

A130 Projects

Please don't pick something you are already accomplished at. If you wish, any of these projects can be turned into a more advanced project to take you beyond your current proficiency.

1. Astrophotography of Constellations:

We have long used film cameras for constellation astrophotography and they continue to work very well. These are what we have available for loan. Until recently only expensive digital cameras could handle constellation astrophotography. However a few of the most recent generation of 'Point and Shoot' digital cameras now have the required capabilities. These include:

- Hi ISO setting, say 800.
- Manual long exposure times, i.e. 15 seconds, along with dark frame subtraction.
- The ability to force the focus to infinity.

If you have such a camera, by all means, consider using it for this constellation astrophotography project. If not, we have film cameras available for this project. In my experience, film cameras still yield better star colors with out resort to special digital processing.

The film astrophotography project can be challenging. Thus it will count for 45% credit (and everything else proportionately reduced by 5%.)

- Photograph two of the following constellations (Big or Little Dipper, Orion (Hunter), Leo (Lion), Taurus (Bull), Canis Major (Big Dog), Gemini (Twins), Bootes (Herdsman), Cassiopeia (the W), Orion is a beautiful constellation and especially good choice because of the pretty red Orion Nebula. **Reproduce or hand draw a simple star chart to the same scale and orientation as your photographs and name the brightest stars.** On the chart connect together the bright stars in the shape of the constellation if these lines do not already exist on the chart.
- Photograph the North Star (Polaris) and the region around the pole, showing star trails (minimum 15 minute exposure; set your camera to f/8). Digital camera users, check with me.
- Photograph a constellation of your choice and include a star chart (as above).
- Take the above photographs from a moderately dark location (An unlit area, the edge of town, not under a street light, not at the shopping center!). If you live in a brightly-lit area of the city, try a few photos from 'home' for comparison with dark site photos.
- Include a data sheet giving full particulars for each photograph, including:
 - Location
 - Camera
 - Lens setting
 - Exposure time
 - Film (for film cameras)
 - Sky conditions (e.g. atmospheric clarity: hazy to crystal clear, light pollution, presence of moon, etc)
 - Date and time.

- Photographs should be 4" x 6" or larger (glossy is better). (Size does not affect your grade. Size only reflects the state of your pocket book and amount of blank wall space you have to fill.)
- The original negatives must be filed with your report. For digital camera users, include a CD of ALL the images from your memory card. I want to see your successes and failures.
- Place everything in a neat notebook. See the special, detailed description of this project for full particulars.
- Optional:
 - Try to get a photo of some planets: e.g. Jupiter, Saturn, Mars, or Venus.
 - Figure out the limiting magnitude of (some) of your constellation photographs. For this, you need a good star chart.
 - Take an 'artistic' photo of the moon with an interesting foreground.
 - Experiment with telephoto or wide angle lenses if using your own equipment.
 - Experiment with a Light Pollution Filter.
- More Advanced:
 - Use a telescope mounting or 'barn door' tracking platform to take a several minute exposure of the stars while tracking them to avoid star trails. This allows much fainter objects to be photographed.
- Those with special interests are welcome to propose a variation of this astrophotography project.

2. **Astrophotography of the Moon:**

(we have equipment available for this project: 4 1/2" Dob and Canon or Fuji digital camera)

- Photograph the moon on two different nights.
- Print at least two good pictures from each nite (inkjet or laser prints are fine)
- On a second set of prints (which may be smaller, cheaper, lesser quality) label the principle lunar seas or Maria visible in your pictures. For the pictures from each nite, identify 5 prominent craters or other lunar features (mountains, rills, rays, etc). After 2 nites, this will give you 10 identified features (no duplicates!). Lunar maps are available in numerous places. The free <Virtual Moon Atlas>, indexed on my BYA Software page, is comprehensive.
- Make an index page listing:
 - Dates, TIME, and locations from which the pictures were taken.
 - Equipment used.
 - Any software used to process the pictures.
 - The printer used to print your pictures.
- Place everything in a neat notebook.

3. **Constellation Study:**

- Use Sky Globe, Stellar Pro 1.53e or a planetarium program of your choice to learn the most prominent constellations.
- Specifically:
 - Starting from the Big Dipper, find Mizar and Alcor, the double star in the handle of the dipper, and the following constellations and stars.
 - the Little Dipper and Polaris.
 - Bootes and the star Arcturus.
 - Virgo and the star Spica.

