Oregon Star Party Observing Program

Oregon Star Party

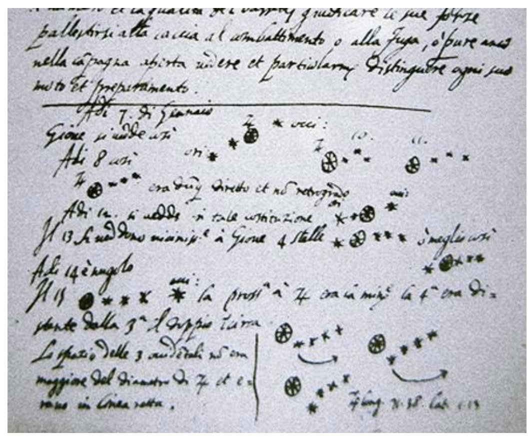
Prepared by James Still (*james.still@gmail.com*) and Brian Hatley (*hatleyb@comcast.net*)

Welcome to OSP! If you are a beginner who wants to start observing the sky and recording your observations then this guide is for you. Most amateur astronomers keep an observation log. If you don't already do so, the OSP observing program is designed to encourage you to start.

A Little History

Recording the night sky is a time-honored practice going back to most every ancient civilization. By the third millennium BCE the Egyptians were tracking the night sky and had created a 365-day calendar to predict the annual flooding of the Nile.

By 2000 BC the Babylonians had developed a base-60 number system and divided the night sky into our now-familiar 360 degrees with its 60-minute hours. Just last year a paper was published demonstrating that the Babylonians used a form of precalculus called the "trapezoidal rule" to calculate the velocity of Jupiter over time in order to predict its position in the night sky (*Science*, Vol. 351, Issue 6272, pp. 482-484). We have Babylonian cuneiform clay tablets from around 1800 BCE with mathematical calculations of the distance Jupiter travels as a function of velocity and time.



In early 1610, Galileo had improved his telescope design and built a 30X refractor. It saw first light when he pointed it at Jupiter and observed three of its moons in a straight line. Over the next several nights he observed, sketched, and made notes of the movements of Jupiter's moons (*image at right*). He published his findings later that year in a book entitled *Sidereus Nuncius* ("The Starry Messenger").

Thanks to careful observation logs amateur astronomers have discovered comets and just in the last few years it's been possible for amateurs to contribute to exoplanet research. Hopefully I've convinced you of the importance of logging your observations! Now let's go over the observing program rules.

Observing Program Rules

All observations must be made at Indian Trail Spring during the week of the Oregon Star Party. We encourage everyone to describe and sketch each of the objects. We have limited copies of blank log sheets on site for you to take and use. Or if you prefer you can use your own log book. Observations may be carried over to the next year if you do not complete them in one year, but they must be made on-site during OSP. Please have proof of OSP registration when you turn in your observations. An observation record should include:

- Your Name
- Date of Observation
- Time of Observation
- Observing conditions (*seeing* and *transparency, limiting magnitude also useful*)
- Type of instrument used
- Magnification used while observing the object
- A brief description of the object

Seeing is a measure of the steadiness of the Earth's atmosphere and **transparency** is a function of how dark the night sky looks to you. We use the five-point Antoniadi scale to record seeing where 1 is the best and 5 is the worst. In general the poorer the seeing the more the object seems to boil, blur or twinkle. Note that in general, seeing degrades as you begin to approach the horizon –

since the light from objects lower down in the sky take a significantly longer path through the atmosphere. If you want to split a tight double, do it when the star is well above the horizon.

Antoniadi Scale	
1	Perfect seeing, without a quiver.
2	Slight quivering of the image with moments of calm lasting several seconds.
3	Moderate seeing with larger air tremors that blur the image.
4	Poor seeing, constant troublesome undulations of the image.
5	Very bad seeing, hardly stable enough to allow a rough sketch to be made.

