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◀ This May 2014 image by the European Space Agency's Mars Express orbiter captures a mid-summer view of the shrinking North Polar Cap (right). Vaporizing ice generated strong winds that spawned a low-pressure system rich with water-ice cirrus clouds (left). Dust raised by seasonal storms helped create the Cap's characteristic laminated ice-and-dust deposits.

NORTH POLAR CAP: ESA / DLR / FU BERLIN / J. COWART, CC BY-SA 3.0 IGO; MAP: DAMIAN PEACH / GREGG DINDERMAN / *S&T*

Mars in Fine Form

The Red Planet's draw is irresistible even during a relatively distant opposition.

Mars doles out face time like Charles Dickens's penny-pinching Scrooge parts with money. Observers feel an urgency to get their scopes out on good nights for the few months every two years when the planet is closest and at its best.

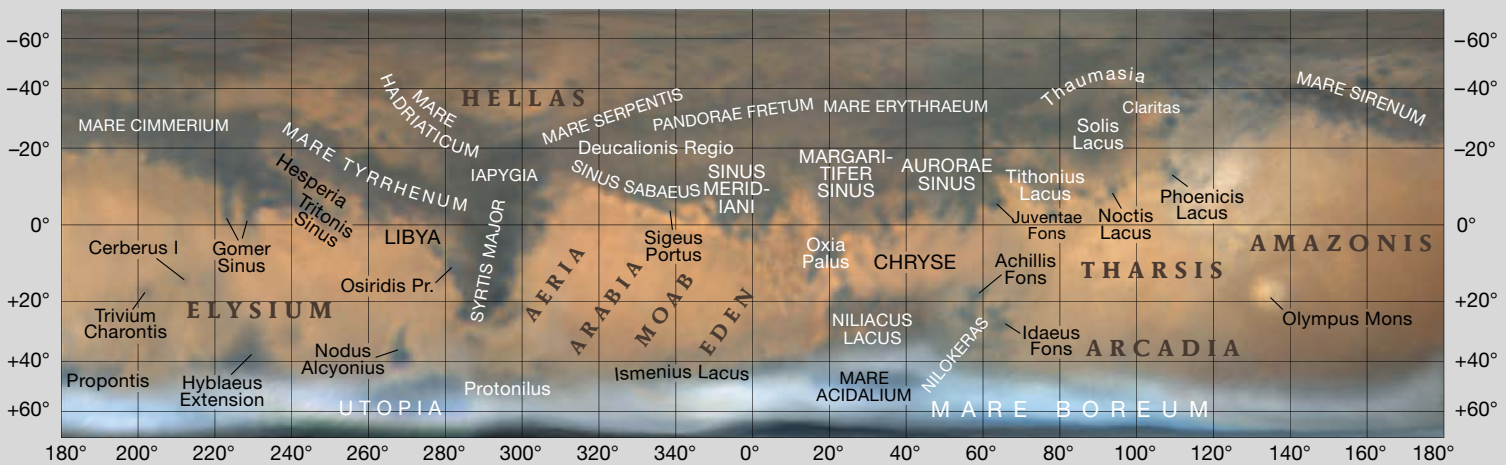
Mars equals Sirius, the brightest nighttime star, when it reaches opposition on January 15/16 and shines at magnitude −1.4. That night the Red Planet forms a nearly straight line with Castor and Pollux in Gemini and stands in stark color contrast to blue-white Sirius. Closest approach to Earth occurs on January 12th, when the two planets are 96.1 million kilometers (59.7 million miles) apart.

The Red Planet can be frustrating to observe with a telescope and tests our resolve like no other target. The cold, desert world is big enough to allow glimpses of dark surface markings and patchy, bright atmospheric features, but clearly discerning such details requires high magnification, which unfortunately exaggerates the effect of sub-par seeing conditions. If your observing site is like mine, better than half the nights in a year are challenging for planet observing. Fortunately, most amateurs possess the requisite attention span and patience to net those rock-steady seconds of perfect calm when all is revealed.

