

ASTR181: Principles of Astronomy II

Spring 2017: January 9–May 12
MWF 10:00 PM–10:50 PM, Room: STB 226

Version 1: January 6, 2017 (subject to change)

Professor: Kathy Cooksey, Ph.D., STB 219; kcooksey@hawaii.edu; 808-932-7195
Office Hours: W 9–9:50 PM & 2–3 PM, F 11–11:50 AM, and by appointment
Website: [Laulima ASTR-181-001 \(HIL.13467.SP17\)](http://Laulima.ASTR-181-001)
Textbook: *The Cosmic Perspective, 7th Ed.* by Bennett, Donahue, Schneider, & Voit
(no MasteringAstronomy required)

Course Description:

A survey of modern stellar, galactic, and extragalactic astronomy, with emphasis on the underlying physical principles. Topics covered include stellar structure, interstellar environments and the formation of stars, stellar evolution and death, the structures of galaxies, and cosmology. Intended for science majors and prospective science teachers. The student should have a good operational familiarity with high school algebra. (CRN: 13467, Section: 001)

Pre-requisite: ASTR180

Learning Objectives:

- Broad course goals:
 1. Understand how astronomers know what they know about the universe by identifying the observations on which fundamental principles of astronomy are based.
 2. Form a conceptual framework of the content, structure, and evolution of the universe as evidenced by the ability to connect topics in astronomy in multiple, meaningful ways.
 3. Practice and improve problem-solving skills, especially in how an approach is motivated, how a solution is formatted, and how the answer is verified to be reasonable.
 4. Learn/practice “reading” equations and figures for information so that even unfamiliar equations or figures can be assessed for their meaning.
 5. Learn/practice addressing questions on-the-fly.
- Specific content goals:
 1. Physical quantities have units that are used units to understand the physical quantities, solve problems, and support intuition about the relative scales of physical quantities.
 2. Dimensional analysis is a way of solving problems and “reverse engineering” equations.
 3. All astronomers have is light to study so the properties of light (e.g., blackbody radiation, flux-luminosity relation, magnitude system) are exceedingly important to understand
 4. Gravitational force is the mover and shaker of the universe, so it and related concepts (e.g., orbital motions, etc.) are also exceedingly important to understand.
 5. To understand how astronomers know what they know, students should understand modern astronomical observing (e.g., types of telescopes, importance of wavelengths, etc.)
 6. There is an interplay between the motion of an object and its signature in astronomical observations (i.e., Doppler shifts).

Email, Textbook, and Website:

- UHH considers email and Laulima an official form of communication; students are responsible for receiving and returning information in a timely manner.
- The professor will email students at their `hawaii.edu` accounts only.
- The required textbook is *The Cosmic Perspective, 7th Ed.* by Bennett, Donahue, Schneider, and Voit, which was used for ASTR180.
- The Laulima course website is listed under ASTR-181-001 (HIL.13467.SP17). This site will be the hub for all course information.

Class Rules:

- Students are responsible for their own learning, which includes preparing for class, submitting work, asking questions, and seeking additional help.
 - The majority of college students use instructors' office hours and/or tutoring services (e.g., Kilohana; info below).
 - Office hours are good times to get individualized help from the expert (i.e., the instructor), and office hours are part of the instructor's job.
- Students must respect and support their peers' learning, which means helping each other with difficult concepts but not just giving the answer.
- Students need to convey (either in person, by email, through an intermediary, or somehow) to the professor questions, comments, and concerns about the course.
- The professor will be receptive to and respectful of the students' needs and interests and must generally follow the class rules as detailed for the students (also see next section).
- Group work is encouraged in class and for homework assignments. However, all submitted work must be the original work of the student with reference to any homework partners.
- All references (e.g., websites, books other than the official course textbook, etc.) used to complete assignments must be cited, including numbers, techniques, facts, etc.
- Students need to sign the attendance sheet each class.
- A non-smart-phone calculator is required for every class. Students should practice with the calculator they will use for quizzes and the final exam.
- Solutions to problems must show sufficient supporting work to receive full points.

Good-to-Know about the Professor:

- She enjoys teaching and wants to be better at it, and she really cares about helping students be better. These aspects combined mean she is on the students' side; trust in that and knowledge that she is receptive to feedback will smooth over rough patches.
- She chooses teaching techniques based on physics-education research to support student learning as best as possible. This means she has one or more reasons for nearly every component of and action in a course. She'll gladly motivate these choices whenever necessary or asked.
- Her primary goal is to help students improve *how* they learn with the logic that if students learn how to learn, they can master any content. The related goal is to focus on transferrable skills so that time and effort spent for the class yield benefits beyond the course and semester.
- Generally, she does not answer questions directly. A student making connections and constructing a solution her- or himself will ingrain the answer more effectively, and the professor facilitates the process by asking leading questions. Since the motivation is to help the students, they should embrace and engage with this process. (It is also a transferrable skill to discuss ideas and answer questions on the fly.)

