Astronomical Observations and Instrumentation I
ASTR 3510 – Fall 2019
T/R 2:00 – 3:15pm – Duane E126 or SBO S125
https://canvas.colorado.edu & https://www.colorado.edu/sbo

Instructor: Dr. Seth Hornstein (seth.hornstein@colorado.edu)
Office: Duane D317 and SBO N125
Office Phone: (303) 492-5631
Cell Phone: (303) 900-2202 (Only for observing questions or problems)
Office Hours: Tues 3:15-4:30 (Duane D317), Thur 11-12 (SBO N125), or by appt.

Teaching Assistant: Tatsuya Akiba (tatsuya.akiba@colorado.edu)
Cell Phone: (314) 520-1099
Office Hours: Mon 6:30-8:30pm
Wed 3:00-5:00pm and by appt. (email for appt.)
Office: Duane E122

Observatory Manager: Fabio Mezzalira (fabio.mezzalira@colorado.edu)
Office: SBO C150
Office Phone: (303) 492-2699
Cell Phone: (720) 329-4482

COURSE DESCRIPTION: ASTR 3510 is the first semester of a two-semester sequence on Astronomical Observations and Instrumentation. The first semester provides an introduction to the sky, coordinate systems, telescopes and imaging observations. Our goal is that by the end of this semester you will be comfortable using telescopes and taking and analyzing CCD images, as well as be familiar with basic techniques of data calibration and analysis. These methods are immediately applicable to many programs in astrophysics research, and are also broadly useful in many other fields requiring image processing and data analysis.

Specific topics include:

- Celestial coordinates and astronomical time
- CCD solid-state light detectors, instrument characterization
- Introduction to telescope optics, aberrations and design
- Astronomical photometry: image processing, measurement techniques and calibrations
- Practical statistics: measurement errors, propagation, hypothesis testing

Lab exercises will utilize a variety of equipment at CU's on-campus Sommers-Bausch Observatory (SBO), including the computer lab, optical benches, CCD detectors and (of course) telescopes. Since you will be working within a lab group of ~3 people and because Colorado weather is always uncertain, **your flexibility in scheduling, especially for late nights and weekends, will contribute to your success in completing the exercises.** In general, we can accommodate reasonable outside work and class schedules, but please be aware that this can be a time-consuming class, with many hours expected in the observatory and computer lab. CU's nominal expectation for a 4-credit class is an average of 8-12 hours per week outside of our regular meeting times. If you have specific concerns about scheduling and time requirements, please see the instructor or TA as soon as possible.

SCHEDULE: We will have class meetings during our scheduled time TR 2-3:15 pm each week. Tuesdays we will nearly always be meeting in Duane E-126, and many (but not all!) Thursdays we will be meeting at the Sommers-Bausch Observatory computer lab. I'll try to remind you about these changes in the previous class meeting, but the best guide to this will be a course schedule posted on Canvas. The course schedule will also list assignments that are due, solutions available for download, and other class information. PowerPoint lectures will be posted in PDF format within a day or two after class. The schedule will be somewhat fluid during the semester, and so it's best to check this page regularly, especially if you miss any class meetings. I will try to keep it as up-to-date as possible- but please email right away if you see any problems or if something you need is missing.

According to the registrar, we have a nominal Tuesday evening lab session. However, this time is simply on the books so you get credit for the (*significant!*) time you will spend at the telescope completing the observing labs. Occasionally we will use this evening session for review sessions or other activities. These will be announced in class.

Many of our labs require using the 24" & 20" telescopes in groups of ~3 people at time, which means that you will also be expected to carry out and analyze observations on other nights (not just Tuesdays). A general expectation is that our class will use the telescopes every clear night this semester (including weekends and holidays!) Your group will likely need *at least* one 2-4 hour evening per week to complete observations for class, and additional hours in the SBO computer lab for data analysis. We will set up a process that will allow you to sign up for specific times to use the telescope; if the weather is not good, you will need to schedule a new time. Again, the more flexible and energetic you are, the better success you will have; we will monitor your efforts to get your work finished. The SBO computer lab room is available to you for data analysis at any time, as long as it is not actively in use for other classes (there is a schedule posted on the door). Most labs are designed for the evening hours (before midnight), but please be aware that, because of weather, astronomical or scheduling issues, you may need to be at the observatory for later hours on occasion. In our first weeks, we will teach you the techniques and policies that are required for you to use the observatory effectively and safely.

