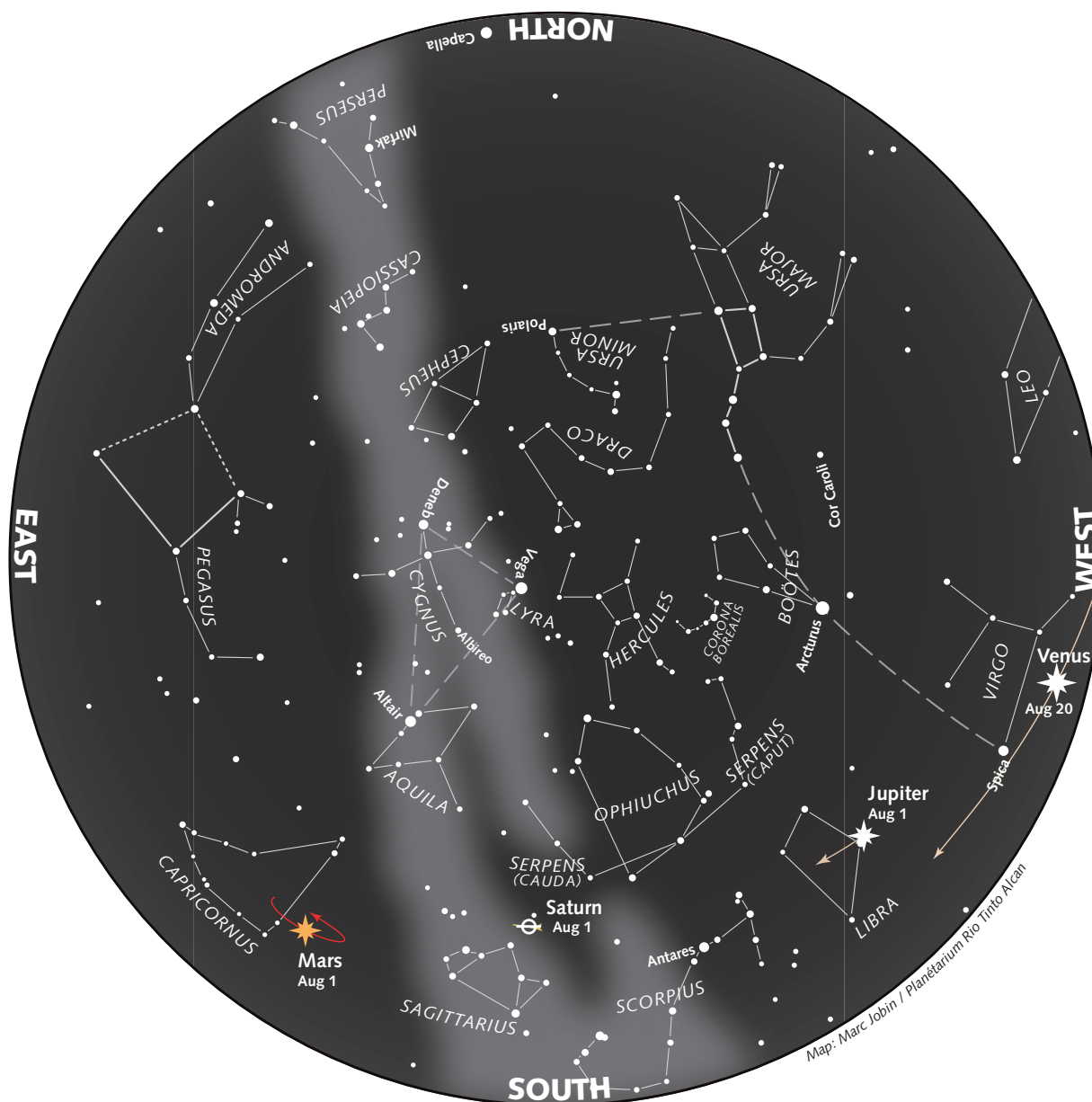


## The Starry Sky — Summer 2018



### How to Use this Map

The above map represents the night sky as it appears at the indicated times, and remains usable several hours before and after.

