ASTRONOMY 3130: OBSERVATIONAL ASTRONOMY
SPRING 2015

Instructor: Steven Majewski

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Office Hours: Fridays 4-6PM, after class, or by appointment. Note that I am often in my office afternoons and evenings.

Lecture Time & Location: 11:00 a.m. – 12:15 p.m. T, Th in ASTR 265. Note that because of an unavoidable travel schedule, I may periodically miss a lecture. While I hope to find substitute lecturers, in cases where that is not possible I hope we can find some other time when we can meet for a make-up lecture.

Lab (McCormick Observatory) availability:

Although you may have signed up for a specific “Lab Time” on ISIS, please realize that due to the vagaries of weather, this class cannot operate with fixed lab times. We will use the official “Lab Time” to introduce you to equipment and concepts needed to do lab work, but you will almost always be working on the labs outside of those hours. You will have “free access” (within the limits described below) to McCormick Observatory for getting lab work done, and will be expected to make use of it and other department facilities as weather and telescope availability allow. Because we are not the only users of the observatory facilities, it is up to you to be aware of the availability of equipment, sign up for it in advance, and abide the schedule that exists for the telescopes.

We share observatory facilities with other astronomy classes, with the Charlottesville Astronomical Society, and with the regularly scheduled Public Nights. This means that McCormick will be unavailable for ASTR3130 use the following times: (1) Jan. 26 – Apr. 27 – M, Th 9-11 PM for other astronomy classes; (2) Public Nights – almost every Friday night until 9 or 11 PM; (depending on daylight savings time); (3) the first Wednesday of every month from 6-10 PM; (4) during other miscellaneous events. To keep all of this straight, see the Observatory Calendar, linked from the class home page. See below for details on how to sign up for telescope time. Later in the semester it may not be possible to use the 26-inch telescope on certain nights depending on the availability of certain equipment.

Day Lab: You will also have 24 hour access to the computing facilities set up for you in the computer lab in Room 233 in the Astronomy Building.

Teaching Assistants (TAs): offices in AST Rm. 267 (Tel. 4-0686), office hours by appt.

PREREQUISITES

You should have a background in Astronomy at the level of ASTR 2110-2120. You are also expected to have basic computer skills including some experience writing computer programs with, e.g., C or FORTRAN. You should know multivariate calculus and basic statistics. If you do not have this kind of background, you must discuss your situation with Mr. Majewski as soon as possible and obtain permission to take this course.

COURSE DESCRIPTION

This course has two main parts, lectures and observational projects; both emphasize you gaining experience with astronomical observing and data analysis. The philosophy of the class is “active learning”. In the lectures you will learn background material needed to understand the night time sky, telescopes and modern observational techniques and equipment. Thus the lectures are intended to prepare you to

1. plan and make astronomical observations using a variety of modern instruments,
2. reduce the data you obtain, and
3. understand and analyze the results.

At the observatory and during labs, you will put these techniques into practice. Most of your time for this class will be spent: (1) at the telescopes (at night), (2) reducing and analyzing your data (either day or night in the Day/Computer Lab), and (3) formally reporting on your results.

The overall goal is to train you in scientific data collection and interpretation of observations. You will use equipment at the McCormick Observatory, which includes a 10-inch Meade reflecting telescope, and 6-inch and 26-inch refracting telescopes, as well as modern instrumentation (e.g., CCD cameras, spectrographs, computers). Use of smaller telescopes in the Astronomy Night Lab area may also be required. Depending on how the class proceeds with negotiating lab assignments and the weather, we will conclude the semester with experiments using research-grade facilities at Fan Mtn. Observatory and/or Apache Point Observatory.

Because of its dependence on lab reports, his class satisfies the second writing requirement of the College of Arts and Sciences.

I hope that this will be an enjoyable and challenging course for you. Some laboratory experiments in this class make use of research-grade instrumentation and software. Even if you do not become a professional astronomer, your skills in careful observation, and interpretation and analysis of data will be useful in many fields. The skills you will learn in this class may also put you at an advantage if you should apply for Research Experience for Undergraduates (REU) programs, since many undergraduate programs at other universities do not include hands-on experience with data collection and reduction at the level you will have in this class. UVa students traditionally have had good success getting into these programs.