TEXTS: Both texts for this course are *optional*. While I recognize the high costs of textbooks these days, if you are preparing to go on as a professional astronomer (or scientist), these are VERY useful texts to have on your bookshelf. There will be assigned reading from both books to supplement material we will cover in class. Both books are also available in the SBO library *(and may not be removed from SBO!)*

"Observational Astronomy," by Birney, Gonzales & Oesper.

This is a well-written and comprehensive introduction to observational astronomy. We will be covering much of the material in this book (though we will be jumping around in chapter order).

"An Introduction to Error Analysis," by John Taylor. (a CU Physics Professor!)

This book is one of the classic texts on statistical analysis and we will be covering several chapters of it. While we will not have time to cover all the material in detail, this book is essential for anyone thinking about working with data of any sort and so I recommend buying it and keeping it on your shelf forever!

GRADING:
30% of your grade will be based on four laboratory exercises. These exercises will include data acquisition and analysis, and answering questions about each step of the process. You will complete the exercises in groups of 3 over the course of 2-3 weeks and produce a joint lab write-up with your results. In general, these lab write-ups should be several pages in length and will include figures, plots and calculations. More details about preparing write-ups will be included in the individual lab exercises.

30% of your grade will be based on a number of homework (4-5) assigned over the course of the semester. These should be completed and handed in as individual work. While I encourage working together to solve homework problems, each write-up must reflect your own work, and duplicate work (identical answers, plagiarism) will be penalized.

20% of your grade will be based on two in-class exams, which will cover the material presented in class and practiced in the homework. The exam dates are listed on the class schedule.

20% of the grade will be based on a final research project. This may be based on observations from Sommers-Bausch or other facilities. You may choose to work in groups of 2-3 or individually (with approval). Your topic and research plan must be approved before mid-October—we'll make lots of opportunities to talk with us about possibilities. Your project grade will be based on both your preliminary work on defining the project and your final presentation of the results as a scientific "poster", during final exam week.

GROUP WORK:
Much of the lab work for this class is prepared as part of a group of ~3 students. Your group will need to schedule observing time when you can all be there, and share observing and analysis tasks. You may change groups between assignments, as you find schedules and styles that are compatible- please keep the instructor and TA informed of these changes. We'll try to make a few minutes available during class for groups to get initial logistics set up, but **it is your responsibility to know with whom you are working for each assignment, to participate equally in your group's work, and to inform us promptly if any problems arise.** The final credit for any assignment will be based on the name(s) written on the assignment write-up, and each person will share the assigned grade. If you are finding any aspect of group work problematic, please let us know as soon as possible.

LATE WORK:
Late work is NOT accepted without prior arrangement. That said, it is well understood that weather and schedules can complicate observational work. If you or your group feel that you need extra time to complete an assignment, please contact me, cc-ing the TA, at least 24 hours before the work is due to explain and make arrangements for extra time. If you are past the 24-hour mark, I may not accept your work.

MISSED CLASSES:
If you must miss more than 2 classes in a row, please email me/us to let us know. We DO notice and would like to know if you are not well or are away. If you must miss a scheduled class meeting at SBO, either day or night, please let us know in advance if possible. Make-up sessions are generally not possible, and we will need to make special arrangements for you. Failure to contact us promptly will result in a penalized lab grade.

QUESTIONS & PROBLEMS: Please don't hesitate to get in touch with us if you have questions about any aspect of the class, or if you start running into difficulties following the material or keeping up with assignments – remember, **we're here to help!**

CU HONOR CODE: All students enrolled in a University of Colorado Boulder course are responsible for knowing and adhering to the Honor Code. Violations of the policy may include: plagiarism, cheating, fabrication, lying, bribery, threat, unauthorized access to academic materials, clicker fraud, submitting the same or similar work in more than one course without permission from all course instructors involved, and aiding academic dishonesty. All incidents of academic misconduct will be reported to the Honor Code (honor@colorado.edu); 303-492-5550). Students who are found responsible for violating the academic integrity policy will be subject to nonacademic sanctions from the Honor Code as well as academic sanctions from the faculty member. Additional information regarding the Honor Code academic integrity policy can be found at the Honor Code Office website.

