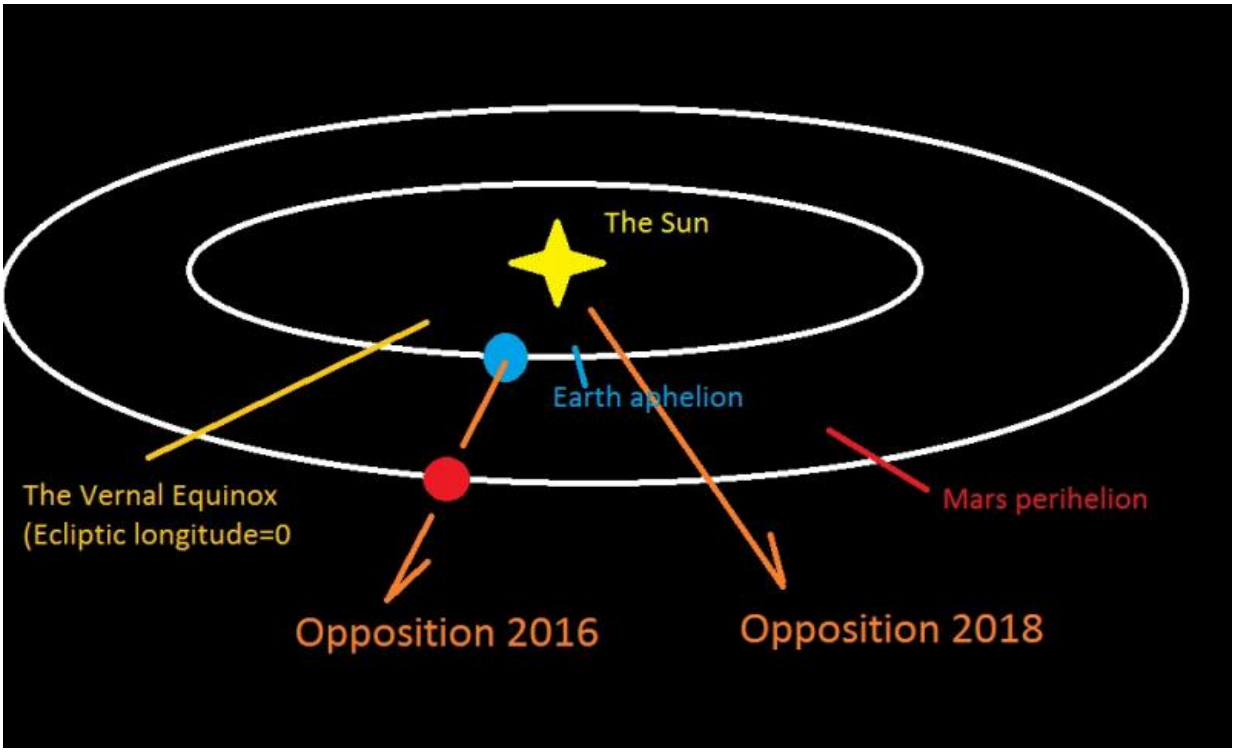
Complete guide to Mars opposition 2016

April 27 2016, by David Dickinson



Oppositions 2016 and 2018 compared (sizes not to scale). Credit: Dave Dickinson

Ready to explore the Red Planet? Starting in May, Mars invades the evening skies of the Earth, as it heads towards opposition on May 22nd. Not only does this place Mars front and center for prime time viewing, but we're headed towards a cycle of favorable oppositions, with Mars near perihelion, while Earth is near aphelion.

As the name implies, Mars rises opposite to the setting sun near opposition for us terrestrial-bound observers. The technical time of opposition—when a planet reaches a point near 180 degrees opposite to the sun in right ascension—is, like a full moon, an instantaneous moment. For Mars, that moment occurs at around 10:00 Universal Time (UT) on sunday, May 22nd. Mars makes its closest pass to the Earth eight days later on May 30th, at 75.3 million kilometers distant. This discrepancy is due to the elliptical nature of planetary orbits, as Mars races towards perihelion on October 29th, 2016, while Earth heads towards aphelion on July 4th, 2016.