Hold the map up to the sky in front of you and turn it so the direction you are facing appears at the bottom. Lines identify the constellations. The light-coloured area outlines the Milky Way.

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### This Star Map is Accurate on...

(Eastern Daylight Time)

June 21 at 1 a.m.

July 6 at midnight

July 21 at 11 p.m.

August 6 at 10 p.m.

August 21 at 9 p.m.

September 6 at 8 p.m.

# All Eyes on Mars

About every 26 months, Earth catches up with Mars and draws closer to the planet during an opposition period that amateur astronomers spend almost two years dreaming about. For a few weeks, the distance between our blue planet and the red planet is much reduced. This summer, the opposition of Mars is particularly striking since the planet will be the closest, brightest and largest-looking it's been in the past 15 years.

## With the naked eye

Mars summers on the west side of the constellation Capricornus, near its border with Sagittarius. You can't miss this brilliant orangey dot, the most luminous object in a region devoid of bright stars. In early summer, the red planet emerges above the southeastern horizon only after 11 p.m. and finally culminates in the south at dawn, around 4 a.m. Luckily, as the weeks go by, Mars becomes visible earlier and earlier, making it easier to observe. By mid-July, the planet rises around 10 p.m. and culminates around 2 a.m. Once it reaches opposition on July 27, Mars is visible all night long, rising at sunset, climbing to its highest point in the sky around 1 a.m. and disappearing in the southwest at sunrise. By mid-August, Mars reaches its ideal position for observations around 11:30 p.m., and around 9:30 p.m. by mid-September.

The red planet is known for the big retrograde loops in its celestial path, which astronomers once had great trouble explaining. The retrograde motion is a simple effect of perspective: in the weeks surrounding opposition, as Earth, on its smaller orbit, catches up with and passes Mars, the red planet seems to stop, go backward for a few weeks in relation to the stars, and then stop again before moving forward. During opposition this year, Mars undergoes its retrograde loop from June 28 to August 28 and moves closest to Earth on July 31.

For 10 weeks, from June 26 to September 5, Mars is brighter than magnitude  $-2$  and its apparent diameter is greater than 20 arc seconds, which is already much bigger than its maximum size during the last opposition, in 2016. This period is the main observation window for opposition in 2018, but conditions are also decent a few weeks before and after. The minimum distance between Earth and Mars (0.385 astronomical units or 57.6 million kilometres) doesn't coincide with opposition but occurs instead a few days after, on July 31. On this date, the planet's apparent diameter increases to 24.3 arc seconds, and its brightness reaches magnitude  $-2.8$ , even outshining Jupiter.

Unfortunately for those of us in the Northern Hemisphere, opposition this year takes place when Mars is in the southernmost leg of its celestial journey. In the middle of the night, when the red planet climbs to its highest point in the sky, it's only 19 degrees above the southern horizon, a location that hinders observations of Mars through a telescope.

## Through a telescope

If possible, observe the red planet when it's at its highest point in the sky so that conditions are best.

But your first look at Mars through a telescope may be disconcerting because the planet is so bright near opposition that it's almost blinding and also because its

image is often continually distorted by atmospheric turbulence. Observe it as many nights as possible. That way, your eye gets used to looking for and recognizing its surface details. You also have more chance of finding a night when conditions are better than average. Mars is worth the effort, so keep trying. A small telescope is powerful enough to make out the main features of

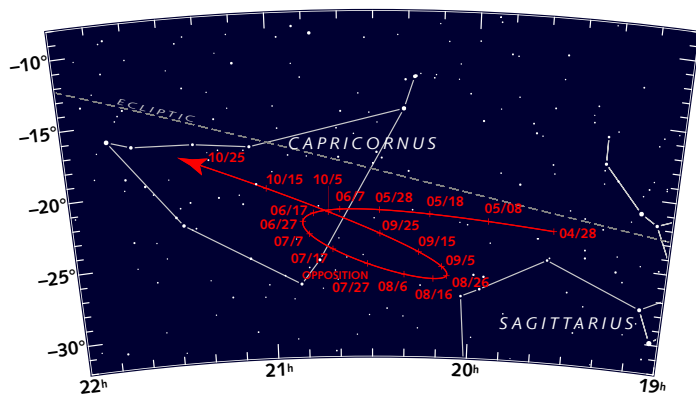
the planet's geography, but a larger telescope with greater magnification can reveal subtler surface details.

