Mars in 2018

by J. Randy Attwood, RASC Executive Director

During a trip to visit family in New Brunswick in 1971, I noticed a brilliant red-coloured star low in the southwest. I soon determined that this was the planet Mars. Mars isn't always brilliant and impressive; I was just lucky to be seeing it at one of its closest approaches to Earth in my lifetime.

Earth makes one trip around the Sun in about 365 days, an Earth year. Mars takes longer—some 687 Earth days, or 1.88 Earth years. When Earth in its faster orbit catches up to Mars such that the two planets are in a straight line with the Sun, both being on the same side as the Sun, we say that Mars is in opposition. The two planets are as close as they get. At opposition, Mars is visible all night, rising at sunset and setting at sunrise.

By the time Earth has made another one-year trip around the Sun, Mars has moved along in its orbit. It takes Earth another 413 days—over a year—to catch up. The time between Mars oppositions is 778 days, approximately 2 years and 2 months.

As the two planets orbit the Sun, the distance between Earth and Mars varies from approximately 56 million kilometres to 378 million kilometres, which explains why Mars can appear as a brilliant red star sometimes and only as bright as the stars in the Big Dipper at other times.

Mars is best seen in a telescope near opposition. Not all oppositions are the same, though. Mars's orbit is elliptical, so some oppositions are great, while others are not so good. If the opposition takes place when Mars is near perihelion (its closest point to the Sun), the Earth–Mars distance is approximately 56 million kilometres. If it takes place near aphelion (its farthest point from the Sun), the Earth–Mars distance is approximately 99 million kilometres. This can make a big difference when viewing Mars through a telescope. Close Mars oppositions took place in 1971, 1988, 2003, and will in 2018.

This year, at opposition, Mars will be nearly as close as it was in 2003 and won't be as close again until 2035. So it is a great opportunity to observe the planet.

Mars' path through the night sky seems peculiar. The ancients noticed that Mars moves east, slows down and stops, then spends several weeks seeming to move west. It then slows down and stops and continues its eastward motion. Trying to explain this in an Earth-centred Solar System was a challenge to say the least. This odd motion of Mars can be explained by looking at the motion of Earth with respect to Mars. As Earth catches up to and passes Mars, Mars' position as seen from Earth seems to slowly change against the background stars, independent of its motion around the Sun. We call this retrograde motion.

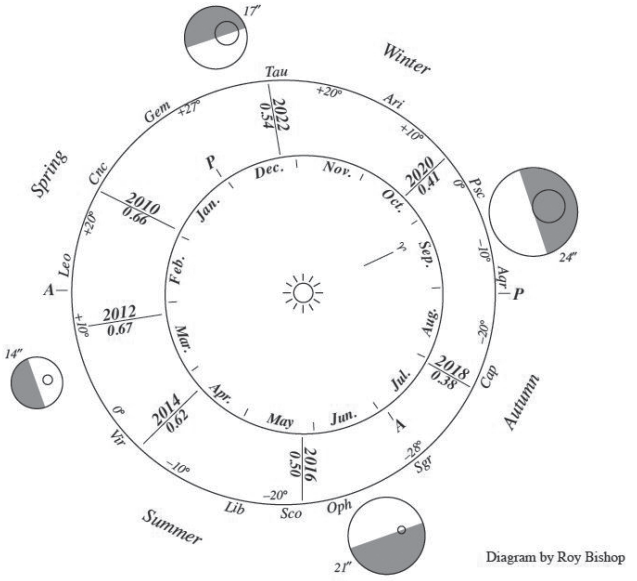

Figure 1 — Past and future oppositions of Mars showing how the distance from the Earth to Mars varies from opposition to opposition (see page 220 in the current Observer's Handbook *for a complete description). Diagram by Roy Bishop.*

An interesting astro-imaging project is to follow Mars's path through Sagittarius and Capricornus from May through November. In May and June, Mars will move east through Sagittarius and Capricornus. Then it will stop and move west in July and August before it resumes its eastward motion again in September.

Most of the time Mars presents as a very small orangish disk with few, if any, features. Around opposition you may be able to detect some surface markings or a white polar ice cap. There were two times when I was impressed observing Mars through a telescope. The first was in April 1976 when Mars occulted, or covered up, a bright star in Gemini, Epsilon Geminorum. Luckily, my Celestron 8 has very good optics. The resolution when looking at planets is outstanding when the seeing is good, and that night the seeing was quite good. I remember seeing Mars slowly approach the star and just before occultation the two resembled a red giant star next to a white dwarf star. At occultation, the star did not blink out in an instant but slowly dimmed as its light passed through the tenuous Martian atmosphere.

The other time I was impressed was in August 2003. Mars was making its closest approach to Earth in thousands of years, not to be outdone until 2287. Favourable Mars oppositions are always in August since Mars' perihelion is in Capricornus, a summer constellation.

