

El Camino College
Division of Natural Sciences
ASTRONOMY DEPARTMENT
Course Syllabus

COURSE: Astronomy 12
TITLE: Astronomy Laboratory
Section: 1044
CREDIT: 1 Unit
INSTRUCTOR: Wade Mayo
ASSISTANT: Jeff Kincaid

TIME: 7:30 p.m. to 10:40 p.m.
EVENING: Thursdays
DATE: September 3rd through December 17th
LOCATION: Physics Room 101
OFFICE HOURS: Before class by appointment

DESCRIPTION: The Astronomy Laboratory experience includes telescopic observations of the moon, planets, stars, and deep sky objects and currently available technology; interpretations of observational results; and demonstrations of the principles underlying astronomical equipment and procedures.

TRANSFER: Degree applicable transfer to CSU and UC.

PREPARATION: Completion or concurrent enrollment in Astronomy 20 or 25 or equivalent is strongly recommended.

TEXTBOOKS: Astronomy 12 Laboratory Manual for Students of El Camino College by David Vakil, The Night Sky Planisphere (star dialer) by David Chandler, Wil Tirion and Brian Skiff's Bright Star Atlas 2000.0 published by Willmann-Bell, Inc. and access to an astronomy textbook used in astronomy like those held on reserve in the library.

MATERIALS: Planisphere, star atlas, pencils, clipboard, flashlight with red filter are required for every class. Blanket or towel and plastic transparent paper covers are optional, but recommended. Dress warmly most of our time outside in the Los Angeles night air that can make you colder than you might think.

GOALS: Provide students a CSU/UC transferable science laboratory course in astronomy that introduces the beauty and wonder of the night sky by:

- **Understanding** simple astronomical observational nomenclature and terminology
- **Orienting** direction by looking at the sky
- **Identifying** naked eye astronomical objects in the winter or spring skies
- **Using** a planisphere, bright star atlas and telescope
- **Applying** star charts and telescopes for astronomical observations
- **Performing** night sky astronomy related laboratory exercises
- **Doing** cloudy sky astronomy related laboratory exercises
- **Running** astronomy related computer simulations
- **Learning** to observe and record astronomical data
- **Forming** well-reasoned conclusions from interpreting astronomical data gathered
- **Developing** technical writing skills based on laboratory activities conducted

LEARNING OUTCOMES: Upon completion of Astronomy 12 Laboratory, the student will be able to:

1. Describe the motions of the celestial sphere, the sun, the earth, the moon and the planets.
2. Identify the key components of an equatorial mounted Schmidt-Cassegrain telescope.
3. Apply drift timing techniques to determine field of views of telescopic eye pieces.
4. Determine angular distances between objects in the night sky
5. Convert drift timing measurements into linear distances on the Earth's moon
6. Determine star magnitudes using photometry techniques.
7. Use a small equatorial mounted Schmidt-Cassegrain astronomical telescope to observe and sketch night sky objects such as the moon, planets and the sun.
8. Use a small computerized azimuth-elevation mounted Schmidt-Cassegrain astronomical telescope to locate and sketch deep night sky object such as nebulae, binary stars and star clusters.
9. Use a large equatorial permanently mounted Schmidt-Cassegrain astronomical telescope to observe special night sky targets of opportunity.
10. Identify locations of constellations, asterisms, bright stars and some deep sky objects in the winter night sky and in the planetarium.
11. Run astronomical computer simulations.
12. Write a technical report on an astronomical laboratory assignment that includes an introduction, observations, results sections and appendices.
13. Demonstrate sufficient night sky knowledge and telescope skills to be considered an amateur astronomer.

CLASS FORMAT: Each class will start in the assigned class room with pre-laboratory explanations, discussions and initial activities. For most laboratory activities, the class will adjourn to the Astronomy Observation Deck located on the Mathematics Building roof (use northeast staircase) for night sky observing. Some class exercises may use the computer laboratory in the Mathematics Building basement for astronomy related computer simulations. On occasion, the planetarium may be used. In case of an exception, a note will be posted on the classroom door.

