

ASTR 510: EXOPLANETS
SPRING 2023
SECTION 01, Class Number: 10349

COURSE INFORMATION

Class Days: Mon, Wed	Professor: William Welsh
Class Times: 2:15 – 3:30	Contact Information:
Class Location: PA-215	Office: Physics P-235
Mode: In-Person Lecture	Email: wwelsh@sdsu.edu
Platform: Canvas	Office Telephone: (619) 594-2288
Office Hours: Mon and Wed 3:30–4:15, and by appointment	
Course Web Site: https://wwelsh.sdsu.edu/~wwelsh/CLASSES/ASTR510/astr510.html	

E-mail is by far the best way to contact me. I will normally answer within one business day.

Official Course Catalog Description: Extrasolar planet detection; mass and radius determination; transits and eclipses; orbital dynamics and transit timing variations; internal and atmospheric characteristics; the exoplanet population and formation scenarios.

Enrollment Requirements: Either ASTR 350 + ASTR 440, or PHYS 350 + PHYS 354; with minimum grade of B- in any of these courses; and in addition, consent of instructor. If you are a graduate or transfer student, the equivalent courses from your previous college/university are acceptable. Some computing programming experience (i.e. writing code) is required.

COURSE MATERIALS

Required Materials:

The required textbooks are:

- *The Exoplanet Handbook*, 2nd Ed., by Michael Perryman (2018; Cambridge University Press)
- *Transiting Exoplanets*, by Carole Haswell (2010; Cambridge University Press)

Also recommended for this course: *Exoplanets*, edited by Sara Seager (2011; Univ. Arizona Press)

Internet access is required in order to use Canvas and other websites and on-line tools. Computing facilities for writing and running code is required. Access (accounts) on linux computing workstations can be provided if required.

COURSE SCHEDULE AND GRADING POLICY

Exam and Project Due Dates:

MLO Remote Observing: dates (evenings) to be determined

Exam #1: Wednesday March 8

Exam #2: Wednesday April 5

Presentation Topic: Monday March 20

Presentation Talk: Wednesday April 12

Research Project Paper: Wednesday May 3

Final Exam: Monday May 8, 1:00-3:00pm.

Scored Activities and Weighting by Percentage of Total Score:

15% Homework Assignments

15% Exam #1

15% Exam #2

15% Presentation

20% Research Project Paper

20% Final Exam

Note: The exams, presentation, and research paper due dates are subject to change should circumstances require, but as per University regulations, the time of the final exam cannot be changed. Please review the rules regarding final exams in the SDSU General Catalog and at: https://registrar.sdsu.edu/calendars/final_exam.schedule/spring-2023.

The exams and the final exam are open-book: the course textbooks, lecture material, notes, calculators, etc. may be used.

Presentation: Students will present a brief talk on an exoplanet topic of their choice. This will allow the students to pursue a topic in more detail than covered in this introductory course. The presentations should be 5 minutes in length, similar to AAS conference talks. The students will choose the topic, review the literature, and construct the presentation (PowerPoint or something similar). Ideally the presentation will be about a single exciting result, such as a discovery of an interesting exoplanet or specific phenomena, or the implications of a theoretical calculation. It should not be general or broad. The topic must be approved in advance (no later than March 20) to prevent duplicates. The presentation itself is the product to be graded; nothing will be handed in. If there is time, students are expected to ask questions during the presentations, but if there is not enough time, students will write down their questions to be collected and graded as a homework assignment.

Research Project: If conditions permit, students will use SDSU's Mt. Laguna Observatory to collect data for their research projects. Students will remotely observe an exoplanet transit, calibrate the data, analyze the transit, and write-up the results in a short, research-style paper. *If conditions allow*, the observations will be acquired by the students working together in teams, with the professor's help. This will require students to meet during the evening for 4-6 hours, starting just before sunset, once during the semester (date to be determined). If COVID-19 or any other circumstances prevent us from observing, archival data obtained at MLO will be used. Students will calibrate the data using the software AIJ and create a detrended and normalized light curve. Additional archival data will supplement the students' own observations to create a more complete data set. Students will then analyze the data using various software tools, possibly including the ELC code of Dr. Orosz. The results (e.g. planet radius, mass, equilibrium temperature, etc.) will be written up in a research paper, along with background material. The paper is limited to 3 pages of text, plus 4 additional pages for figures, tables, and references. The research paper must be written individually. While students may (and should) discuss their techniques and findings, the students must do the work on their own. The sharing of specific data products or measurements or using any information from another student's paper will be considered cheating.

