

## **Syllabus for Astronomy 104—Alien Skies: A Tour through the Universe University of Michigan, Winter 2017**

**About this course:** Astronomy is one of the oldest activities known to civilization. When you look at the night sky, you participate in a tradition that spans uncounted generations across continents and millennia.

The sky is our laboratory. Most of what humans know about the Universe has been learned by applying mathematical, physical, or chemical laws and principles to what we observe in the sky. Throughout history, the nature of observation has changed from qualitative, naked-eye observations to pattern recognition over periods of centuries. We have progressed from making quantitative measurements using simple mechanical tools to complex big-data algorithms that stretch the limits of our technology.

We cannot travel to our laboratory, the sky and Universe beyond. But we can imagine what the journey might be like based on what we observe there. This course invites you to consider the bizarre, spectacular, and otherworldly destinations that might await us and to reimagine our own place in the cosmos.

**Section:** Astro 104.001 (lecture)

**Dates:** January 04, 2017, through April 17, 2017 (a total of 41 sessions)

**Times:** Monday, Wednesday, Friday, 3:00-4:00 PM (lecture begins at 3:10 PM)

**Location:** Weiser Hall, room 260 (Weiser Hall is located at 500 Church St.)

**Credit:** 3 credits (has *NS*, *BS*, and *QR/2* designations)

**Prerequisites:** None

**Credit Exclusions:** Please note you cannot receive credit for this class if you have already taken Astro 102, 142, or 201. Please consider Astro 101, 105, or 115, or a higher level astro class if you took 201.

**Instructor:** Dr. Ian U. Roederer

**Email:** iur@umich.edu

**Phone:** 734-615-7374

**Office:** West Hall 306D (West Hall is located at 1085 S. University Ave.)

**Office hours:** West Hall 306A, Tuesday 9:00-11:00 AM, or by appointment

**Free homework help:** The Student Astronomical Society (SAS) offers free homework help and astronomy tutoring on Tuesdays and Wednesdays from 5-6PM in West Hall 438, beginning January 11. The upper-level undergraduate students who provide this service can help you if you have questions or are stuck on a problem, but of course they will not work it out for you completely. (Note: the SAS help sessions on Feb. 21 and Mar. 21 will be held in West Hall 470.)

**Required text:** *Alien Skies: A Travelogue of the Universe* by Mario Mateo. Cognella, Inc., first edition. ISBN 978-1-5165-0632-3. Either the print or digital versions are fine, so go with the one that best suits your study habits.

**Recommended software:** Stellarium and Celestia, which are two pieces of software that simulate the sky. Each one of these is FREE, and they can be downloaded to your computer from <http://www.stellarium.org> and <http://celestiaproject.net>. There are no versions for smartphones as far as I know. If you have a laptop, I recommend installing this software there and bringing the laptop to class. I will try to alert you ahead of time for the days we'll use this. The class activities will be done in groups; if you do not have a laptop, you are welcome to share with your neighbors. Stellarium and Celestia are also installed on computers in Instructional Support Services labs, like the Fish Bowl in Angell Hall.

**Learning objectives:** By the end of the course, you should be able to

- (1) Appreciate that virtually all that humans know about the Universe beyond Earth is based on the application of mathematical, chemical, or physical principles and laws to what we observe and measure by looking at the sky.
- (2) List the basic properties that characterize and distinguish atoms, planets, moons, stars, nebulae, galaxies, and larger structures in the Universe.
- (3) Recognize that basic motions and characteristics of matter observed in the Universe can be readily predicted from relatively simple mathematics.
- (4) Apply algebraic and geometric principles to calculate and explain astrophysical phenomena.
- (5) Predict the future appearance, relative location, and general characteristics of astronomical objects based on existing observations and mathematical tools.
- (6) Apply conversions from one unit of measurement to another.
- (7) Recognize astronomical and real-world situations where order-of-magnitude estimates are appropriate, and practice making such estimates.
- (8) Explain the fundamental astrophysical principles that limit our ability to study everything in the Universe in infinite detail.
- (9) Articulate the history of the development of the Universe from the Big Bang until today, citing evidence, identifying uncertainties, and describing why these uncertainties do not undermine the overall picture.
- (10) Differentiate questions that fall within the realm of science from those that science is not equipped to answer.
- (11) Evaluate scientific claims about astronomy found in the media, and differentiate reputable sources of scientific ideas from disreputable ones.
- (12) Assess and articulate the extent to which your worldview has changed in response to the concepts and information covered in this course.