A COMMENT ON THE TIME COMMITMENTS FOR ASTR 3130

Note that this is a four hour, laboratory class geared for third and fourth year astronomy/astrophysics majors and minors; thus, you should expect this class to take more time, and perhaps be more demanding, than other classes you probably have had. It is important that you understand the time commitment for this class and evaluate whether your semester
schedule will accommodate such a commitment. The night work in this class will take quite a lot of time and you must also contend with the vagaries of the weather, so your academic schedule should be flexible enough to allow you to observe on any clear night.

While demanding, this class will probably prove commensurately more rewarding as well. For many students, ASTR 3130 provides the first opportunity to experience what real observational/research astronomy is like.

CLASS WEB PAGES

For general information about the Astronomy Department, consult the World Wide Web URL address of the department’s home page: http://www.astro.virginia.edu. The web page for the class is http://www.astro.virginia.edu/class/majewski/astr313. On the latter site you can find important information about the class, links helpful for doing lab work, and sign-up information and the calendars for observing time. There are also links to weather pages, where you can get cloud and Doppler (rain) maps and forecasts.

Some lecture material for this class can be found on the web page. This material is provided as a service to the students because: (a) The class often requires interpreting complex figures that are too tricky for me to draw on the board and equally difficult to copy into notes quickly. (b) I can make use of sky animations and other “web videos” to illustrate complex concepts. (c) Much material I present is not in any one textbook, indeed, not in any textbook at all. (d) Students will have a guide to the organizational aspects and important themes of the class, which are often missed or not properly emphasized in notes taken from chalkboard lecturing.

WARNING: The web lecture notes are not a substitute for attending lecture. You are expected to use the web lecture notes as a resource to, not a substitute for, attending lecture. The class is small enough that non-attendance will be obvious and noted. In any case, I will not put all material on those web pages (with deliberate use of the blackboard on occasion), so it is essential to attend lectures to keep up.

You may wish to make copies of the notes ON YOUR HOME COMPUTER to bring with you to lecture. However, do NOT use the department computers for printing out these pages!

COURSE REQUIREMENTS

Text and Supplies:

The list below gives the primary references for this class. Unfortunately, there are no textbooks that match well the range of topics that will be covered in this class. However, the new edition of Observational Astronomy does a better job than previously available texts; I’ll explain in class why I think this book is a remarkably good match to the lectures of this class. I am putting copies of this text as well as an alternative text by Chromey, on reserve in the Astronomy Library. I’ve asked you only to buy the Lyons book.


2. Data Analysis for the Physical Science Students by L. Lyons
3. *Astronomy 3130/5110 Observatory Handbook* edited by M. Richards, S. Majewski, et al. This manual is linked from the class home page and can be found here: http://www.astro.virginia.edu/local/observatory/. It is recommended that you print out chapters as you need them at each lab. HOWEVER, do not use the department printing facilities for this — it is a violation of the honor code to use department printing resources excessively for personal purposes (equivalent to theft) If you wish a printed copy please use your own resources for this outside of the department.

You may also find useful to your work *Norton’s 2000.0 Star Atlas and Reference Book* edited by Ian Ridpath. There will be a copy of Norton’s on reserve in the Astronomy Library so you can make finding charts in advance of going to lab, but note that this reserve copy (or ANY reserve books) *must not* leave the library. Several other useful reference books you may find useful are *Compendium of Practical Astronomy (Vol. 1)* edited by G. D. Roth, the *Astronomical Almanac*, and the *Royal Astronomical Society of Canada (RASC) Observer’s Handbook*, which will be on reserve in the Astronomy Library.

You will also need to make use of the guides for the software used to run the CCD cameras and analyze the data in the ASTR 3130 lab. More on this as the semester develops. You will need a flashlight (preferably one that has a red filter) – a good option is the MagLite flashlight, which can be purchased with red filters and also a belt holster for that nerdy, but prepared look (trust me, it is really handy to know where that flashlight is at all times when you are in the dark!). Headlamps with red filters are a very helpful option. I strongly encourage you to purchase a bound lab notebook (not a looseleaf spiral pad) for keeping in one place your data and reduction notes from the telescope and day lab. This is an important habit to develop as scientists.

