

Fall 2015

Lecture: Meyer 121  
Lab: Meyer 161Monday and Wednesday  
9:30 a.m. - 10:45 a.m.  
Instructor: Prof. Sergei Dubovsky  
Office: Meyer 502  
Office Phone: (212) 992-87-82e-mail:[dubovsky.classes@gmail.com](mailto:dubovsky.classes@gmail.com)  
Office Hours: Wednesday 3:30-4:30 p.m.  
or by appointment

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**Course Description**

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This course aims to introduce you to the modern understanding of the 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.

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**Course Objectives**

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- Learn how to absorb qualitative information about a variety of science topics and discuss it.
- See how we understand the natural world through observation, experimentation, and theory.
- Show how light is a messenger carrying information about the cosmos.
- Understand how to make measurements of the distant Universe, including distances and motions.
- Understand how the Sun and other stars generate energy.
- See how stars form and evolve into white dwarfs, neutron stars and black holes.
- To understand what black holes are, what evidence there is for them.
- Look at the evidence for dark matter, and understand what it might be.
- Understand the expansion of the Universe, and the evidence for dark energy.
- Provide an overview of the Big Bang theory, and the imprints of the early Universe in the leftover radiation from the Big Bang.

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**Course Texts**

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1. *Astronomy Today, Volume II: Stars and Galaxies*, 8th edition, Chaisson and McMillan
2. *Quarks to Cosmos: Laboratory Manual*, 2012.

## Lectures

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Lectures are to help you learn the material, clarify what you are responsible for and to help you succeed on exams. In the beginning of most lectures you will receive a “True or False” quiz to be returned at the end. The main purpose of these quizzes is to help you to follow the key points of each lecture. These quizzes and homework questions will form the basis of what you are responsible for. Some of these questions are answered in your books, but all will be discussed in class or in labs.

## New York Times readings

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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 (on any topic, but it *should not* be an ad) in the NY Times science section. These will be submitted via email to your TA (either Shahab Kohani [sk3431@nyu.edu](mailto:sk3431@nyu.edu) or Stefano Storace [stequarkstocosmos@gmail.com](mailto:stequarkstocosmos@gmail.com)), as well as to [dubovsky.classes@gmail.com](mailto:dubovsky.classes@gmail.com). All emails should have a header NYT: Title of article. This is to help make sure they get recorded. *The first NYT assignment is due Sep 11 at 5 p.m.*

## Course Examinations

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The examinations will be based on (1) the lecture questions and text material, (2) exercises assigned in class, and (3) material covered in lab sections.

We will have two exams. For exams, you will need to bring a calculator (not a phone). The midterm will focus on detailed aspects of the course. The cumulative nature of the final exam will be reflected in concepts from the mid-term exam that were the subject of those questions that had the most incorrect responses. The final exam will be cumulative with a design to test you on concepts from the mid-term exam that the most students had trouble with.

## Examination Schedule and Course Grade

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Midterm examination (in Meyer 121)	15%	<b>Wed Oct 28, regular class time and place due Fridays, 5pm (Sep 11 start)</b>
NY Times summaries	10%	
Lecture quizzes	10%	
Laboratory	40%	<b>Weekly (Sep 14 start)</b>
Final examination (in Meyer 121)	25%	<b>Mon Dec 21, 8:00-9:50 am</b>

## Homework

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Homework assignments will be posted online on a weekly basis. 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 first lab the week following their assignment and will constitute 1 point out of 10 of that week lab score.

## Laboratory Sessions

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These 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 five days* to submit the final report if you cannot do so in the lab session. They will be devoted to

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

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

*Absence Policy* Excused absences will only be given in the case of illness (with a doctors note) or observation of a religious holiday. You must notify the lab instructor in advance in writing if you miss a lab due to religious reasons, **this must be done in the first two weeks of the semester**. All other absences will be considered unexcused and will result in a lab grade of zero. The same policy applies to lecture quizzes. **You cannot make up a lab by attending a laboratory session that you are not registered for.**

*Late Assignments* Late assignments will be penalized for each day late (excluding weekends). If you wish to submit a late lab report you must do so only at the laboratory instructors office.

*Late NY Times summaries* NY Times summaries will not be accepted late for any reason other than illness, supported by a doctors note.

*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 location and office hour schedule will be announced in lab. Lab instructors e-mails are: [sk3431@nyu.edu](mailto:sk3431@nyu.edu) (Shahab Kohani), and [stequarkstocosmos@gmail.com](mailto:stequarkstocosmos@gmail.com) (Stefano Storage).

