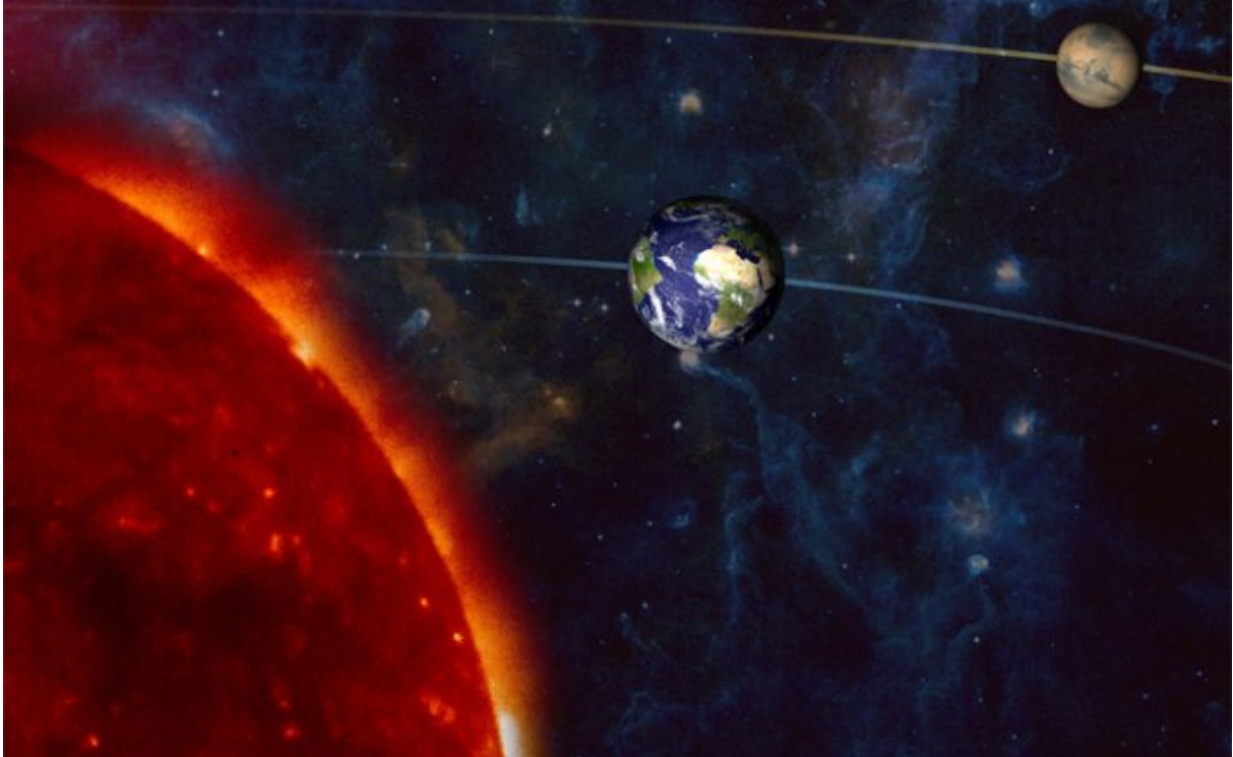


When will Mars be close to Earth?

April 10 2017, by Matt Williams



Approximately every two years, Earth and Mars are at the closest point to each other in their orbits (i.e. opposition). Credit: NASA