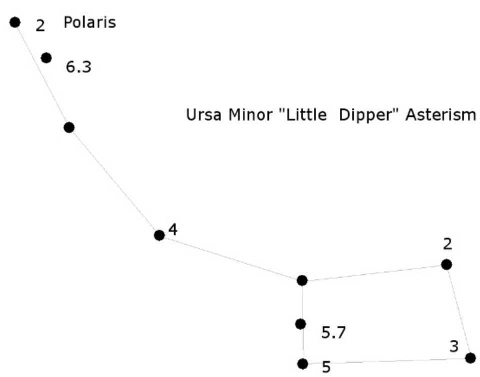
We use the Jordan scale to measure **transparency**. Several conditions can affect transparency: light pollution, moonlight, clouds or even an aurora.

Jordan Scale	
1	Very clear; transparent
2	Clear (can see low contrast objects like galaxies and nebulae)
3	Average; some haze (open clusters and most globulars are visible)
4	Below average; cloudy (large globulars are visible)
5	Very poor; heavy clouds (planets and very bright stars only)

Limiting magnitude tells us how bright the dimmest star is that the unaided eye can see. Although seeing and transparency contribute, light pollution, moon phase, and time after dusk/before dawn are larger contributors, as well as the observers eyes and/or adaptation. Thankfully, at OSP, light pollution has little to no impact – it's about as good as it gets.

A method to determine this is to look for stars that you know the magnitude for, and determine if you can see them. If you can, then the limiting magnitude is the brightness or better. Different observers have different favorites – some have been described in the OSP Observer during various years. For more detailed information, consider attending Howard Knytych's "Limiting Magnitude" talk at OSP.

The OSP Observer shows a northern star pattern around Polaris that can be used to determine limiting magnitude. An alternate object that may be simpler to use initially is the Little Dipper. It's a relatively dim constellation, visible all night from northern latitudes. See if you can locate stars in the familiar asterism – if you can, you know limiting magnitude is at least that good as the magnitude of the star you see. Note – you'll likely need to use averted vision to see much dimmer than 5. See pattern below – (values below 5 rounded).



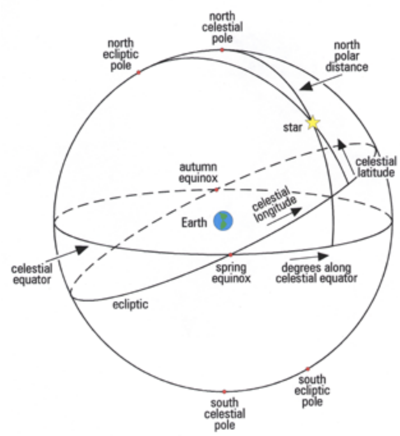
Use your best judgment following these descriptions. What's most important is that later you can look back on an observation you made and get a sense of the conditions under which you saw the object.

We'll post on the Information Tent bulletin board the days and times when you can bring your finished observing list to a reviewer who will then sit with you and go over your record. Even if you have yet to finish your list feel free to drop by and ask any questions you might have. Participants who successfully complete an observing list can purchase an OSP Observer pin on site.

Recording Your Observations

Orientation

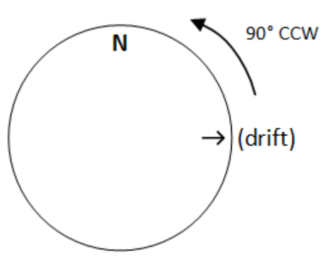
When describing or sketching an object you'll want to get in the habit of indicating which way is "north" in the field of view. North is a loaded word here. The sun, moon, planets, and stars all appear to rotate around us overhead inside a celestial sphere. This apparent sphere is an extension (or projection) of the earth outward in all directions so that the celestial equator aligns with the Earth's equator, the north celestial pole aligns with Earth's true north, and the south celestial pole aligns with Earth's true south. This is illustrated in the diagram below.