The newly formed Mississauga Astronomical Society (now the Mississauga Centre) was holding its first major public outreach event. We held the event near the City Hall and Central Library complex, which is surrounded by condominiums. Mars was low in the southwest and had to be viewed between the

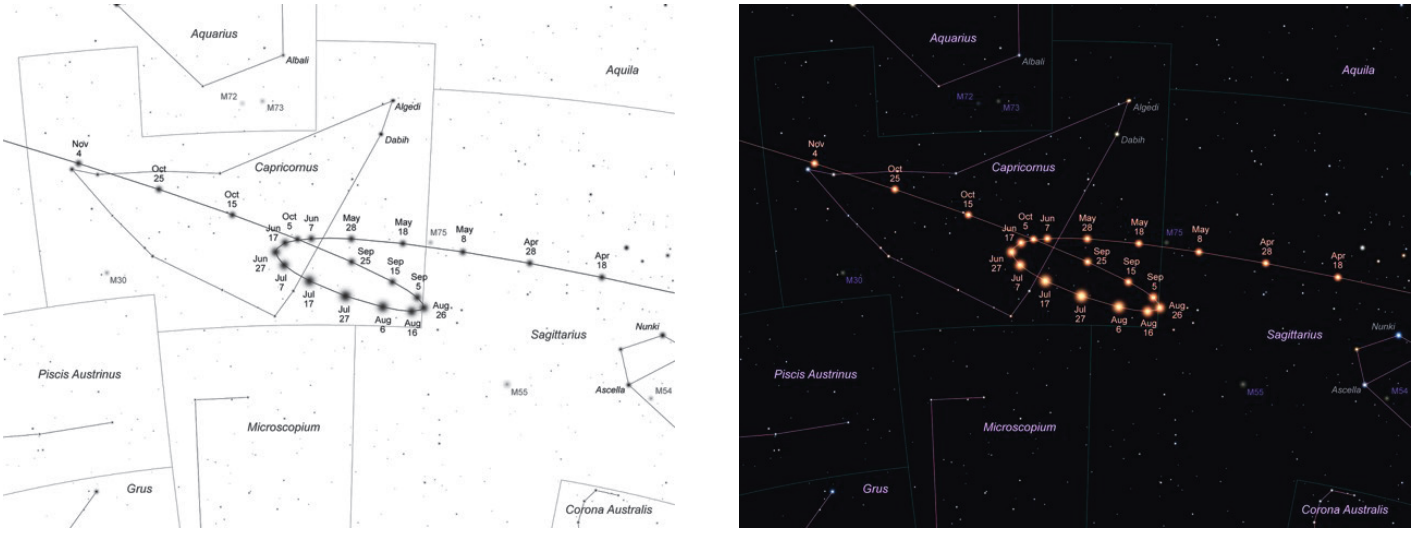

Figure 2 — (one Colour and one B&W) Path of Mars through the night sky from April to November 2018, showing its retrograde motion. Diagram by Glenn LeDrew.

condos. The turnout was very good, and each telescope had lineups of 20 to 30 people. As the evening progressed and Mars moved across the sky, we had to move the telescopes to follow Mars between the condos. It was comical to see the long lineups shuffle as we moved the telescopes.

The media coverage was good, and we continued long after our 11 p.m. advertised stopping time. People were still arriving at 1 a.m. Before we closed up shop for the night, I took a last look at Mars. The seeing had improved, and the image was the best I had ever seen. I remember seeing a lot of detail on the planet and actual detail in the polar cap.

How will the 2018 opposition compare to the 2003 opposition?

The angular diameter of Mars in 2003 was 25.11 arc seconds. This year it will be 24.31 arc seconds, a difference of only 3%. So the view of Mars this year should be just as good as the view in 2003. (It was 24.91 arc seconds in 1971.)

During a close Mars opposition, I am impressed how the planet appears to the naked eye, as a brilliant red "star" brighter than Jupiter. This summer when you are observing the red star, you might think about the future of space exploration and the fact that in the next few decades people may finally make the trip to Mars.

One thing to consider when we send people to Mars is the communication time: During the Moon landings, the distance between Earth and the Moon meant that radio signals made the trip in just over one second. When people finally go to Mars, talking to them will be more challenging. Since the Earth–Mars distance varies so much, so, too, will the radio travel time. At its farthest point (378 million kilometres), it will take 21 minutes for a one-way conversation. You say hello and have to wait 42 minutes to get a reply. Mission control won't be able to help with problems right away.

At a close opposition like the one this year, when Mars is only 58 million kilometres away from us, the one-way radio travel time is just 3.2 minutes.

In 2003, during the close opposition, an Internet hoax started, stating that Mars will appear in the sky as big as the full Moon. Unfortunately, the hoax appears every August, like clockwork. No doubt it will appear again when Mars is in the news later this year.

I look forward to setting up my telescope later this year at public star parties, pointing it at Mars, and talking to visitors about this interesting planet. ✶