Mars Opposition – Tuesday 13th Oct 2020

Mars is about 6,780 kilometres in diameter or roughly half the size of the Earth (diameter 12,742km). However, it only has about 11% of the Earth's mass and 38% of Earth's surface gravity. As they orbit the Sun, the minimum distance between the Earth and Mars is about 55 million kilometres, while the maximum distance is about 400 million kilometres. Thus, Mars can appear as small as 3.5" in angular diameter or as large as 25.4".

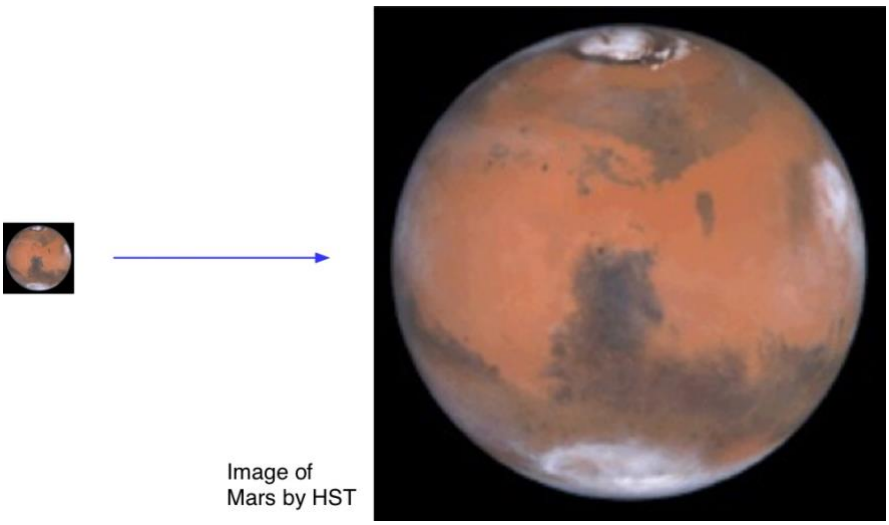
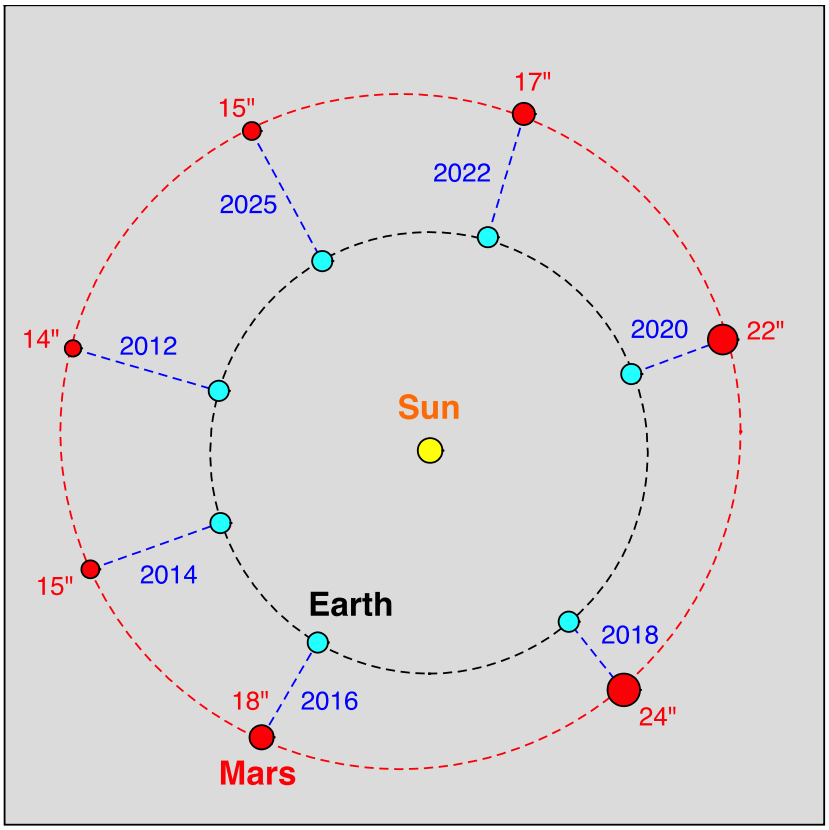