So when you look through the eyepiece which way is north? The easiest way to determine this is to find west. West will be the direction of drift. If your telescope has a motor mount shut it off. Then center a bright star in your eyepiece and watch it over the next minute or so, it will gradually move in your eyepiece toward one edge. *The direction of travel (or drift) toward which the star is moving is west.* Once you know which way is west then the north-south line will be perpendicular to the east-west line. To find north you must know what kind of telescope you have:

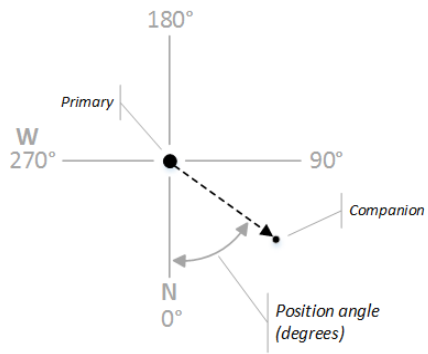
Refractor (straight through)	90 degrees *counterclockwise* from west
Refractor (star diagonal)	90 degrees *clockwise* from west
SCT (straight through)	90 degrees *counterclockwise* from west
SCT (star diagonal)	90 degrees *clockwise* from west
Newtonian/Reflector	90 degrees *counterclockwise* from west

By convention, when you sketch an object in a circle representing the field of view you denote the drift (west) with an arrow and north with the letter N. Here's an example from a typical Newtonian reflector where north is 90 degrees counterclockwise from west:



Double Stars

Double stars are a pair of stars that are either physically or apparently close. The brighter of the two is said to be the primary star and the other one is its companion (or secondary) star. Most references use the capital letter A to refer to the primary star and the capital letter B to refer to its companion star. When you observe a double star pair you're looking for two main things: (1) the separation in arcseconds; and (2) the position angle. Let's set separation aside for now since you need an instrument called a micrometer to measure it accurately. But you can and should be able to sketch the pair's position angle. In an inverting telescope (like a Newtonian reflector) double stars in the field of view have directions like in this diagram:



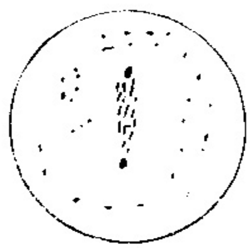
The position angle (abbreviated P.A.) is the angle in degrees as measured counterclockwise (CCW) from the primary star relative to north. In the diagram above the primary star is at the center. The companion star is about 45° or 50° CCW from north. In your sketch you would put the primary star at the center and estimate the P.A. of the companion star with north at the top. Most field guides (like the Night Sky Observer's Guide) contain double star charts listing the separation and position angles of major double stars in each constellation. See if you can first estimate the P.A. and then check your estimate against a field guide to see how close you came!

Another aspect of double stars – and often one of the most interesting – is the color differences. Colors are driven by the star's surface temperatures, and convey important information to astronomers. They also help make the observing experience that much more enjoyable!

Finally, some double starts are very close together. It you like pushing your skills and equipment to the limit, and seeing is good, it can be fun to see just how tight a pair you can split.

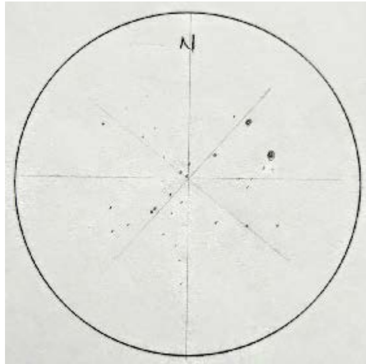
Sketching Deep-Sky Objects

Your sketches at the telescope do not have to be works of art. Very simple lines and dots get the idea across just fine. Here's a sketch drawn of a cluster in Cassiopeia in 1783 by Caroline Herschel, the first professional female astronomer. She used a 4.2-inch reflector (her "comet sweeper") with an eyepiece at 24X and about a 2° field-of-view:

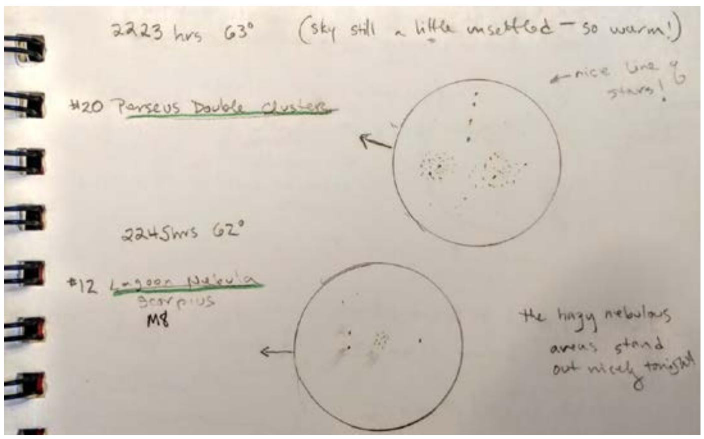


Notice the tell-tale signs of sketching in the dark: stars are irregular in shape or otherwise drawn hurriedly as little line segments. And yet the sketch is good enough! It communicates what she saw at the eyepiece. We see two bright anchor stars and a tightly-coupled group of dimmer stars in a narrow band between them. Other surrounding stars are drawn with distinct patterns that help put the whole field of view in context. The point is you don't have to be an artist to start sketching. However, the more you practice at it the better you'll get.

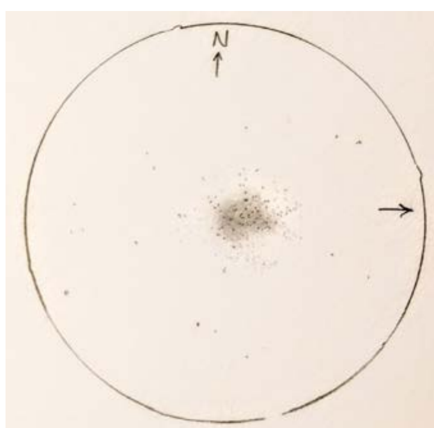
Ready to try your hand at sketching? Most people draw a circle on their paper as a template. Others find this too constricting. Try both and see which you prefer. When sketching any object (especially open clusters) it can sometimes be helpful to divide up your field of view into pie slices as in this sketch of NGC 457 in Cassiopeia:



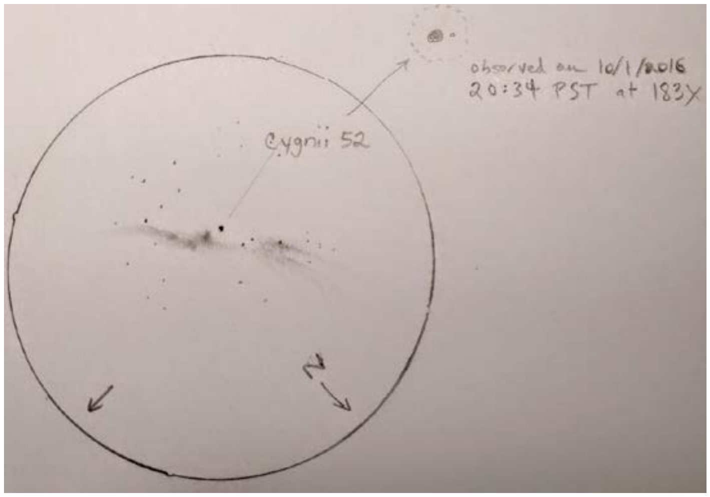
I like to do this with open clusters since they can otherwise be very intimidating to sketch. You'll want to add notes to your sketches and to record the date and time you saw the object. Who says these notes have to be on a printed template? Maybe you prefer something a little more free form as in this log book:



Notice how the drift is indicated in each of the two sketches. The recorder has also put down the time, temperature, and made some notes in the margin. There's no one way to do this so find the one that suits you best. Here's another example of M13 in Hercules (53X) showing both drift (West) and North:



Your notes and sketches are something you can refer back to often. You might also want to revisit them and add to them over time. Here's a sketch I did of NGC 6960 (the so-called "Witch's Broom" in the Veil Nebula) at OSP in August 2015. The next year I realized that I could add to it by showing that Cygnii 52 was a double star. So I observed it and added a little inset to the sketch. This is a very effective way to learn about the night sky and build up your knowledge of it over time.