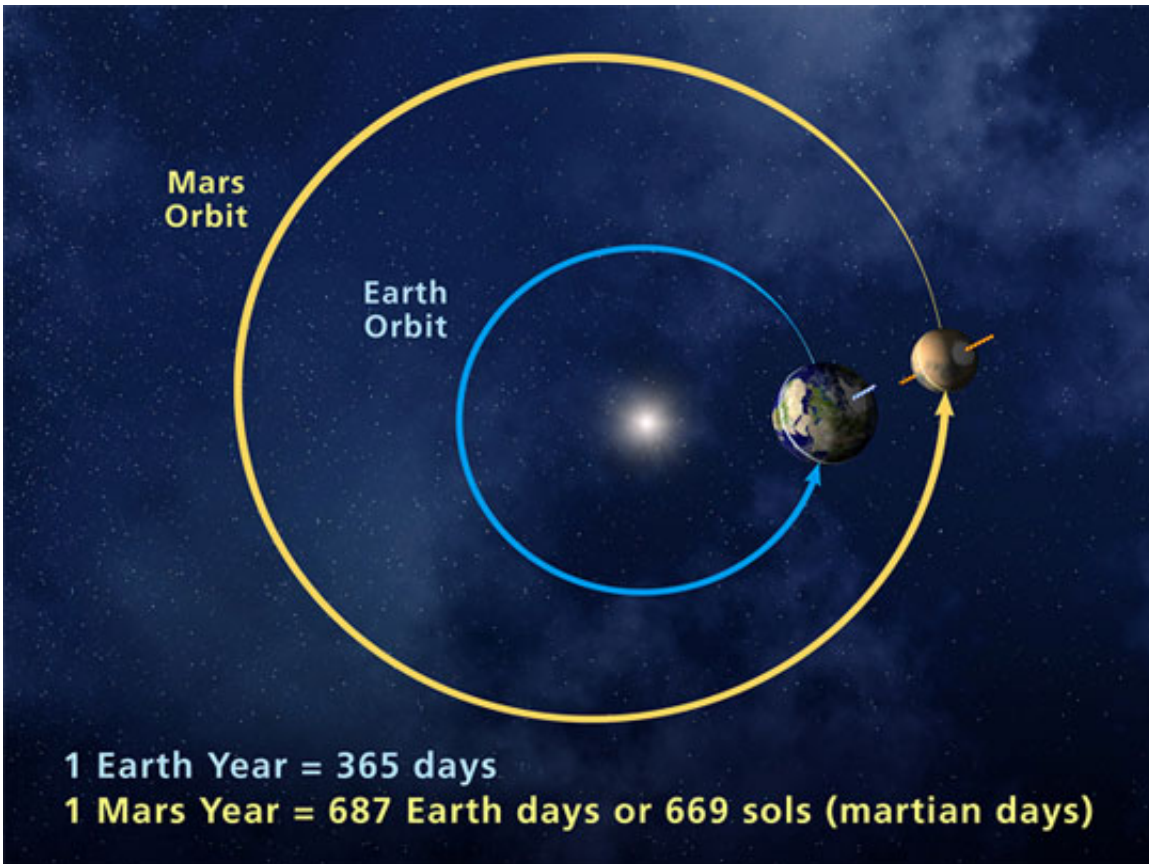
As neighboring planets, Earth and Mars have a few things in common. Both are terrestrial in nature (i.e. rocky), both have tilted axes, and both orbit the sun within its circumstellar habitable zone. And during the course of their orbital periods (i.e. a year), both planets experience variations in temperature and changes in their seasonal weather patterns.

However, owing to their different orbital periods, a year on Mars is significantly longer than a year on Earth – almost twice as long, in fact. And because their orbits are different, the distance between our two planets varies considerably. Basically, every two years Earth and Mars will go from being "at conjunction" (where they are farther from each other) to being "at [opposition](#)" (where they are closer to each other).

Orbital Period:

Earth orbits the sun at an average distance (semi-major axis) of 149,598,023 km (92,955,902 mi; or 1 AU), ranging from 147,095,000 km (91,401,000 mi) at perihelion to 152,100,000 km (94,500,000 mi) at aphelion. At this distance, and with an orbital velocity of 29.78 km/s (18.5 mi/s) the time it take for the planet to complete a single orbit of the sun (i.e. [orbital period](#)) is equal to about 365.25 days.

Mars, meanwhile, orbits the sun at an average distance of 227,939,200 km (141,634,850 mi; or 1.523679 AU), ranging from 206,700,000 km (128,437,425 mi) at perihelion to 249,200,000 km (154,845,700 mi) at aphelion. Given this difference in distance, Mars orbits the sun at a slower speed (24.077 km/s; 14.96 mi/s) and takes about 687 Earth days (or 668.59 Mars sols) to complete a single orbit.



