Observing the Sun, Moon & Planets

by Ken Graun

Observing considerations

On average, solar system objects, especially the Moon and planets can use a lot of magnification. This potentially will bring out detail. But, unfortunately, our atmosphere is often turbulent and limits the amount of magnification that can be used. On some nights, when the atmosphere is steady, magnifications of 200x to 400x are possible and the detail that you will see is tremendous. But, unfortunately, really great seeing is infrequent.....so read on.

Seeing

There is a 1 to 10 Seeing scale (yes, the scale/term is called "Seeing") that amateurs use to indicate seeing conditions. "1" is the worst—everything is basically blurry and "10" is crystal clear seeing, that is, you can use any magnification to see details on the planets or Moon. Both 1s and 10s are rare so you end up with something in the middle, most of the time. If you hit a 9 or 10 night, stick with observing at that time because you don't know when you will get another like it!

The planets and the Moon are ideally observed at higher magnifications of around 200x plus because you can see more detail at higher magnifications. *However*, you might be limited to 100x or so if the atmosphere is turbulent, which is more frequent than any of us would like.

You will know if the atmosphere is turbulent because images of the planets will be blurry as you increase magnification, so you back down the magnification until the image quality is reasonable.

Almost, always, the seeing is better the higher you go in altitude. Seeing is almost always poor near the horizon because you are looking through more atmosphere. Generally the planets and Moon look horrible when near the horizon, that is blurry, but the higher up they are, starting around 1/4 the distance up from the horizon to the top of the sky, the better/clearer they usually look.

City Slickers

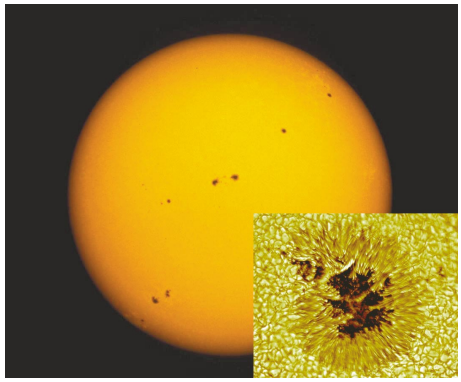
Because of Light Pollution, major cities are bad for observing the night sky, especially the stars but NOT some planets and the Moon! Venus and Jupiter are visible in major cities—they are not the lights of airplanes. So, if you have a scope, observe them—imagery should be fine. Now, when Mars is close to the Earth every 2 years, you will see it with your eyes and can observe it from the city. And, depending on your city, Saturn might be naked eye, so that's one more planet you might be able observe.

Special Solar Filters **MUST** be placed over the entire aperture of any telescope to SAFELY observe the Sun.

Safety in observing the Sun!

The Sun is exceeding bright and just staring at it for a short period of time can damage your eyes. With any optical system, including telescopes, binoculars or the viewfinder of a camera, you can quickly and permanently damage your eyes looking at the Sun without the use of special solar filters. With properly fitted solar filters, it is safe to look at the Sun and there is a good chance that you see some sunspots.

NEVER
LOOK AT THE SUN THROUGH ANY OPTICAL DEVICE THAT IS NOT PROPERLY FITTED WITH A SOLAR FILTER! SERIOUS EYE DAMAGE WILL RESULT!



Above. A properly fitted white-light Solar Filter allows you to safely view sunspot. At this time, 2022, the Sun is fairly active with sunspots.

Observing Venus

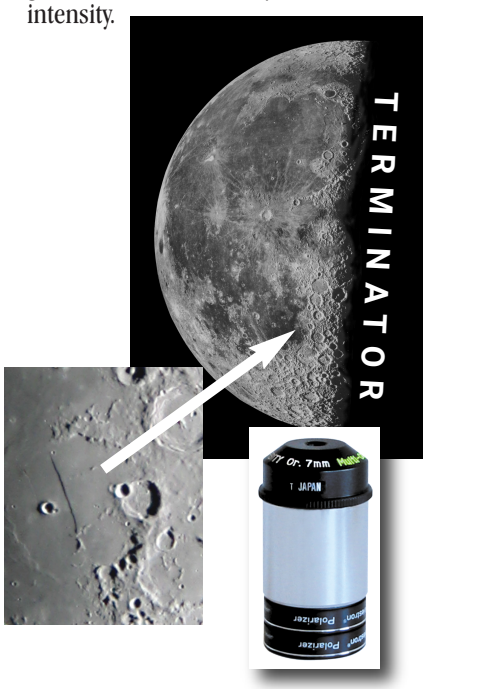
Venus has no features because it is completely covered in white clouds. But, because it orbits inside Earth's orbit, it will cycle through phases just like the Moon. It is pretty to see Venus as a crescent. And, because it orbits inside Earth's orbit, it is only visible for a few hours after or before sunset. Remember, Venus is *always* the brightest planet and "star" in the whole sky. When it is shining very bright, you might wonder what it is and if the Moon is not out it will cast shadows.