**Assignments:** Because this is a lab course designed to give you experience with important techniques of astronomical measurement (e.g., imaging, photometry, spectroscopy, etc.), the work in ASTR 3130 will center on your observational experiments at the observatory. You will conduct these experiments in much the same way that professional astronomers do observational research. Thus, you will be expected to prepare for the observations in advance, make a request for telescope access, keep observing logs and detailed notes of your work at the telescope, and then prepare a report in the style of a “published paper” of a professional astronomer, including: a description of the purpose of the experiment, presentation of the data (including a copy of the observing log) and its reduction (including images and plots), analysis of the data (including calculations used), and a discussion of the outcome/conclusions of the experiment. If you are not familiar with this style of scientific presentation, I encourage you to spend 30 minutes in the library or on-line leafing through a copy of the *Astrophysical Journal* to see how this is done. If you have questions about this, ask BEFORE handing in the lab. In each lab I will try to give some general guidelines for expectations. Each lab also has a set of questions that you are to answer. Mark clearly in your reports where you put the answers to these questions.

There will also be periodic homework assignments in this class, in addition to, or in support of, the labs. Assignments should be handed in at class time. There will be penalties for work turned in late; I reserve the right to not accept work beyond the deadline.

**Signing Up For Telescope Time:** You will need to sign up in advance for all telescope time. Go to http://www.astro.virginia.edu/class/majewski/astr313/telescope.signout.html (linked from the ASTR 3130 home page) to request time; use the “RESERVE OBSERVATORY” option when you get to the telescope reservation page. Each group will have its own login user name to sign out telescope time for this class. The standard time allotment will
be two hours; this will give everyone a chance to have telescope access during clear observing time. To ensure that telescope time is equitably shared, you will be limited to signing up for one two hour slot each night. However, because we do not want to inhibit ambitious, hard working students, this two hour restriction is removed within 24 hours of any particular time slot, so that you can sign up for more telescope time after everyone has had a fair shot at it. It should be obvious from this mechanism that it will be important for observing groups to plan ahead. Note that should the semester be particularly encumbered by poor weather, we reserve the right to alter the time allocation/reservation policy.

The TA for the class will be generally available at a number of times during the week, and you must pre-arrange to have a TA at your first sign-up slot for each new lab ahead of time so that the TA can introduce you to the equipment needed for that lab. After this first session, you may work without TA assistance, but only if you feel comfortable with the telescope and instrument you are using; remember that you are responsible for anything that breaks when you are at the telescope! Requests for TA assistance should always be negotiated directly with the TA. Please remember that the TAs have their own classes and deadlines, and may not be available on short notice for observing time that has not been pre-arranged.

Computing: You will need to have access to computers in the Astronomy Department. The primary PC computers for this class are located in Room AST 233. They are kept up to date with the 3130 software and patches. You will be introduced to these computers and the software later in the semester.

In the /net/astro_owners/astro3130 folder there will be subdirectory folders for each group in the class. These areas are for you to store data taken with the CCDs. You should probably make subdirectories for each lab experiment, to keep things organized.

Note: The disk space allotted for you is intended for storing, reducing and analyzing your data, or to prepare the reports on your observing exercises. The computer access given to you is intended only for ASTR 3130 work. Do not abuse it. When using the department computer please exercise the usual security protocols regarding passwords (do not give them out!) and unattended login sessions (do not leave computer without logging out!).

Weather Conditions: Your ability to complete work in this class will depend heavily on the availability of good weather, and, in some cases, on the brightness (phase) of the moon. Your observing will be delayed if there is inclement weather; therefore, you must remain cognizant of weather conditions and forecasts. You should be prepared to observe if the weather improves unexpectedly. There are numerous websites available (linked from the course webpage) with satellite imaging maps and forecasts that you can use in your planning. A prediction of sky clearness and darkness can be found on the “Clear Sky Clocks” link on the class home page, and at 6 PM each day one of the Astronomy Department TAs for the lower division classes leaves a phone message regarding the weather and the status of the observatories for those classes at 924-7238. While you may avail yourself of this late afternoon telephone prognosis as well as the Clear Sky Clocks, remember that predicting changes in conditions is difficult and unreliable and that you are ultimately responsible for tracking them. Note that poor weather will NOT be accepted as an excuse for assignments turned in past the established due dates (see below). Only in the case of consistently poor weather will these dates be renegotiated with the class, and such decisions are at the discretion of the professor.

Keys: You will need keys to gain access to the Astronomy Building, the Astronomy Library, the Day Lab area and the McCormick Observatory. The keys can be obtained from our...
department secretary, Ms. Jackie Harding for a modest deposit of $15. The deposit will be reimbursed at the end of the semester when you return your keys. (See also Key Policy.)

