

A Great Year for Mars

The Red Planet won't be as good as this again until 2035.

It's time to cash in those Mars chips. The Red Planet reaches one of its best recent oppositions on October 13th, when it will be just 62.7 million kilometers (39.0 million miles) from your front door — close enough to outshine planetary kingpin Jupiter, and large enough for satisfying telescopic views of the Martian surface.

Mars will actually be about 664,000 kilometers nearer on October 6th, when it has its closest approach to Earth. Martian perihelion occurred on August 3rd, and ever since the planet has been

slowly moving away from the Sun, while at the same time Earth has been catching up in its orbit. The result is the October 6th “sweet spot” — a compromise between Mars's increasing solar distance and proximity to Earth.

Mars circles the Sun in a slightly elliptical orbit, and so its distance from Earth varies at each opposition. The two planets are at their closest when Mars's perihelion and opposition occur at roughly the same time. These so-called *perihelic* oppositions are when Mars shines exceptionally bright and presents

▲ UK planetary imager Damian Peach captured this sequence of images as the distance between Mars and Earth decreased during the 2018 apparition.

a disk near its maximum size. Unfortunately for observers at mid-northern latitudes, the timing of these favorable oppositions often coincides with Mars sinking to the bottom of the ecliptic, where it's positioned very low in the sky. Poor seeing at low altitudes often muddies the view, making it difficult to discern surface details except on nights of nearly perfect steady seeing.

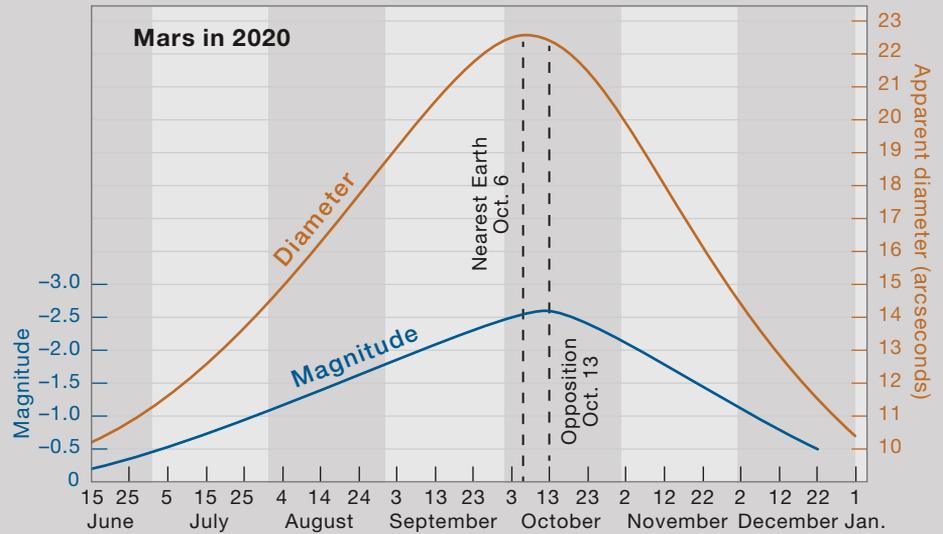
That's why the current opposition is so exceptional — it's a perfect balance between proximity and altitude. On October 13th Mars shines from Pisces

at a declination of slightly greater than +5°, which is a full 30° higher than during its 2018 opposition. Size-wise, the planet swells to 22.6" this time at closest approach (on October 6th), compared with the 24.3" it achieved during the last go-round. Get your scope tuned up and clean your eyepieces because Mars won't be this close again until 2035.

Surface highlights. The Martian south pole nods 20.4° earthward this opposition, offering spectacular views of the feature-rich southern hemisphere, including the South Polar Cap (SPC). Martian southern hemisphere summer began on September 3rd, so much of the cap's frozen carbon dioxide has vaporized into the planet's thin atmosphere. Still, on steady nights with a 6-inch or larger telescope used at high magnification, you should nevertheless be able to detect a remnant of the SPC's former expanse.

