AST 152M - STELLAR ASTRONOMY LABORATORY - FALL 2013
COURSE ID 48560 SYLLABUS
3 SEPT 2013

Teaching Assistant:	Brian Mulligan
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Cell phone:	763-772-3485 [Telescope problems only]
Office phone:	512-471-0445 [This is not a reliable way to reach me]
Lab meeting:	RLM 15.201
Office Hours:	Tuesdays 2-3 pm, RLM 16.216 or by appointment
Course web page:	`http://www.as.utexas.edu/astronomy/education/fall13/dinerstein/152m.html`
Blackboard:	`http://courses.utexas.edu`
Textbook:	None
Prerequisites:	Phys 316 and Phys 116L.
Suggested courses:	concurrent or prior enrollment AST 352K is recommended.

1. Overview

This lab course is a hands-on introduction to observational astronomy with use of a visual light telescope and detectors. No previous experience in astronomy is required. Physics 316 and 116L are prerequisites to this class. It is recommended that you have taken or are concurrently enrolled in AST 352K (Stellar Astronomy). Over the course of the semester you will learn how to operate a modern telescope and instrumentation system (e.g. CCD camera) and how to do astronomical data reduction and analysis using software packages such as IRAF. Other skills which will be emphasized in this course are error analysis (as a part of data analysis) and lab report writing. You are strongly encouraged to use LaTeX for writing reports.

2. Textbook / Written materials / Labs

There is no official textbook for this course. The individual labs will be given out over the course of the semester and will be available from the website. Some required reading will be taken from important books. Copies of the required reading will be given out in class and be available on the course website.

If you wish to pursue a career in astronomical instrumentation and/or observational astronomy, some useful books are

- "Handbook of CCD astronomy" Steve B. Howell., Cambridge, U.K.; New York : Cambridge University Press, 2000.
- "Electronic imaging in astronomy : detectors and instrumentation, 2nd Ed." Ian S. McLean., Berlin; New York : Springer; Chichester, UK : Published in association with Praxis Pub., 2008.
- "Observational astronomy, 2nd Ed." D. Scott Birney, Guillermo Gonzalez, David Oesper., Cambridge, UK; New York : Cambridge University Press, 2006.

3. RLM 16" Telescope

For this course we will make use of the RLM telescope located on the roof of the building. During the beginning of the semester you will learn how to use the facilities and equipment. Once you have demonstrated proficiency with the equipment, you will have full access to the telescope. Be aware the telescope is used for public observing on Wednesday evenings, and so it not available for scientific use on these nights. There may be other occasions in which the telescope is not available due to special groups or hardware problems. These may be unpredictable (especially hardware problems), but we will do our best to schedule observing around these events.

4. Time commitment

Because this course focuses on observational astronomy, the time commitment will not be a weekly 1-2 hour meeting. The later labs require the students to take their own data using the observing facilities; this usually means a late night at the telescope. Weather, hardware, and software problems will hamper progress, so plan accordingly (do not expect that a single night will be sufficient). The deadlines for observational labs are intended to allow enough time for all student groups to gather data. Expect to spend 1-2 hours at the telescope for each of the observing labs (astrometry, photometry, spectroscopy, and open cluster photometry). The time domain photometry lab will require a little more time on the telescope. Data reduction and analysis typically takes 2 - 6 hours per lab. Finally, plan for 2 - 4 hours for each lab write up. You will be given about three weeks for each observational lab.

At the beginning of the semester we will meet weekly in order to go over telescope operations and introduce the software and concepts. Once you are proficient in telescope and software usage we will meet less frequently as a class (although you will likely meet with your group during this time). It is expected that you will continue to work on labs even on weeks that we do not meet.

5. IRAF / PyRAF / Alternatives

IRAF is a common software package of choice for astronomical data processing. This package is freely available at `http://iraf.noao.edu/`. This software works on Mac and linux, but seemingly can be run on Windows as well (`http://acs.pha.jhu.edu/~shy/x-iraf-windows/`). Departmental computers that have IRAF installed will be available to students during the semester. You are welcome to install IRAF on a personal laptop or computer as well.