While most students understand what the honor code means on quizzes and exams, there is often confusion on what it means for homework and labs. Students are encouraged to work together on homework, but your write-ups must be independent. Copying, whether by hand or cut-and-paste on your computer, constitutes cheating. The best way to ensure you understand the assigned material is to split off from the group when writing up or submitting your answers. Assignments that seem identical will receive split credit. If you copy text or other information from any source for any reason, you must also include a citation to that source
When in doubt about plagiarism, paraphrasing, quoting, or collaboration, consult with me.

CLASSROOM BEHAVIOR: Students and faculty each have responsibility for maintaining an appropriate learning environment. Those who fail to adhere to such behavioral standards may be subject to discipline. Professional courtesy and sensitivity are especially important with respect to individuals and topics dealing with race, color, national origin, sex, pregnancy, age, disability, creed, religion, sexual orientation, gender identity, gender expression, veteran status, political affiliation or political philosophy. 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 or gender pronoun. Please advise me of this preference early in the semester so that I may make appropriate changes to my records. For more information, see the policies on classroom behavior and the Student Code of Conduct.

STUDENTS WITH DISABILITIES: If you qualify for accommodations because of a disability, please submit your accommodation letter from Disability Services to your faculty member in a timely manner so that your needs can be addressed. Disability Services determines accommodations based on documented disabilities in the academic environment. Information on requesting accommodations is located on the Disability Services website. Contact Disability Services at 303-492-8671 or dsinfo@colorado.edu for further assistance. If you have a temporary medical condition or injury, see Temporary Medical Conditions under the Students tab on the Disability Services website.

RELIGIOUS OBSERVANCES: Campus policy regarding religious observances requires that faculty make every effort to deal reasonably and fairly with all students who, because of religious obligations, have conflicts with scheduled exams, assignments or required attendance. In this class, please contact me at least 2 weeks in advance of the religious observation to make possible arrangements. See the campus policy regarding religious observances for full details.

SEXUAL MISCONDUCT, DISCRIMINATION, HARASSMENT AND/OR RELATED RETALIATION: The University of Colorado Boulder (CU Boulder) is committed to fostering a positive and welcoming learning, working, and living environment. CU Boulder will not tolerate acts of sexual misconduct intimate partner abuse (including dating or domestic violence), stalking, protected-class discrimination or harassment by members of our community. Individuals who believe they have been subject to misconduct or retaliatory actions for reporting a concern should contact the Office of Institutional Equity and Compliance (OIEC) at 303-492-2127 or cureport@colorado.edu. Information about the OIEC, university policies, anonymous reporting, and the campus resources can be found on the OIEC website.
Please know that faculty and instructors have a responsibility to inform OIEC when made aware of incidents of sexual misconduct, discrimination, harassment and/or related retaliation, to ensure that individuals impacted receive information about options for reporting and support resources.

ASTR 3510/3520 Course Agreement

I, _____, understand the importance of Sommers-Bausch Observatory to this class and agree to behave appropriately and professionally at all times when at the Observatory.

I understand that the primary purpose of these rules are to protect the safety of everyone using Sommers-Bausch Observatory (and, secondarily, the safety of the Observatory itself).

If I suspect that are any issues with the equipment or the Observatory, I will promptly report them to the Course Instructor and/or SBO Manager.

I recognize that violating any SBO rules, including those discussed during class, telescope training, or referenced below, may result in (among other repercussions) dismissal from ASTR 3510/3520, failure of the course (F grade), financial responsibility for any damage caused, and/or permanent ban from Sommers-Bausch Observatory.

IMPORTANT OBSERVATORY RULES:

- Never use observatory equipment under the influence of any drugs or alcohol.
- Never remove/modify any equipment without prior permission from the Course Instructor or SBO Manager.
- Treat all observatory equipment, furniture, and facilities with appropriate respect and professionalism.
- If using SBO after regular business hours, please ensure the doors are locked at all times (and especially when you leave).

Name (printed): _____ Date:_____

Signature: _____