A day on Mars lasts 24 hours and 37 minutes, slightly longer than a day on Earth. If you observe Mars at the same time every evening, the visible part of its surface will seem virtually identical to the previous viewing with, however, a slight daily shift. But these little differences add up, and after a few evenings, you'll see a totally different region. After 40 days or so, the entire Martian surface will have passed before your eyes, and you'll be back where you started.

Because of a contrast in colour, certain Martian regions are easier to pick out. The ones facing us directly when the red planet is highest in the sky are the following: *Syrtis Major*, a triangular plateau of dark basalt bordered to the south by *Hellas Planitia*, a large, light-coloured and very bright basin (June 7, July 13, August 16, September 21); *Sinus Meridiani*, a dark area that stands out from the surrounding regions (July 6, August 9, September 14); *Solis Lacus*, "the Eye of Mars", and the volcanoes of *Tharsis* region which, along with nearby *Olympus Mons*, the highest mountain in the solar system, are sometimes covered with frost or crowned with bright white clouds (June 26, July 31, September 3). The ice cap at the south pole should also be visible but will gradually shrink as the weeks pass since it'll be spring in this hemisphere on Mars.

## Encounters with the Moon

The Moon meets up with Mars several times over the summer. On the mornings of June 30 and July 1, the waning gibbous Moon lies a few degrees from the red planet (they both culminate in the south around 3 a.m.). On the nights of July 26–27 and 27–28, while Mars is in opposition, the Moon (full on July 28) is found close to the red planet (they culminate in the south around 1 a.m.). On the nights of August 22–23 and 23–24, the waxing gibbous Moon lies near Mars (they culminate in the south around 11 p.m.). Finally, on the evening and night of September 19–20, the waxing gibbous Moon passes  $4\frac{1}{2}$  degrees above Mars (they culminate in the south around 9:30 p.m.). ★



This map of the apparent trajectory of Mars between April 28 and October 25, 2018 (180 days) shows the red planet's retrograde loop. Ticks mark its position every 10 days.

# The Sky This Summer

*The planets are on full display from evening to morning all summer long. Though Mars stands out boldly in the sky for weeks on end, Venus, Jupiter and even Saturn also deserve a close look.*

## Venus, the queen of twilight

Venus is dazzlingly bright as the Evening Star, but though the planet continues to drift away from the Sun till mid-August, its visibility dwindles over the summer. In early June, Venus reaches its maximum height at twilight, about 20 degrees above the western horizon. Thereafter, however, Venus is found lower than the Sun on the celestial sphere. Consequently, for observers in the Northern Hemisphere, the planet's orbit seems to tilt in relation to the horizon, and the planet loses height in the sky. As summer progresses, Venus therefore appears lower and lower on the horizon at nightfall and sets sooner after sunset. When Venus reaches its greatest elongation on August 17, 46 degrees east of the Sun, it is only about 12 degrees above the horizon in the early twilight and sets less than 90 minutes after our star.

Venus then plunges back toward the Sun. It achieves maximum brightness on September 24 (magnitude -4.8) but gets lost in the twilight glow in late September, one month before its inferior conjunction (October 26), during which Venus passes 6 degrees south of the Sun.

If you observe Venus through a small telescope, you'll see that this lovely planet has phases much like the Moon's. Over the summer, Venus moves closer to Earth, and between the June solstice and September equinox, its apparent size almost triples. Meanwhile, the planet gradually turns its back on us, going from a "gibbous phase" in June, to a "half phase" (dichotomy) around August 15 and then to a "fat crescent" in September.