- She designs quizzes and exams so that no one gets 100% and no one gets 0% because either score would not be useful in assessing what the students understand and how to help. The rule-of-thumb is to score above the median (see Grading below). She has no interest in failing students who make good-faith effort in the class (e.g., good attendance, submit completed work, ask questions in and out of class).
- She thinks no single resource is comprehensive, so the expectation is that the student will have to work with the professor, her materials, the textbook, and the wealth of material available on the internet.
- The expectation is that a course requires 2–3 hr outside-of-class time per credit per week. Hence a 15-cr semester equals 30–45 hr per week (i.e., a full-time job).
- She generally responds to email 24-to-48 hours after receipt. If the matter is urgent, the student should call (office voicemail is automatically emailed) or stop by her office (her generally weekly schedule is on her homepage: <http://www2.hawaii.edu/~kcooksey>).

General Course Outline¹

Reading assignments are assigned before the class in which they will be reviewed. Students are expected to come to class with questions about the assigned reading, which include Mathematical Insights.

The class is too small for ABCD-card concept questions and in-class *group* problem solving. The active-learning technique will be randomly drawing names to address concept questions and other prompts, especially on Wednesdays' in-class problems (see Grading below). Answering questions on-the-fly is a skill that takes practice; it is acceptable to say "I don't know" and all right to be wrong. The instructor and classmates will help.

Homeworks (HW) are due every two weeks, on Wednesdays, at class time. The homeworks are all quantitative (e.g., problems, figures, etc.) and posted to Laulima:Resources. The homeworks include one or more of the in-class (IC) problem set. One problem is graded in detail, the rest checked for completeness (including proper setup and assessment). The problem graded in detail is worth 25 of the 50 total homework-points.

Quizzes are every third week starting 15 February and all content from a cutoff and earlier are fair game, including problems. The cutoff is determined by what assignments have been submitted and have solutions posted (hence the assignment(s) named in the square brackets by the scheduled quiz below). This pattern is designed so that students have a chance to: (1) learn the material via lecture and assignments; (2) practice the content via assignments; and (3) receive feedback via graded work and/or posted solutions. Thus there is a lag between material being the focus of lecture and when the material will be on a quiz. There will be no group portion on quizzes; they will be five conceptual questions for 60% and two quantitative problems for 40%.

¹Subject to change.

Detailed schedule:¹ acronyms: HW = homework; IC = in-class problem solving; LS = Laulima survey; RfC = read-for-(next) class.