Image of Mars by HST

As the Earth travels around the Sun it catches up with the slower Mars every 780 days (roughly 2 years and 2 months). At this time, the Earth passes between Mars and the Sun, forming an angle of 180 degrees with the other two. The term "**opposition**" derives from the fact that Mars and the Sun appear on opposite sides of the sky. At opposition, Mars is roughly closest to the Earth in its orbit. None of the planet's orbits are coplanar and the orbit of Mars about the Sun is much more elliptical than the Earth's. Its distance from the Earth and its angular size can vary markedly over successive oppositions.



Dates of Mars Oppositions

The angular diameter is shown in the table for Mars at each opposition from 2003. It illustrates how the angular size can vary from one opposition to the next.

Year	Opposition Date	Angular Size
2003	28th August	25.1”
2005	7th November	20.0”
2007	24th December	15.8”
2010	29th January	14.1”
2012	3rd March	13.9”
2014	8th April	15.1”
2016	22nd May	18.4”
2018	27th July	24.3”
2020	13th October	22.4”
2022	8th December	17.1”
2025	16th January	14.6”

At the opposition of 2003, Mars had come closer to the Earth than it had done for almost 60,000 years – a distance of 55.8 million kilometres and angular size 25.1”. It will be Aug 15th 2050 before Mars hits 25” again. However, it will be Aug 28th 2287 before Mars tops the 2003 record with an angular size of about 25.2”.

Mars Opposition 2020

Of course, the opposition of 2020 at 22.4” still compares pretty favourably with these record beaters! And you don’t have to view Mars right on the opposition date. Its apparent size will be greater than 20” for about two months. The following table gives the distance of Mars from the Earth, the angular size and the visual magnitude of Mars every week from Sep 1st at 9pm (or 10pm DST from Oct 4th) and 11pm (or midnight DST). Alt = Altitude above horizon in degrees. Data sourced from SkySafari.

Date (2020)	Distance of Mars	Angular Size	Vmag	Alt at 9pm	Alt at 11pm
Sep 1	73.9 million km	19.0”	-1.8	-3 degs	20 degs
Sep 8	70.0 million km	20.0”	-2.0	+1 degs	25 degs
Sep 15	66.7 million km	21.0”	-2.2	+7 degs	30 degs
Sep 22	64.2 million km	21.8”	-2.3	13 degs	35 degs
Sep 29	62.6 million km	22.4”	-2.5	20 degs	41 degs
Oct 6	62.1 million km	22.6”	-2.6	27 degs	45 degs
Oct 13	62.6 million km	22.4”	-2.6	34 degs	49 degs
Oct 20	64.4 million km	21.8”	-2.5	40 degs	51 degs
Oct 27	67.3 million km	20.8”	-2.3	45 degs	51 degs
Nov 3	71.4 million km	19.6”	-2.1	48 degs	49 degs
Nov 10	76.4 million km	18.3”	-1.8	50 degs	46 degs
Nov 17	82.4 million km	17.0”	-1.6	51 degs	43 degs

Observing Mars and some of the other planets

Even at opposition, Mars will never look bigger than Jupiter (whose angular size can vary from about 30" to 50"). But Mars will look bigger than the main body of Saturn (17"). And Mars will be brighter than Jupiter from 29th September (Jupiter mag -2.4) to 28th of October (Jupiter mag -2.2).

