



Observing Mars

Features, Tips & Tricks for the Red Planet

Observing Mars

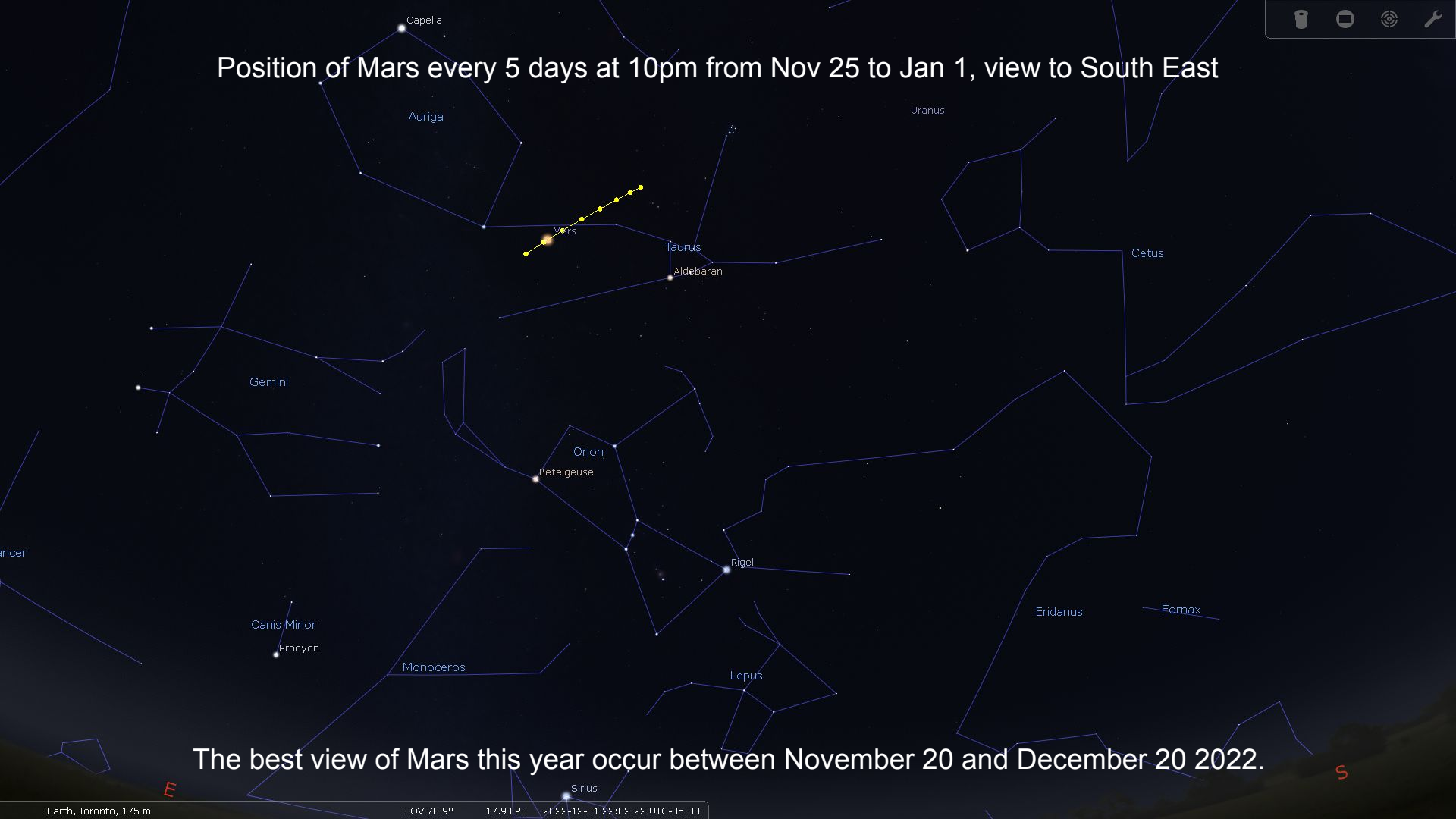
The Red Planet holds many delights for the patient observer. From the polar ice caps to dark albedo features to clouds and dust storms, even with a relatively small instrument one can see a tantalizing amount of surface detail when the planet is near opposition.

This talk will discuss:

- Where to find Mars in the sky this month
- Some features you may see
- Tips and tricks for observing Mars



Position of Mars every 5 days at 10pm from Nov 25 to Jan 1, view to South East



The best view of Mars this year occur between November 20 and December 20 2022.

