Astronomy 104: Astronomy Laboratory Syllabus, Schedule, & Information

Fall 2019

Questions: astron-104-ta@uwm.edu

Instructor: Prof. David Kaplan [he/him/his]
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- •Office hours: by appointment

Teaching Assistants:
- •Suraj Pandey
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  - •Office hours: Tuesday/Thursday, 1:30pm-3:00pm

Course Website: http://www.gravity.phys.uwm.edu/~kaplan/astron104/

Location: all sections meet in PHY 226.

Meeting Times:
- •Section 801: Tuesday 7:30-9:20pm (Pandey)
- •Section 802: Wednesday 7:30-9:20pm (Horst)
- •Section 803: Thursday 7:30-9:20pm (Horst)
- •Section 804: Wednesday 3:00pm-4:50pm (Horst)

Goals: Students will be exposed to a variety of techniques, tools, and ideas to understand how we explore the Universe around us. Students are encouraged to question, think, estimate, and explore.

Time Investment:
- 2 hours/week: laboratory exercises
- 2 hours/week: reading about the next week's exercises. The assignments will be posted online in advance, and students are expected to read through and be familiar with the material for the week before the laboratory begins.

Objectives: Students will:

- •Plot and interpret graphs
- •Use tools and reference materials
- •Perform calculations
- •Learn ways to estimate
- •Assess the accuracy of measurements

Evaluation: This course consists of 13 laboratory exercises, described below. Students must perform the exercises during their scheduled sections. Each assignment will be graded. The final grade for the class will be the average of the top 12 of the 13 grades, so the lowest grade will be dropped.

Attendance: Attendance is required. Absences will only be allowed with the **advance permission of the instructor (Prof. Kaplan) - not the teaching assistants**. If you miss a lab due to medical reasons please provide the instructor with appropriate documentation (a Doctor's note). The last week of the lab (December 9-12) is a makeup date, used if any exercises have been missed with excused absences. You cannot just miss a lab and show up: permission is necessary.

It is usually possible to accommodate students who have to switch their lab to a different day of the week (for example due to a religious observance). Please let the instructor know in advance if this is required.

To request an approved absence, please submit an Absence Request Form

Corequisites: Astronomy 103 or a comparable Astronomy Survey course (Astronomy 300 or 400 is acceptable).

Equipment: Please bring a scientific calculator with you to each lab.

Textbook: The required textbook is:
Pearson Custom Library: Astronomy
Astronomy 104: Astronomy Laboratory
ISBN: 1-323-34259-1
Price: $17.50

Note that this is a custom-printed book for this course, so you cannot get a used copy or a copy from elsewhere. Many of the exercises will be found within this book, and you will fill them in and then hand the material in to the teaching assistants.

The textbook from Astronomy 103 (*Astronomy*, by Fraknoi, Morrison, and Wolff) is recommended: it will help to put the exercises into context, and each lab refers to a particular section (or sections) of the book. Please bring your textbook to the lab sessions if you have it. This book is free, so you can just download a PDF if needed.

University Policies: For information on university policies such as religious observances, incompletes, discriminatory conduct, and so forth, see: http://www.uwm.edu/Dept/SecU/SyllabusLinks.pdf. No weapons are permitted in any building on the UWM campus.

Contact Information: Announcements and other items will be made over email and over Canvas (http://uwm.edu/canvas). Please check Canvas regularly, and make sure that your preferred email address is listed.

GER Natural Science Requirements: This class satisfies the GER criteria for Natural Science courses (see http://www/Dept/Acad_Aff/academic/ger.pdf).

Student Learning Outcomes:

1. Students will learn how observations and experiments formed the underpinnings of modern astronomy (aligns with Divisional Criteria 1, 2, and 4)

2. Students will learn how to take and assess data, and how to make and interpret graphs and plots (aligns with UW System Shared Learning Goal 2)

3. Students will learn to assess the accuracy of measurements, and how measurement errors affect our knowledge of the Universe (aligns with Divisional Criterion 4)

Assessment of Learning Outcomes:

1. After each laboratory exercise the students will complete an anonymous survey to assess how much the learned from the lab and how well it matched the material in the lecture. We will evaluate these surveys to determine which laboratories to continue and which to switch out in favor of new material.