Tips for Locating Objects Visually

If you are new at observing and locating objects in the sky – or are looking for pointers - this section is intended to provide some guidance on the subject, including use of a sky atlas, how to align and use a finder, and how to zero in on objects. We also give some tips on how observing conditions might impact what you can see. Finally, we share some tricks to seeing objects near the very limit of your equipment and eyes – taking best advantage of our exceptional dark skies here at OSP. We hope it will help you enjoy your time under the stars even more!

Using a Sky Atlas

To locate things – whether on the ground, or in the sky, it helps to have a map. A sky atlas is simply a map of the sky. Many sources explain them in great detail, and the specifics of how each atlas shows things varies. The goal here is to give you a quick overview, and some basics of how to locate things in any of them.

The sky is divided up into 88 constellations, based on (usually) recognizable patterns in the sky that resemble people, animals, or other objects. Though these are often shown as traced out patterns between the brighter stars, astronomers have defined specific borders for each. In the popular Pocket Sky Atlas for instance, these are shown as faint dotted lines. A good analogy is a road atlas of the continental United States. Such an atlas would show state borders, and may show a one or more states on page, along with portions of others. Where a city, town, or site to see is located can be defined by which of the 48 states it's in, based on where it's located relative to state borders. The location of objects relative to constellations in the sky is no different.

To get more precise about object locations, we need coordinates. On terrestrial maps, we use Latitude and Longitude. In a star atlas, we use Declination and Right Ascension.

The equivalent of Latitude (lines going around the globe parallel to the equator) is called Declination (or Dec) in a sky atlas, and is measured in degrees, minutes and seconds, just like on a terrestrial map or globe. They measure how far north or south you are from the equator, which is the zero reference. Declination lines are literally projections of the terrestrial latitude lines onto the sky. Zero degrees is the equator, +90 degrees is the north celestial pole, -90 degrees is the south celestial pole.

The equivalent of Longitude (lines around the globe all passing through the North and South poles) is called Right Ascension (or R.A.), stated in hours, minutes and seconds, since motions in the sky track like a 24-hour clock. Since there are 24 hours in a day, and 360 degrees around the equator, there are 15 degrees in an hour of Right Ascension.

The zero reference for Right Ascension is the Sun's location at the Vernal (Spring) Equinox. This line passes just outside of Caph in the constellation of Cassiopeia, near Alpheratz in Square of Pegasus (actually within Andromeda), and down through Pisces, Cetus, and Scultpor, then through Phoenix, Tucana, and Octans in the southern hemisphere (passing near 47 Tuc and the SMC.)

So, Declination and Right Ascension are the key elements of the coordinate system used to precisely locate objects in the sky. If you have these coordinates and a sky map, then you can locate them, just like on a terrestrial map. Constellations get you in the general area, Dec and R. A. get you to the exact spot.

Declination lines are often curved, typically horizontal, with the scale going up-down on the y-axis along the R.A. lines. Right Ascension lines are shown straight, typically near vertical (or as spokes from one of the celestial poles), with the scale going left-right on the x-axis (along the Dec lines).

What is different from a conventional map, is East and West in the sky aren't directions you face on the ground anymore – they are the directions objects appear to move due to Earth's rotation. Objects move from East to West – just like the Sun. Unless you are right on the Equator, North isn't on the horizon – it's above it (at least in the northern hemisphere like OSP), about where Polaris (the North Star) is. Also, since you are looking up, if you have a sketch or map of the sky where West is on your left and East is on your right, then North is down, not up.

If you point your scope at a spot in the sky, the apparent counter-clockwise rotation of the sky around Polaris will cause objects to appear to drift west. The scope view thus drifts towards increasing Right Ascension. (Rotation is counter-clockwise, approximately about Polaris.)

If you are pointing at the north celestial pole (near Polaris), you are at +90 degrees Declination. As you move farther away from it, and closer to the celestial equator, you reach 0 degrees. Below the equator (towards the South), Declination becomes negative, until at -90 degrees you reach the south celestial pole.