**Organization of your time:** It is worth repeating that this course requires a substantial amount of initiative and diligence on your part throughout the semester. You will need to plan your observing schedule carefully so you can make use of **EVERY** clear night, starting from the very first week of classes. Note, in addition, that the TAs will be available at the observatory for only limited and set hours. *To distribute telescope time fairly, you will have to sign up for all telescope time (either with or without a TA present) in advance, via the procedures on the observatory web page.* We will do our best to make sure that each student or group has an equal chance to get “prime time” hours throughout the semester, as long as requests are made sufficiently in advance. Obviously, we cannot guarantee the weather, and signing up for a time slot that gets weathered out does not alleviate you of your responsibilities to get observing work done.

It usually takes more than one observing session to complete each observing exercise. Given the demands on the department telescopes, you will probably even need to use unusually late hours (e.g., past midnight) or weekends to complete your work. The nature of night observing means that you should not take this course if you have a night job or other commitments that prevent you from observing. Bad weather will not be accepted as an excuse for incomplete work, and you will receive only minimal credit if you have completed your observations but have not analyzed them. Note also that some of the experiments may build on data taken in previous experiments. Therefore, failing to complete one lab will not only be a severe blow to your grade, but will impact your ability to complete future labs.

The lab assignments will be typically be due every two weeks, but you should make sure to spread the work out over the full two weeks to avoid having large assignments impacting your homework in other classes every other week.

**GRADES and DEADLINES**

Because this is a lab course, the majority of your grade will be based on your lab results and write-ups as well as homework assignments, which are due at the beginning of class on the due dates. There will be roughly 6 lab assignments this semester, depending on the weather; therefore you should expect that labs will be due roughly every two weeks. Other, shorter assignments will be interspersed between these lab deadlines. I appreciate that there can be periods of consistently poor weather, and in those cases where there was little chance of completing the labs I will extend deadlines. This will **NOT** be done, however, if we believe there were enough clear nights to complete the work, whether or not you elected to use them.

In addition to the lab assignments and other homeworks, there will be a midterm and a final exam (final exam date is Tuesday, May 5, 9:00 AM to noon).

The grading scheme for this course is: $A \geq 94\%, \ 90\% \leq A- < 94\%, \ 87\% \leq B+ < 90\%, \ 83\% \leq B < 87\%, \ 80\% \leq B- < 83\%, \ 77\% \leq C+ < 80\%, \ 73\% \leq C < 77\%, \ 70\% \leq C- < 73\%, \ 65\% \leq D+ < 70\%, \ 60\% \leq D < 65\%, \ 55\% \leq D- < 60\%, \ F < 55\%.$
GROUP WORK AND HONOR CODE

For much of the observing and reduction work you are encouraged to work in lab groups of three to four people; in your write-ups you should explicitly identify any cooperation or assistance from anyone, including other students in the class. **Groups larger than four people will require prior approval of the TA.** Note that each lab experiment in this course requires different data, skills, reduction procedures, analysis, etc. and what is expected as group work and as individual effort may be expected to vary. We will try to make clear with each lab any variations in where lies the dividing line between group and individual work, but, **IF EVER IN DOUBT, PLEASE ASK.** Groups should use the following general guidelines (exceptions will be noted in the labs):

1. You may observe as a group if you keep track in your observing notebook and on the observing logs who was present each night and when. Due to the nature of the projects in this class, which often involve collecting one set of data shared by all members of the group, it is expected that you keep the same members of a group together until the observing for each experiment is fully completed. One observing log may be kept for the entire group each night, but each member should include a copy of that log with their reports.

2. The responsibilities of finding objects with the telescope and operating the instruments must be shared equally, and duties should be traded throughout the observing. By the completion of Lab 3 every student is expected to know how to operate the telescopes and find objects on their own.

3. In the case of some labs involving the collection of data with computerized equipment, at the end of each night of observing at least two copies of the data should be saved and kept by different members of the group. This is important not only to allow multiple avenues of access to different members of the group for independent work with the data, but to ensure that backup copies of the night’s work are preserved. Each member of the group should also obtain their own copy of the observing log for the night’s observations.

4. In most cases (exceptions will be noted), post-observing reduction of the data (e.g., using computer analysis software) may also be done as a group (no more than four people), as long as the reduction duties are shared equally among the group members, and all cooperative efforts are clearly noted. It would be safest and best for you if each member of the group saved their own versions of the final, computer-related products (plots, datafiles, images, tables) so that you can each have them available for writing up your lab reports.