Laboratory Activities: Laboratory activity sheets are included in the required Astronomy 12 Laboratory Manual. This material allows students ample time to read and prepare for the next week's laboratory activities prior to class. Laboratory activity assignments are due at the beginning of class, one week following the laboratory activity. Laboratory activity assignments that are late will be accepted, but multiplied a 5% penalty factor for each week that the assignment is late. Even with an excused absence, a zero will be issued for all required laboratory activities missed unless made-up within the specified time limits. Tentatively, night sky viewing laboratories will be performed chronologically (first to last) as listed in the Lab Manual. If clouds prevent night sky viewing, then the next assigned indoor activity in the Lab Manual will be performed. Deviation from this plan will be announced in class in order to take advantage of targets of opportunity.

Winter Night Sky Exam: Class time will be used to take students on a visual tour of the winter night sky. Time and weather permitting, the winter night sky tour may be conducted outdoors or in the planetarium weather not permitting. The Winter Night Sky Exam requires students to be able to point out by memory the locations of a few winter night sky bright stars, constellations, asterisms and approximate locations of several deep sky objects. Grade requirements for the Winter Night Sky Exam are in Appendix A of this course syllabus. The Winter Night Sky Exam is usually completed later in the fall semester when the bright stars and constellations are visible in the night sky.

Formal Laboratory Reports: A single formal laboratory report is required for this course. Format, requirements and guidelines as well as a sample formal laboratory report are given in the Astronomy 12 Laboratory Manual. The choice of which laboratory activities to write a formal laboratory report about is up to each student. Research, write and submit the laboratory report after receiving a laboratory activity grade on an assignment of your choice. Make sure that particularly pertinent answers to questions on the laboratory activity sheet are indirectly included in the formal laboratory report. Make sure to attach your original laboratory activity sheets including observations to all laboratory reports. Failing to submit observations has been determined to be a frequent loss of points for students. Failure to strictly follow the format and requirements for the formal laboratory report will result in significant loss of points. Formal laboratory reports should be typed in your own unique words and not copied from other classmates or plagiarized from previous classes. A rewrite of the first laboratory report may be submitted and an average of the two formal laboratory reports will count toward your final grade if the first report is attached. Allow 2 weeks for a formal laboratory report to be graded

and returned. The last date that a formal laboratory report or rewrite will be accepted is 3 weeks prior to the last day of class.

PRACTICAL LABORATORY EXAM: During one of the last few class sessions, each student will be given a performance evaluation where they are expected to complete a set of astronomy tasks that demonstrate skills with the telescope. This will involve pointing the telescope at a specific location with known equatorial coordinates. Part of the score will be determined by target accuracy while the rest of the score will be determined by ability to perform the observation.

GENERAL LABORATORY EXAM: During one of the last few class sessions, an open book and open laboratory sheets may be administered in which the same principles used in the laboratory exercises are applied.

EXTRA CREDIT: Extra Credit points may be earned and added to your total score for the class in a variety of ways. See Appendix B for details.

DROP POLICY: If any student decides to stop attending the course, it is the individual responsibility of the student to fill-out and turn in a drop card to the Admissions Office. There is a last date by which the course must be dropped in order to receive a grade of **W** instead of an **F**. Students may be dropped by the instructor if 3 or more laboratory exercises are missed.

GRADING POLICY: The student's course grade is based upon the sum of earned points from laboratory assignments, pre-laboratory quizzes, mid-term laboratory test, formal laboratory report, final practical examination and extra credit work. The final course percentage is determined by the total of scores achieved including extra credit divided by the maximum possible total points that could be earned exclusive of extra credit times 100%. The course grade is assigned as follows

- $87.50\% \leq A$
- $75.00\% \leq B < 87.50\%$
- $62.50\% \leq C < 75.00\%$
- $50.00\% \leq D < 62.50\%$
- $F < 50\%$

SCORING POLICY: The maximum possible earned points for various activities are

- | | | |
|-----------------------------|----------------|---|
| • Laboratory Activities | 25 points each | (Lowest 25 Point Score Dropped) |
| • Winter Night Sky Exam | 25 points | (Later in the Semester) |
| • Formal Laboratory Report | 50 points | (Early submittal encouraged) |
| • Practical Laboratory Exam | 25 points | (Demonstrate skills using a telescope) |
| • General Laboratory Exam | 50 points | (Open Lab Activity Sheets Given after Mid-Term) |
| • Extra Credit Activities | 50 points | (Not Required) |