While the North Polar Cap (NPC) is tipped out of view it should be easy to spot the lens-shaped North Polar Hood (NPH), located along the northern limb of the Martian disk. Comprising clouds that huddle over the planet's north polar region in winter and early spring, the NPH is often so bright that beginning observers understandably confuse it with the NPC.

Martian surface markings make the planet both a joy and a challenge to explore. Mars rotates once every 24.6



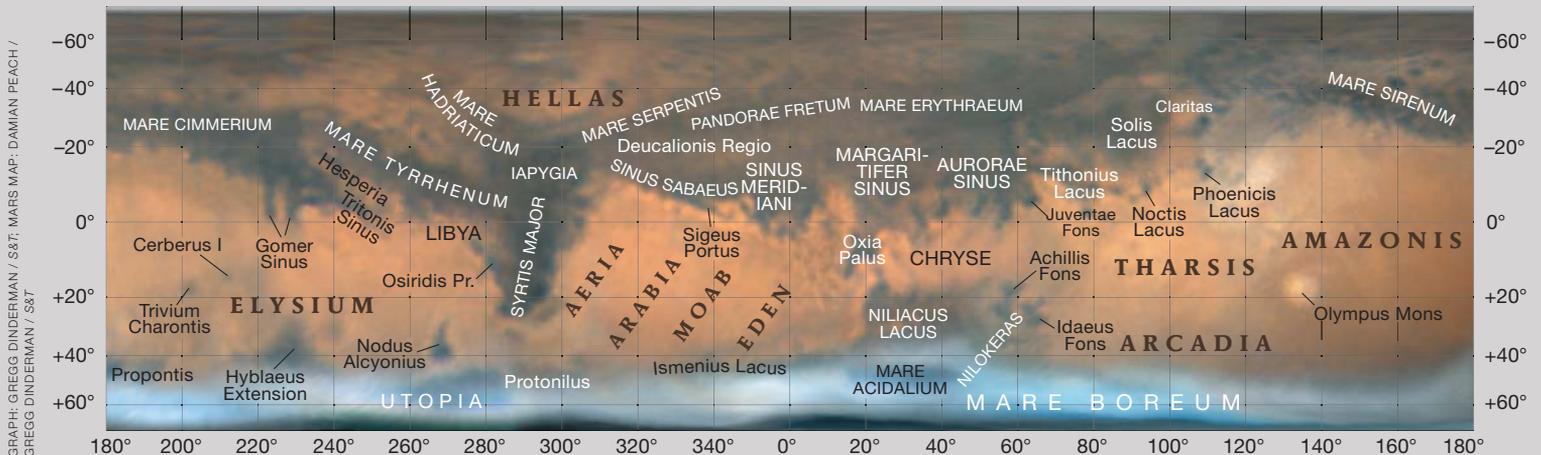
hours, nearly the same rate as Earth. That means features drift 9.5° of longitude toward celestial east each passing night. So, if you observe the planet around the same time each night you'll notice that a given marking gradually slides eastward. Any marking seen on a particular night at a specific time will return to that spot at the same time 41 days later. An orange eyepiece filter (Wratten #21) will help the dark markings stand out better against the bright desert regions.

Let's take a quick tour of the most prominent features, starting with the thumb shape of Syrtis Major, an ancient shield volcano composed of dark basaltic rock. Like a low, thick branch extending from the trunk of a

tree, Mare Tyrrenum reaches to the south and west of Syrtis, ending at a bright gap called Hesperia, which separates it from the dark garland of Mare Cimmerium.

Follow the arc of Cimmerium and you'll arrive at a short, dark stripe called Mare Sirenum, the most prominent albedo feature on the planet's "boring" hemisphere, where easy-to-see formations are few and far between. A cursory glance may reveal nothing but a bland orange desert extending all the way to the NPH; however, if you look more carefully you might just spot one of the solar system's biggest volcanoes, Olympus Mons. Towering 25 kilometers above the surrounding desert and covering an expanse about the size of France,

▼ Use this map to locate key surface features on the Martian surface. South is presented up to match the orientation in Newtonian reflector telescopes, as well as refractors and Cassegrain instruments used without a right-angle diagonal.