A top-down image of the orbits of Earth and Mars. Credit: NASA

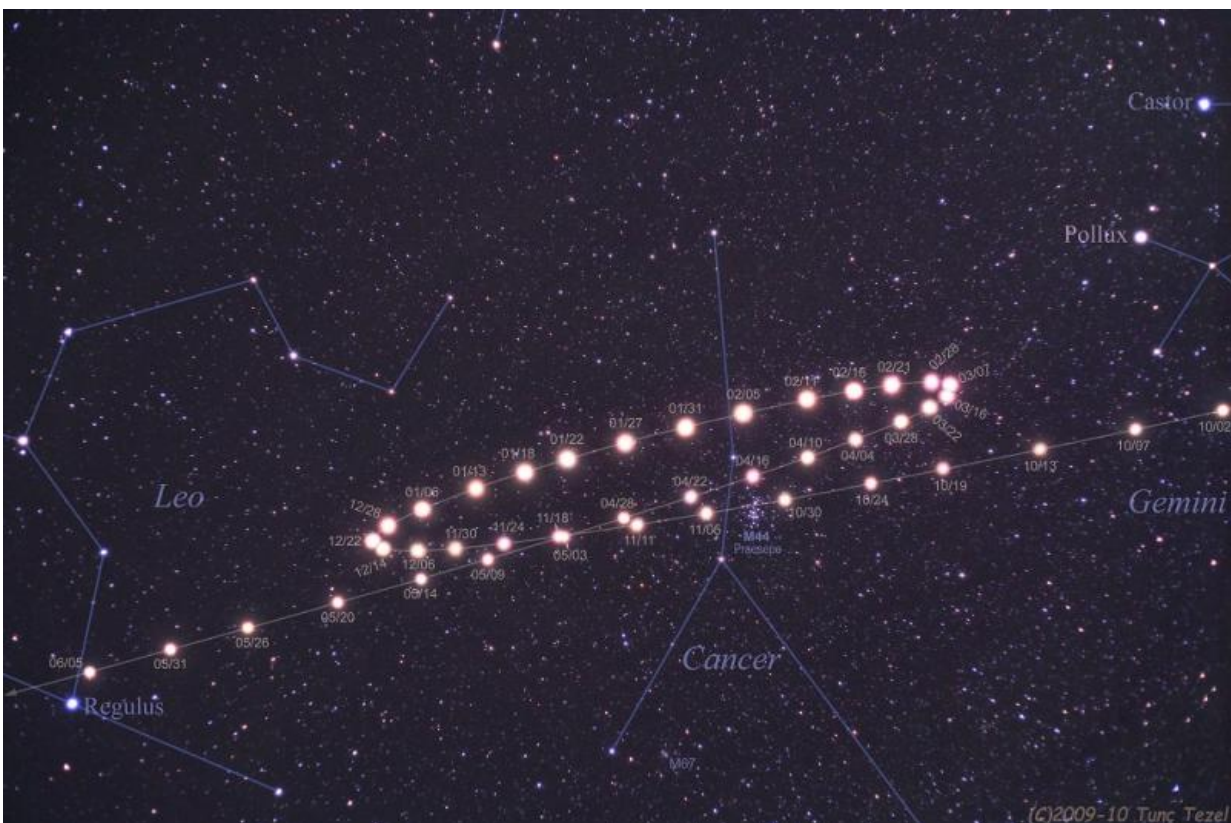
In other words, a Martian year is almost 700 days long, which works out to being 1.88 times as long as a year on Earth. This means that every time Mars completes a single orbit around the sun, the Earth has gone around almost twice. During the moments when they are on opposite sides of the sun, this is known as a "conjunction." When they are on the same side of the sun, they are at "opposition."

Mars Opposition:

By definition, a "Mars opposition" occurs when planet Earth passes in between the sun and planet Mars. The term refers to the fact that Mars

and the sun appear on opposite sides of the sky. Because of their orbits, Mars oppositions happens about every 2 years and 2 months – 779.94 Earth days to be precise. From our perspective here on Earth, Mars appears to be rising in the east just as the sun sets in the west.

After staying up in the sky for the entire night, Mars then sets in the west just as the sun begins to rise in the east. During an opposition, Mars becomes one of the brightest objects in the night sky, and is easy to see with the naked eye. Through small telescopes, it will appear as a large and bright object. Through larger telescopes, Mars' surface features will even become apparent, which would include its polar ice caps.



