

## NYU CORE: UA209 From Quarks to Cosmos (4 credits) - Fall 2021

**In person Lecture: Mon & Wed 2:00 p.m. – 3:15 p.m. ET**

**Instructor: Prof. Maryam Modjaz (she/her/hers)** (you may call me "Professor Modjaz", "Dr. Modjaz" or just "Professor")

E-mail: [profmodjaz@yahoo.com](mailto:profmodjaz@yahoo.com) (not my NYU one please!)

Student/Office Hours: TBA

### **Course Philosophy & Description**

This course aims to introduce you to the modern understanding of the (**awesome!**) universe. This is a big topic, so it's likely we won't get to everything, but topics to be included are: stars and their relatives, such as white dwarfs, neutrons stars, supernovae and black holes; the structures of the universe, namely galaxies and galaxy clusters; the expansion of the universe, and the big bang theory, and the light from the birth of the universe; the constituents of the universe, including "ordinary" matter, dark matter and dark energy. We will emphasize not only the concepts, but how we have arrived at them, and the challenge of testing ideas about cosmology, when we only have one universe, and we can only directly probe a limited scope of it. This is an introductory, one-semester course designed for non-science majors. Mathematics at the level of high school or first-year algebra is used.

### **Course Objectives**

- Develop a basic understanding of the central ideas of astronomy, such as:
  - Light, and more broadly, the electromagnetic spectrum as a tool
  - Size and scale of the cosmos
  - All kinds of cool and hot stars (exploding stars!) and objects in the universe
- Recognize how astronomy is connected to your daily lives
- Acquire the skills and motivation to pursue life-long interest in astronomy
- Learn to use critical thinking and reasoning instead of relying on memorization or plug & chug arithmetic. See how we understand the natural world through observation, experiments, and theory.

### **Class Web Site**

A Brightspace web site for this class exists and is accessible through your *NYUHome* account.

### **Required materials**

**1) Free/online Book: *Astronomy***, Senior Contributing Authors: Andrew Fraknoi, David Morrison, Sidney C. Wolff. A print version and a free ebook version are both available from OpenStax (<https://openstax.org/details/books/astronomy>) or Amazon Kindle. It also has resources for students, including time management and note-taking (<https://openstax.org/details/books/astronomy?Student%20resources>)

2) **Laboratory Manual (in bookstore) : *Quarks to Cosmos: Laboratory Manual for Modjaz, Fall 2021***

3) **Scientific calculator:** While the course is mostly conceptual, we will do some quantitative work. Thus it is recommended you have a **scientific calculator** for use on homework and examinations.

### **Lectures: Active Engagement & In-class Exercises**

Lectures are to help you learn the material, clarify what you are responsible for and to help you succeed on exams. *Please note that lecture will cover some material not in the book that you will be responsible for knowing*, but the book will also have some items not covered in class.

Students can only learn a limited amount of information from lecture alone, no matter how clear or entertaining. Therefore, this course makes extensive use of “interactive learning” and “peer instruction” where students engage with their instructor and their classmates in order to work through a concept together. All students are expected to participate in “call-and-response” (the instructor asks the entire class a question and expects a verbal response) and peer instruction (“Think-Pair-Share”). **The questions that are part of the Think-Pair-Share exercises will not be shown on the online postings of the lecture slides, so you have to be present in class for them!**

**VOTING CARDS** are REQUIRED for every class and will be used for multiple-choice in-class interactive activities. It is your responsibility to either get the [PDF](#) printed out in color, make one with markers or crayons (colors and format should be very similar to the PDF), or figure out how to use your handheld device to display the individual card. The PDF can be found in the “Class Resources” section of our NYU Brightspace website.

In-class exercises will be given regularly throughout the semester to help you develop your knowledge and skills - and also for you to have input into our class. For some assignments you will work individually and for other assignments you will work in a group. These in-class exercises are designed to be completed during the class in which they are given. They are not being graded, but will benefit you in understanding the material and in feeling engaged.

**If you miss a lecture, there is no need to email me, as there is no attendance taken.** I will announce during class how students can access the slides of the classes they missed.