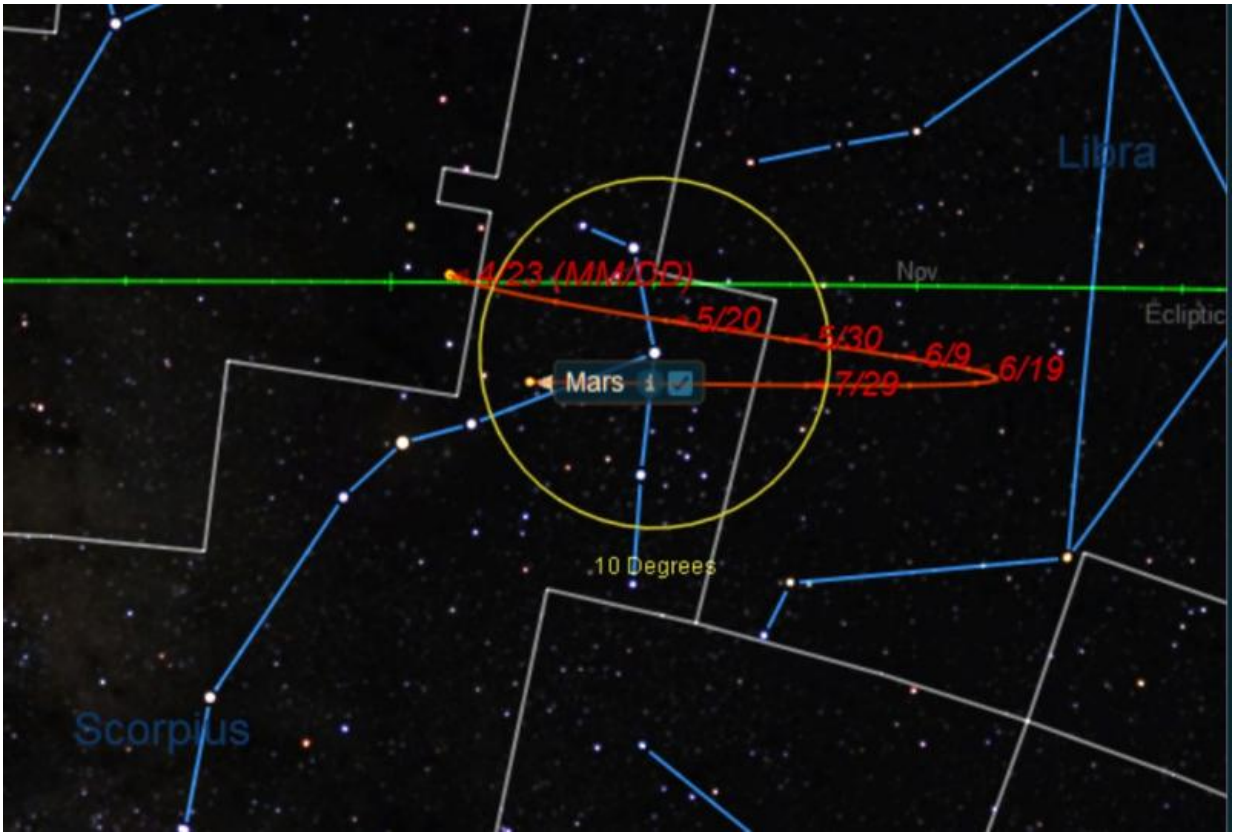
Not all oppositions of Mars are created equal. Mars orbits the sun once every 687 days, and Earth catches up to Mars about once every 26 months. Mars has a markedly eccentric orbit deviating 0.093 (9.3%) from circular, meaning it can pass anywhere from 54 million to 103 million kilometers from the Earth. The oppositions of Mars follow a roughly 15 year period from one favorable cycle to the next.

Opposition 2016 favors the southern hemisphere, as the retrograde loop of Mars crosses from the constellations Ophiuchus, through Scorpius into Libra and back into Scorpius this summer. Though that keeps Mars down around declination -22 degrees south, observers located at 40 degrees north will still see Mars transit about 28 degrees above the southern horizon around local midnight near opposition. Mars will appear 18.6″ in size at closest approach, the largest we've seen since 2005. The 2014 opposition only reached 15.2", and the next one on July 27th, 2018 approaches the historic 2003 opposition within an arc second, featuring Mars as a 24.3" disk.