On the evening of July 15, an hour after sunset, look above the western hori-

zon and admire the crescent Moon lying only 2 degrees to the right of Venus. Through binoculars, note the ashen glow, or earthshine, clearly visible on the dark side of the Moon. On August 13 at twilight, the crescent Moon is 10 degrees to the right of Venus; the next evening, on August 14, it's 6 degrees above the planet. Finally, on the evening of September 12, a half hour after sunset, the crescent lies 9 degrees above Venus, which itself is very low on the west-southwestern horizon.

## Jupiter, a jewel in the evening sky

Jupiter, which now shines in Libra, is in retrograde motion till July 11, moving right in relation to the background stars before it resumes its direct motion and moves left. On August 16, the giant planet passes just over a half degree north of Zubenelgenubi, the alpha star in the constellation, which serves as a marker to track the planet's travels over the summer.

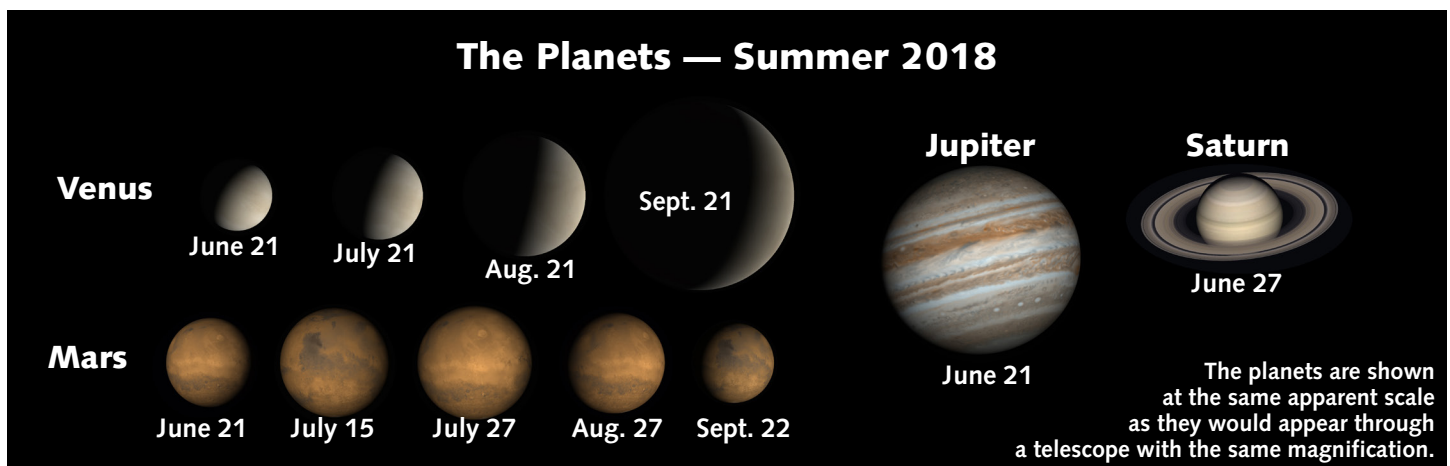
The first evenings of summer are the best time to aim a telescope at the planet to discover its cloud bands, the swirls and vortices in its atmosphere and its four Galilean moons. In June, Jupiter is indeed in an ideal position for observations at nightfall and culminates due south at twilight at about 30 degrees high. Later in the evening, Jupiter sinks toward the west-southwestern horizon, and observation conditions deteriorate. The same scenario plays out as summer progresses: from week to week, Jupiter appears lower in the southwest at twilight. Hence, by September, Jupiter is only about 12 degrees high after sunset. Don't wait till it's too late to admire this stunning giant planet, a must-see of the season.