The Best Views of Mars Occur Around 'Opposition'

Opposition is when a planetary body is opposite the sun in our night skies. Generally, the closest approach to the planet occurs at or near opposition, offering the largest angular size. Note in the image the different size of Mars approaching and departing from opposition in the 2018 apparition:



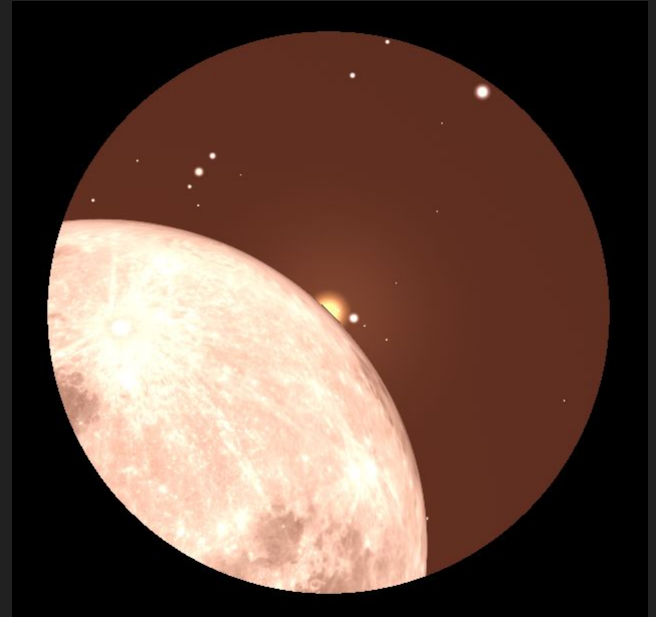
Upcoming Event - Mars Occulted by Moon December 7

The Moon is going to pass in front of Mars on the evening of December 7.

Start time: 10:26pm

End time: 11:14pm

Watch for the jagged outline of the Moon's surface standing out in stark relief against the reddish disc of Mars!



Observing Mars - Things to Consider

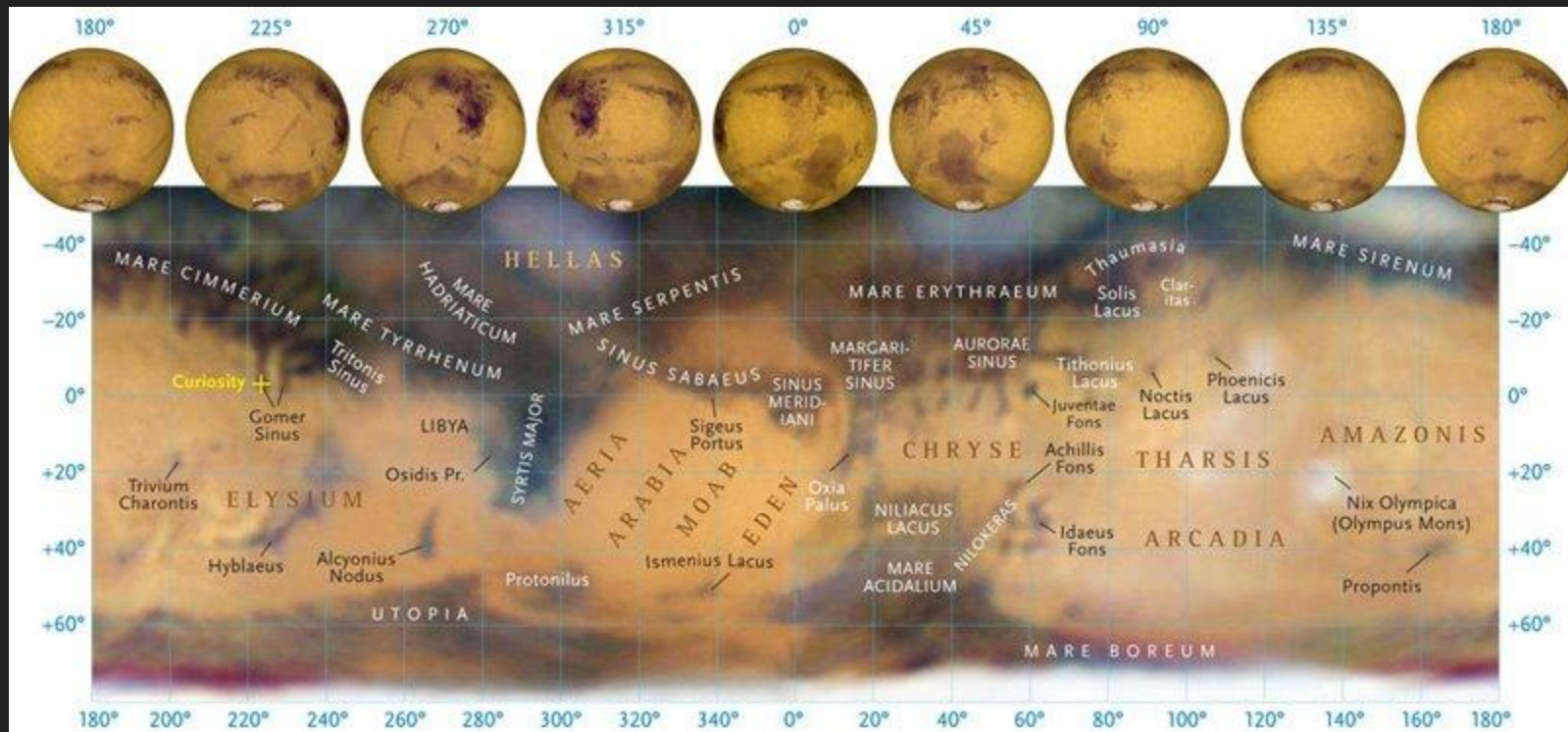
- Mars' Changing Face - How Rotation Period Affects What We See
- Telescope Considerations
- Seeing Conditions
- Eyepieces for Planetary Observation
- Using Filters
- Sketching
- Imaging