Observing the Moon

The Moon is a wonderful object to observe. When the atmosphere is steady and allowing you to pump up the magnification to 250 or so, you will feel like you are flying over its surface.

The terminator is the "line" that divides the night side from the day side. Craters appear their best, because of contrasty shadows, along the terminator. So, the Moon is not great to observe at or near full because the craters appear washed out.

When the Moon is bright, and you observe the Moon through a telescope, your eye will get fatigued because the image will be intense bright To reduce the brightness, you need to screw in light reducing filters at the bottom of the eyepiece. My preference are two polarizing filters that can be turned against each other to vary the admitted light. You can also use a single dark Neutral Density Filter to reduce the intensity.



Above. The craters along the Moon's Terminator look the best because of the contrast from shadows. The Straight Wall is a favorite object. It is 70 miles long fault with a height topping 900 feet. The Moon can be bright to the eye. To lessen eye fatigue, use two polarizer at the bottom of your eyepiece to turn down the brightness.

Below. Venus appears as a crescent when it is closest to Earth.

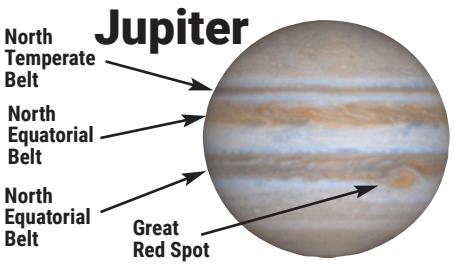
Observing Jupiter

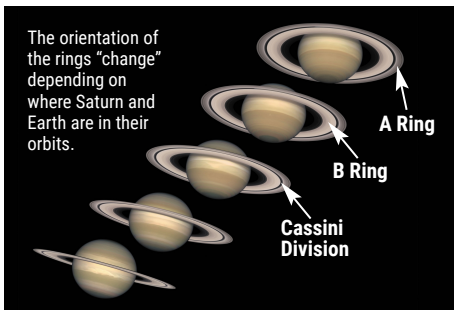
This is an easy and "exciting' planet to observe because it is large in scopes, even at lower magnifications, and there is always something happening with its four moons.

One of the first thing that you will notice when observing Jupiter are the "stars" that are close to it but they are the Galilean moons—these are those four. You will often see four but this can be reduced by one or two because sometimes one or two can be either directly in front or behind the planet. When in front, if you scan Jupiter closely, you should be able to see a small round shadow (need reasonable seeing). Although the four moons are often in a line, their overall positions change and you can see movement in several minutes, especially when they are close to the limb of Jupiter. Some configurations of the moons are geometric and just beautiful!

The other features that are noticable are its parallel cloud belts, especially the prominent North and South Equatorial Belts. The Great Red Spot, which is larger than Earth is embedded in the south Equatorial Belt. It was redder in the past but is now paler.

With bigger scopes and/or a stable atmosphere, you can see more bands and festoons (circular cloud storms) within and around the bands.





Planet	Diameter	Rotation	Revolution	Distance
Sun	865,000	30 days	–	–
Mercury	3,032	59 days	88 days	36 million
Venus	7,521	243 days	225 days	67 million
Earth	7,925	24 hours	365 days	93 million
Mars	4,228	24.5 hours	687 days	142 million
Jupiter	88,844	9.8 hours	11.8 years	484 million
Saturn	74,900	10.2 hours	29 years	887 million
Uranus	31,764	18 hours	84 years	1.8 billion
Neptune	30,777	19 hours	164 years	2.8 billion

Observing Saturn

Of course, Saturn is known for its magnificent rings and they are truly magnificent!

No one knows exactly how old and how the rings formed but they are made mostly of water ice, with an average size of about an inch across. The diameter of the visible rings is 170,000 miles. Overall, the thickness of the rings vary from a few to 100 feet or so.