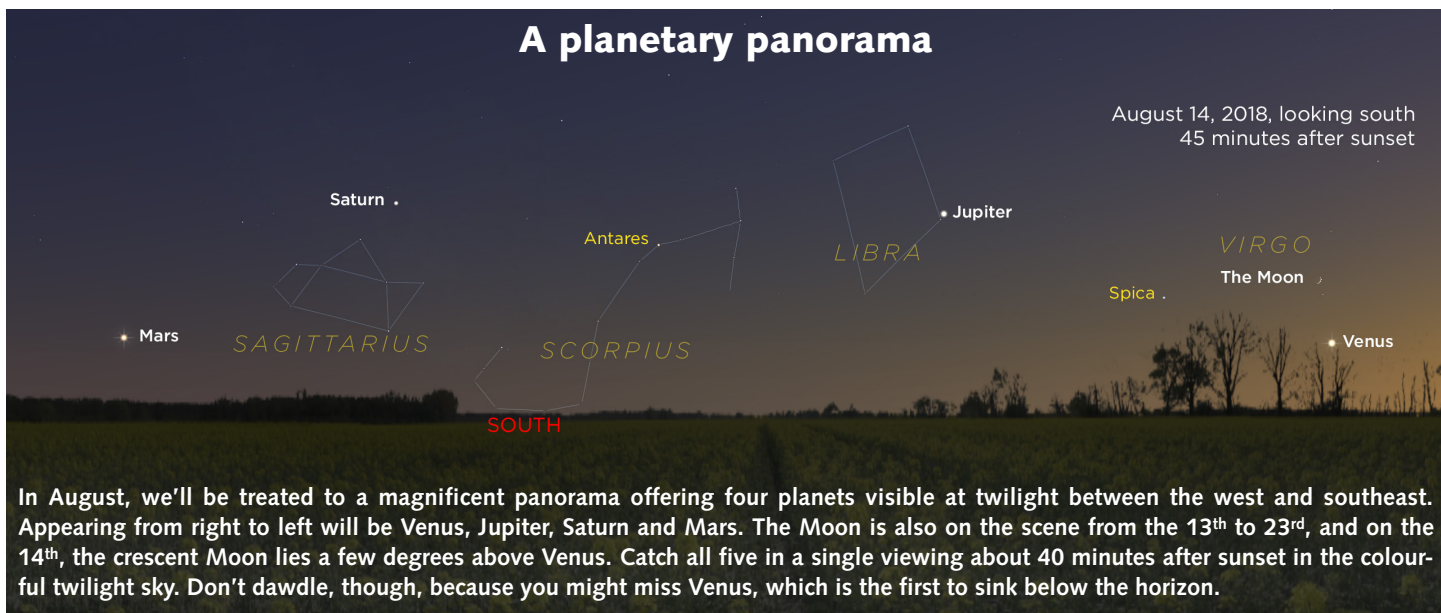
On the evening of June 23, the waxing gibbous Moon lies less than 4 degrees to the left of Jupiter, and the pair disappears after 2 a.m. below the west-southwestern horizon. On the evening of July 20, the waxing gibbous Moon appears only 3½ degrees above Jupiter. On the evenings of August 16 and 17, the Moon (first quarter on the 17<sup>th</sup>) approaches the planet again. Finally, on September 13, the crescent Moon is less than 4½ degrees to the upper right of Jupiter, which is low on the southwestern horizon at twilight.

## Saturn in opposition

On June 27, it's Saturn's turn to reach opposition, and as if to mark the event, on the night of June 27-28, the full Moon appears only 1 degree above the planet. This dynamic duo shows up at twilight very low in the southeast, culminates due south around 1 a.m. and disappears at dawn very low in the southwest.

Use a telescope and you'll see Saturn's famous rings at almost maximum tilt toward Earth (about 26 degrees). Titan, the largest of its 60 or so moons, is also easy to spot with a small telescope and looks like a dim star (magnitude +8.2) alongside Saturn. Unfortunately, the ringed planet is in an unfavourable position in the sky because it's in the southernmost leg of its journey, just above the lid of the Tea Pot in the constellation Sagittarius. Since this part of the starry sky doesn't rise much over Quebec, its light must take a longer path through the atmosphere before it reaches our telescopes, and this results in blurrier images. But because Saturn moves slowly through the constellations of the zodiac, it won't be in a better position for another few years. So do ➡





In August, we'll be treated to a magnificent panorama offering four planets visible at twilight between the west and southeast. Appearing from right to left will be Venus, Jupiter, Saturn and Mars. The Moon is also on the scene from the 13<sup>th</sup> to 23<sup>rd</sup>, and on the 14<sup>th</sup>, the crescent Moon lies a few degrees above Venus. Catch all five in a single viewing about 40 minutes after sunset in the colourful twilight sky. Don't dawdle, though, because you might miss Venus, which is the first to sink below the horizon.