Assessment and Grading Policy: Grades will be based upon homework assignments, the research project paper, the oral presentation, the two exams, and a comprehensive final exam. Collecting observations is also required. Homework assignments will be posted on the class webpage. All homework assignments must be typed and written in proper, college-level English (and stapled together). Students can work with classmates to think things through, but the homework must be done individually, not as a team, and all work for the problem-solving questions must be shown. Homework is due at the start of class. Each homework is worth 50 points. Late homework loses 5 points if 1 day (24 hours) late, and 1 point is deducted each day thereafter. Weekend days are counted as normal days. The maximum late penalty is 11 points (after 1 week); after that, there are no more deductions. So it is always worth it to turn in a late homework assignment. If a student is defending their thesis, presenting a research talk at a conference, observing at MLO the entire night before, or something similar, a 1-day grace period will be allowed before the late penalty begins.

No individual extra credit projects will be offered or accepted. However, things that benefit the whole class (not just an individual) may be deemed worthy of earning extra credit. For example, a student may alert me to a major error in the syllabus (e.g. wrong final exam date) or notify me of a problem with something on the course website. Letting me know of these things benefits the whole class, and the student may be rewarded with extra credit points.

Please review the definitions of letter grades and the SDSU policies regarding grades on page 475-476 of the 2019-2020 General Catalog. If you are taking the course with the "credit/no-credit" option, you need a C or

above to earn the credit (see pages 475-476 of the 2019-2020 General Catalog). An incomplete grade (“I”) for the course will only be given in cases involving serious medical or legal issues that prevent the student from completing the course on time. The entire responsibility for arranging to make up the lost work lies with the student.

Excused Absence Make-up Policies: No make-up exams/quizzes will be allowed unless there is a serious, legitimate reason (e.g. medical emergency). If a make-up exam is deemed appropriate, an oral exam via Zoom or an essay exam may be administered instead of the normal exam format.

COURSE DESIGN

Style of the Course: This course will be fully in-person, in traditional lecture style. No on-line Zoom broadcast or recordings of the lecture will take place.

Technology Utilized in the Course: Internet access is required for this course in order to use Canvas, and to access course material from the course website, and use tools available on the web (e.g. NASA’s Exoplanet Archive).

Class Website: The class website is an important part of this course. Be sure to frequently refer to the website and links therein. The website is where homework assignments will be posted, papers can be downloaded, images and data can be obtained, and where important class resources will be posted.

In general, use of Canvas will be minimal. Canvas will be mainly used for announcements and posting on-line notes, etc.

Individual and Group Activities Required: Students may work and study together but *exams and homework assignments must be completed individually*. Homework that is not done independently will result in a zero grade for the assignment. Cheating in any form will result in failure of the assignment or exam and be reported to the Center for Student Rights and Responsibilities.

STUDENT LEARNING OUTCOMES

Upon successful completion of this course, the student will be able to:

- Explain the methods used to discover exoplanets and assess their contrasting strengths
- Calculate exoplanet masses from radial velocity data, both analytically and numerically
- Summarize the information that can be obtained from a light curve (time series data)
- Apply physical laws and knowledge to characterize exoplanet properties
- Measure exoplanet radii from a light curve
- Describe characteristics of various planet formation scenarios
- Identify/recall the astrophysical effects that confound accurate planet characterization
- Cite the key exoplanet missions and state their unique advantages
- Employ on-line tools/resources for exoplanet research

Diversity and Inclusion: As part of the Student Learning Outcomes, in this course we will attempt to emphasize the important role of diversity, equity, and inclusion with respect to race and gender. Examples will be given throughout the lectures and in reading assignments. While we will not dwell specifically on the following topics, diversity in ethnicity, sexual orientation, age, socioeconomic status, religion, and disability should be celebrated as a strength of our common heritage. We will strive to make the classroom and office hours an inclusive learning environment where diverse students, particularly those from marginalized communities, are supported and welcomed. Your participation in this important endeavor is encouraged and expected, and suggestion for ways to improve the course environment in this regard are most welcome.