Just over a century ago, oppositions of Mars were a time of frenzied activity, as observers strained to catch fleeting moments of good seeing when details jumped out in crisp relief. Asaph Hall discovered the two tiny moons of Phobos and Deimos using the US Naval Observatory's 26″

refractor during the opposition of 1877. In 1894, astronomer Percival Lowell stunned the world during opposition with reports of canals on Mars, representing what Lowell was convinced was a massive construction project undertaken by a dying alien race.

Today, the months leading up to opposition represents an optimal time to send spacecraft to the Red Planet. In 2016, only the European Space Agency's ExoMars Trace Gas Orbiter seeks to make the trip.

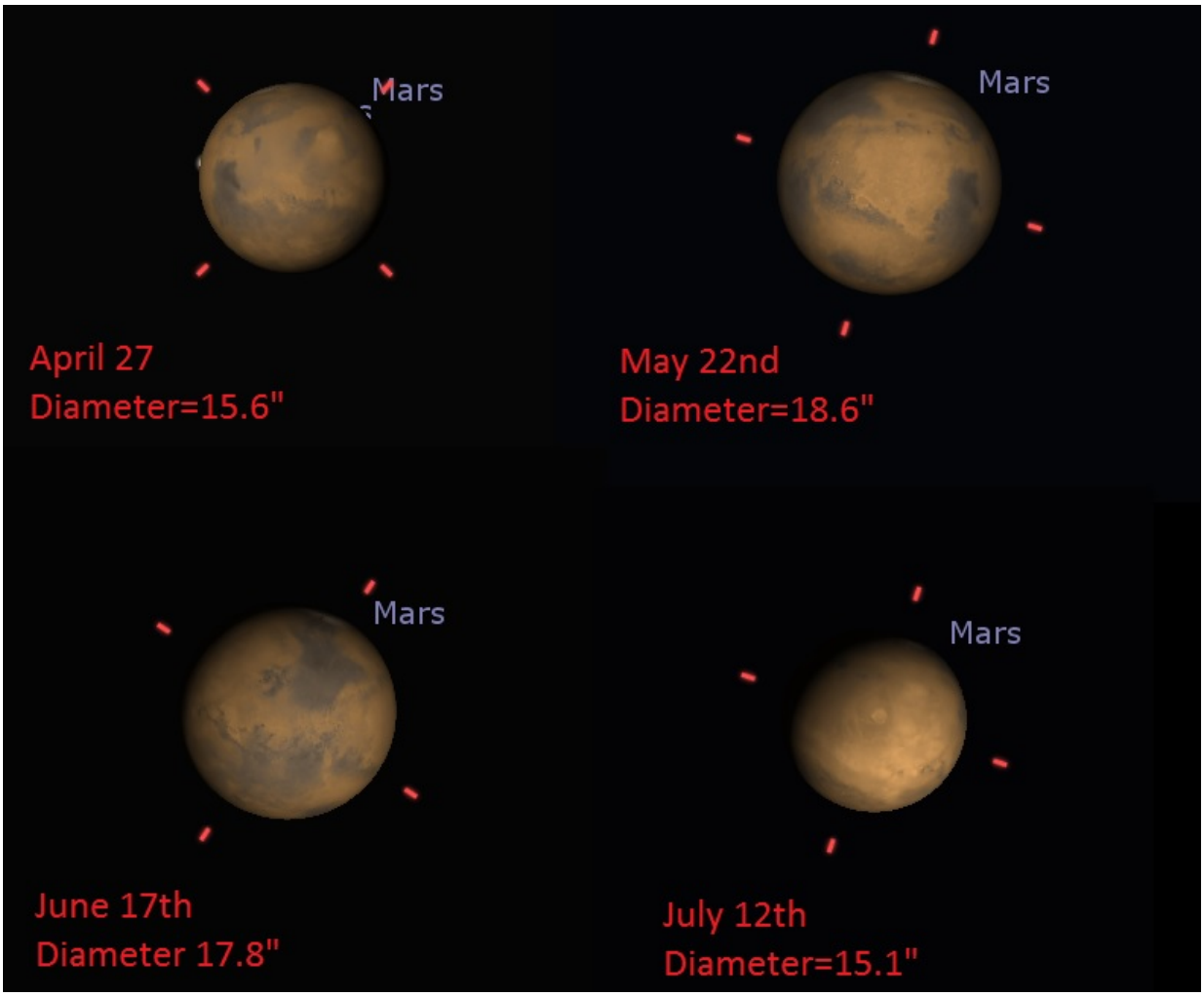


The apparent celestial path of Mars through the summer of 2016. Credit: Starry Night

