

Spring 2021

PHYS 202-002: Introductory Astronomy and Cosmology

Ian Gatley

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**New Jersey Institute of Technology
College of Science and Liberal Arts
Department of Physics
Introductory Astronomy and Cosmology, Section 002
Phys 202–002
Spring 2021**

SYNCHRONOUS ONLINE COURSE using Webex:

**Tuesdays 2:30 p.m. to 3:50 p.m. at: <http://njit.webex.com/join/gatley>
Fridays 2:30 p.m. to 3:50 p.m. at: <http://njit.webex.com/join/gatley>**

Instructor

Ian Gatley, Ph.D.
ian.gatley@njit.edu

Textbook: The electronic version of the textbook is available online at no cost

Astronomy (Yes, the name of the book is *Astronomy*)

Senior Contributing Authors: Andrew Fraknoi, David Morrison & Sidney C. Wolff
<https://openstax.org/details/books/astronomy>

Grade

Your final grade will be based upon homework, two written reports, four in-class examinations, and one Final Examination. The in-class examinations will be held using Canvas on the following dates.

| | |
|--------------------|---------------------------|
| First Examination | Tuesday, February 9, 2021 |
| Second Examination | Tuesday, March 2, 2021 |
| Third Examination | Tuesday, April 6, 2021 |
| Fourth Examination | Friday, April 30, 2021 |

Instructions for the two written reports will be posted on Canvas.
The date and time of the Final Examination will be announced later.

There will be no “make-up” examinations. If you miss an examination, you will receive a grade of zero for that examination. The scores you earn will determine your final grade based on the following table.

| | |
|-------------|----|
| 85% to 100% | A |
| 80% to 84% | B+ |
| 70% to 79% | B |
| 65% to 69% | C+ |
| 50% to 64% | C |
| 40% to 49% | D |
| 0% to 39% | F |

The homework grades will not be “curved,” nor will the scores on the written reports be “curved.” The examination grades will not be “curved,” nor will the final grades be “curved.” The homework and the examinations will cover topics discussed in class and/or topics discussed in the textbook. The Final Examination will cover the entire course’s material.

Introductory Astronomy and Cosmology (Phys 202) and Introductory Astronomy and Cosmology Laboratory (Phys 202A) are two separate courses for which you will receive two separate and independently-determined grades. Moreover, you are free to be registered for either one of these courses without being registered for the other course. If you are registered for both courses, withdrawal from one course does not mean you must withdraw from the other course.

Academic Integrity

Any student who is disruptive in the online session will be in violation of the Academic Honor Code and will be reported to the Dean of Student Services.

Any student who cheats during an examination or in the writing of a report will be in violation of the Academic Honor Code. The student will automatically fail the course and will be reported to the Dean of Student Services so that further action may be taken. Examples of cheating during an examination include, but are not limited to, talking with another student, copying work from another student's work, or allowing another student to copy work from your own work.

Syllabus

| | | |
|---------|--------|--|
| Tuesday | 19-Jan | Observing the Sky (Chapters One & Two) |
| Friday | 22-Jan | Orbits and Gravity (Chapter Three) |
| Tuesday | 26-Jan | Earth, Moon, and Sky (Chapter Four) |
| Friday | 29-Jan | Radiation and Spectra (Chapter Five) |
| Tuesday | 2-Feb | Astronomical Instruments (Chapter Six) |
| Friday | 5-Feb | Introduction to the Solar System (Chapter Seven) |
| Tuesday | 9-Feb | Exam 1 (Chapters 1-7) |
| Friday | 12-Feb | Earth and Other Cratered Worlds (Chapters 8 and 9) |
| Tuesday | 16-Feb | Venus and Mars (Chapter Ten) |
| Friday | 19-Feb | Giant Planets, Rings, Moons (Chapters 11 and 12) |
| Tuesday | 23-Feb | Comets, Asteroids, Samples (Chapters 13 and 14) |
| Friday | 26-Feb | The Sun (Chapters 15 and 16) |
| Tuesday | 2-Mar | Exam 2 (Chapters 8-16) |
| Friday | 5-Mar | Starlight and Stars (Chapters 17 and 18) |
| Tuesday | 9-Mar | Distances. Gas & Dust in Space (Chapters 19 and 20) |
| Friday | 12-Mar | Star & Planet Formation (Chapter Twenty-one) |
| Tuesday | 23-Mar | Stars' Adolescence to Old Age (Chapter Twenty-two) |
| Friday | 26-Mar | Death of Stars (Chapter Twenty-three) |
| Tuesday | 30-Mar | Review of Chapters 17-23 |
| Tuesday | 6-Apr | Exam 3 (Chapters 17-23) |
| Friday | 9-Apr | Black Holes, Curved Spacetime (Chapter Twenty-four) |
| Tuesday | 13-Apr | The Milky Way Galaxy (Chapter Twenty-five) |
| Friday | 16-Apr | Galaxies (Chapter Twenty-six) |
| Tuesday | 20-Apr | QSOs, Black holes, Galaxy Evolution (Chapters 27 & 28) |
| Friday | 23-Apr | The Big Bang (Chapter Twenty-nine) |
| Tuesday | 27-Apr | Review of Chapters 24-29 |
| Friday | 30-Apr | Exam 4 (Chapters 24-29) |
| Tuesday | 4-May | Review of Chapters 1-29 |

New Jersey Institute of Technology
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Department of Physics
Introductory Astronomy and Cosmology (Phys 202)
Learning Objectives and Outcomes

Comprehend our place in the universe.
Describe the size of the universe, and relate this size to everyday human experience.
Describe the age of the universe, and relate this age to every day human experience.
Understand various astronomical coordinate systems.
Analyze the changes in the sky from different locations on the Earth.
Recall the brightest stars in the sky and several constellations in the sky.
Comprehend the electromagnetic spectrum.
Use the Doppler effect to analyze redshifts and blueshifts.
Understand the laws of optics, and use them to construct telescopes.
Comprehend atomic theory, including subatomic particles.
Analyze different types of spectra.
Describe the changes in perspective that led to the Copernican revolution.
Apply Kepler's laws to explain observations of planetary motion.
Describe Newton's model of the universe, including Newton's laws and Newton's theory of gravitation.
Describe the origin of the solar system, and explain how this model explains the properties planets.
Comprehend the geology and the atmospheric processes of the terrestrial planets.
Analyze the Jovian planetary systems as microcosms of the entire solar system.
Discuss the minor objects of the solar system, including asteroids, meteoroids, comets, and dust.
Describe the properties of the Sun.
Analyze the interior of the Sun, including the nuclear reactions in its core.
Analyze other stars in the context of the Hertzsprung-Russell diagram.
Use the Hertzsprung-Russell diagram to discuss the birth, evolution, and death of stars.
Evaluate various Hertzsprung-Russell diagrams for different types of star clusters.
Analyze the evolution of binary star systems.
Describe Einstein's model of the universe (both the special relativity and the general relativity theories).
Describe the properties of the Milky Way galaxy.
Analyze other galaxies in the context of the Hubble sequence.
Discuss various theories of the birth, evolution, and death of galaxies.
Describe the large-scale structure of the universe.
Explain the evidence, both theoretical and observational, for the expansion of the universe.
Calculate the age of the universe from the Hubble law.
Formulate the Big Bang model of cosmology.
Comprehend theories on the frontiers of theoretical physics.
Explain the history of the universe.