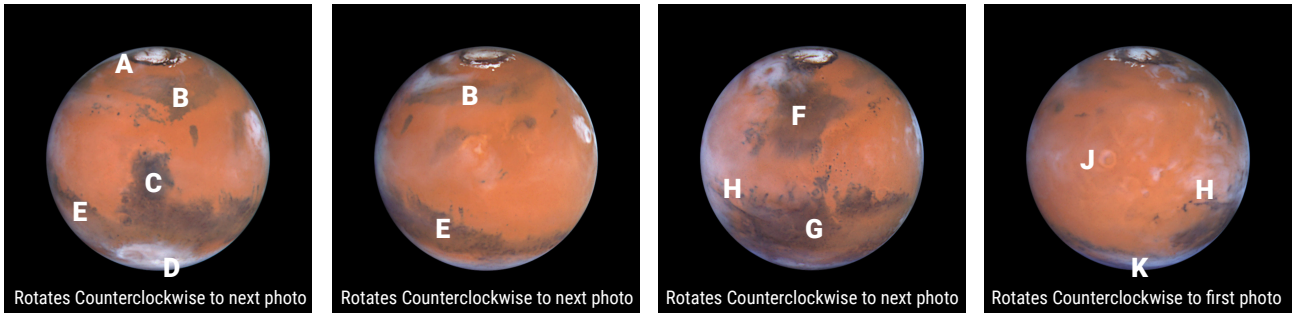
Although there are many divisions in the rings, the two major divisions are called the A Ring and the B Ring. They are separated by a 3,000 mile black gap called the Cassini Division which can be seen on nights when the atmosphere is more stable. The inner B Ring is bright and the outer A Ring fainter but both are always visible.

Saturn has five moons that can be seen in small scopes. Four are fainter and look like little specks of light close to the planet/rings. Titan, which is the second largest moon in the solar system is fairly bright and often a little farther away from Saturn that you might expect.

Uranus & Neptune

Both of these planets are not visible to the naked eyes. My recommendation is to use a GOTO telescope to locate them. Both will be very small in a telescope. Uranus is blue-green in color and Neptune more blue.

Mars



Observing Mars

Mars is a really neat planet to observe because of its polar caps, various surface colorations, and clouds.

Unfortunately, you can only effectively observe Mars every two years when it gets close to Earth, otherwise it is too small to really see any detail. You have about 3 really good months to observe it when close. And, it is not really large even when close. When Mars gets close, when it is at opposition, it will be very bright in the sky rivaling Jupiter—you can't miss it. Opposition is when Mars is directly behind the Earth, in line with the Sun. At this time, it rises in the east as the Sun sets in the west.

Atmospheric turbulence will dramatically interfere with seeing details on Mars. So, around opposition, view it as often as possible and the closer to midnight, the better, because this is when it is the highest in the sky. By observing often, you will get to see all of its "sides" and have a greater chance of hitting an exceptional night or two when the atmosphere is very stable allowing really great views of its surface using higher magnifications.

Four sides of Mars

Note: The lighter/darker surface colorations are more or less permanent and are nothing more than a difference in the "soil" color cause by dust and exposed rocks/soil. Also, clouds are present on Mars, but they are not widespread as on Earth.

- **A**. North Polar Cap. Usually fairly prominent but if Mars' axis is tilted from us, may not be visible.
- **B**. Utopia—dark surface coloration.
- **C**. Syrtis Major, a unique and prominent shape—dark surface coloration.
- **D**. Hellas, a very large impact basin. Usually there are clouds over it. It is *not* the South Polar Cap.
- **E**. Sinus Sabaeus—dark surface coloration.
- **F**. Mare Acidalium—dark surface coloration
- **G**. Mare Erythraeum—dark surface coloration.
- **H**. Valles Marineris is a 2500 mile long grand canyon but don't expect to see it.
- **J**. Olympus Mons. The largest inactive volcano in the solar system. Sometimes it has clouds over it making it identifiable. It is to the right of the letter J.
- **K**. South Polar Cap is not visible in any of these photos but it is tiny in comparison to the North Polar Cap.

Hey, what about Mercury?

I think it is more exciting to see Mercury visually with your eyes than through a telescope. Since Mercury is very close to the Sun, it does not poke itself very far from our rising and setting star, making it more difficult to "catch." Usually there are a few times each year that you can catch it before it sets or gets lost in daylight—you have about an hour to spot it.

Hey, what about Pluto?

Pluto cannot be viewed in any small telescope because it is too faint. You need a minimum of a 15-inch diameter telescope to just see Pluto and it would be difficult to even identify it because it would look indistinguishable from the many other faint stars. Years ago, I photographed Pluto on film using a 4-inch refractor over three days and I identified it by its movement amongst the background stars.