Though often termed 'the Red Planet,' Mars can take on a visual hue spanning pumpkin orange to a sickly yellow, hinting that a planetary wide dust storm is underway. What color does Mars appear to you tonight? A painter's wheel or color swatches ranging from yellow, red and orange are useful for coming up with colorful descriptors at the eyepiece. May sees the northern polar cap of Mars tipped Earthward, as late northern hemisphere summer is currently underway.

Mars starts off the month of May rivaling Jupiter (which passed opposition on March 8th) at magnitude -1.5. The planet then reaches a brilliant magnitude -2.1 on the night of opposition, and doesn't drop back down below magnitude -1 until June 28th. Interestingly, Mars is also in the general vicinity of ruddy-orange Antares in 2016, the original +1 magnitude 'anti-Mars' of yore. Mars also passes one degree from Delta Scorpii on May 19th.

At the eyepiece, the first surface feature you'll notice at low power is the white dot of the northern polar cap. Crank up the magnification, and dark and light surface features will begin to pop into view. Mars rotates once on its axis every 24 hours and 37 minutes, meaning you'll see about 7.5 degrees of new longitude revealed to you if you're watching at the same time each night. Sky and Telescope's Mars Profiler is an excellent resource to peg a name on just what surface features are currently turned Earthward.



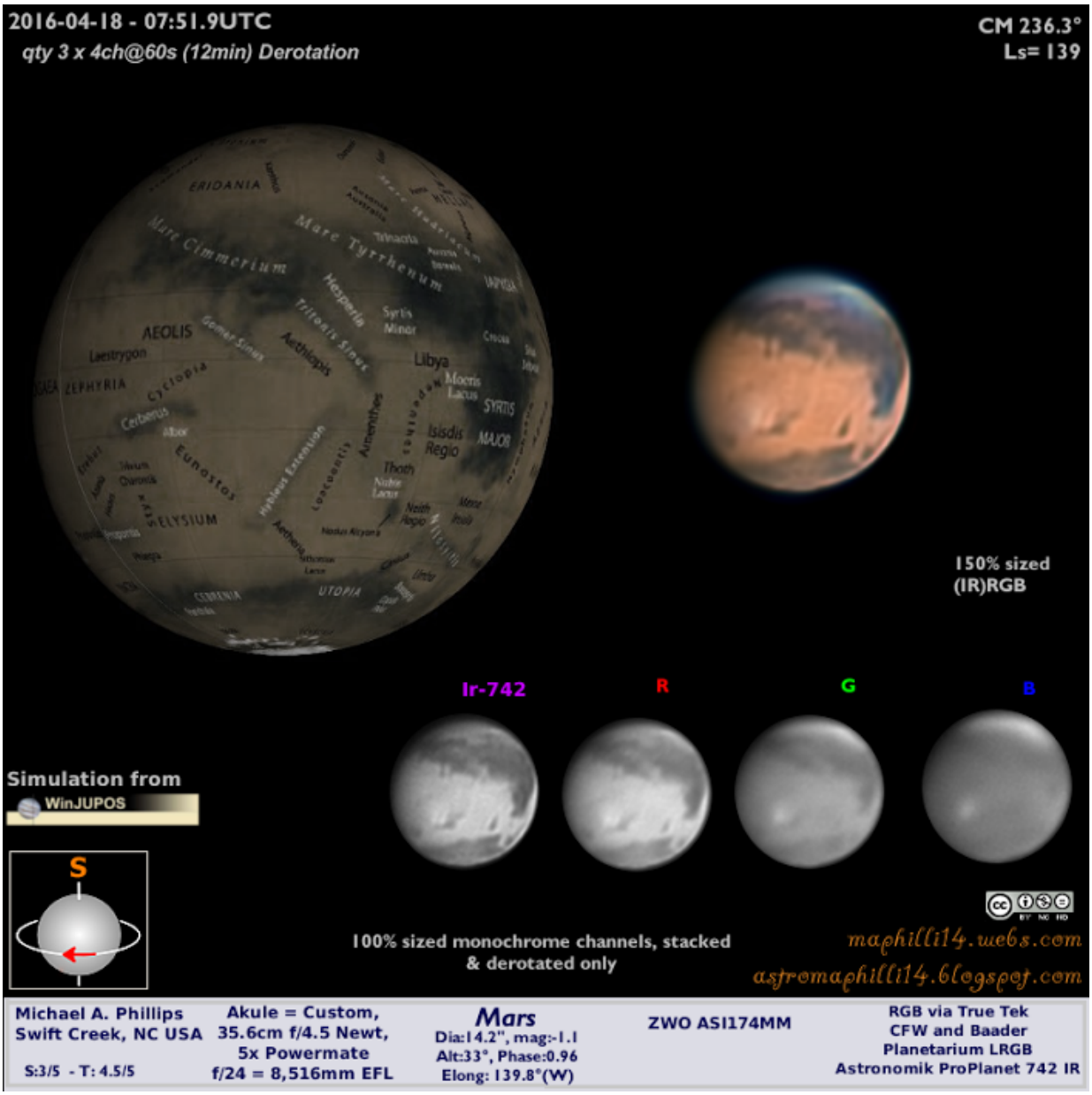
The changing size of Mars near opposition 2016. Credit: Stellarium