5. Once the observations have been obtained and reduced, each person in the group should write his or her own report independently (i.e., in your own words). You may discuss the results and interpretation of the data with each other, but your lab report should reflect your own assessment, assembly, and description of the data, reduction, analysis and conclusions. Each experiment is a little different and the lab instructions may have specific guidelines about where group work is to end. In general, the rule to follow is that anything involving the creation or manipulation of an image, video, spectrum, or table of data values will be allowed as a group activity, and most things involving the creation of plots, prose, computer programs or requires the calculation of quantities is an individual effort. Any collaboration should be indicated in the lab report.

6. If you decide to reobserve, remeasure or reanalyze any data because of some disagreement with members in your group, your report should include a statement of what was wrong and your reasons for redoing the experiment.
SAFETY AND RESPONSIBILITY

The telescopes and equipment that you will use in this course are delicate, expensive, and sometimes priceless and irreplaceable. In addition, there are many unavoidable hazards associated with an observatory: working in the dark, high voltages, heavy equipment, wires and cables, etc. Be very careful, and use common sense when moving around. Read all instructions carefully and thoroughly, and then obey them. They are for your protection and for the safety of the equipment. Always carry a flashlight, and NEVER OBSERVE ALONE.

It is worth reiterating these warnings. The equipment you will be using is needed for a number of undergraduate and graduate courses, and, in some cases, for research programs of faculty and their students. Any breakage will affect not only your fellow ASTR3130 students but a wider pool of users. Much of the equipment is expensive to replace. Therefore it is imperative that you conduct your work with the utmost of care, patience and forethought. You should get in the habit of moving about in the dark slowly and cautiously. It is very easy to bump into things, get tangled in cables or wires, or trip over things in the dark.

As with all delicate equipment, NEVER force any moving part beyond reasonable and expected resistance. Never move the telescope by pushing on the mounted instrumentation (CCD, spectrograph, etc.), and never lean or support yourself by holding onto the equipment. If you suddenly get entangled in cabling in the dark, freeze and then alert a partner to turn a light on you and assist in disentangling the situation. Do not yank on cables because this will break connectors or pull equipment or computers onto the floor.

Optical elements, in particular, are very delicate and expensive. Never, NEVER, touch any optical element. Your skin is corrosive, and oils from your skin will permanently embed into glass surfaces and optical coatings. It is preferable to leave small amounts of dust on optical surfaces rather than risk scratching or marring the surfaces with attempts at cleaning. If the dust seems to you intolerable, let the TA know the next time he/she is available. If you are in doubt about how to operate a piece of equipment, you should consult an expert (but see “Calling for Help” below). THINK BEFORE DOING.

To minimize the potential for accidents, and to make most efficient use of your observing time, read all lab instructions and relevant manual pages and prepare finding charts and coordinate lists in the daytime before you head to lab and make any attempt to touch the equipment. Make a plan of your activities and have a clear idea of your observing strategy for the evening, including the hour angles/airmasses of your targets at the time you intend to observe them. High airmass observations (i.e., observing objects near the horizon) should be avoided for both scientific and safety reasons.

PLEASE HEED THE PREVIOUS PARAGRAPH. Lab time with clear weather, especially when the TA is available, is extremely valuable. If you take the time to plan out the evening in advance, then you can concentrate on your project during the observing session, when telescope and TA time is precious.

You should be patient and not hurry through the observing. Always double check the safety of the equipment before you move the telescope, close the roof, etc., and be especially careful about opening and closing the telescope and dome during your observing session. Note that because the telescope will be tracking, you must not only be aware of where the telescope is, but where it will be throughout the time you observe any particular object. Collisions of the telescope with the pier, ladders and any other objects in the dome MUST be avoided.

If something breaks or jams, do not attempt to fix it yourself! If the problem does not endanger the damaged equipment or any other piece of equipment, you should shut the
equipment down in accordance with the instructions. If equipment is endangered (e.g., the dome slit is jammed open), then you should contact the TA immediately. Failing this, you should contact the professor. If neither of us can be found, then get help from any faculty member or graduate student. In any event, any damage to the equipment must be immediately reported to the TA, who will contact me.