An alternative to IRAF which uses the Python language is PyRAF (`http://www.stsci.edu/institute/software_hardware/pyraf`). Students are free to use PyRAF instead of IRAF.

IDL is another alternative to IRAF. It is a proprietary (read 'expensive') software package / language that is similar to Python in its capabilities. IDL is available on most departmental computers for use. Many analysis and reduction routines are available in IDL. Contact me if you wish to use IDL.

Finally, code can be written in C, c++, or FORTRAN to do all data analysis and reduction. While the data processing for these languages will be much faster, writing the programs will take more time. Some packages are available to help read the FITS files (`http://fits.gsfc.nasa.gov/fits_libraries.html`). Contact me if you wish to use your own compiled code.

As IRAF is a standard within the field (and PyRAF likely to be the future standard), you are strongly encouraged to use one of these packages.

6. Computer access

Use of computers is absolutely required for this course. Computers in room RLM 15.201 are available for student use during the semester. During the first week of class we will work with the computer group in the department to grant all enrolled students access to the room as well as logins for the computers. Note that room access is tied to your University issued ID card.

The computer room is available most of the time for student use; the room is also used for other classes, so be sure to check the schedule and not walk in on a class. A schedule is posted on the door of the classroom. Students in the other classes will also be using the computers outside of class time (as you will be). Be respectful of other students and classes!

7. Groups and participation

Students will work in groups of 2 or 3 students for purposes of data gathering. The students in each group will share data and may (and are encouraged to) communicate freely about their work. All data reduction, analysis, and graded assignments (e.g. worksheets, lab reports) must be individual work. Groups will be formed during the first two weeks of class. I will assign groups, but will also take requests for group members such that you may work with friends. I will attempt to include someone with prior observing and/or astronomical data analysis experience in each group.

In order to ensure all group members are participating we will use a system of peer and self evaluation four times during the semester (25 points per evaluation).

8. Lab Reports

Papers and lab reports are the fundamental form of communication in the scientific community. In order to develop your writing skills and make you more familiar with the process, lab reports will be required for most of the labs that we do. The lab reports will account for the majority (2/3) of your grade in the class.

Because of its use in astronomy, physics, and mathematics, you are strongly encouraged to use LaTeX (or TeX) in preparing your lab reports. LaTeX is a document preparation system (`http://www.latex-project.org/`) that is available for nearly every operating system. There is no one particular editor, and users may have individual preferences between how to do the editing. Some popular versions are TeX Live (`http://www.tug.org/texlive/`) for linux, proTeXt (`http://www.tug.org/protext/`) for Windows, and MacTeX (`http://www.tug.org/mactex/`) for Mac.

If you prefer to use Microsoft Word or another word processing system (e.g. LibreOffice) please contact me. If you use one of these systems and send me lab reports by email, you must first convert the document to a PDF.

A rubric for grading the lab reports will be provided before the first lab in which a report is required. You will receive 60 points (equivalent to D-) for turning in a lab which meets minimal requirements.

9. Grading

This course is intended to be hands-on and collaborative, and as such there will be little in the form of 'normal' homework. Lab reports will count for 1/2 ($\sim 50.0\%$) of the grade (4 reports at 100 points each). Participation, including peer evaluation, will count for 1/8 of the grade (100 points). The final 3/8 (100 points) will consist of in-class worksheets, which will be during the first few of weeks of class.

+/- grading will be used in this class. The breakdown will be as follows:

Grade	% Range	Point range
A	92.50 - 100.00	740 - 800
A-	90.00 - 92.49	720 - 739
B+	87.50 - 89.99	700 - 719
B	82.50 - 87.49	660 - 699
B-	80.00 - 82.49	640 - 659
C+	77.50 - 79.99	620 - 639
C	72.50 - 77.49	580 - 619
C-	70.00 - 72.49	560 - 579
D+	67.50 - 69.99	540 - 559
D	62.50 - 67.49	500 - 539
D-	60.00 - 62.49	480 - 499
F	59.99	0 - 479

If you are taking the class as pass/fail, a D- or better is considered a passing grade.