Sketching what you see on Mars is also fun, and can serve to sharpen your visual skills as well. Constructing a modified webcam to image the planet is also an easy project. If you've got a webcam, a telescope and a laptop, you can be off and imaging Mars tonight. Several free autostacking programs exist which allow you to select and stack images from a video sequence, the most time honored being Registax.

We've modified 20$ webcams for use at the eyepiece by simply

removing the lens and attaching a 1 1/12" eyepiece barrel to the front, effectively making the telescope its 'lens'. Smartphone astrophotography is reaching the point where planetary imaging is possible.

Stalking the Moons of Barsoom

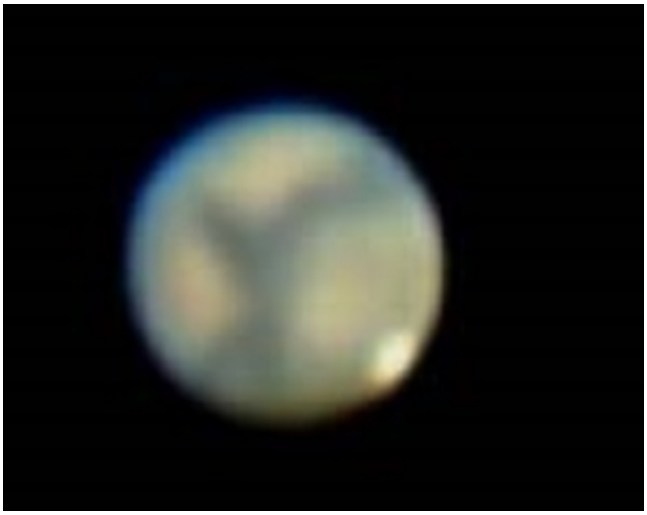


Mars from April 18th, 2016. Credit: Michael Phillips

Opposition is also a great time to cross the Martian moons of Phobos and Deimos off of your life list. Phobos and Deimos both shine at magnitude +12 and neither would present much of a problem, were it not for the glare of nearby Mars at 14 magnitudes and 400,000 times brighter. Phobos and Deimos never stray more than 18" and 54" from the limb of Mars, respectively.

Phobos orbits Mars once every 7.7 hours, and Deimos takes 30.4 hours to complete one circuit of the Red Planet. A great tool to know just when a particular moon is at greatest elongation is a desktop planetarium program such as Stellarium or Starry Night. Use SETI's Ring-Moon Systems Node tool to generate a handy 'corkscrew chart' of the Martian moons.