CLASS POLICY: Throughout this class, most assignments will involve group activities. You may choose your own groups, but the instructor reserves the right to reassign students. Groups should be limited to 3 or 4 students each depending upon class size. Collaboration outside of class is encouraged, particularly within your own laboratory group. As a minimum, students are expected to read and have a basic understanding of the laboratory activity to be performed before class commences. Please be on time for class and do not leave class early prior to completing the laboratory exercise. Class attendance is mandatory. If you miss a laboratory, zero credit will be given for that laboratory unless it is made-up. In case of an absence, the student is still responsible for any material covered in class, any announcements made in class, any instructions or assignments made by the instructor and any schedule changes made in class. Contact other students for missed information.

TUTORING: Astronomy students may receive free laboratory assistance on the Math Building Observation Deck and classroom tutoring services in the Learning Resources Center. Availability of an Astronomy Laboratory Assistant and an Astronomy Tutor will be posted. These services are provided for students to take advantage and I sincerely hope that students will not hesitate to use them.

SAFETY: El Camino Police Department offers free escorts for students to and from any location on campus or to your vehicle. However, this service only runs from 5:30 a.m. to 10:30 p.m. Monday through Thursday. You

can still use the blue phones or your cell phone to call the police outside of those hours, but there is a chance you may have to wait a while for an officer to arrive. Ask the dispatcher for an estimated time of arrival (ETA).

ACADEMIC ACCOMMODATION STATEMENT

A student with a disability, who would like to request an academic accommodation, is responsible for identifying herself/himself to the instructor and to the Disabled Student Programs and Services (DSPS). To make arrangements for academic accommodations, contact the DSPS Department. A freight elevator with roof access is available for students requiring a wheelchair, crutches or who have physical disabilities that preclude using stairs.

HONESTY POLICY: Academic dishonesty or cheating is defined as an intentional act of fraud in which a student seeks to claim credit for the work of efforts of another without authorization. This includes assisting other students in acts of dishonesty or coercing students into acts of dishonesty, whether it is in coursework or on exams. There is absolutely no tolerance for cheating in this class. Any student caught cheating or assisting another student in the act of cheating, will receive a zero grade for that assignment. Appropriate paperwork documenting the academic dishonest incident will be filled and will become part of the cheating student(s) permanent record at El Camino College.

CELL PHONE POLICY: Other than during exams, student cell phones may be left active in vibrate mode or manner mode. Common courtesy and common sense with cell phone use is expected that will not disturb the class. If a single cell phone rings out loud, the entire class may be asked to turn-off their cell phones for the duration of that session until the next break. Students with known preexisting emergent situation may be exempted by the instructor. Cell phones should not be answered except in emergencies. If you receive an emergent call during class or laboratory, quickly take your phone outside of the classroom or laboratory area to respond. Abuse of cell phone privileges by a single student, by a group of students or by the class in general; may result in a total moratorium against activated cell phones in the classroom laboratory area.

APPENDIX A

WINTER NIGHT SKY EXAM

Point out in a city light polluted environment the following constellations, asterisms, stars, planets and approximate locations of deep sky objects using accepted pronunciations.

Targets

C Grade

Definitions
Ursa Major

Ursa Minor
Orion
Taurus
"The Winter Hexagon"

Visible Planets

B Grade

Definitions
Ursa Major

Ursa Minor
Orion

Taurus
Winter Hexagon Stars
Winter Hexagon Constellations
Visible Planets

A Grade

Definitions
Ursa Major

Ursa Minor
Orion

Taurus
Deep Sky Objects (Approximate Locations)
Winter Hexagon Stars plus

Winter Hexagon Constellations
Visible Planets
Milky Way
Celestial Equator

Stars, Planets and Deep Sky Objects

Cardinal Directions
Big Dipper Asterism
Pathway to Polaris
Polaris & Kochab
Outline (Belt & Sword)
Red Eye of the Bull
Rigel, Sirius, Procyon, Pollux, Castor, Capella & Aldebaran
Mars & Saturn