Schedule

Lab 1: Week of September 2, 2019 **Planetary Motion and the Night Sky (book)**
You will infer the structure of the Solar System based on simple observations you can make with the naked eye. **(Chapter 2)**

Lab 2: Week of September 9, 2019 **Retrograde Motion & Shape of Mars' Orbit**
You will discover how the puzzling "retrograde," or backward apparent motion of the planet Mars occurs **(Section 1.1)**.
Based on data from Tycho Brahe, you will plot the orbit of Mars and see how different shapes (circle, ellipse) fit the data **(Section 1.3)**.

Lab 3: Week of September 16, 2019 **Orbital Motion of a Planet (Computer)**
Moving on to the planets of our solar system, often the brightest objects after the Moon in our night sky, you will learn two ways to determine the length of a year on Earth and decide which is a better method. You will determine the maximum elongation of Venus, as well as the size of its orbit and the length of its year. You will then use this information to verify one of Kepler's laws for the motion of planets. **(Section 3.1)**

Lab 4: Week of September 23, 2019 **Gravity and Orbital Motion (book, Computer)**
You will use a gravity simulator to investigate orbital motion and Kepler's Laws. **(Section 3.1, 3.3)**

Lab 5: Week of September 30, 2019 Phases of the Moon (book)
Long an object of mystery to ancient cultures, you will learn about the geometrical relationship of the Earth/Moon/Sun system. You will discover the different phases of the moon and what process creates them. You will also learn about eclipses. **(Section 4.5)**

Lab 6: Week of October 7, 2019 Spectral Analysis
How do we tell what distant objects in the sky are composed of? We will explore one method, called spectroscopy. You will observe several unknown emission spectra using spectrographs. After sketching the spectra, you will try to identify the unknown elements by comparing your spectra with the spectra of several common elements **(Sections 5.3)**.

Lab 7: Week of October 14, 2019 Colors of Stars (book, Computer)
You will investigate what the color of a star reveals about its physical properties. **(Section 17.2, 17.3)**

Lab 8: Week of October 21, 2019 HR Diagram
What are other stars like in the Milky Way? We will use surface temperature, luminosity and peak wavelength to map out the variety of stars found in the night sky, recreating the H-R Diagram: one of the fundamental relations for all astronomers. **(Section 18.4)**

Lab 9: Week of October 28, 2019 Nuclear Fusion and Energy in Stars (book)
You will explore the creation of heavy elements and release of energy through nuclear fusion in stars. **(Section 16.2)**

Lab 10: Week of November 4, 2019 Gravity and Black Holes (book)
You will investigate some of the exotic phenomena that result from the enormous gravity in the vicinity of a black hole. **(Chapter 24)**

Lab 11: Week of November 11, 2019 Solar Energy and the Habitable Zone
We explore the object at the center of our solar system, the Sun. We learn about the energy it provides to the planets, how the Sun's energy interacts with atmospheres and determine the Solar System's Habitable Zone: the zone where life is most likely to exist. **(Section 7.2)**

Lab 12: Week of November 18, 2019 Radial Velocity and Exoplanets (book)
You will investigate the indirect detection of exoplanets using the observed reflect motion of stars. **(Section 21.4)**

Week of November 25: <u>No Lab</u> (Thanksgiving)

Lab 13: Week of December 2, 2019 Hubble Law (Computer)
You will calculate the age and size of the Universe using software to measure how far away galaxies are and how quickly they are moving away from the Sun. **(Section 26.5)**

Week of December 9, 2019 Makeup (last day of classes: December 12, 2019)
If you have missed any exercises with <u>excused</u> absences, this will be an opportunity to do a makeup.

OTHER IMPORTANT INFORMATION

1. **Discriminatory conduct (such as sexual harassment):** Discriminatory conduct will not be tolerated by the University. It poisons the work and learning environment of the University and threatens the careers, educational experience, and well-being of students, faculty, and staff. See: https://www4.uwm.edu/secu/docs/other/S_47_Discrimina_duct_Policy.pdf

2. **Cheating and academic misconduct:** all work handed in for grading (including electronic submissions) must be the result of your own efforts. Copying the work of another student or reproducing the solutions/answers to problems from an on-line or other source and presenting them as your own, original work, will be regarded as cheating. Cheating/academic misconduct will be dealt with by the instructor according to the UW policies and procedures. Cheating on exams or plagiarism are violations of the academic honor code and carry severe sanctions, including failing a course or even suspension or dismissal from the University. See: http://www4.uwm.edu/dos/conduct/