Finders

An essential aspect of locating things in the sky is using a finder of some sort. The eyepiece field of view (how big a part of the sky can be seen through it) through most scopes, even at low power, is just too narrow. Finders are typically part of most telescope setups and give a far wider field of view than the telescope itself.

Types

One type is a mini telescope, or "finder scope" attached to the main telescope. Typical versions of these have field-of-view similar to binoculars (4-8 degrees), about the size of the constellation Lyra. This lets you point the scope in a general direction, then look through the finder and get it approximately aimed by looking at the stars in the wide field of view. Note – many finder scopes, like telescopes, invert the image. Some flip the image back – some types will do this but as a mirror image, others are correct image (built like binoculars). During the daytime (looking away from the Sun!) you can look at objects (perhaps with text) and determine the type your telescope has.

Another type is a 1x style finder (sometimes called a reflex sight). With this type you look at the sky directly through a glass plate or lens where you view the sky unmagnified. The finder projects a pattern (circles or dot) that is superimposed on the sky. You use it by moving the telescope until the red dot or the center of the projected circles are centered on the area you want to view. There are several popular types. The Telrad style projects a multi-circle pattern with circles at 4, 2, and ½ degrees. The Rigel Quickfinder style is similar, with circles at 2 and ½ degrees. The Red Dot type (many brands) do just that - project a red dot that you align with where you want to point.

Alignment

Before using any finder scope, it's essential to align it first. Trying to find objects with a misaligned finder will mislead you and can be very frustrating. Make sure it's aligned well before every observing session – it will make finding objects much easier, and a lot more fun.

To align a finder, first complete any telescope collimation (alignment of internal optics) you may be planning first – any change to that will change where the scope is pointing. Once complete, find a bright star. Assuming it's visible, I like to use Polaris (the North Star), as it moves the least of any relatively bright star. You can use other stars, but you need to keep re-centering the scope. Another option in daylight is to use a distant tree-top or other recognizable object. Just make sure it's miles away. DO NOT POINT ANYWHERE NEAR THE SUN – best to point the opposite direction if doing this, for safety.

To start, use your finder(s) as they are, and a low-power eyepiece to get Polaris centered in the field. Polaris is the brightest star in that local area of the sky. If you really want to "dial it in" once you complete this switch to a higher power eyepiece, and center it again. Then, adjust the finder until Polaris is right in the center – on the cross hairs, on the dot, or in the center of the circles. Then go back and look through the eyepiece and confirm Polaris is still centered. To test – move your scope way off-target, then re-acquire using your finders. They should lead you right to the target. That's all there is to it! Remember – if you re-collimate, you need to re-align your finder(s). Also, sometimes mirrors can shift a little or the finder mount itself can move – causing the same issue. If your finder seems to be misleading you – re-check the alignment, and adjust if needed.

How do they adjust? Finder scopes typically have 2 or 3 adjustment screws or knobs that let you adjust how it's aimed relative to the scope. Both the Telrad and Rigel Quickfinder have 3 adjustment knobs that operate similar to collimation knobs on a telescope, and actually do move a little mirror inside the unit to aim the projected pattern. Red dot finders typically have two knobs – up/down and left/right. Another tip – make sure the finder mount itself is solidly attached, screwed down etc. so it doesn't move.

Locating an Object

Once you've chosen an object to find, found it in a star atlas (or observing program), and have your scope and finder aligned and ready, a process that's worked well for me goes like this:

1. Determine if the object is visible, or when it will be, and where it is approximately in the sky. A planisphere can used for this purpose (and to locate many bright objects as well). So can computer software or phone/tablet apps. To use a planisphere, rotate the disc to align the time of night (-1 hour for DST) and month to see approximately what will be visible at that time, and where. Locate the constellation of interest to see where it is in the sky. If it's not up yet, you can rotate to a different time to see when it will be up.
2. Visually locate the constellation of interest in the sky. A planisphere can help with this.
3. Locate the item you are looking for in that same constellation in your sky atlas or software/application. Note where the object is located relative to the visible stars.
4. Comparing the main stars of the constellation in your map and in the sky, position the scope so it's pointing approximately that direction. 1x finders make this especially easy. With a finder scope and a brighter object, it may be directly visible there (just small and/or dim).
5. 1x finders with circles can be used to "star hop" a known number of degrees at a time. A trick some use is to build a transparency with the pattern of their 1x finder on it, scaled to their star atlas. With this type of finder, it's unlikely you'll see the object directly unless it's a relatively bright star, planet, or bright deep-sky object. However you are able to see a very large area of the sky.
6. Now that you've pointed the scope with the finder, user your widest field eyepiece to look through the telescope for the object. Move the scope around to get the object approximately centered. With a typical telescope that inverts the view, a mindset that works well if you are operating the scope from the front (objective end) is "pulling the sky around".
7. If the object fills a reasonable amount of the field of view – you are done.
8. If the object is rather small, step up to your next highest magnification eyepiece, and see how it looks in that. Continue until you feel the view is optimum. You may find the object is worth a thorough look at several magnifications. For example, M11 has a beautiful "diamond dust" appearance a lower magnifications, but higher magnifications will show more details of the cluster.
9. Once sighted, periodically move the scope to follow the motion of the object, observe, and record what you see. Comment on details. Draw a sketch. You'll find that as you continue to observe, more details tend to reveal themselves. Enjoy!

Impacts of Limiting Magnitude, Transparency, and Seeing Conditions

Observing conditions can greatly affect how an object looks, how bright it is, and how much detail you can see.

Limiting Magnitude (competing light from other sources)

Limiting magnitude is driven by the amount of light in the sky that's not from the stars or other objects (moon and sun are exceptions). Lights from cities/towns are a big contributor (thankfully not a problem at OSP), dusk and dawn drive it as well, as does the phase and altitude of the moon, and (if your targeting very deep-sky objects), the Zodiacal light, and even aurora or other skyglow sources. Transparency can also impact it. As limiting magnitude degrades (for example, as dawn approaches), dimmer objects become difficult or impossible to observe, but brighter objects are still just fine (though perhaps with less contrast or detail.) As it progresses eventually your observing session is over. The moon, when more than just a thin crescent can also wipe out most deep-sky objects (that's why OSP is held around new moon each year).

Transparency (light blockage in the atmosphere)

Transparency is driven by the amount of water vapor or particulates in the air. Light haze is a mild example of this. Smoke and other particulates can have a more severe impact, and can make objects dimmer or change their color. One year, smoke from nearby forest fires made L1 lists a bit more like L2, and L2 more like L3 (and made most stars anywhere near the horizon very reddish). When smoke is the issue, often objects near and around zenith (straight up) can be near-normal, but as you scan towards the horizon things get noticeably dimmer or are completely invisible. This can vary throughout the night as winds change.

Seeing (optical distortion from the atmosphere)

Seeing is driven by atmospheric turbulence – in the column of air between your telescope and space, and also within your telescope (due to internal air currents as it cools etc.) More atmospheric motion increases image blur. The impact increases as telescope aperture goes up. This effect limits the sharpness and detail of the view, and effectively limits the useful magnification that can be used. One thing that can help is giving your scope plenty of time to temperature-normalize. This will help reduce air currents within and minimize locally-generated seeing issues. The rest of it depends on the weather and what's going on in the atmosphere in line with your target. Also, seeing in general degrades as your view approaches the horizon, since you are looking through more atmosphere.

The effect of seeing can be dramatic. On good nights, in a moderate-sized scope, either of the double-double pairs (typically highr overhead in the evening at OSP) can be cleanly split into tight, steady, separate stars. Other nights, with especially bad seeing, they can blur together into a fuzzy oval snowball, with no way to be sure there are even two stars there. So – for double stars, good seeing is a big help for splitting tight ones. Good seeing also helps you see dimmer stars, since they are sharp points rather than fuzzy blurs. Good seeing is also essential to observing planetary details. It can mean the difference between a fuzzy view moving around like a view through a glass of water, to crisp clear views of Saturn's Cassini and Encke division in the rings, or detailed surface features on Mars or even Jupiter's moon Io.