ENROLLMENT INFORMATION

Prerequisites: Astronomy 350 and 440 (or equivalent) - or - Physics 350 and 354, with minimum grade of B-, and consent of instructor.

Relation to Other Courses: This course helps fulfill the 30-unit requirement for the MS in Astronomy.

Mathematical Skills: Mathematical skills at the advanced undergraduate level appropriate for an Astronomy or Physics major are required.

Adding/Dropping Procedures: We will adhere to the standard SDSU add/drop policy. The last day to add or drop the class or change the grading basis is 2023 Jan 31.

OTHER COURSE POLICIES

The lectures and all material contained therein, including the material on the course web pages and on-line lecture notes, are copyrighted - no material can be reused or reproduced in any fashion without written permission. Note that students maintain intellectual property rights to any products they create as part of this course.

Attendance Policy: While attendance is not mandatory, and no roll-call will be taken, it is expected that students will attend all the lectures and participate in class (e.g. ask questions, contribute to discussions, etc.). Students are expected to come to office hours for help or for additional discussion.

Classroom and Zoom Etiquette: Students should maintain a professional atmosphere and show respect to their fellow students at all times. In particular, the following is prohibited in the classroom:

- Cell phones and similar devices (please silence them)
- Texting, tweeting, emailing, etc.
- The reading of newspapers, magazines, etc.
- Talking above a whisper
- Eating or drinking anything noisy
- Doing homework for this or any other course
- Disrupting class by handing in homework after the class lecture has started.

Any form of behavior deemed by the instructor to be disrespectful will not be tolerated. A student will be advised once by the instructor that his/her behavior is inappropriate. If such behavior occurs again, the matter will be turned over to the University's Judicial Procedures Office for appropriate disciplinary action.

Communication: When writing email to me, or speaking to me in person, please address me as Professor Welsh. If you send me an email, be sure to tell me your full name and what class you are in. Otherwise I may think your email is spam (or some form of malware) and not reply. I will strive to answer all emails within one business day. Likewise, if I send a student an email, I expect a similar one-business day acknowledgment/reply if the content requires an urgent response. Otherwise, two days is acceptable.

Students are provided with an SDSU Gmail account, and the SDSU address will be the primary email address used for all communications. Per University Senate policy, students are responsible for checking their official university email once per day during the academic term. For more information, please see the Student Official Email Address Use Policy.

Class rosters are provided to the instructor with the student's legal name. I will gladly honor your request to address you by an alternate name and/or gender pronoun. Please advise me of this early in the semester so that I may make appropriate changes to my records.

UNIVERSITY POLICIES

Please see the *SDSU Student Academic Success Handbook*¹ for information essential to your success at SDSU, including campus policies and support resources. If there is any conflict between the Student Academic Success Handbook and the information in this syllabus, the Student Academic Success Handbook has precedence.

Accommodations: If you are a student with a disability and are in need of accommodations for this class, please contact Student Ability Success Center at (619) 594-6473 as soon as possible. Please know that accommodations are not retroactive, and I cannot provide accommodations based upon disability until I have received an accommodation letter from Student Ability Success Center.

Student Privacy and Intellectual Property: The Family Educational Rights and Privacy Act (FERPA²) mandates the protection of student information, including contact information, grades, and graded assignments. I will use Blackboard to communicate with you, and I will not post grades or leave graded assignments in public places. Students will be notified at the time of an assignment if copies of student work will be retained beyond the end of the semester or used as examples for future students or the wider public. Students maintain intellectual property rights to work products they create as part of this course unless they are formally notified otherwise.