This grading policy is a bit stricter than most science labs or classes. I will adjust the median score for each lab to make sure that grades don't fall too low (e.g. adding points if I deem the median to be too low), but I reserve the right decide what constitutes 'too low'.

10. Alternative lab 5 and extra credit

Lab 5 has two options for students: (1) time domain photometry or (2) spectroscopy. Because each group will only do one of these, the other lab shall serve as extra credit. The extra credit lab report is due by the last class day and is worth a full lab (100 points).

11. Lab make up

Inevitably problems will come up for someone during the semester. In general, you are expected to be with your group during all data taking activities at the telescope. In the event of extended and documented illness or other emergency you may rely on your group to take data for you for one lab. If the issue persists long enough that you miss more than one lab, contact me and we will arrange for alternatives.

For general, documented, illnesses and emergencies I will allow extra time for doing / making up labs; you must contact me two days before the deadline for these circumstances, although exceptions will be made for truly last minute emergencies.

12. Incomplete grades

If you are unable to complete the course due to "compelling, nonacademic circumstances beyond a student's control" you may receive an incomplete. In order to be eligible for an incomplete you must have a 'D-' average or better in the course to date. If you receive an incomplete you are expected to do all missing labs on your own in the following academic semester.

13. Email

When emailing me please include "AST 152M" (or some variant) in the subject line. Do not expect an immediate response - I will respond to emails within 2 business days.

I will accept all lab reports and other worksheets via email.

14. Telephone contact

My cell phone number is provided for emergency use regarding the telescope facilities (such as equipment failure). I will do my best to have my phone on and be available to take calls anytime a group is known to be at the telescope. During the first week of class I would like to receive contact phone numbers for all students (or at least one for each student group) so that the phone numbers appear in my contact list. Student privacy is taken seriously, and your contact phone number will not be given out to anyone for any reason. It will be deleted from my phone at the end of the semester. I ask that my phone number be similarly deleted from your contact list(s).

15. Blackboard

I will use Blackboard to post grades and communicate with you outside of class. Blackboard may also be used for scheduling of the telescope.

16. Course website

The course website will be used to post lab information as well as practice or additional data sets used in some labs.

17. Religious holy days

In general, you should be able to schedule your observing time and reporting deadlines to avoid conflicts with religious observances. If you are unable to do so, please contact me at least one week before a conflict arises.

18. Student Conduct and Academic Dishonesty

Each student is expected to do and present their own work and be respectful to other students in the class. Bullying, plagiarism, cheating, and falsifying data will not be tolerated. Students are expected to behave in a professional manner within the classrooms (including the telescope dome and operations room), and to not disrupt the learning of other students. The codes for student conduct, academic integrity, and plagiarism can be found at `http://deanofstudents.utexas.edu/sjs/acint_student.php`. All incidents of academic dishonesty will be brought to the attention of the appropriate Dean's Office and may be subject to academic penalties commensurate with the severity of the offense.

19. Special needs and Disabilities

It is University policy to provide reasonable accommodations to students who have documented disability or special needs conditions which may affect their ability to participate in course activities or to meet course requirements. Students with disabilities or special needs should contact Services for Students with Disabilities (`http://ddce.utexas.edu/disability/`)(located in the student services building (SSB) on Dean Keaton St.) as well as myself to arrange for appropriate accommodations.

The RLM telescope and rooftop are not wheelchair accessible (there is only a somewhat steep flight of stairs that provide access to the roof). If you are unable to access the telescope, please contact me so that we may discuss options.

