

Fall 2023

PHYS 202 - 105: Introductory Astronomy and Cosmology

Robert Duffin

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New Jersey Institute of Technology
College of Science and Liberal Arts, Department of Physics
Introductory Astronomy and Cosmology,
PHYS 202, Section 105 (95719) Fall 2023 09/09/2023

Lecture Location: KUPF 209

Lecture Time: Tuesdays 6 pm - 8:50 pm (No class November 21)

Instructor

Robert Duffin, Ph.D.

rtd24@njit.edu

Office Hour: Tuesdays 5:00 - 5:45 pm.

Office Hour Location: TIER 453 (Physics department offices)

Email: Only email me from your email account.

Course Description: A non-mathematical presentation of contemporary views of the origin, evolution, and structure of the solar system, stars, galaxies, and the universe. Special topics include neutron stars, black holes, gravitationally strange objects, and the big bang.

Might change by end of first week.

Required Textbook: Astronomy (Open Stax), an **Online E-text** at no cost.

Senior Contributing Authors: Andrew Fraknoi, David Morrison & Sidney C. Wolff

<https://openstax.org/details/books/astronomy>

Grade Details		
	Participation	3%
	Quizzes	12%
	Midterm 1	20%
	Midterm 2	20%
	Midterm 3	20%
	Final Exam	25%

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

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

Any student who cheats during quiz, examination or 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.

For an excused absence, student needs to contact the Dean of Students to have a verification sent to the instructor.

Midterm exams will be held during class time. There will be no "make-up" exams. If you miss an examination, you will receive a grade of zero for that examination. Exams are 2.5 hours long.

“Academic Integrity is the cornerstone of higher education and is central to the ideals of this course and the university. Cheating is strictly prohibited and devalues the degree that you are working on. As a member of the NJIT community, it is your responsibility to protect your educational investment by knowing and following the academic code of integrity policy that is found at: <http://www5.njit.edu/policies/sites/policies/files/academic-integrity-code.pdf>.

Please note that it is my professional obligation and responsibility to report any academic misconduct to the Dean of Students Office. Any student found in violation of the code by cheating, plagiarizing or using any online software inappropriately will result in disciplinary action. This may include a failing grade of F, and/or suspension or dismissal from the university. If you have any questions about the code of Academic Integrity, please contact the Dean of Students Office at dos@njit.edu”

Syllabus	Lecture	Quizzes, Exams
T Sep 5	Observing the Sky (Chapter 1 and 2) Orbits and gravity (Chapter 3)	
T Sep 12	Earth Moon and the Sky (Chapter 4) Radiation and Spectra (Chapter 5)	
T Sep 19	Astronomical Instruments (Chapter 6) Introduction to the Solar System (Chapter 7). Q&A	Quiz1 (Ch. 1-5)
T Sep 26	Midterm 1 (Chapter 1-7)	Midterm 1
T Oct 3	Earth and the other cratered worlds (Chapter 8 and 9) Venus and Mars (Chapter 10)	
T Oct 10	Giant Planets, Rings and Moons (Chapter 11 and 12) Comets, Asteroids, Samples (Chapter 13 and 14)	
T Oct 17	The Sun (Chapter 15 and 16). Q&A	Quiz2 (Ch. 8-14)
T Oct 24	Midterm 2 (Chapter 8-16)	Midterm 2
T Oct 31	Starlight and Stars (Chapter 17 and 18)	
T Nov 7	Distances, gas and Dust in Space (Chapter 19 and 20) Star and Planet Formation (Chapter 21)	
T Nov 14	Stars Adolescence to old age (Chapter 22) Death of Stars (Chapter 23)	Quiz3 (Ch. 17-21)
T Nov 21	No Class. Thursday class meets Tues., Fri. class meets Wed	
T Nov 28	Midterm 3 (Chapter 17-23)	Midterm 3
T Dec 5	Black Holes and Curved Space Time (Chapter 24). The Milky Way Galaxy (Chapter 25). Galaxies (Chapter 26). Active Galaxies (Chapter 27). Evolution of Galaxies (Ch. 28)	
T Dec 12	The Big Bang (Chapter 29). Q&A (Chapter 1-29)	Quiz4 (Ch. 24-28)
Final Exam	Cumulative Final (Chapter 1-29)	Final

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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, North & South star references.
Analyze the changes in the sky from different locations on the Earth.
Recall the brightest objects and stars in the sky, and several constellations in the sky.
Know the electromagnetic spectrum. Calculate wavelength or frequency of a wave.
Understand how simple geometry and logic was used to measure Earth 2250 years ago.
Use the Doppler effect to analyze Redshift and Blueshift.
Understand the laws of optics, and use them to draw cross-sections of telescopes.
Comprehend atomic theory, including subatomic particles.
Analyze different types of spectra (Continuum, Emission and Absorption).
Describe the changes in perspective that led to the Copernican revolution, and his science
Know Galileo's observations and science which helped acceptance of heliocentric theory.
Apply Kepler's laws to explain observations of planetary motion.
Describe Newton's model of the universe: Include Newton's laws + theory of gravitation.
Describe the origin of the solar system: Show how model explains properties of planets.
Comprehend the geology and the atmospheric processes of the terrestrial planets.
Know details of: terrestrial, jovian and exo-planets; the Kuiper Belt and the Oort cloud.
Analyze the Jovian planetary systems as microcosms of the entire solar system.
Discuss minor objects of the solar system: include asteroids, meteoroids, comets, dust.
Know Sun's properties: its magnetic field, size, zones, temperatures, events & content.
Analyze the interior of the Sun, including the nuclear reactions in its core.
Analyze stars in the context of other stars of the HR (Hertzsprung-russell) diagram.
Comprehend star formation from stardust to Main Sequence
Comprehend star evolution from the Main Sequence for low-mass and high-mass stars.
Use HR diagram to discuss the Main Sequence life, evolution, and death of stars.
Know dark clouds, reflection & emission nebula. Evaluate HR diagrams for star clusters.
Describe the properties of the Milky Way galaxy, its black hole and evidence, and size.
Analyze other galaxies in the context of the Hubble Tuning Fork model.
Discuss various theories of birth, evolution & death of galaxies.
Analyze Active Galaxies of the past, similarities and differences with Normal Galaxies.
Explain the evidence, both theoretical and observational for the Universes' expansion.
Calculate the age of the universe from Hubble law. Calculate star distance using parallax.
Describe large-scale structure of universe. Formulate the Big Bang model of cosmology.
Explain the historical evolution of the universe.