Religious observances: According to the University Policy File, students should notify the instructors of affected courses of planned absences for religious observances by the end of the second week of classes.

Academic Honesty: The University adheres to a strict policy prohibiting cheating and plagiarism³. Examples of academic dishonesty include but are not limited to:

- copying, in part or in whole, from another's test or other examination;
- obtaining copies of a test, an examination, or other course material without the permission of the instructor;
- collaborating with another or others in work to be presented without the permission of the instructor;
- falsifying records, laboratory work, or other course data;
- submitting work previously presented in another course, if contrary to the rules of the course;
- altering or interfering with grading procedures;
- assisting another student in any of the above;
- using sources verbatim or paraphrasing without giving proper attribution (this can include phrases, sentences, paragraphs and/or pages of work);
- copying and pasting work from an online or offline source directly and calling it your own;
- using information you find from an online or offline source without giving the author credit;
- replacing words or phrases from another source and inserting your own words or phrases. *In particular, use of ChatGBT for assistance with assignments is prohibited.*

The California State University system requires instructors to report all instances of academic misconduct to the Center for Student Rights and Responsibilities. Academic dishonesty will result in disciplinary review by the University and may lead to probation, suspension, or expulsion. Instructors may also, at their

¹<https://docs.google.com/document/d/1rXNpNGs1K7nIxcS73o6R-fxZqPIWQwS9gHD7XpIqjhM/edit>

²<https://bfa.sdsu.edu/oerc/students/ferpa.aspx>

³http://go.sdsu.edu/student_affairs/srr/cheating-plagiarism.aspx

discretion, penalize student grades on any assignment or assessment discovered to have been produced in an academically dishonest manner.

Statement on Cheating and Plagiarism: Cheating in any form, which includes plagiarism, will not be tolerated. Cheating and plagiarism may warrant two separate and distinct courses of disciplinary action: (a) academic sanctions, such as grade modifications; and (b) disciplinary sanctions, such as probation, suspension, or expulsion. See page 486 of the University's 2019-2020 General Catalog for details. *Cheating will result in an automatic zero grade for that assignment/exam and potentially a letter grade deduction in the course grade.* Any evidence of cheating will be promptly reported to the Judicial Procedures Office. Executive Order 1006 mandates faculty to report all incidents to the Center for Student Rights and Responsibilities.

Resources for students: A complete list of all academic support services—including the Writing Center⁴ and Math Learning Center⁵—is available on the Student Affairs Academic Success website⁶. Counseling and Psychological Services (619-594-5220) offers confidential counseling services by licensed therapists; you can Live Chat with a counselor at http://go.sdsu.edu/student_affairs/cps/therapist-consultation.aspx between 4:00pm and 10:00pm, or call San Diego Access and Crisis 24-hour Hotline at (888) 724-7240.

Classroom Conduct Standards: SDSU students are expected to abide by the terms of the Student Conduct Code in classrooms and other instructional settings. Prohibited conduct includes:

- Willful, material and substantial disruption or obstruction of a University-related activity, or any on-campus activity.
- Participating in an activity that substantially and materially disrupts the normal operations of the University, or infringes on the rights of members of the University community.
- Unauthorized recording, dissemination, or publication (including on websites or social media) of lectures or other course materials.
- Conduct that threatens or endangers the health or safety of any person within or related to the University community, including
 - physical abuse, threats, intimidation, or harassment.
 - sexual misconduct.

Violation of these standards will result in referral to appropriate campus authorities.