Cardinal Directions, Horizon & Zenith
Big Dipper Asterism
Mizar & Alcor
Pathway to Polaris
Polaris & Kochab
Outline (Belt, Sword, Shoulders, Foot & Knee)
Betelgeuse, Bellatrix, Rigel & Saiph
Pathway to Sirius
Pathway to Pleiades
Red Eye and Horns of the Bull
Rigel, Sirius, Procyon, Pollux, Castor, Capella & Aldebaran
Orion, Canis Major, Canis Minor, Gemini, Auriga & Taurus
Venus, Jupiter, Mars & Saturn

Cardinal Directions, Horizon, Zenith, Azimuth & Altitude
Big Dipper Asterism
Mizar & Alcor,
Pathway to Arcturus & Spica
Pathway to Polaris
Polaris & Kochab
Outline (Shoulders, Belt, Sword, Foot, Knee, Club & Shield)
Betelgeuse, Rigel, Bellatrix & Saiph
Alnitak, Alnilam & Mintaka
Pathway to Sirius
Pathway to Pleiades
Red Eye and Horns of the Bull, El Nath & Hyades
M1 (Crab Nebula), M42 (Orion Nebula), M45 (Pleiades)
Rigel, Sirius & Mirzam, Procyon & Gomeisa, Pollux, Castor, Capella & Aldebaran
Orion, Canis Major, Canis Minor, Gemini, Auriga & Taurus
Mercury, Venus, Jupiter, Mars & Saturn
Approximate path through "The Winter Hexagon"
Approximate path through Orion & night shy

Appendix B

EXTRA CREDIT FOR ASTRONOMY 12

Each one of the following activities may be done for up to 50 points maximum of extra credit. Students may not receive more than 50 points total of extra credit. All extra credit work submitted is due in class by two weeks prior to the last class unless prior arrangements are made with the instructor.

Visit an astronomical establishment and type a trip report of up to 5 pages detailing your observations and impressions. You may not visit the same location twice for double extra credit. Some possible ideas to address in your trip report are:

- Name of establishment, location and date of visit.
- Names of presenters and subject titles.
- Overview of presentation
- Detail information on 2 or 3 points made in the presentation
- Why the visit was worthwhile
- Why the show or program was enjoyable
- What impressed you the most or the least
- What did you see or learn that you did not know previously
- Suggestions and compliments for the exhibits/presentations
- Why you would (would not) recommend the event to others

Some local establishments with astronomy interests are:

1. **Jet Propulsion Laboratory** Von Karman Lecture Series presented once a month at Jet Propulsion Laboratory in Pasadena and Pasadena City College. See <http://www.jpl.nasa.gov>.
2. **Planetariums** in the local vicinity which may offer shows or exhibits that you can view and report on for extra credit include: Santa Monica College, Orange Coast College (Costa Mesa), Santa Ana College (Tessmann Planetarium), Griffith Park Observatory (temporary facility in LA Zoo parking lot) and Fleet Space Center in San Diego. Obtain the operator's signature on the brochure or other proof of attendance. Search web for applicable URLs.
3. **Orange County Astronomers** meet monthly at Chapman University in the City of Orange. Meetings are free and open to the public and have major lectures on astronomy related topics. See <http://www.ocastronomers.org>.
4. **Mt. Wilson Observatory**, north of Pasadena, may be open to visitors on weekends. Their 100-inch reflector was the world's largest during the first half of this century. See <http://www.mtwilson.edu>.
5. **Palomar Mountain Observatory**, about 100 miles south, has a small astronomical museum and a gallery for viewing of (not through) the 200-inch telescope. For information see <http://www.astro.caltech.edu/palomar>. Feedback about the posters in the gallery is required in your report - Professor Vakil designed the ones there. Be careful about visitor hours!
6. **El Camino College** has a variety of astronomical events that can be attended, including talks and observing sessions at the ECC Observatory (on top of the MCS/math building).
7. **Proposed alternative** with negotiable extra credit for an active participation astronomy related task you would like to submit for extra credit. Typed short preliminary proposal and instructor approval is required.