**Attendance and in-class writing summaries:** I will follow the established LSA attendance policy (<http://lsa.umich.edu/lsa/academics/degrees-requirements/academic-policies/class-attendance.html>) regarding religious holidays, illnesses, representation of the University, etc. Other personal reasons not covered explicitly by this policy should be discussed with me well in advance (two weeks or more) of the absence. Documentation (e.g., doctor's note from U.H.S.) may be requested in accordance with this policy to count as an excused absence.

A total of 13% of your final grade will be based on short in-class writing summaries that will be completed during the last five minutes of some of the class meetings. (Dates will not be posted in advance.) I will announce a couple of questions or prompts and ask you to respond to these, but I will only check for completeness. Each day's writing summary is worth 1 point, and you need to submit 13 of these over the course of the term to receive full credit. Although I will offer more than 13 opportunities for these responses, no extra credit will be granted for having completed more than 13.

There are several purposes for this activity. The simple act of writing a summary or response to material that is still fresh in your mind can improve retention and focus attention on the most important points. After class, I read each of these responses. I do this to gather feedback so that I can evaluate my own performance—did most students identify the important concepts, or is there something I need to cover again (perhaps more effectively the second time)? Finally, I use this activity to incentivize class attendance. It will be extremely challenging for you to pass this course without regular attendance and participation. With that in mind, I strongly encourage you to attend all class meetings, and so I offer this additional incentive to attend and engage.

**Homework assignments:** There will be seven homework assignments, roughly one every two weeks. These will give you the opportunity to practice using math (and, in some cases, words!) to explore and explain some of the basic characteristics of the destinations we will visit. These assignments will be posted on the Canvas site. Each one is worth 6 points, for a total of 42 points.

Some homework assignments will contain more problems or questions than you are required to do to receive full credit. (Detailed instructions will be provided on the assignments themselves.) I encourage you to try the remaining problems or questions at some point before the exams, because these may resemble what you find on the exams.

**Exams:** There will be three written exams in this course. The goal of the exams is to provide an opportunity for you to demonstrate what you have learned. The exams will consist of a mix of multiple choice and short essay (i.e., a few words or a few sentences) questions. Each exam is worth 15 points, for a total of 45 points.

All exams will take place in our normal meeting room. The first two exams will take place during our normal class meetings. The third exam will take place during the scheduled exam period on Thursday, April 27, 10:30AM-12:30PM.

Each exam will be mildly cumulative, so you can expect that the exams will become progressively more difficult. My aim is that you engage with the material in such a way that you accomplish the learning goals I have for you for this course. In that spirit, if you demonstrate learning (at least to the extent that learning can be measured with these exams) by the end of the course, I consider that a success. To incentivize this, if your grade on Exam #3 exceeds your grade on either Exam #1 or #2 (or both), I will replace those earlier, lower scores with your grade on Exam #3. For example:

Exam #1 (out of 15)	Exam #2 (out of 15)	Exam #3 (out of 15)	Total exam score (out of 45)
10	13	15	$15+15+15 = 45$
15	13	10	$15+13+10 = 38$
12	14	13	$13+14+13 = 40$
14	0	13	$14+13+13 = 40$
13	12	0	$13+12+0 = 25$

If you are absent on either day that Exam #1 or Exam #2 is given (e.g., you are sick, representing the University off-campus, etc.), there is no make-up exam. In this case, your score from Exam #3 will also count for the exam you missed. If you know you will be absent for Exam #3, please inform me at least two weeks in advance so that we can make alternate arrangements.