GRAPH: GREGG DINDERMAN / S&T; MARS MAP: DAMIAN PEACH / GREGG DINDERMAN / S&T

Olympus Mons is often topped with bright, white orographic clouds that give away the volcano's location.

Returning to Mare Sirenum, let's continue west. Get out your swimsuit because we'll soon arrive at Solis Lacus (Lake of the Sun), a prominent, circular dark patch that looks like a giant eye. Nearby Mare Erythraeum is blotchy and resembles the shape of Russia. Auro-rae Sinus splays its fingers northward alongside a delightful Martian version of a soul patch called Margaritifer Sinus. While in the area, take a side excursion across the desert of Chryse, into the northern hemisphere to visit the prominent, mesa-like duo of Niliacus Lacus and Mare Acidalium. Despite being tipped away from us they're worth a look.

Besides Syrtis Major I also anticipate the appearance of Sinus Meridiani and Sinus Sabaeus, which blend together to resemble a marshmallow on a stick. A quick jaunt across Sinus Meridiani brings us to the great arch of Mare Ser-

▼ Several prominent Martian surface features appear in this image from August 2018 showing the face of the planet often regarded as the most interesting. The bright oval near the South Polar Cap is the Hellas basin; Syrtis Major, Sinus Sabaeus, and Sinus Meridiani are the most conspicuous dark markings.



▲ This pair of Hubble Space Telescope portraits shows how the state of Mars's atmosphere drastically affects what we see. During the May 2016 opposition (left) many dark albedo features are visible; however, a global dust storm in July 2018 (right) partially obscures surface detail that stood out clearly several weeks earlier.

pentis branching east from Syrtis Major. Immediately south of Syrtis you'll find Hellas. Spanning some 2,300 kilometers, it's the largest impact structure on Mars. Even a 4-inch scope will show this enormous basin as a pale, round patch bounded by dark albedo features. At certain times of the year Hellas is coated with frost, transforming it into a misplaced faux polar cap.

Atmospheric features. Watch for isolated clouds as well as pale white limb hazes created by dust and dry-ice crystals scattering light high in the Martian atmosphere. Morning clouds form at the (celestial) east limb, evening clouds at the west limb. Violet and blue filters (Wratten #47 and #80) help enhance the visibility of these clouds.

As noted earlier, southern hemisphere summer began on Mars on September 3rd, so be on the lookout for the formation of dust storms, which tend to break out during this season. They can form in many places, but keep a close watch on Chryse, located between Margaritifer Sinus and Niliacus Lacus, and the region due south of Sinus Meridiani. If a feature you saw one night appears altered or disappears several nights later, a storm is the likely reason. A yellow filter (Wratten #8) shows dust clouds most clearly.

Mini moons. Mars has two tiny satellites: 10.7-magnitude Phobos and 11.8-magnitude Deimos. I observed them several times at favorable oppositions with an 11-inch telescope and an

eyepiece fitted with an occulting bar. You can make your own by taping a tinsel-wide piece of aluminum foil to the eyepiece's field stop. (Basic designs such as orthoscopes and Plössls are best suited to this modification.) Use magnifications of 200× or greater, and position Mars behind the occulting bar. Seek the moons when they're at maximum elongation.

Although Deimos is fainter than Phobos, it orbits farther from the planet, which makes it easier to spot. At their greatest elongations this opposition, Deimos is about 67" from Mars, while Phobos ventures just 20" from the Martian disk. Were it not for the planet's overwhelming brilliance, both moons would be easy to see in a 6-inch scope. Most planetarium software will show the current locations of Phobos and Deimos.

On the evening of October 2nd, the nearly full Moon passes just 1° south of Mars, as if to herald the arrival of the most exciting phase of the Red Planet's current apparition. Settle in with your telescope and enjoy the show!

HELPFUL RESOURCES

To find out which side of Mars is visible at any time use S&T's Mars Profiler: <https://is.gd/marsprofiler>.

For the location of the two Martian Moons, visit: <https://is.gd/MarsMoons>.

Instructions for making an occulting bar are here: <https://is.gd/OccultingBar>.