- Cassiopeia.
- Starting from Orion, find the stars Betelgeuse and Rigel, the Great Orion Nebula, and the following constellations:
 - Taurus, the star Aldebaran, and the Pleiades.
 - Canis Major and the star Sirius.
 - Gemini and the stars Castor and Pollux.
- Starting from the 'Summer Triangle'
 - Identify the stars Deneb, Vega, Altair (the summer triangle), and Antares.
 - The constellations Cygnus, Lyra, Aquila, Sagittarius, and Scorpius
- For all these constellations, learn what figure they represent. Learn the colors of the bright stars mentioned above.
- Proficiency will be tested by having you identify the constellations on my office computer with ALL the sky markings turned off and ONLY stars and the Milky Way showing. You will know which way you are looking and what constellation or star you are looking for.
- Most any introductory book on amateur astronomy will help you with the above project. Try Half Price Books. Or find help on the web.

4. Sky Predictions:

- Planetarium programs such as Sky Globe can be used to predict the appearance of the sky at past and future times. Use Sky Globe, Stellar Pro 1.53e, or the program of your choice to determine the following. (Be sure the date, time, and location are included in any printouts.) Assume you are in Indianapolis unless otherwise specified or appropriate.
 - The time of sunset, the approximate phase of the moon and time of moon rise, and the location of the planets Venus, Mars, Jupiter, and Saturn on March 15, this year, (Spring Break) from the place you would really like to be over Spring Break (NOT Indianapolis). Print a chart showing sunset, moon rise, and any planets visible in the western sky ½ hour after sunset. Is the Big Dipper visible from your location? Print out a chart showing its location in the sky at midnight.
 - The Perseid meteor shower occurs in the early morning hours of August 12-13 each year. For 1AM of the years 2010, 2011, and 2012 determine where the moon will be on this time and date. Will it interfere with observing the meteor shower on any of these dates? Which date is best? Print a chart showing the sky on each of these dates.
 - According to astrologers, your Sun Sign is very important. Your sun sign is the constellation the sun was in at the time of your birth. Print out a chart showing the location of the sun among the constellations on the day of your birth (pick noontime for the print out, but confirm that the result doesn't change noticeably with the time of day). Does it make any difference what city (location) you assume you were born in? What did you think your sun sign was? What does the chart show it to be? Ah well. By the way, those of you born at the 'wrong' time may discover that the sun is in the constellation of Ophiuchus, which is not even a member of the Zodiac.
 - Some famous constellations are only visible from very southerly locations such as Hawaii. Print out a chart showing the time of night and time of year when Crux, the Southern Cross, can be well seen from Hawaii.
 - The 'Star of Bethlehem', visible at the time of Christ's birth, may refer to a gathering (conjunction) of the bright planets (Venus, Mars, Jupiter, and Saturn) in the sky. Scholars date the birth of Christ to as early as 4 or 6 BC. See if you can find any conjunctions of several bright planets near this time. Print your results. PS: There is no year zero.

- Above the Arctic Circle, the sun never sets during the summer time. At high northern latitudes it sets very late and rises very early. What time does the sun set on July 4 in Anchorage, Alaska, and rise on July 5? Because the sun never gets very far below the horizon it never really gets very dark at this time of year in Anchorage.

5. **Messier Objects:**

- Charles Messier was a French comet hunter working in the late 1700's who compiled a list of fuzzy objects in the (northern) sky, which were not to be confused with comets. Many of these objects are visible with binoculars and all are visible with a small telescope. The list includes all the most spectacular objects visible with a small telescope and is the favorite starting place of beginning (and veteran) sky observers. In its current form the list now includes 110 objects, labeled M1 to M110.
- Below is my personal selection of the more interesting and famous objects on this list (The list has been broken into two parts. Those objects with a special name, e.g. the Great Andromeda Galaxy, M31, and those without.)
- For each object:
 - Learn the type of object (supernova remnant, planetary nebula, diffuse nebula, open cluster, globular cluster, or galaxy)
 - Learn the special name, where applicable.
 - Learn the name of the constellation in which the object appears.
 - Learn which are visible with the naked eye from dark sites (and therefore often visible from suburban locations with binoculars).
 - Download a picture of the object from the web or copy one out of a book or magazine.
 - Put the above material together in a notebook for submission.
- Finally, I will test you by selecting twelve objects at random from the list, show you a picture from my library and ask you for the particulars (M#, name, type) of the object. A few objects are most readily identifiable when shown with their neighbors. They are listed together below. Open (or galactic) clusters are often hard to uniquely identify from a simple picture. M35, M41, and M44 need only be recognized as open clusters. Don't worry about which is which.
- Named Objects:
 - M1, M4, M8, M11, M13, M20, M27, M31 & M32, M33, M42 & M43, M45, M51, M57, M64, M97, and M104.
- No special name objects:
 - M35, M41, M81 & M82, M84 & M86, M101.
 - Finally, the famous Double Cluster in Perseus is a fine naked eye and binocular object which is not on Messier's list, but which I will expect you to know.