The privilege of having a key to the observatory should not be viewed as an opportunity to give your friends a tour. It is for the sole purpose of completing your assignments.

In light of the above, you will be required to sign three separate agreements (and an Honor Contract): loss and breakage, safety, and a key policy agreement.

TA HOURS

The TAs are paid for only a specific number of hours to assist with this class. Moreover, they have their own classes, research and departmental work to worry about throughout the semester. You are asked to please respect their limitations and schedule. Do not make your deadline emergencies their problem. The TAs have scheduled hours at the observatory on certain nights to assist with getting you started with labs. These hours must be spread evenly to all students in the class, so you will not be allowed to dominate the telescopes during these hours. All telescope time, whether or not during the TAs’ hours, must be requested in advance (see web page) in order to accommodate everyone in the class. In the event that the TAs determine that their scheduled slots are hopelessly weathered out, they will try to reschedule their observatory hours for that week.

CALLING FOR HELP

Phone and email contact for the instructor and TAs are given on the first page of this syllabus. Access to the instructor and TAs at home should not be abused. It is worth reiterating the policy for calling the TA or professor for help when neither are with you at the telescope. You should NOT bother us if you have a question about lab procedures or activities: These are things you should have read through and asked about during class, previous lab, or office hours. If you have a problem with a piece of equipment not working, first make sure you have followed all procedures correctly in starting up the equipment. If this still does not work, shut down all of the equipment (following proper procedures) and restart completely from scratch (again, following the startup procedures carefully). If this still does not help, only then call the TA for assistance. Note, the TA will not be happy if he finds that your problem is a result of not following directions! Finally, only in the case where people, equipment or the observatory are in imminent danger (e.g., telescope stuck in a dangerous position, dome slit frozen open) you MUST make every effort to contact a TA (first), Mr. Majewski (second), or any other faculty member or graduate student immediately. Mr. Patterson lives near McCormick and may be a person to call for an emergency situation with the facilities (971-7103). Obviously, in the case of a medical emergency, call 911 first. Please exercise judgement: The safety of people and equipment should be your highest priority, and if you believe there is any risk, you should take appropriate steps to take care of the situation.
LOSS AND BREAKAGE, KEY, AND SAFETY AGREEMENTS

Loss and Breakage Agreement

The equipment you will use in this course is **fragile**, expensive and very difficult to replace. In order that everyone has equal opportunity to complete the course requirements and that responsibility for any breakage can be assigned fairly we have implemented the following loss and breakage agreement.

1. You are on your honor to report all damage to the instructor or TA immediately. **Do not** attempt to fix it yourself. Shut down the equipment and report the problem. If the nature of the damage endangers other equipment (roof won’t close, electrical problems) you **must** contact us. If neither the instructor nor the TA can be reached, contact any astronomy department member.

2. A written description of any damage or problem is to be given to the instructor the following day. In order for observing equipment to be repaired promptly, we must know specifics about the problem. Damage caused by the student will be assessed against you.

3. In the case of loss or damage which cannot be assigned as the responsibility of a given individual, all students authorized to use the equipment during the time period in which the problem occurred will share equally the cost of replacement or repair. Checks on the equipment will be made daily and the last users will be held responsible for its condition. If an item appears damaged or is missing when you first check it out, notify your instructor in writing and the previous users will be assessed damages.

4. **Always fill out the telescope log for every observing session.** The 26-inch has a log book on site wherein you are to record your use of the telescope. No credit will be given for observations carried out during an unlogged session.

5. In all cases the judgment of the Astronomy Department in assessing the damage costs is final. We will make every effort to be fair subject to the constraint that the costs must be paid. Normal wear will be allowed for. All assessed costs must be paid within 4 weeks of notification. Your grade will be withheld until all payments have been made.

6. Failing to treat the telescopes or day lab properly will result in revocation of key privileges, which may make it impossible for you to do lab work, and result in a failing grade.

Key Agreement

For completion of the requirements of this course you will be issued one or more keys which you **must** return at the end of the semester. Any keys signed out over night should be returned promptly the next weekday morning.

**Your grade will be withheld until all keys are returned to the department.** These keys are loaned to you for use in completing the requirements of this course. They are **not** to be copied, loaned to friends, or used to gain access to the department’s facilities for any non-astronomy related purpose. You may not bring friends with you to the observatories or
the Day Lab. Make sure that no one other than registered ASTR 3130 students follow you into any area for which you have been given key access. This applies especially to the Day Lab and the observatories. Note that other undergraduate classes make use of these facilities for limited, and often highly oversubscribed, open lab periods. Your special key access allows you to circumvent these restricted and busy open lab hours. However, this privilege brings the responsibility to allow no other person into the Day Lab or the Observatory. If it is found that these rules are not followed, special access privileges will be revoked.