### **Seating Arrangement, Handheld devices and Laptops**

This is an interactive class and we need to be close to each other in order to engage in conversation. Students should sit in groups of 2–3 classmates. Handheld devices must be OFF, not just set to vibrate, and out of sight. If you choose to vote with your handheld device, it must be set on Airplane mode. Frequent abuse of this rule will result in the entire class being restricted to paper-only voting.

If you do choose to use a **laptop** to take notes:

- You must sit in the designated part of the classroom (front right section from your point of view)

- Only a text editor may be open during class.

Any violation of this policy is a disrespectful to the instructor, as well as fellow students (who would have to stare at your bright screen with non-class content), disrupts everyone in class and is grounds for being asked to leave.

### **Newspaper readings & summaries**

A major goal of this course is to expose you to the wealth of research that is going on. To this end, you will be required to submit weekly three-paragraph summaries of one article (any article on *scientific research* - not science policy or local weather/storm news - see the detailed instructions on NYU Brightspace!) in the **NY Times science section or equivalent**. These will be submitted via the NYU Brightspace "Assignment" function. ***The first NYT assignment is due Friday, Sept 17 at 5pm EST.***

### **Course Examinations**

The examinations will be based on mainly (1) the lectures, lectures questions and text material, and (2) exercises assigned as homework and less so on (3) material covered in lab sections.

We will have one midterm exam and one final exam, all in a multiple-choice format. **They will be in person.** For exams, you will need a calculator. The midterm will focus on detailed aspects of the course. The cumulative nature of the final exam will be also reflected in concepts from the mid-term exam that were the subject of those questions that had the most incorrect responses.

### **Examination Schedule and Course Grade**

NY Times/Newspaper summaries	10%	<b>Due Fridays, 5PM EST (Sept 17 start)</b>
Lab & Homework:	30%	<b>Weekly (Sept 15/16 start)</b>
Midterm examination	30%	<b>Wed Oct 27, during class time</b>
Final examination	30%	<b>Fri Dec 17 2pm-3:50pm</b>

### **Homework**

Homework assignments will be posted online by the end of the week. Homework assignments are to help you understand the material and to prepare you for course examinations. Homework problems are to be handed in with your lab the week following their assignment and will constitute 1 point out of 10 of that week's lab score.

### **Laboratory Sessions**

These weekly sessions are an important part of the course. You must be registered for one lab

section, which will meet in **Meyer 161**. You will have to submit a lab report for each experiment performed. The lab report has to include answers to all questions and any data you may have collected. Most lab reports should be completable within the lab period, however you will have *no more than two days* to submit the final report if you cannot do so in the lab session. The 2 lowest lab scores will be dropped at the end of the semester. **The laboratory sessions will be held in Meyer 161 and will begin the week of Sept 13.**

They will be devoted to

1. Doing experiments described in your laboratory manual.
2. Discussing the homework problems
3. Going over questions from class.

### **Course Policy on Lab Attendance**

Performing experiments and analyzing data are central to scientific inquiry. For this reason, the lab component of the course is an essential part of your learning experience. You are required to attend all lab sessions during the semester and arrive on time according to the lab schedule, as well as only leave after the lab is over.

### ***Attendance & Absence Policy***

**There are exceptions given the continued pandemic: If you feel sick, don't come to the lab nor class – and there is no need to submit a doctor's note.**

Also, according to NYU policy, attendance exceptions are made for religious observances of holidays - If you will be absent for a religious holiday during the semester, you must inform your lab instructor and Prof. Modjaz **in the first two weeks of the semester. There are no make-up labs - you cannot make up a lab by attending a laboratory session that you are not registered for.** Note that you are still responsible for the content of any missed lectures and labs for the upcoming exams.

The lab instructor will deduct points from your lab grade for arriving late or leaving early.

**Lab Instructors** Each lab instructor will hold a weekly office hour or be available by appointment where you can discuss lecture and laboratory material. Office locations and office hour schedule will be announced in lab. The lab instructors are:

Cara Giovanetti ([cg3566@nyu.edu](mailto:cg3566@nyu.edu)) & Chandrika Manohara ([cm5877@nyu.edu](mailto:cm5877@nyu.edu)) & Shalma Wegsman ([srw9487@nyu.edu](mailto:srw9487@nyu.edu)).