During its closest recent opposition, in July 2018, the Martian disk grew to 24.3″ in apparent diameter. This time it maxes out at 14.6″. While its smaller size is disadvantageous, the current apparition's northern declination provides significant compensation for observers at mid-northern latitudes, who will get to enjoy the planet's improved altitude.

If the orbit of Mars were more circular, it would always remain about 78 million kilometers away at opposition and have an apparent diameter that would vary little. But our rusty-dusty neighbor's orbit is eccentric, which causes its distance from the Sun to vary considerably over its 687-day period. As a result, we see the planet best at oppositions that occur at or near Martian *perihelion*, when the planet is closest to the Sun; those that happen around *aphelion* (farthest from the Sun) are less favorable. Oppositions follow an approximately 15.8-year cycle from one perihelion to the next. The most distant opposition in the current series takes place in February 2027, when the planet's disk spans 13.8″.

But even during a middling opposition like this year's, Mars is an intriguing telescopic sight. The North Polar Cap (NPC) features prominently this time and should be easily visible in a 3-inch telescope as a gleaming, lens-shaped dab of bright white. Northern-



hemisphere spring began on Mars last November, when the clouds of the North Polar Hood slowly began to part and reveal the polar cap. As the season progresses, the NPC's carbon-dioxide ice sublimates and exposes the permanent water-ice lying beneath. A dark collar of basaltic sand dunes, part of which comprises Mare Boreum (see map), encircles the NPC and helps define its boundaries. The dunes typically become more prominent as spring deepens and the cap shrinks.

Prominent dark albedo features in the northern hemisphere include the vast, low-lying plain of Mare Acidalium, which looks like a truncated version of Syrtis Major, the enormous, thumb-shaped shield volcano in the planet's southern hemisphere. Niliacus Lacus and Oxia Palus appear as dark, southward extensions of Mare Acidalium. See if you can also spot the dark hump of Utopia — another northern-hemisphere albedo feature, located at about the same latitude as Mare Acidalium but north of Syrtis Major. To Utopia's south you'll see a large, pale expanse dubbed Utopia Planitia. With a diameter of about 3,300 km, it's the largest known impact basin in the solar system. It's also where NASA's Viking 2 lander touched down in September 1976.

On nights of very steady seeing, additional dark markings materialize from the Martian glare. Some of the easier ones include Sinus Sabaeus, Sinus Meridiani, Mare Tyrrhenum, Mare Cimmerium, Aurorae Sinus, and Mare Erythraeum — all located in the southern hemisphere. South of Syrtis Major, look for Hellas, a large, circular impact basin with a pale floor. When it's covered in frost or overtopped by clouds, it mimics the appearance of the South Polar Cap.

If you manage to see these, try for subtler features such as Solis Lacus, Idaeus Fons, and the towering extinct volcano Olympus Mons. Every opposition I look for orographic clouds hugging its slopes. I succeeded once!

Color eyepiece filters work wonders on Mars. A light-red Wratten 23A for smaller scopes and deep-red Wratten 25 for larger instruments will show dark albedo markings more clearly. For clouds and limb haze, a blue Wratten 80A or 38A improves the contrast. A magenta filter (Wratten 30) enhances both surface and atmospheric details, while an orange Wratten 21 can help identify and enhance the visibility of dust storms. Although most major storms occur during southern-hemisphere summer, they can appear anytime, so remain vigilant. As the NPC continues to shrink during Martian spring, powerful seasonal winds can whip up a dust storm in a hurry.

A day on Mars lasts approximately 39 minutes longer than one on Earth, so a feature on the Martian central meridian will reappear there 39 minutes later on the following night. If you view Mars at the same time on successive nights, the planet will seem to slowly rotate backwards.

To find out which face of Mars you're observing, use our online Mars Profiler Tool at **https://is.gd/marsprofiler**.