6. **Observing Projects:**

- There are a number of sky phenomena which some of you may find interesting to pursue. These will depend on the weather cooperating. Choose some from the following list and make a proposal. Get your proposal APPROVED by me.
 - **RISING AND SETTING TIMES OF STARS:** The stars rise about 4 minutes earlier each night and set about 4 minutes earlier each night. Pick a star you know well and time it's rising or setting time for a few weeks. This will require that you keep your watch precisely calibrated and that you observe from the exact same spot always so that you are using the same horizon each night. From your data, make your own estimate of the change in stellar rising and setting time. Indirectly, this is a measure

of the length of the year. Take 24 hours divided by your time estimate to get the estimated number of days in the year.

- **THE SUN: WARNING: LOOKING AT THE SUN CAN BE DAMAGING TO YOUR EYES!!** As spring approaches, the sun rises a little further to the north along the horizon and sets a little further to the north each day. Pick a location (or two) where you have a good view of a distant horizon (both East and West if possible). Take a few pictures at mid-day of the Eastern and Western horizons when the sun is high in the sky and NOT PART OF THE PICTURE. Then each day when it is clear, glance at the sun VERY BRIEFLY to note the place where it is rising or setting and mark (and date) it on your photograph. Over a period of a few weeks the northerly march of the sun as summer approaches should be readily visible. The first day of Summer is the day on which the sun rises and sets at its most northerly point. This occurs on June 21 and is also called the Summer Solstice.
- **THE MOON:** The moon rises about an hour later every night (and crosses a given point in the sky about an hour later each night). Observe the time the moon rises (or sets) for several nights. Or, observe when the moon passes some marker point which you can reproduce each night. For instance stand in the same exact spot each night and observe when the moon passes behind a light pole. The delay in rising and setting time of the moon depends on the time of year. The results you obtain for the Fall will not apply exactly to other times of year.
- **JUPITER:** The (four brightest) moons of Jupiter are visible with a small telescope and can be observed to change position relative to Jupiter in as little as a few hours. Plot the position of the Jovian satellites on several nights and see if you can identify which is which. The monthly chart in *Sky and Telescope* or a planetarium program may be helpful.
- **SUN SPOTS: WARNING: POTENTIALLY DANGEROUS PROJECT!!** Using the solar projection screen available on some of our telescopes, sunspots can be observed. By plotting the position of these over a period of several days, it is possible to measure the rotation period of the sun. The plotting can easily be done by simply putting a piece of white paper on the projection screen and marking the location of the spots with a pencil. Also, by watching for a few weeks one can get a feel for the average lifetime of a sunspot.
 - This project is **not** for klutzes or those with inquisitive children. Any attempt to actually look through the telescope at the sun will result in eye damage. The safety of the above method depends on projecting the image of the sun on a white surface and it is this image which is viewed with the eye, **not** the image through the telescope. The small finder telescope attached to the main telescope must be **removed** to prevent anyone accidentally looking through it. Finally, the telescope must be lined up with the sun by observing the telescope's shadow on the ground and moving it around until the sun's image appears on the white projection screen. This takes some coordination. At no time is it permitted to look through the scope to initially find the sun!!!!
- **LUNAR OBSERVING:** Observe the moon on at least three different nights and make a rough drawing showing and naming the lunar seas (Maria) and several prominent craters which are visible. The drawings should have accurate times and dates.

7. Astrophotography of Planets & Deep Sky Objects through Telescopes:

- These projects are likely to difficult to accomplish in a 5 week course. With the appropriate, but inexpensive gear, awesome pictures of the planets are possible. A

modest sized telescope and a few hundred dollars of software and hardware are all that are needed.

8. **Internet Project:**

- Choose three (3) astronomy topics of interest to you. If in doubt, check with me for appropriateness.
- For each topic, find five (5) good, different, Internet sites with useful information on this topic. (Different areas of the same site do not count as different!)
- Print out some of the most interesting pictures or information from each site; say 10 - 20 pages per topic.
- Include a paragraph for each site, rating its quality and usefulness (Be sure to include their URL's!). You may want to mention what level the site is aimed at - youth, beginning amateur, advanced amateur or professional astronomer?
- For each topic, write a few paragraphs summarizing some of the useful information you learned from the sites on this topic.
- Repeat for each of your three topics.
- You should demonstrate that you actually looked at these sites and learned something.
- There may be some overlap in sites between the three topics. Make sure you include at least ten (10) different sites total in your report.

9. **Light Pollution Project:**

- Our first assignment involves some research on light pollution. If you would like to pursue this topic further, talk to me and we will design a project.

10. **Your Project:**

- Give me a proposal.