Date	Topic	In-class	Assignment	Due
M 9 Jan	L1. ASTR181 Overview	Concept pre-quiz	Read "Secret to Raising Smart Kids" (Dweck, <i>Scientific American</i> , 28 Nov 2007) if you haven't or need to again.	
W 11 Jan F 13 Jan	L2. Overview of Universe L3. Light and Matter		RfC: Review Ch 5 RfC: Review Ch 5 (cont'd)	
M 16 Jan W 18 Jan	MLK Day (no class)	IC A: Properties of Light	HW #1: Light (incl. IC B) RfC: Ch S4.1-4.2	
F 20 Jan	L4. Fundamental Physics I		RfC: Ch 14	
M 23 Jan W 25 Jan F 27 Jan	L5. Sun I L6. Sun II	IC B: Fundamental Physics	RfC: Ch 14 (cont'd) RfC: Ch 14 (cont'd)	
M 30 Jan W 1 Feb	L7. Sun III	IC C: Sun	HW #2 is IC C & D RfC: Ch 15	HW #1 (incl. IC B)
F 3 Feb	L8. Stars I		RfC: Ch 15 (cont'd)	
M 6 Feb W 8 Feb F 10 Feb	L9. Stars II L10. Stars III	IC D: Stars	RfC: Ch 16 RfC: Ch 17	
M 13 Feb W 15 Feb	L11. Stellar Evolution I	Quiz #1 [HW #1, IC A-B]	HW #3: Stars (incl. IC E) RfC: Ch 17 (cont'd)	HW #2 (IC C & D)
F 17 Feb	L12. Stellar Evolution II			
M 20 Feb W 22 Feb F 24 Feb	President's Day (no class) L13. Fundamental Physics II	IC E: Stellar Evolution I	RfC: Ch S4.3-4.4 RfC: Ch 18 LS #1: Mid-term course evals. (due F Mar 3)	
M 27 Feb W 1 Mar	L14. Stellar Evolution III	IC F: Stellar Evolution II	HW #4: Stellar Evolution (incl. IC F) RfC: Ch 18 (cont'd)	HW #3 (incl. IC E)
F 3 Mar	L15. Stellar Evolution IV		RfC: Ch 19	LS #1
M 6 Mar W 8 Mar F 10 Mar	L16. Milky Way Galaxy I L17. Milky Way Galaxy II	Quiz #2 [HW #2/IC C-D]	RfC: Ch 19 (cont'd) RfC: Ch 20	
M 13 Mar W 15 Mar	L18. Galaxies I	IC G: Galaxies I	HW #5: Milky Way Galaxy (incl. IC G) RfC: Ch 20 (cont'd)	HW #4 (incl. IC F)
F 17 Mar	L19. Galaxies II		RfC: Ch 20 (cont'd)	
M 20 Mar W 22 Mar F 24 Mar	L20. Galaxies III L21. Galaxies IV	IC H: Galaxies II	RfC: Ch 21 RfC: Ch 21 (cont'd)	
27-31 Mar	Spring recess (no class)			
M 3 Apr W 5 Apr	L22. Galaxy Evolution I	Quiz #3 [HW #3-4, IC E-F]	HW #6: Galaxies (incl. IC H) RfC: Ch 21 (cont'd)	HW #5 (incl. IC G)
F 7 Apr	L23. Galaxy Evolution II		RfC: Ch 21 (cont'd)	
M 10 Apr W 12 Apr F 14 Apr	L24. Galaxy Evolution III Good Friday (no class)	IC I: Galaxy Evolution	RfC: S3.1-3.4 Read "Misconceptions about the Big Bang" by Lineweaver & Davis, <i>Scientific American</i> , 2005, Vol. 292, pp 36-45 (ISSN: 0036-8733). Available at Mookini.	
M 17 Apr W 19 Apr	L25. General Relativity & Cosmology I	Discuss "Misconceptions" IC J: Cosmology	HW #7 is IC I & J RfC: Ch 22	HW #6 (incl. IC H)
F 21 Apr	L26. Cosmology II		RfC: Ch 22 (cont'd)	
M 24 Apr W 26 Apr F 28 Apr	L27. Cosmology III L28. Cosmology IV	Quiz #4 [HW #5-6, IC G-H]	RfC: Ch 23	
M 1 May W 3 May	L29. Course Synthesis	Course evals. & Concept post-quiz		HW #7 (IC I & J)
W 10 May	Final Exam	9:40 AM-11:40 PM, STB226		

Grading:

- The grade depends on the following items: quizzes (40%); homework assignments (30%); final exam (20%), Wednesdays' participation (5%), and completing pre/post-quizzes (5%). The lowest homework and quiz grades will be dropped.
 - If a student notices an inconsistency in the instructor's grading, s/he should ask; it might be a mistake or it might be a subtle point. Students are encouraged to ask questions about grading.
 - Wednesdays' participation is more than attendance. It includes a good-faith effort to answer the instructor's questions, when randomly called upon, and to participate when answering is opened to the whole class. The instructor will record a holistic grade per student, on a scale of 0 (no participation) to 3 (great participation), after each Wednesdays' in-class problem solving.
- There will be no make-up work other than the final exam.
 - If a student were excused, the graded work will not be included in her/his final grade.
 - If a student must miss a class for a reasonable reason, s/he must email the professor before the start of class time.
 - If a student were unable to email in advance due to extreme circumstances, s/he should contact the professor as soon as possible. Such instances will be judged on a case-by-case basis.
 - * In such (and similar) situations, the student is strongly encouraged to contact Student Services (info below). Student Services are liaisons between students and instructors, when Life adversely impacts Academics. If Student Services intervenes on a student's behalf, the instructor will work to accommodate any missed content and points.
 - If a student were excused from all points in a given category, the percentage of the other categories will be increased to fill the void.
- Homework assignments are never excused since their due dates are known in advance. It is the student's responsibility to turn in the homework somehow, either by giving it to another student to submit or by scanning and emailing it to the professor.
- Late homework is accepted within 24 hours of the deadline for 75% credit.
- Cheating is not tolerated. Any question of cheating will be tested with an oral exam, to see whether the student(s) involved understand the material. Cheating will result in a zero for the item in question and a report to the University. It may result in immediate failure of the course.
- The final letter grade will be given based on the class statistics (e.g., the 25th, 50th/median, 75th percentiles). The goal is to score higher than the median on all graded work. The expectation is that final grades higher than the median will pass with at least a C and that the 25th to 50th percentiles will likely earn something in the C range.