20. Emergencies in the classroom / dome

In the event of a building or campus emergency such as a fire or other evacuation event: the stairs in RLM should be used as soon as it is possible and safe. The nearest stairs to the computer lab are located across the hall, just west of the elevators. If those stairs are unusable there are stairs located at the far (westernmost) end of each fork of the office hallways. The rooftop is considered a safe evacuation area; from the 15th floor it is recommended that you go to ground level if possible, but the rooftop may be used as a backup. If you are in the dome you may remain on the rooftop or take the stairs to the ground level. The stairs at the west end of the building are the only ones accessible from the dome area. Finally, from the astronomy classroom (RLM 15.216b), the closest stairs are located at the (westernmost) end of the hallway.

In general, if you are unable to use the stairs, contact me within the first week of class to make a contingency plan.

In the event of a stay in place emergency: if in the computer classroom, the students should remain in the classroom if possible. The Evans conference room can act as a backup to this (the Evans conference room has no windows). Regardless of which room is used, the hallway doors of the computer classroom and Evans lounge should be closed (both lock automatically). The door between the computer classroom and Evans conference room should also be closed. If students are at the telescope, the rooftop and the dome door should be closed, and the students remain in the telescope control room. If we are meeting in the astronomy classroom (RLM 15.216b) the doors should be closed and we will stay in that classroom.

21. Due dates

Tentative due dates are listed in the schedule below. Lab reports are due by Friday at 5 p.m. central time in their respective week. 10 points per 24 hours will be deducted for labs turned in after the deadline; e.g. turned in 7 p.m. Friday or 3 p.m Saturday results in a loss of 10 points, turned in at noon Sunday results in 20 point deduction, etc. A very short grace period will be allowed within a few minutes (less than 15 minutes) around 5 p.m., allowing for email speed, etc. The grace period may be revoked for individuals who abuse it. The only exception to this is the final lab; the due date is Dec 6, but I will not deduct points until Dec 13 at 5 pm.

If my email (`mailto:bwmulligan@astro.as.utexas.edu`) is down on Friday or the weekend the deadline will be extended to account for this. [Note that there is a record of email outages that I can check against]. There will be no extensions given for problems with your personal email.

Labs are accepted by email or in person; if I am not in my office you may place them on my desk or slide them through the mail slot on the door.

22. List of labs and activities

Lab #	Title	Description
1	Position & Time	Introduction to the positional astronomy and measurements of time
2	IRAF / CCDs	Introduction to data processing and practical use of CCD cameras
3	Planning an observing night	Scheduling observations based on time of day and telescope limitations
4	Astrometry	Measuring the position of an object on the sky
5	Photometry	Measuring the brightness (apparent magnitude) of a stellar object
6a	Time domain photometry	Measuring how the brightness of a variable object changes
6b	Spectroscopy	Measuring the spectrum of an object
7	Open cluster photometry	Developing a color-magnitude diagram of a star cluster.

23. Tentative schedule

Week	Activity	Lab Due (Date)	Other
Sep 1-7	1	1 (Sep 6)	Add / drop date [no permission required]: Sept 3.
Sep 8-14	2		Drop date with full refund: Sept 13.
Sep 15-21	3	2	
Sep 22-28	4	2 (Sep 27)	
Sep 29-Oct 5		3 (Oct 4)	
Oct 6 - 12	5		
Oct 13 - 19		4 (Oct 18)	
Oct 20 - 26			Grading method change: Oct 23.
Oct 27 - Nov 2	6a / 6b		
Nov 3 - 9		5 (Nov 8)	Withdrawal or drop deadline: Nov 5.
Nov 10 - 16			
Nov 17 - 23	7		
Nov 24 - 30		6a / 6b (Nov 27/29)	Thanksgiving
Dec 1 - 7		7, extra credit (Dec 6)	Last official class day: Dec 6.
Dec 8 - 14			

24. Disclaimer

I reserve the right to change the information on this syllabus during the course of the semester. Students will be notified of changes as they occur.