Base image: Stellarium.org / Annotations: M. Jobin, Planétarium Rio Tinto Alcan

## An outstanding year for the Perseids

Good news: the Perseids occur under excellent astronomical conditions in 2018, and observers in Quebec may be well positioned to see the meteor shower.

A gift from Comet Swift-Tuttle, the Perseids are extremely popular with the public and one of the three strongest meteor showers of the year. **Their peak is expected on the evening and night of August 12–13** between 4 p.m. and 4 a.m. EDT. The radiant (the point in the constellation Perseus where the meteors seem to originate) appears above the northeastern horizon in the evening and continues to rise till dawn. The cosmic event therefore usually reaches its climax only after midnight.

This year should offer excellent visibility because the Moon is new on August 11 and won't interfere with observations of "fall-

ing stars." Also, peak activity is likely to occur while the sky is dark over Quebec. If you're in a fairly dark area, you can see about 30 meteors an hour, but this number could rise to over 60 or 70 if the sky is crystal clear and free of light pollution. Consider travelling outside your city or town and seeking a site that's as dark as possible to take full advantage of these nearly ideal conditions.

If the weather doesn't co-operate on the night of August 12–13, keep in mind that the Perseids are also worth watching the night before and after, even though the number of observable meteors drops by half. The first Perseids can be spotted as early as mid-July, and the shower remains active till the third week of August.

Hope for clear skies and draw up a wish list!

➡ take this opportunity to check out the most beautiful planet in our solar system. With a bit of luck, you might hit on excellent weather conditions and an exceptionally stable sky.

**On the night of July 24–25**, the waxing gibbous Moon moves to within 1 1/4 degrees of Saturn and then moves away as they both set around 3 a.m. On the evening of August 21, it lies 4 1/2 degrees from the ringed planet. The first quarter Moon draws near Saturn on the evenings of September 16 and 17.

### Two apparitions for Mercury

Mercury orbits close to the Sun, so it always remains near our star and is visible only at dawn or twilight. These apparitions are more favourable or less favourable depending on the circumstances of each. This summer offers two windows for observing this small planet. Mercury first makes a very average appearance in the

evening sky from mid-June to mid-July (GEE 26 degrees on July 12). Look for the planet low on the west-northwestern horizon 30 to 45 minutes after sunset. Mercury is much brighter at the beginning of this period and quickly dims after July 10. On the evening of July 14, the crescent Moon (2.2 days old) lies 1 1/2 degrees above Mercury.

After reaching inferior conjunction on August 8, Mercury emerges in the morning sky where it puts in a very good appearance from August 21 to September 12 (GWE 18 degrees on August 26). The small planet is visible above the eastern horizon a half hour before sunrise. Too dim before August 21, Mercury is much brighter at the end of this period, but the planet then sinks too low on the horizon. On the morning of September 8, the thin crescent Moon lies 6 degrees above Mercury.

*Clear skies!*

Research and text: **Marc Jobin**

### Seasonal Milestones

The **summer solstice** occurs on June 21, 2018 at 6:07 a.m. EDT, and the **autumn equinox** takes place on September 22 at 9:54 p.m. Summer will last exactly 93 d 15 h 47 min

On July 6 at 1 p.m., Earth reaches **aphelion**, the point in its orbit farthest from the Sun. The Earth-Sun distance will be 152 095 566 kilometres.

### Phases of the Moon

(Eastern Daylight Time)

New moon	First quarter
June 13 at 15:43	June 20 at 6:51
July 12 at 22:48	July 19 at 15:52
August 11 at 5:58	August 18 at 3:49
September 9 at 14:01	September 16 at 19:15
Full moon	Last quarter
June 28 at 0:53	July 6 at 3:51
July 27 at 16:20	August 4 at 14:18
August 26 at 7:56	September 2 at 22:37
September 24 at 22:52	October 2 at 5:45