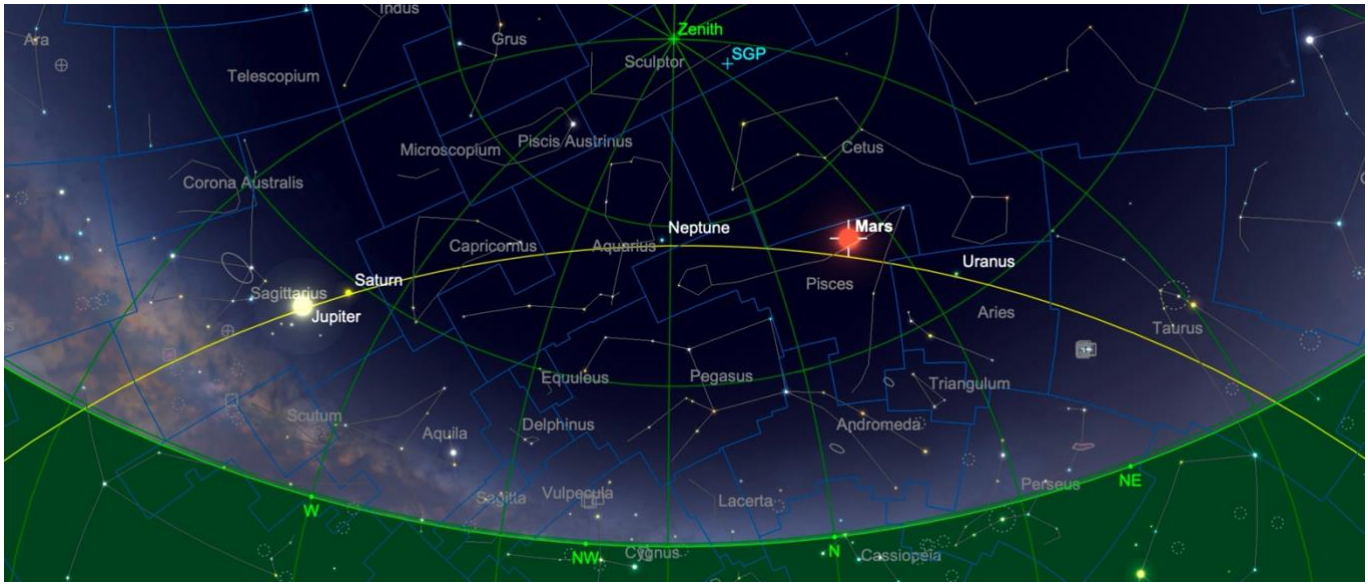
It's a great time to look at all three of the planets!

This diagram (clips from SkySafari) compares the apparent sizes of Mars 22", Jupiter 39" and Saturn 17" at 10pm DST on Tuesday 13th Oct 2020.

You don't need a dark sky to observe these planets. Even a smaller telescope will show you some major features of these planets – albedo (dark and light) features on Mars, the equatorial belts and Galilean moons of Jupiter and the rings of Saturn. However, larger telescopes will allow more magnification and resolve finer features.

Of course, good seeing conditions are required to bump up the magnification on your telescope. More often than not, average seeing will only allow good views to about 250x even if your telescope's manual says it can go to 500x. Having said that, one of the best views of Saturn I've ever had was at 600x on a night of excellent seeing at Penrith Observatory. If you can score a night with really good seeing conditions, you might get some unforgettable views of Mars and its features.

Positions of Jupiter, Saturn and Mars on Tues 13th Oct at Midnight.



SkySafari screen clip.

Some of the surface features of Mars

The northern hemisphere of Mars consists mainly of smooth, low-lying lava plains covered in dust (dust storms can cover the entire planet for weeks) while the southern hemisphere is mostly rocky highlands with exposed craters. Hellas Planitia is a plain located in the huge **Hellas** crater. About 2,000km in diameter and 7,000m deep, it was formed from a massive impact 4 billion years ago. Hellas is the largest known visible impact crater in the solar system.