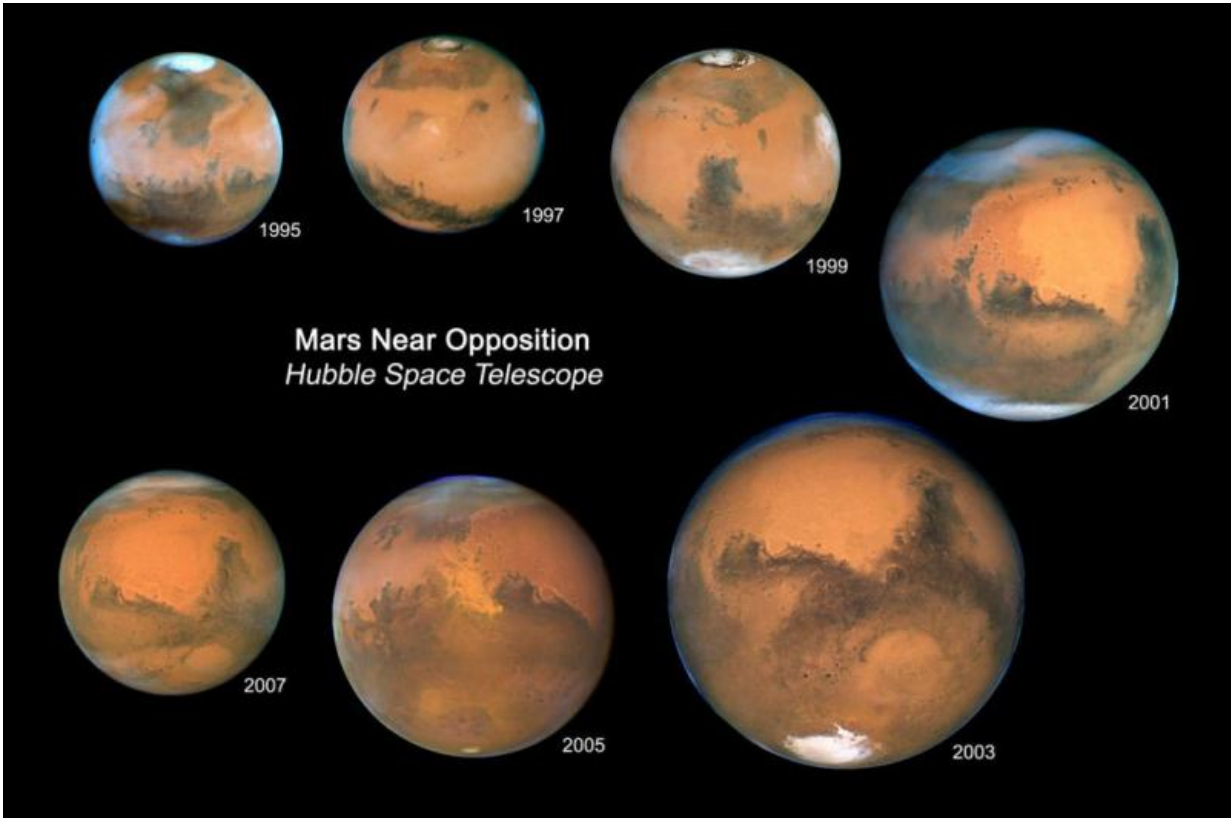
About every two years, the Earth passes Mars as they orbit around the Sun.
Credit: NASA

An opposition can also occur anywhere along Mars' orbit. However, opposition does not necessarily mean that the two planets are at their closest overall. In truth, it just means that they are at their closest point to each other within their current orbital period. If Earth and Mars' orbits were perfectly circular, they would be closest to each other whenever they were at opposition.

Instead, their orbits are elliptical, and Mars' orbit is more elliptical than Earth's – which means the difference between their respective perihelion and aphelion is greater. Gravitational tugging from other planets constantly changes the shape of our orbits too – with Jupiter pulling on Mars and Venus and Mercury affecting Earth.

Lastly, Earth and Mars do not orbit the sun on the exact same plane – i.e. their orbits are slightly tilted relative to each other. Because of this, Mars and Earth become closest to each other only over the long-term. For instance, every 15 or 17 years, an opposition will occur within a few weeks of Mars' perihelion. When it happens while the Mars is closest to the sun (called "perihelic opposition"), Mars and Earth get particularly close.

And yet, the closest approaches between the two planets only take place over the course of centuries, and some are always closer than others. To make matters even more confusing, over the past few centuries, Mars' [orbit](#) has been getting more and more elongated, carrying the planet even nearer to the sun at perihelion and even farther away at aphelion. So future perihelic oppositions will bring Earth and Mars even closer.



Color composite of Mars from seven of its previous oppositions, taken with the Hubble Space Telescope. Credit: NASA/ESA/HST

On August 28th, 2003, astronomers estimated that Earth and Mars were just 55,758,118 km (34,646,488 mi; 0.37272 AU) apart. This was the closest the two planets had come to each other in almost 60,000 years. This record will stand until August 28th, 2287, at which point the [planets](#) will be an estimated 55,688,405 km (34,603,170.6 mi; 0.372254 AU) from each other.

Future Oppositions:

Want to organize your schedule for the next time Mars will be close to

Earth? Here are some upcoming dates, covering the next few decades. Plan accordingly!

- July 27th, 2018
- October 13th, 2020
- December 8th, 2022
- January 16th, 2025
- February 19th, 2027
- Mar 25th, 2029
- May 4th, 2031
- June 27th, 2033
- September 15th, 2035
- November 19th, 2037
- January 2nd, 2040
- February 6th, 2042
- March 11th, 2044
- April 17th, 2046
- June 3rd, 2048
- August 14th, 2050

And in case your interested, Mars will be making close approaches on two occasions this century. The first will take place on August 14th, 2050, when Mars and Earth will be 55.957 million km (34.77 million mi; or 0.374051 AU) apart; and on September 1st, 2082, when they will be 55,883,780 km (34,724,571 mi; 0.373564 AU) apart.

There's a reason missions to Mars depart from Earth every two years. Seeking to take advantage of shorter travel times, rovers, orbiters and landers are launched to coincide with Mars being at opposition. And when it comes time to send crewed mission to Mars (or even settlers) the same timing will apply!

Provided by Universe Today

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