### **Missed Exams**

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**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. Dubovsky by phone or email before the start of the exam and follow up with a doctors note. If you miss an examination, for a valid reason (illness, injury or family emergency), your grade will be based on the following allocations:

Midterm examination (in Meyer 121)	X	
NY Times summaries	10%	<b>due Fridays, 5pm (Sep 11 start)</b>
Lecture quizzes	10%	
Laboratory	40%	<b>Weekly (Sep 14 start)</b>
Final examination (in Meyer 121)	40%	<b>Mon Dec 21, 8:00-9:50 am</b>

*Final Exam* A make-up for the final examination will be given under truly exceptional circumstances, which must be discussed with Prof. Dubovsky before the examination. A doctors note must be provided in the case of illness. In this case a grade of incomplete will be assigned and **the make-up will entail taking the final exam for the next offering this course, which is no sooner than Spring 2016**. Please avoid making travel plans before the date of the final exam.

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

***Tentative*** Schedule of Topics:

<b>Date</b>	<b>Lecture Topic</b>	<b>Reading</b>	<b>Weekly Lab</b>
Wed Sep 2	Overview: Science and the Universe		
Wed Sep 9	Observing the Cosmos and the Seasons	<b>1</b> sec 1-4, 6	
Mon Sep 14	Keplers Laws of Planetary Motion Newtons Laws of Motion	<b>2</b> sec 4-8	
Wed Sep 16	Waves of Electricity and Magnetism	<b>3</b> sec 1-3	Math Review
Mon Sep 21	Thermal Radiation and the Doppler Effect	<b>3</b> sec 4-5	
Wed Sep 23	Spectral Lines and Atomic Structure	<b>4</b> sec 1-2	Kinematics
Mon Sep 28	Spectral Line Analysis	<b>4</b> sec 3-5	
Wed Sep 30	The Sun: Energy Generation and the Interior	<b>16</b> sec 1-3, 6-7	Newton's Law
Mon Oct 5	Stellar Parallax, Luminosity and Temperature	<b>17</b> sec 1-3	
Wed Oct 7	Stellar Sizes, the H-R Diagram and Masses	<b>17</b> sec 4-8	Parallax
Tue Oct 13	Stellar Evolution of Stars like the Sun	<b>19</b> sec 2, <b>20</b> sec 1-3	
Wed Oct 14	Supernovae	<b>21</b> sec 1-3	Spectroscopy
Mon Oct 19	Supernovae	<b>21</b> sec 3-6	
Wed Oct 21	Neutron Stars and Pulsars	<b>22</b> sec 1-4	Young's Experiment
Mon Oct 26	Black Holes and Einsteins General Relativity	<b>22</b> sec 5-8	
Wed Oct 28	Midterm Exam		Midterm Exam Review
Mon Nov 2	The Milky Way Galaxy: Size and Structure	<b>23</b> sec 1-4	
Wed Nov 4	The Milky Way Galaxy: Mass and the Galactic Center	<b>23</b> sec 5-7	Photoelectric Effect
Mon Nov 9	Galaxy Classification and Hubble's Law	<b>24</b> sec 1-3	
Wed Nov 11	Active Galaxies, Quasars and their Nuclei	<b>24</b> sec 4-5	Inverse Square Law
Mon Nov 16	Dark Matter	<b>25</b> sec 1-4	
Wed Nov 18	The Expanding Universe and the Big Bang	<b>26</b> sec 1-4	Principle of Equivalence
Mon Nov 23	Quarks and matter in the early Universe	<b>27</b> sec 1-3	
Mon Nov 30	The accelerating Universe	<b>26</b> sec 5-6	
Wed Dec 2	The Cosmic Microwave Background Radiation	<b>26</b> sec 7, <b>27</b> sec 6	Cosmological Redshift
Mon Dec 7	Inflation and "before" the Big Bang	<b>27</b> sec 4	
Wed Dec 9	Catch up		Hubble's Law
Mon Dec 14	Final Exam Review		
Wed Dec 16	Reading Day		Final Exam Review
Mon Dec 21	Final Exam		

## Frequently Asked Questions

Q: What email address should I use to contact you?

A: Use [dubovsky.classes@gmail.com](mailto:dubovsky.classes@gmail.com). My nyu email address generally receives 100 emails/ day and so lots of emails got lost in the noise. If you use this gmail address, I can go back and check that I've responded to you.

Q: Why do we need to put NYT in the subject header of our NYT emails?

A: This allows me to separate out the non-NYT email so I can again make sure I'm not missing important class emails.

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, provide your TA and me with a doctor's note and that zero will not be counted against you.

Q: I missed a lab or a test because I was sick, but didn't get a doctor's note. Can I still have that lab not counted?

A: No. If you are too sick to be in class, that's very sick, extremely sick, even, your-parents-would-want-you-to-see-a-doctor sick, and you should see a doctor.

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

A: You'll either be able to make it up or you'll be excused from it if that's not possible. However, you must notify me in the first two weeks of the semester (so, by Sep, 16).

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. If you have a note from a doctor, the final will have added importance. If you have no note, you will receive a zero.

Q: I missed the final, can I make it up this semester?

A: No. If you have a note from a doctor, then you will have the opportunity to take the final from the next time this course is offered. There will be no makeups this semester. That includes showing up or emailing later in the day of the final.