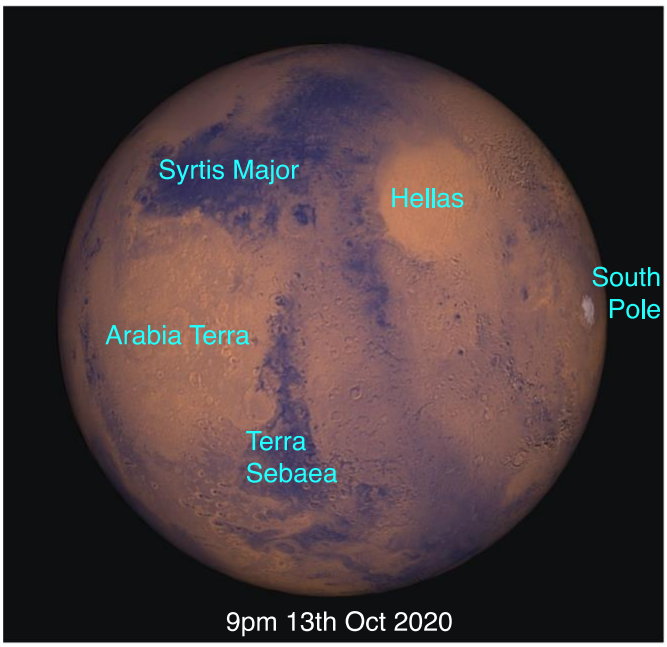
Olympus Mons, near the eastern edge of Amazonis Planitia, is one of 20 huge volcanos that dominate the landscape. It is one of the largest volcanos in the entire solar system (the largest on a planet), standing at 22km in height with a base some 600km wide. However, despite its size, you won't see volcanoes through your telescope.

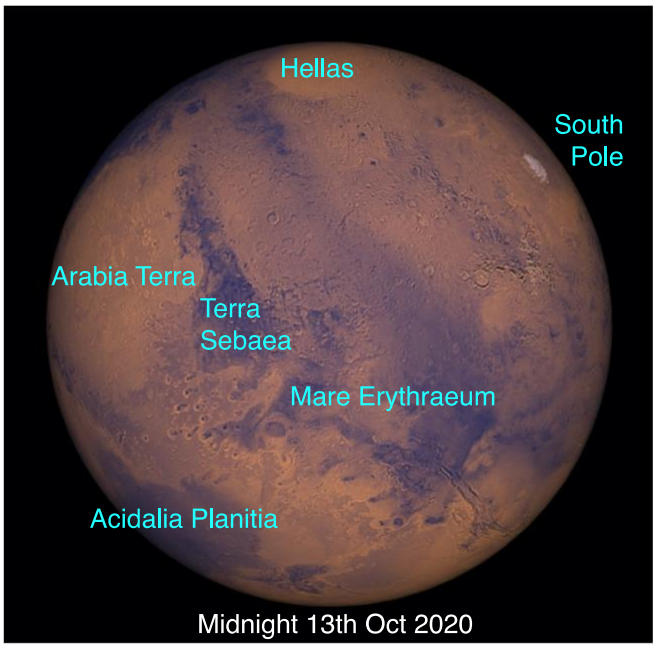
Bright and dark areas visible through a telescope are albedo features. The brighter plains were thought to be continents and the darker areas thought to be seas (Mare). The plains are covered in dust and sand rich in reddish oxides. Amazonis Planitia is one of the smoothest plains on Mars.

Note: Planitia is the IAU descriptor for a low plain. Terra is an IAU descriptor for an extensive land mass e.g. **Arabia Terra**. On Mars, most of the Terra regions are rugged and often heavily cratered.

The dark grey areas are exposed rock (mostly basalt) blown clear of dust by winds e.g. **Acidalia Planitia** and **Syrtis Major Planum**. The largest dark feature seen from the Earth is Syrtis Major Planum (named after a Libyan gulf). Planum is the IAU descriptor for a plateau or high plain.

The following screen clips from SkySafari shows some of the features that can be seen on Mars at 9pm and midnight on the 13th of October 2020. My labelling.





Very similar to the Earth, Mars rotates on its axis (Martian day) about every 1.026 days or 24hr37min. Mars has an axial tilt of about 25degrees to its orbital plane. Because of this, only the Northern Polar Ice Cap could be seen at the 2016 opposition. Only the Southern Polar Ice Cap could be seen for the 2018 opposition. However, widespread dust storms on the planet spoiled a lot of the potentially good views of the planet for that opposition. For the 2020 opposition, only the Southern Polar Cap will be seen again.

 Rob Horvat (WSAAG).