

AS202 - Principles of Astronomy I (Section A1) - Fall 2016

Class Hours: Monday, Wednesday, and Friday; 11:00 am - 12:00 pm, room CAS 213.

Class Dates: Wednesday 07 September - Monday 12 December.

Final Exam: Friday 16 December, 12:30 pm - 2:30 pm.

Your instructor is Professor Paul Withers and your TFs are Mark Veyette, Isaac Lopez, and Ben Roulston. Contact us by email, phone, or a face-to-face conversation. There is a mailbox for this class in room CAS 514 that is accessible 9am-5pm Monday-Friday.

Person	Office	Email	Phone	Office Hours
Withers	CAS 604	withers@bu.edu	617 353 1531	Monday 2-3, Wednesday 3-4, Thursday 10-11
Veyette	CAS 524	mveyette@bu.edu	617 353 6554	Tuesday 2-3, Friday 2-3
Lopez	CAS 524	idlopez@bu.edu	617 353 6554	Tuesday 11-12, Thursday 1-2
Roulston	CAS 524	roulstbr@bu.edu	617 353 6554	Monday 12-1, Wednesday 1-2

Course Overview

“Astronomical observing and the night sky; optics and telescopes; birth of modern astronomy; atoms, spectra and spectroscopy; planetary motion and orbits; overview of solar system; uses observatory. Intended primarily for astronomy or physics majors. Lectures and laboratories. Carries natural science divisional credit (with lab) in CAS.”

AS 202 is an introductory course aimed primarily at students intending to major or minor in astronomy. In particular, it is typically the first astronomy course taken by freshman students who plan to major in astronomy. The goal of the course is to introduce astronomy as an observational science, as distinct from an experimental science. Astronomers and geologists observe what nature has created, whereas physicists and chemists perform idealized experiments under controlled laboratory conditions. Paralleling the historical development of astronomy, the focus of the class is solar system astronomy. An associated course, AS 203, introduces the astronomy of stars and galaxies.

Calendar Overview

First day of class	Wednesday 07 September
First day of labs	Monday 12 September
Last day to add classes:	Monday 19 September
Last day to change from credit to audit status	Monday 19 September
Holiday, classes suspended:	Monday 10 October (Columbus Day)
Academic Monday	Tuesday 11 October
Last day to drop without W grade	Wednesday 12 October
Last day to drop with a W grade	Thursday 10 November
Thanksgiving Break, no classes	Wed. 23 November – Friday 25 November
Last day of class	Monday 12 December
Final exam	Fri. 16 December, 12:30 pm – 2:30 pm.

Main topics of this class

Astronomy and astrophysics are not the same thing. Astronomy implies observing the sky and describing the shapes, positions, sizes, and motions of observed objects. Astrophysics implies uses the tools of physics to discover much, much more about the universe and its contents.

This course will cover the development of astronomy, specifically astronomy of the solar system, to the beginnings of astrophysics. It will begin with naked eye astronomy, then advance to the revolutionary invention of the telescope. It will next introduce the first application of physics to the universe beyond Earth – the orbital mechanics made possible by Newton – and finally conclude with the concepts of spectroscopy that were central to the transition from astronomy to astrophysics. A central theme of the course will be the determination of properties of solar system objects from available observations. That means measuring the angular size, diameter, distance, period, speed, mass, density, and temperature of the Sun, Moon, and planets using naked eye, telescopic, and spectroscopic observations

1. The night sky (Sky)
2. Optics and telescopes (Optics)
3. Origins of modern astronomy (Origins)
4. Orbital mechanics (Orbits)
5. Spectra and spectroscopy (Spectra)

The first midterm exam will cover Sky and Optics. The second midterm exam will cover Origins and Orbits. The final exam will cover all topics.

Textbooks

There is no required textbook for this course. There are many textbooks on introductory astronomy that cover the contents of this course, but none of them are perfect. They are either too simple (suitable for AS101), too advanced (suitable for physics juniors taking a first astronomy course), or too broad (you're buying hundreds of unnecessary pages). Don't worry, extensive readings from a selection of relevant resources will be provided.

I advise you to look through the Astronomy Library on the 6th floor at these books on the reserve shelf. If you find one you like, consider buying a copy. Don't buy anything before looking at it in the library.