### **Late Assignments:**

- **Labs:** you have up to 2 days after the lab to submit your lab reports to your lab instructor: at your laboratory instructor's office or by sending them via email your scanned-in

assignment – however it must be **legible!** If you submit more than 2 days late, your grade will be decreased by 25% for each work-day late.

- **Late HW:** Grade will be decreased by 25% for each work-day late.
- **Late NY Times summaries** NY Times summaries will not be accepted late for any reason other than illness.

### **Missed Exams**

**There are no make-up exams for students who miss the mid-term exam.** If you miss the midterm because of illness, you must contact Prof. Modjaz **by email before** the start of the exam. If you miss the midterm, for a valid reason (illness, injury or family emergency), your final exam will be weighted more.

If you miss midterm for a valid reason:

NY Times/Newspaper summaries	10%	10%
Lab & Homework:	30%	30%
<b>Midterm examination</b>	<b>(30%)</b>	<b>(0%)</b>
<b>Final examination (cumulative)</b>	<b>30%</b>	<b>60%</b>

*Religious Holidays* If you will be absent for a religious holiday during the semester for labs, you must inform your lab instructor and Prof. Modjaz **in the first two weeks of the semester.**

**Academic Integrity, Plagiarism, and Cheating** (*adapted from the website of the College of Arts & Science, <https://cas.nyu.edu/content/nyu-as/cas/academic-integrity.html>*):

Academic integrity means that the work you submit is original. Obviously, bringing answers into an examination or copying all or part of a paper straight from a book, the Internet, or a fellow student is a violation of this principle. But there are other forms of cheating or plagiarizing which are just as serious — for example, presenting an oral report drawn without attribution from other sources (oral or written); writing a sentence or paragraph which, despite being in different words, expresses someone else’s idea(s) without a reference to the source of the idea(s); or submitting essentially the same paper in two different courses (unless both instructors have given their permission in advance). Receiving or giving help on a take-home paper, examination, or quiz is also cheating, unless expressly permitted by the instructor (as in collaborative projects). NYU regards acts of academic dishonesty (e.g., plagiarism, cheating on examinations, obtaining unfair advantage, and falsification of records and official documents) as serious offenses against the values of intellectual honesty. The college is committed to enforcing the NYU Policy on Academic Integrity and will pursue cases of academic dishonesty according to the Academic Integrity Procedures

### **ACCOMODATION FOR STUDENTS WITH DISABILITIES**

I am committed to creating an inclusive and accessible classroom environment for students of all abilities. Students who may need academic accommodations are advised to reach out to the

Moses Center for Student Accessibility as early as possible in the semester for assistance (212-998-4980 or [mosescsd@nyu.edu](mailto:mosescsd@nyu.edu)). Information about the Moses Center can be found at <http://www.nyu.edu/csd>. Knowing that ability status may shift during our time together, please let me know how I can best support your learning needs. If you need any support in connecting with the Moses Center or other resources, please also let me know.

## **HEALTH AND WELLNESS**

To access the University's extensive health and mental health resources, contact the NYU Wellness Exchange. You can call its private hotline (212-443-9999) or chat (in six different languages) via the Wellness Exchange app available 24 hours a day, seven days a week, to reach out to a professional who can help to address day-to-day challenges as well as other health-related concerns. Email [wellness.exchange@nyu.edu](mailto:wellness.exchange@nyu.edu).

## **NYU Immigrant Defense Initiative (IDI)**

The NYU Immigrant Defense Initiative (IDI) offers free and confidential legal services to NYU students and employees, and their immediate family members, on their immigration cases. More information at: <https://www.law.nyu.edu/immigrantrightsclinic/IDI>

## **Statement on Inclusion and Respect for Diversity**

It is my intent that students from all backgrounds and perspectives be served well by this course, that students' learning needs be addressed, and that the diversity that students bring to this class be viewed as a resource, strength and benefit. It is my intent to present materials and activities that are respectful of diversity: gender identity, sexuality, disability, age, socioeconomic status, ethnicity, race, nationality, religion, and culture. Your suggestions are encouraged and appreciated. Please let me or the other staff of the class know if any issues arise or how we can improve our approaches, for you personally or for other students or for students from minoritized groups more broadly. (Adapted from Lynn Hernandez, Brown University).