Sexual Violence / Title IX Mandated Reporting: As an instructor, one of my responsibilities is to help create a safe learning environment on our campus. I am a mandated reporter in my role as an SDSU employee. It is my goal that you feel able to share information related to your life experiences in classroom discussions, in your written work, and in our one-on-one meetings. I will seek to keep the information you share private to the greatest extent possible. However, I am required to share information regarding sexual violence on SDSU's campus with the Title IX coordinator, Jessica Rentto 619-594-6017. She (or her designee) will contact you to let you know about accommodations and support services at SDSU and possibilities for holding accountable the person who harmed you. Know that you will not be forced to share information you do not wish to disclose and your level of involvement will be your choice. If you do not want the Title IX Officer notified, instead of disclosing this information to your instructor, you can speak confidentially with the following people on campus and in the community. They can connect you with support services and discuss options for pursuing a University or criminal investigation. Sexual Violence Victim Advocate 619-594-0210 or Counseling and Psychological Services 619-594-5220, psycserv@sdsu.edu. For more information regarding your university rights and options as a survivor of sexual misconduct or sexual violence, please visit titleix.sdsu.edu or sdsutalks.sdsu.edu.

⁴<https://writingcenter.sdsu.edu>

⁵<https://mlc.sdsu.edu>

⁶http://go.sdsu.edu/student_affairs/academic_success.aspx

SDSU Economic Crisis Response Team: If you or a friend are experiencing food or housing insecurity, technology concerns, or any unforeseen financial crisis, it is easy to get help! Visit sdsu.edu/ecrt for more information or to submit a request for assistance. SDSU's Economic Crisis Response Team (ECRT) aims to bridge the gap in resources for students experiencing immediate food, housing, or unforeseen financial crises that impacts student success. Using a holistic approach to well-being, ECRT supports students through crisis by leveraging a campus-wide collaboration that utilizes on and off-campus partnerships and provides direct referrals based on each student's unique circumstances. ECRT empowers students to identify and access long term, sustainable solutions in an effort to successfully graduate from SDSU. Within 24 to 72 hours of submitting a referral, students are contacted by the ECRT Coordinator and are quickly connected to the appropriate resources and services. For students who need assistance accessing technology for their classes, visit our ECRT website (sdsu.edu/ecrt) to be connected with the SDSU library's technology checkout program. The technology checkout program is available to both SDSU and Imperial Valley students.

Medical-related absences: Students are instructed to contact their professor/instructor/coach in the event they need to miss class, etc. due to an illness, injury or emergency. All decisions about the impact of an absence, as well as any arrangements for making up work, rest with the instructors. Student Health Services (SHS⁷) does not provide medical excuses for short-term absences due to illness or injury. When a medical-related absence persists beyond five days, SHS will work with students to provide appropriate documentation. When a student is hospitalized or has a serious, ongoing illness or injury, SHS will, at the student's request and with the student consent, communicate with the student instructors via the Vice President for Student Affairs and may communicate with the student Assistant Dean and/or the Student Ability Success Center⁸.

SAFETY ISSUES

The CSU takes the issue of classroom and campus safety very seriously. The office of Business and Financial Affairs has set up a web site where SDSU staff, faculty, and students can find information about San Diego State University's emergency preparedness plan and opportunities for training on many aspects of the classroom/workplace. See <http://bfa.sdsu.edu/emergency/>. In particular, please note the following:

Campus Safety:

- Be aware of your surroundings.
- If you see something suspicious, report it!
- If you have an emergency, call 911 from any phone on campus.
- Other incidents, call Campus Dispatch at 4-1911.
- In the evening, call Campus Escort if you would like an escort to your vehicle or campus dorm.

Classroom Safety

- If there is an emergency, stay calm, and follow the procedure in the flip book.
- Follow the Evacuation Route if you need to evacuate. *We evacuate to Centennial Mall*, and a roll call will occur there. Please show up at the evacuation area since your absence from roll call could cause resources to be used that could be used to help others who may actually be in trouble.
- "Shelter in place" is usually called when a person that is carrying a weapon on campus has become violent and has injured others, or is threatening to injure others. Lock the door from outsiders, only open to the Department Safety Officer, PDS, or other officials of the University.

⁷<https://sa.sdsu.edu/student-health-services>

⁸http://go.sdsu.edu/student_affairs/sds/

Note that during any emergency, *students should not use their cell phones*. The lines of communication are critical to keep open for emergency information. Only Staff and Faculty should keep their cell phones on, and only receive calls if the situation calls for it.