Foundations of astrophysics, by Ryden and Peterson, ISBN 0321595580

Observing the universe, by Norton, ISBN 0521603935

Cosmic Perspective, by Bennett et al., ISBN 0321839501

The Cosmic Perspective (Bennett et al.) is sold in many different varieties. Suitable varieties include "The Cosmic Perspective", "The Cosmic Perspective: The Solar System", and "The Cosmic Perspective: Stars and Galaxies". Any variety is fine for this course. Some of these books, especially those targeted at the AS101 audience, exist in

multiple editions. Any edition should be fine – Galileo and Newton’s contributions to astronomy have not changed greatly in the past few years.

Relevant materials for Sky are: Ryden Ch. 1; Norton Ch. 1; Bennett Ch. 2 and S1

Relevant materials for Optics are: Ryden Ch. 6; Norton Ch. 2; Bennett Ch. 6

Relevant materials for Origins are: Ryden Ch. 1-2; Bennett Ch. 3 and S1

Relevant materials for Orbits are: Ryden Ch. 3; Bennett Ch. 4

Relevant materials for Spectra are: Ryden Ch. 5; Norton Ch. 3 and 7; Bennett Ch. 5

Course website

Electronic copies of the syllabus and other handouts are online at: <http://learn.bu.edu/>.

Other online resources

www.solarviews.com

Multimedia tour of the solar system

www.nineplanets.org

Overview of the solar system, mostly text

www.heavens-above.com

Customized maps of the night sky

www.skymaps.com

Monthly sky chart

theskylive.com

Online personal planetarium

eyes.nasa.gov

Too cool to describe in words

aa.usno.navy.mil

Essential observing resources

www.masteringastronomy.com Associated with The Cosmic Perspective.

This requires you to pay about \$60 for access to study tools, animated demonstrations, quizzes, and more. Most BU students who have taken AS101 or AS102 will have access and be able to show you the contents.

Grading criteria

Your grade will be based on homeworks, two mid-term exams, one final exam, and several aspects of your observing and laboratory projects.

Homeworks	20% (your lowest score will be dropped and the remainder will be weighted equally)
Observing/laboratory projects	30%
Mid-term exams	25% (each mid-term will be weighted equally)
Final exam	25%

Mid-term #1	Wednesday 12 October	11:00 am – 11:50 am	CAS 213
Mid-term #2	Wednesday 16 November	11:00 am – 11:50 am	CAS 213
Final exam	Friday 16 December	12:30 pm – 2:30 pm	CAS 213

There is no good way for me to use a website to automatically generate an estimate of your final grade based on your work so far. Please see me if you would like to discuss your estimated final grade.

Lab activities

All AS 202 students must sign up for the lecture component (section A1) and a lab component (sections A2, A3, A4, or A5). Students will attend lab one evening each week (Monday, Tuesday, Wednesday, Thursday), nominally between 5pm and 8pm. The TFs will run the lab component of this course.

You will conduct a range of activities during your lab sessions. The TFs will provide you with guidance in how to develop, perform, and interpret an experiment. They will also train you in how to use the observatory on the roof of the CAS building. With this training, you will conduct two laboratory projects and several observing projects. You will use the 10 inch and 14 inch telescopes and their CCD cameras for your observations. The laboratory projects will take place in room CAS 521 and the observing projects will take place in the observatory (observing) and in room CAS 606 (analysis). The TFs will schedule experiments, observing, and data analysis periods during your lab sessions to adapt to the fickle weather conditions.

In order to learn good observational and experimental practice, you will keep an Observing/Laboratory Notebook. This must be a bound notebook so that the pages can't get removed or lost. Always bring this notebook when you go to your lab sessions. In it, keep a record of all you do, including date, time, sky conditions, experimental procedures, instrument settings, observations and measurements, and interpretations. This should be your personal record of what you've done and it should contain everything you need to write comprehensive laboratory reports. Your notebook may be inspected during any lab session and its contents will affect your grade.

Observing projects

The specific projects that you will do will depend on the weather and the objects that are visible in the evening sky this semester. You might look at the Moon, Saturn's rings, Neptune's largest moon, or bright asteroids.

Laboratory projects

Optics and telescopes (first half of the semester): Explore the properties of single lenses, spherical mirrors, and simple telescopes.

Spectroscopy (second half of the semester): Explore the properties of optical spectra.

Assessment of observing and laboratory projects

Your observing and laboratory work will constitute 30% of your grade. You will complete two reports on your laboratory work, one in mid-semester on optics and telescopes and one near the end of the semester on spectroscopy. You will complete a similar number of reports on your observing projects. The precise number of observing reports and their topics will be announced later in the semester. Another contributor to this portion of your grade is the quality of your observing/laboratory notebook, which will be inspected sporadically during the semester. There may also be several other ways in which your observing and laboratory projects will be assessed during the semester.