Seeing the Dimmest Objects – Averted Vision and Other Aids

So, how do folks working the L2 and L3 lists find all those dim or super dim objects? (Especially when they don't have huge telescopes?) Well, it turns out our eyes work differently at night than they do in the daytime. If we understand the difference, we can use it to our advantage.

The part of your eye's retina you use most of the time during the day – to read, drive, and generally look at things directly, is called the fovea. It contains a very high density of what are called cone cells. These cells provide our color vision, and are used for high-detail vision in brighter light. They are also spread out across the rest of our retina, but not with the same density (think in terms of much lower resolution). Want evidence? Try to read the left side of this page while looking at the right edge with your right eye. The main point here is the concentration of cones is so high in the central area that there are very few of the low-light rod cells in that area – in the center of our vision.

Rod cells provide our low-light vision. However, there are so few in our fovea (the center of our vision) that we actually have quite a bit less sensitivity to light there when dark adapted. So, when looking at the night sky, ***if you look to the side of something, it will look brighter***. Here's an example to try – and it's surprising. Look at the Big Dipper asterism in the North. Note the star that ties the handle to the bowl (Megrez). Easily visible right? Now stare ***directly*** at it. It disappears! (Or nearly so.) This is a great example of the benefit of averted vision (or actually, the disadvantage of looking right at a dim object).

When using this aid at the eyepiece, it can make a big difference. And, here's another tip. Our eyes also have a built-in blind spot, where the optic nerve attaches, which we normally don't notice. To avoid it, use the following rules: when observing with the right eye, avert to the right. When observing with the left eye, avert to the left. (Or up or down.) ***Don't*** avert to the left with the right, or right with the left.

Another characteristic of our rod cells is very good sensitivity to motion. (I suspect this helped our ancient ancestors navigate through and survive the night.) How can this help us observe? I've found that when you are looking for objects at the limit of your equipment and vision, jiggling the scope a bit or slowly scanning sometimes coaxes out stubborn objects.

Interestingly, cone cells don't work as well scanning for small specs in the sky as the rods do – which may have to do with the lower density away from the fovea. This becomes very obvious if you try something unique like finding Venus during the daytime (when it is ***well away*** from the Sun). It turns out Venus is easily visible during daylight, and is actually quite a bit brighter than the surface of the moon. But, it's tiny, so you have to scan for it, and it turns out this is very hard to do. Even if you have already found it, and look away briefly, finding it again still takes some effort. So, averted vision doesn't help in the daytime! A big difference compared to finding a star in the sky at night.

Keeping oxygen levels up also can't hurt. Breathing deeply can give a bit of a boost when needed. Note also, OSP is at 5000 feet – which means most of us are running with a little less than normal anyway.

Want to see deeper yet? Use a shroud – in other words, cover your head and eyepiece when observing the dimmest objects, or seeking out the most subtle details. I use a large dark bath towel for this. Others have built creative apparatus to do the same job. Why would that help at OSP you ask - which is such an amazing dark site and all? Well, try it and see. It turns out, even natural sky glow can be significant. I tried using a shroud one night when I was having trouble finding a really dim planetary nebula. At the time I didn't expect it to help much, but what did I have to lose? As it turned out – it made a big difference. It actually let my eyes dark adapt more than usual, and I found the nebula (and it was worth the effort). What was surprising is how well I could see around the site when I took the shroud off! Anyway – see what you think. A final pointer on using a shroud - if the view starts to degrade – double check that the eyepiece isn't starting to accumulate dew from your breath.

Conclusion

That pretty much covers the basics of creating observing sketches, finding the objects to sketch, and optimizing your observing experience with some understanding of observing conditions and some basic equipment know-how (including your eyes).

Enjoy your time here at OSP. Look for hawks and dust devils during the day and listen for coyotes and owls in the middle of the night. But most of all have fun!

(v1.1)