Student's Name

ASTR181 Question X: Problem-Solving Steps

- 1. Recognize the problem:** What's going on? What do I want?
Draw a picture of the situation.
Define useful quantities: identify what you know and don't know.
State the question in terms of something you can calculate.
- 2. Describe the problem in terms of the field:** What does this have to do with...?
State general principles that might be useful to approach this problem.
Give any constraints imposed by the situation.
State any approximations that might be useful.
Draw any diagrams that might be useful.
Translate the general principles into equations specific to the situation.
- 3. Plan a solution:** How do I get what I want?
Identify your target quantity.
Construct a chain of equations linking your target to known quantities.
Check to see if you have sufficient equations.
- 4. Execute the plan:** Let's get an answer.
Math goes here.
Follow your plan to calculate an answer.
Check your units and the order-of-magnitude.
- 5. Evaluate the solution:** Can this be true?
Did you answer the question?
Justify that your answer is reasonable.

Campus-wide Information

Disability Support: Any student with a documented disability who would like to request accommodation should contact the Disability Services Office—Student Services Center, E215; 932-7623 (V), 932-7002 (TTY), uds@hawaii.edu—as early in the semester as possible.

Advising: Advising is a very important resource designed to help students complete the requirements of the University and their individual majors. Students should consult with their advisor at least once a semester to decide on courses, check progress towards graduation, and discuss career options and other educational opportunities provided by UH Hilo. Advising is a shared responsibility, but students have final responsibility for meeting degree requirements.

Kilohana Academic Success Center: The KASC provides academic support opportunities for all UH Hilo students that foster their development into independent, self-motivated learners. Students who visit Kilohana have access to subject-specific and academic skills tutoring from UHH students selected for their academic achievement and dedication to helping others succeed. Kilohana is located on the lower level of the Mookini Library and on the web at <http://hilo.hawaii.edu/kilohana/>.

Human Rights: The University of Hawai'i at Hilo prohibits discrimination in its education programs based on race, national origin, color, creed, religion, sex, age, disability, veteran status, sexual orientation, gender identity or associational preference. If at any time during class you feel uncomfortable about what is being talked about, or feel that your human rights have been violated, please feel free to leave the room. However, the professor asks that you confer with her as soon as possible about what happened so that appropriate action can be taken if necessary to avoid future problems. If you are uncomfortable speaking with the professor about your concern, please contact Kalei Rapoza (kaleihii@hawaii.edu), Interim EEO/AA Director, at 932-7626.

UH Hilo Title IX Policy: The University of Hawaii is committed to providing a learning, working and living environment that promotes personal integrity, civility, and mutual respect and is free of all forms of sex discrimination and gender-based violence, including sexual assault, sexual harassment, gender-based harassment, domestic violence, dating violence, and stalking. If you or someone you know is experiencing any of these, the University has staff and resources on your campus to support and assist you. Staff can also direct you to resources that are in the community. Here are some of your options:

If you wish to remain anonymous, speak with someone confidentially, or would like to receive information and support in a confidential setting, contact: • UH Hilo Counseling Services: SSC, room E-203, 932-7465; • UH Hilo Medical Services: Campus Center, room 212, 932-7369; and/or • Hawai'i Island YWCA, 935-0677.

If you wish to report an incident of sex discrimination or gender-based violence including sexual assault, sexual harassment, gender-based harassment, domestic violence, dating violence, or stalking as well as receive information and support,[†] contact: • Libby Bailey, Title IX Coordinator, 932-7818, libby.bailey@hawaii.edu; • Jennifer Stotter, Director of the Office of Equal Opportunity & Deputy Title IX Coordinator, 932-7641, jstotter@hawaii.edu; and/or • Kalei Rapoza, Interim Director of Human Resources, 932-7626, kaleihii@hawaii.edu.

[†]Please note that you do not have to file a report with the University to receive institutional support or assistance.

As a member of the University faculty, the professor is required to immediately report any incidence of sex discrimination or gender-based violence to the campus Title IX Coordinator. Although the Title IX Coordinator and professor cannot guarantee confidentiality, the student will still have options about how the case will be handled. The goal is to make sure the student is aware of the range of options available and has access to the necessary resources and support. For more information regarding sex discrimination and gender-based violence, the University's Title IX resources and the University's Policy, Interim EP 1.204, go to: <http://www.hawaii.edu/titleix>.

Student Conduct: Students are expected to follow the University of Hawai'i at Hilo Student Code of Conduct available at the following URL: <http://www.uhh.hawaii.edu/catalog/student-conduct-code.html>.