## **Tentative Weekly Schedule of Topics**

I highly encourage you to read/work through the quantitative examples in the chapters of this book. Remember that the NYT articles (NYT) are due **on Fridays by 5pm EST!**

Date	Lecture Topic	Reading - Chapters	Problem set & NYT article that week	Weekly labs
W 9/8	1) Overview & Syllabus			No labs
M 9/13	2) Science & The Universe & Math Review	Ch 1		
W 9/15	3) Observing The Sky & Seasons	Ch 2, 4.2	PS#1, NYT#1	1) Math review

M 9/20	4) Orbits and Gravity	Ch 3		
W 9/22	5) Planetary Motions	Ch 3	PS#2, NYT#2	2) Kinematics
M 9/27	6) Light	Ch 5.1-5.2		
W 9/29	7) Colors of Stars	Ch 5.2-5.3, 17.2	PS#3, NYT#3	3) Newton 2nd Law
M 10/4	8) Telescopes	Ch 6.1-6.3		
W 10/6	9) Spectra and what they tell us about elements	Ch. 5.4-5.5	PS#4, NYT#4	4) Spectroscopy of Light - 1 <sup>st</sup> part
(M 10/11) Tue 10/12	10) Effect of Motion onto Light	Ch. 5.6		
W 10/13	11) The Sun: Energy Generation	Ch. 15.1, 16.1-16.3	PS#5, NYT#5	5) Spectroscopy of Light - 2nd part
M 10/18	12) Stars & Measuring Distances	Ch. 17.3, 18, 19		
W 10/20	13) Our Sun's Life & Death		PS#6	Midterm lab review
M 10/25	14) White Dwarfs & their Explosions	Ch. 19, 22		
<b>W 10/27</b>	<b>Midterm</b>	Ch. 22	NYT#6	6) Doppler
M 11/1	15) High Mass Stars & Their Explosions	Ch. 23.1- 23.3		
W 11/3	16) Supernovae and Gamma-Ray Bursts	Ch. 23.4- 23.6	PS#7, NYT#7	7) Parallax
M 11/8	17) Black Holes	Ch. 24.5- 24.7		
W 11/10	18) More of Black Holes (big and small)	Ch. 24.5- 24.7	PS#8, NYT#8	8) Inverse Sq. Law
M 11/15	19) Milky Way	Ch. 25		
W 11/17	20) Galaxies and Hubble's Law	Ch. 26.1- 26.5	PS#9, NYT#9	9) Principle of Equi
M 11/22	21) Dark Matter	Ch. 28.4- 28.5		
W 11/24	22) The Expanding Universe	Ch. 29.1- 29.3		No labs
M 11/29	23) The Fate of the Universe	Ch. 29.1- 29.3		
W 12/1	24) Big Bang	Ch. 29.4	PS#10, NYT#10	10) Hubble's Law
M 12/6	25) Life in the Universe – 1 <sup>st</sup> part	Ch. 21		
W 12/8	26) Life in the Universe – 2nd part			Final Review
M 12/13	27) Catch up & Final Review			

**FINAL EXAM (to be announced)**

## *Frequently Asked Questions*

Q: I missed my lab because of sickness, can I make it up?

A: No. The lab stations are disassembled every week and all labs are full, so there are no opportunities to make up labs. If you miss a lab b/c of sickness, **let your TA know** .

Q: I will miss a lab or labs due to religious holidays. Can I make it up?

A: No, but you must notify me in the first two weeks of the semester

Q: I missed a lab due to religious holidays! Can I make it up?

A: Did you notify me about it in the first two weeks of the semester?

Q: I missed the midterm, can I make it up?

A: No, the final will have added importance.

Q: I'm going to Aruba on the day before the midterm/final. It's going to be so sunny and warm. Can I take the test early?

A: Nope. Sorry.

Q: I have special needs for test taking, which the university is aware of. Can you help?

A: No problem. Please contact me directly and we'll arrange this.

Q: Do I need to know all the material from the book?

A: Tests are based upon lectures, labs, and HW. Some material in the lecture will not be found in the book. Some material will come from additional web resources or handouts. However, what of this you should know is what I cover in class, thus the best resources for what you need to know are the class slides, the Think-Pair-Share-questions, your HWs and your labs.

Q: I want to change my lab section. Can I?

A: I don't actually handle such changes. Contact the CORE office and they'll let you know what can be done.