Astronomy is a science and so really can only be best understood through investigation. As such, everyone will turn in two (2) projects on subjects of their choosing. At least one of these projects must involve observations of the night sky in some way. These are LAB projects and so must test some hypothesis via experiment or observation. Once each project is completed, you will turn in a write up that, following the scientific method, explains your hypothesis, the method of your experiments/observations, your results, and finally how you drew your conclusions.

There are two parts to each of the projects. First you must actually go out and do some sort of lab project (some ideas for which can be found below). Then you must take the data/observations/conclusion you found and, along with a description of what you did, present a comprehensive report of your project. To help you with this, I have created a rubric, found below. This is not necessarily a section by section description, merely a list of points I will be looking for.

I. Hypothesis and Motivation (20 pts)
   a. Describes the observed ASTRONOMICAL phenomenon and explains the importance of understanding it. (10 pts)
   b. Presents a hypothesis to explain it. (5 pts)
   c. Describes in general something that can be measured or observed about the phenomenon and makes a prediction about the possible outcome of such a measurement/observation. (5 pts)

II. Experimental Method / Procedure (50 pts)
   a. Project Proposal DUE SEP 16\textsuperscript{th} (5 pts)
   b. Describes in detail the method that was followed to obtain the measurement/observation of the phenomenon. (15 pts)
   c. Describes where, when, and with whom you carried out the method, including any difficulties you encountered and how you attempted to overcome them. (30 pts)

III. Results and Conclusions (30 pts)
   a. Presents the raw data/observations obtained from the experiment in a professional form. (10 pts)
   b. Using your data discusses how your result(s) differed from and/or resembled your prediction and then makes a conclusion about the phenomenon and your hypothesis. (10 pts)
   c. Discusses any sources of error in your measurements/observations. (5 pts)
   d. Discusses how you might improve upon the work you have just done. (5 pts)

The write up should be typed. The organization is up to you. You should not need to have more than four pages of double-spaced 12pt written work (i.e. not including tables or figures). If you would like to have me review a rough draft, you can turn one in for the first project by the beginning of class on Oct 7\textsuperscript{th} and I will get it back to you on the 14\textsuperscript{th}. For the second project, rough drafts to me by the beginning of class on Nov. 11\textsuperscript{th} will be
handed back the 18th. Turning in a rough draft will earn you 10 pts extra credit on the final project.

Hopefully this will be a fun and educational experience. If you have any questions on some specific ways to actually carry out your project, visit me during office hours.

Some Project Ideas

Below I have suggested several possible ideas for projects. Notice that many of them require several nights’ worth of observations to work. Start early on this or you will not do well. I have separated out the night sky projects from the others for your convenience.

Night Sky Projects

- Using binoculars or a telescope, examine the motion Jupiter or Saturn’s Moons.
- By observing them at the same time every night, record and examine the motion of Mars, Venus, or Mercury through the sky.
- Examine the difference in the brightness (limiting magnitude), and/or number of stars one can see in a dark area (a field outside the city for instance) as opposed to one with a great deal of light pollution (like downtown Bloomington).
- Chart the phases of the moon over the period of its entire orbit.
- Using binoculars or a telescope, examine the difference in the appearance of the moon in detail in at least three different phases.
- Over the course of a month go out at the same time and chart the position of the stars. Examine their motion.
- Develop a clock or method by which one can tell the time of night by the position of circumpolar stars and test it.
- Observe a meteor shower and discuss what causes what you see.
- Using angles, determine the size of the moon using the distance to the moon given in the book.
- Examine the motion of the stars by taking photographs of star trails.
- Determine the magnitudes of several stars by comparing them to a star with known magnitude.
- Over the course of a month, track the location of sunrise or sunset along the horizon.
- Over the course of a week, track the nightly location of the moon against the stars.

Other Projects

- Measure the circumference of the Earth using the Eratosthenes method.
- Make an accurate sundial.
- Using flour, cocoa powder, and a rock examine the difference between impact craters caused by the rock impacting in different ways.
- Using the method of parallax, measure the distance to several objects of varying distances and examine your data.
- Do any of the CLEA labs found at: [http://www3.gettysburg.edu/~marschal/clea/CLEAhome.html](http://www3.gettysburg.edu/~marschal/clea/CLEAhome.html) that deal with the SOLAR SYSTEM. Do not use their write up, do your own!
- Anything else – but run it by me first just in case!