**Safety Agreement**

This is a laboratory course and like any lab course there are potential hazards that could result in injury. For the most part you will be working in the dark either outdoors conducting observations or in the darkroom. Use common sense when moving about; do not make any sudden, quick movements. Telescopes have sharp corners and parts that stick out. Make a mental note of the locations of all equipment, including steps, ladders and power/data cords. This information may help you to prevent accidents. In any event, always carry a flashlight. Remember that you are more likely to hurt yourself than large pieces of equipment.

**McCormick Observatory**

Much of your observational work will be done here using the 6-inch and 10-inch telescopes in the Doghouse and the 26-inch in the main dome. Some safety notes:

1. The instruments and telescopes have electrical connections. Be alert.

2. Watch your footing in the Doghouse. No horseplay. **No alcoholic beverages** and no food of any kind near the equipment. No smoking.

3. First-Aid equipment is located in the alcove between the dome room and the lobby. There are several phones in the building. Note their locations.

**Fan Mountain:** Any trips to the Fan Mountain Observatory will be supervised by the TA or faculty. It is always about 10 degrees colder at Fan, so you will need to dress warmly.

**Injuries:** If an injury of any kind occurs, notify the instructor if he or she is present. If the injury is minor and no supervisor is present, you should notify the instructors the next day. If the injury appears even remotely serious call the rescue squad (295-1191 or 911). Notify the instructor **immediately.** (Call him at home if necessary.) Emergency numbers are posted by the phone.

Wear suitable clothing at all times. Remember than even 60 degree weather can be chilling if you are engaged in observing outside with a minimum of movement.

Metal surfaces get very cold; numbed hands can lead to accidents. Walk slowly and carefully when leaving a lighted room and entering the dark. It takes a minimum of 5 minutes for your eyes to adjust reasonably back to darkness and more than a half hour for full adaptation. Once your eyes are night adapted, it is best to keep them that way until all observations are completed. Repeated switching from light to dark will cause eye strain.

After reading these agreements, sign the pledges on the next page.
ASTR3130: OBSERVATIONAL ASTRONOMY

Sign and return this sheet to the instructor of this course.

____________________________________

LOSS AND BREAKAGE AGREEMENT
I understand the loss and damage policy described elsewhere and agree promptly to pay replacement or repair charges assessed me by the Astronomy Department. I will report all problems in the manner prescribed as quickly as possible.

Signature: ______________________________

____________________________________

SAFETY AGREEMENT
I understand the policy regarding safety for this course and will act responsibly to prevent accidents.

Signature: ______________________________

____________________________________

KEY AGREEMENT
On my honor as a student I agree to return those keys loaned to me upon completion of the course. I will not duplicate any key nor will I loan a key to anyone under any circumstances.

Signature: ______________________________

____________________________________

HONOR CONTRACT
I have read the syllabus for ASTR 3130, have had an opportunity to ask questions about the requirements of the class and expectations regarding pledged, implicitly pledged and group work, and understand the honor policies in the class.

Signature: ______________________________

ID#: _______________________________ Date: ____________________________
Astronomy 3130 Information Sheet
This information helps the instructor to plan the classes. It is helpful to know your level of astronomy education and your intended career path. Please return this form to the instructor.

Name (print): ____________________________

Email: ________________________________

Major: ________________________________  Phone: ____________

What is your background in *observational* astronomy? (e.g., amateur astronomy, an REU experience, Star Trek-viewing, ...)

What is your background in physics and astronomy generally (e.g., “took physics in high-school, and am majoring in physics now”; note that the last question below asks for previously taken course listings)?

Primary reason for taking this course (e.g., required for major, required for minor, recommended, heard it was an easy grade)

Plans after graduation (e.g., high school science teacher, science writer, graduate school in astrophysics with plans to become a research astronomer with Ph.D., career unrelated to astronomy/physics)

Give a summary of the college level physics, astronomy, and math courses that you have taken or are currently taking. Please list course names (e.g., Electricity and Magnetism) rather than course numbers (e.g., Phys 3390).