** | |
| W9: Oct 21,23,28 | light, stars, and white dwarfs<br>neutron stars, black holes | 7. Planck Radiation |
| W10: Oct 28,30 | Einstein's Special Relativity<br>Einstein's General Relativity | 8. Black Hole |
| | **Is there one galaxy or many?** | |
| W11: Nov 4,6 | Cepheids Variable, The Milky Way Galaxy & Dark Matter | 9. Hubble Deep Field |
| | **Did the universe have a beginning?** | |
| W12: Nov 11,13 | Dark Matter & Galaxies | 10. Dark Matter |
| W13: Nov 18,20 | An Expanding Universe | 11. Speed/Image of a Galaxy |
| W14: Nov 26-30 | Thanksgiving | |
| W15: Dec 2,4 | The Fate of the Universe<br>Review for Final (Last day of class) | 12. Project Presentation |
| W16: Dec 11 | **Final Exam (8:30-11:30 am)** | |

You can expect to spend 12-15 hours per week on this course and the accompanying lab INQ 250L: 6 hours in class and lab, and 6-9 hours outside of class. I have read and understood this syllabus. Sign, date, and submit this page for 10 points toward your participation grade.

**Student's Name (First and Last)** **Date**