Late work and absences

You are expected to attend class. If you miss a class, check the course website for any assignments or news and talk with a fellow student to learn what else you missed. Under normal circumstances, the policies on late work are as follows. Late pop quizzes will not be accepted. Late homeworks and lab reports will have 15% of the maximum possible score deducted for each day they are overdue. The mid-term and final exams must be taken at the scheduled time. Under extreme circumstances, such as a medical emergency, you may petition the Astronomy Department Chairman for a more lenient policy or permission to take a make-up exam.

Astronomy Department Chairman: Professor Tereasa Brainerd, CAS 514, 617-353-2625, brainerd@bu.edu

Dean of Students: Kenneth Elmore, Third Floor, GSU, 775 Commonwealth Avenue, 617-353-4126, dos@bu.edu

Classroom etiquette

Please arrive punctually for the start of class and remain for the duration of the class. If you arrive late or depart early, try to minimize the disruption this causes to other students. Turn mobile phones off during class.

Questions

The classroom is not like a theatre - interrupting the performance is encouraged. Please ask questions during class. They will help you learn, will help me understand what concepts are unclear, and will help other students learn. If raising your hand doesn't get my attention, trying coughing or screaming. Loudly.

Academic integrity

Group study is encouraged, but the graded work that bears your name should be your work, not someone else's. Your homeworks and lab reports should not be identical to anyone else's. If you collaborate closely with another student on an assignment, note that fact at the top of the assignment.

If an answer in a homework question or a lab report requires written sentences, do not copy your answer directly from the textbook, a website, or any other source. Express your answer in your own words instead.

All students are expected to follow the BU Academic Conduct Code. Cases of suspected academic misconduct will be referred to the Dean's Office.

www.bu.edu/academics/policies/academic-conduct-code/

Planned Schedule

This is the plan, but it is subject to change. The exam dates will not change, but the topics covered during a particular day's class may change.

<u>Date</u>	<u>Number</u>	<u>Description</u>
Wednesday 07 September	1	Sky – Earth is round
Friday 09 September	2	Overview of course, labs, observing
Monday 12 September	3	Sky – Size of Earth
Wednesday 14 September	4	Sky – Celestial sphere
Friday 16 September	5	Sky – Years and days
Monday 19 September	6	Sky – Summary
Wednesday 21 September	7	Optics – Lenses
Friday 23 September	8	Optics – Thin lens formula
Monday 26 September	9	Optics – Telescopes
Wednesday 28 September	10	Optics – Telescope properties and performance
Friday 30 September	11	Optics – Angular resolution and diffraction limit
Monday 03 October	12	Optics – Summary
Wednesday 05 October	13	Origins – The Moon
Friday 07 October	14	Origins – Planets
Monday 10 October		HOLIDAY
Wednesday 12 October	15	<u>Midterm exam #1 (Sky and Optics)</u>
Friday 14 October	16	Origins – Size of 1 AU; rotations
Monday 17 October	17	Origins – Speed of light
Wednesday 19 October	18	Origins – Distance to stars
Friday 21 October	19	Origins – Kepler's laws of planetary motion
Monday 24 October	20	Origins – Summary
Wednesday 26 October	21	Orbits – Newton's laws
Friday 28 October	22	Orbits – Circular orbits
Monday 31 October	23	Orbits – Other orbits
Wednesday 02 November	24	Orbits – Mass of the Sun; orbital energy
Friday 04 November	25	Orbits – Vis viva equation
Monday 07 November	26	Orbits – Masses of planets
Wednesday 09 November	27	Orbits – Summary
Friday 11 November	28	Spectra – Interaction of light and matter

Monday 14 November	29	Spectra – Bohr atom; electron energy levels
Wednesday 16 November	30	<u>Midterm exam #2 (Origins and Orbits)</u>
Friday 18 November	31	Spectra – Absorption and emission spectra
Monday 21 November	32	Spectra – Doppler shift; line broadening
Wednesday 23 November		HOLIDAY
Friday 25 November		HOLIDAY
Monday 28 November	33	Spectra – Blackbody radiation
Wednesday 30 November	34	Spectra – The Sun
Friday 02 December	35	Spectra – Planets and stars
Monday 05 December	36	Spectra – Summary
Wednesday 07 December	37	Miscellaneous topics
Friday 09 December	38	Miscellaneous topics
Monday 12 December	39	Miscellaneous topics
Friday 16 December		<u>Final exam</u>