3. **Special Consideration.** The principle of equal treatment of all students shall be a fundamental guide in responding to requests for special consideration. No student should be given an opportunity to improve a grade that is not made available to all members of the class. This policy is not intended to exclude reasonable accommodation of verified student disability, or the completion of work missed as the result of religious observance, verified illness, or justified absence due to circumstances beyond the student's control. (**Authority:** UWM Faculty Documents 860B and 1927)

4. **Religious observance.** In the syllabus, you will find a schedule of tests. Please inform the instructor ASAP and no later than MONDAY FEBRUARY 13TH if you see a conflict with religious observance. Also inform the instructor ASAP and no later than MONDAY FEBRUARY 13TH if the deadline of a quiz or an assignment conflicts with religious observance. A suitable date/time for the test (that does not conflict with the religious observance) or other deadline can then be arranged. Please note the following official UW policies: http://www4.uwm.edu/secu/docs/other/S1.5.htm See also: http://uwm.edu/academicaffairs/wp-content/uploads/sites/32/2014/12/calendar.pdf

Authority: UWS 22 and UWM Fac. Doc. 1918

I. Declaration of policy. It is the policy of the board of regents that students' sincerely held religious beliefs shall be reasonably accommodated with respect to all examinations and other academic requirements. The board of regents adopts this chapter in order to ensure that all institutions of the university of Wisconsin system have in place appropriate mechanisms for ensuring the reasonable accommodation of students' sincerely held beliefs, and for appeals related to these matters.

II. Accommodation of religious beliefs.

1. A student shall be permitted to make up an examination or other academic requirement at another time or by an alternative method, without any prejudicial effect, where:

(a) There is a scheduling conflict between the student's sincerely held religious beliefs and taking the examination or meeting the academic requirements; and

(b) The student has notified the instructor, within the first three weeks of the beginning of classes (within the first week of summer session and short courses), of the specific days or dates on which he or she will request relief from an examination or academic requirement.

2. Instructors may schedule a make-up examination or other academic requirement before or after the regularly scheduled examination or other academic requirement.

3. Instructors shall accept, at face value, the sincerity of students' religious beliefs.

4. Student notification of instructors and requests for relief under sub. (1) shall be kept confidential.

5. Complaints of failure to provide reasonable accommodation of a student's sincerely held religious beliefs as required by this rule may be filed under UWM Complaint and Grievance Procedures.

6. The chancellor shall, through appropriate institutional publications (to include at a minimum the Schedule of Classes and Bulletin), provide notification to students and instructors of the rules for accommodation of religious beliefs, and of the procedure and appropriate office for filing complaints.

5. **Students with disabilities:** please give me the written authorization issued by the Accessibility Resource Center (ARC) **as soon as possible**. Suitable arrangements can then be made. Students with special requirements/learning disabilities should see me as early as possible during the semester: this is the student's responsibility. The ARC will issue formal instructions to me about how students with disabilities are to be accommodated. See: http://www4.uwm.edu/sac/ for ARC contact information.

6. **Students called to active military duty:** accommodations for absences due to call-up of reserves to active military duty are available at this link: http://www4.uwm.edu/current_students/military_call_up.cfm

7. **Complaint procedures:** Students may direct complaints to the head of the academic unit or department in which the complaint occurs. If the complaint allegedly violates a specific university policy, it may be directed to the head of the department or academic unit in which the complaint occurred or to the appropriate university office responsible for enforcing the policy. See: https://www4.uwm.edu/secu/docs/other/S_47_Discrimina_duct_Policy.pdf
For your information:
Chair of Physics: Professor Prasenjit Guptasarma: KEN 3077, (414)229-6497, pg@uwm.edu

Dean of Students' Office: http://www4.uwm.edu/dos/

Equity and Diversity: http://uwm.edu/equity-diversity-services/about/

8. **Grade appeal procedures:** A student may appeal a grade on the grounds that it is based on a capricious or arbitrary decision of the course instructor. Such an appeal shall follow the established procedures adopted by the department, college, or school in which the course resides or in the case of graduate students, the Graduate School. These procedures are available in writing from the respective department chairperson or the Academic Dean of the College/School. Two useful links are given below.
http://www4.uwm.edu/secu/docs/other/S_28_Grade_Appe_by_Students.pdf

http://uwm.edu/letters-science/advising/answers-forms/policies/appeal-procedure-for-grades