**Extra credit:** Later in the semester, I will present several small projects that can be used for extra credit. This work could potentially be worth 5 points (i.e., a boost of 5% in the final course grade). No other opportunities for extra credit will be considered.

**Grades:** I use high standards to evaluate your work in this course. I do so because I believe that each of you is capable of meeting those standards. Grades will be calculated by summing scores on the homework assignments (7 worth 6 points each, accounting for 42% of the total course grade), in-class writing responses (13 worth 1 point each, accounting for 13% of the total course grade), and exams (3 worth 15 points each, accounting for 45% of the total course grade). Grades will be assigned to the point score as follows:

99+: A+	87-90: B+	77-80: C+	67-70: D+	0-60: E
93-99: A	83-87: B	73-77: C	63-67: D	
90-93: A-	80-83: B-	70-73: C-	60-63: D-	

I reserve the right to lower the cutoffs for each letter grade, but I will not raise the cutoff marks (e.g., under no circumstances would 90 points receive a B+ or below). If you wish to contest a score on an assignment or exam (for example, you think something was graded incorrectly), let me know of your intent to contest this score within 72 hours of the assignment being returned to you. We can later find a mutually-convenient time to discuss the matter.

**Credit:** This is a three-credit course, and I will expect a commensurate level of out-of-class effort on your part (i.e., ~6 hours per week) on your part.

**Drop/add deadline:** January 24 is the last day to withdraw for regular drop/add or to change to pass/fail status.

**Office hours:** My office hours are a time that I reserve for you. Please feel free to stop by, ask questions about the classes, course materials, homework assignments, etc., or anything else of interest. In a large course, like this one, this will help me to get to know you better. If you cannot attend the posted hours (maybe because you have another class then), send me an email, and we'll schedule a meeting that works for each of us. I have other responsibilities in my schedule, so I may not always be present in my office at other times of the day.

**Academic integrity:** The LSA community, like all communities, functions best when its members treat one another with honesty, fairness, respect, and trust. The “LSA Community Standards of Academic Integrity” statement (<http://www.lsa.umich.edu/academicintegrity>) outlines the principles we will follow in this class, and the “LSA Procedures for Resolving Academic Misconduct” (<http://www.lsa.umich.edu/academicintegrity/procedures>) will be used to resolve any issues that arise. Graded material deemed, after due process, to be plagiarized will receive a zero.

**Devices in the classroom:** You are more than welcome to use laptops, smart phones, or other devices in my class if they are used responsibly and do not pose a distraction to me, you, or your neighbor. These devices must remain silent. In the interest of common courtesy, if you find yourself in need of your phone (perhaps in the case of an emergency), please quietly excuse yourself from class and do what you need to do in the hallway.

**Accommodations:** If you think you need an accommodation for a disability, please let me know at your earliest convenience. I am happy to help. Some aspects of this course—the assignments, the in-class activities, and the way the course is usually taught—may be modified to better enable your participation. As soon as you make me aware of your needs, we can work with the Services for Students with Disabilities (SSD) office to help us determine appropriate academic accommodations. SSD (<http://ssd.umich.edu>) typically recommends accommodations through a Verified Individualized Services and Accommodations (VISA) form. Any information you provide is private and confidential and will be treated as such.

**Contacting me:** Email is the best way to contact me. Please write “Astro 104” in the subject line. Typically I will respond to email only during normal business hours. The phone number listed is a desk phone that cannot receive text messages, and it is only answered during normal business hours. As a matter of policy, I decline facebook messages or friend requests from students. I am happy to discuss course material or other matters with you during my office hours, via email, before or after class, or at other times by appointment.



This course is taught by a member of the Lecturers' Employee Organization, AFT Michigan Local 6244, AFL-CIO.