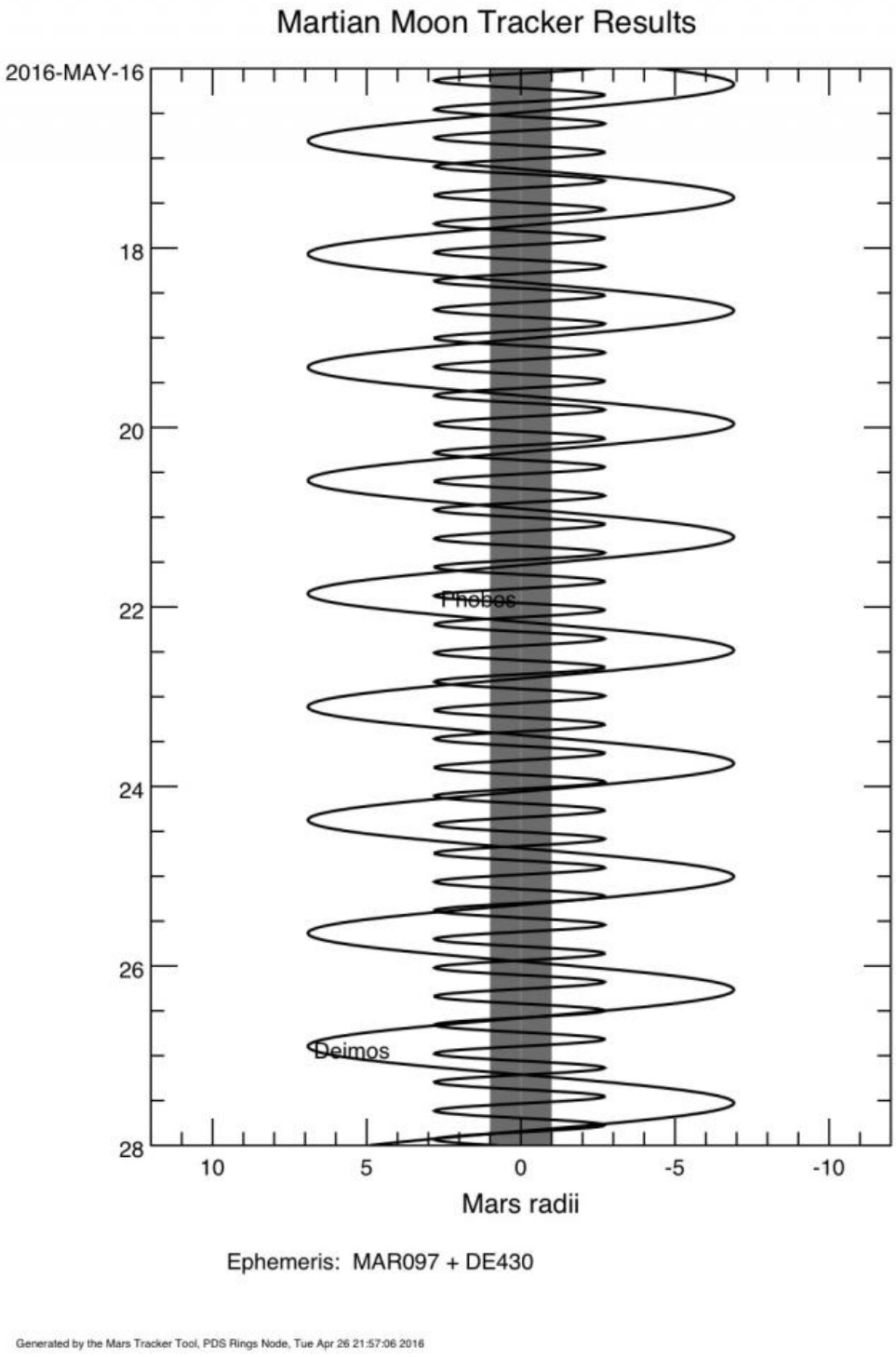
You'll need to either put Mars just out of the field of view to spy the planet's moons, or use an occulting bar eyepiece to block its glare. A tiny strip of foil attached to an eyepiece will do the job.



Mars with a '$20 Walmart Webcam.' Credit: Dave Dickinson

Finally: Ever seen Mars… in the daytime? We completed this unusual feat of visual athletics with binoculars back in 2005, using the nearby moon as a guide. Fast forward to 2016, and the waning moon one day past Full passes seven degrees from Mars… on the night of opposition. Southern hemisphere viewers have the best shot at this on the morning of May 22nd, as Mars and the moon set to the west, just after the sun rises in the east.

This opposition 2016 ushers in the start of a series of great passes over the next few years, climaxing in 2018. Don't miss it!



Greatest elongations for the moons of Mars one week on either side of

opposition. (times in UT) Credit: PDS Rings/Moons Tracker

Source: Universe Today