Mars' Changing Face

Mars rotates once every 24 hours and 40 minutes. This is a discrepancy with Earth's rotation time, causing us to view a slightly different view of Mars every 24h

- Observing at the same time over a few days gives us slightly different views
- Observing multiple times over a set number of hours in an observing session gives us slightly different views of Mars as it rotates
- Combined, we can view a good proportion of the Martian surface over a given period if we take multiple observations per observing night over several nights

Sights you can See on Mars



What Will It Look Like?

At first, before your eyes adjust to Mars' striking brightness through a telescope, you might see nothing but a orange-red disk with a slight white cast.

Be patient. Let your eyes relax. As your vision adjusts to the level of incoming light you will start to make out dark albedo features. You may see bright white near the poles - these would be polar ice caps. If you see more of a hazy blue-white near the poles, this is called a 'polar hood' - sublimated water and carbon dioxide from the polar ices forming a dense (for Mars, anyway) fog above the poles.

Sometimes Mars has local, regional, and even planet-wide dust storms that obscure its features.

With filters, you may be able to see more details with better contrast.

Verify Your Observations with A Mars Simulator


Some planetarium software, such as Stellarium, simulates what the face of Mars looks like - you will see albedo features and estimates of the polar ice caps.

Another independent free tool you can use is Sky and Telescope's Mars Profiler:

<https://skyandtelescope.org/observing/interactive-sky-watching-tools/mars-which-side-is-visible/#>

Note that regional and planet-wide dust storms, clouds and polar hoods will not be displayed in these tools as they are ephemeral features, so what you see may differ than their output.

Mars Profiler



Mars Profiler

This map depicts the Martian hemisphere facing Earth for the entered date, time, and telescope type. The red circle indicates the region of Mars pointed directly toward us.

Date: Time: UT
(mm/dd/yyyy)


Time-zone offset from UT in hours (from your Web browser):

Telescope type: **Inverted view**

Direct view
(Erect-image system)

Inverted view
(Newtonian / Dobsonian)

Mirror reversed
(SCT/Mak/refractor + diagonal)



Basic Data about Mars for telescopic observers:

Apparent visual magnitude: 1.8	Angular diameter (arcsec): 3.7
Distance from Earth (a.u.): 2.53	Elongation from the Sun (°): 24
Illumination (%): 99	Central-meridian longitude (°): 230
Position angle of north pole (°): 22	Opposition 2018 countdown (days): 294

Telescope Considerations - Design and Aperture

Even small refractors with sharp optics can do a great job on Mars.

Large apertures allow for greater magnification and resolution of detail, but suffer increasing disturbance in seeing due to atmospheric turbulence.

Serious planetary observers tend to use long focal length 4-6 inch achromatic and apochromatic refractors, Maksutov-Cassegrain, or Maksutov-Newtonian telescopes in the 6-8 inch range.

Schmidt-Cassegrain telescopes and large Newtonian & Dobsonians can also provide good images, but the large secondary mirror obstruction decreases sharpness and contrast.

A tracking/Go-To mount is not strictly necessary, but helps with maintaining the field during high-magnification observations.

Refractors & Mak-Cass & Mak-Newts



Seeing Conditions & Being Patient

Wind and atmospheric instability - 'seeing conditions' can greatly affect your ability to make good observations.

In bad seeing, the image will almost 'boil' and 'waver', and there will be lots of glints of false colour, making it hard to determine what you are 'really' seeing.

Nights with good stable seeing are still not perfect, but they go a long way to helping.

When observing, take your time. Observe for at least 2 minute intervals with brief breaks in between. Use the breaks to write down notes or make sketches.

Moments of excellent seeing will come and go, and you will notice details that are a little ephemeral and can only be really grasped in fleeting moments.

Eyepieces for Observing Mars



Eyepieces for Observing Mars

Serious planetary observers favour eyepieces with minimal numbers of lens elements to maximize contrast and light transmission. Usually these eyepieces have 60° or less of apparent field of view.

Plossls - Reliable performers, but eye relief below 7mm is very tight.

Brandons - Eyepiece design from 1940s, good with long focal length scopes for high contrast and bright planetary views.

Vixen HR Eyepieces - Excellent contrast and eye relief, but sizes too small for scopes with focal lengths beyond 700mm.

Orthoscopics - longtime favourite if planetary observers. Excellent contrast and small form factor.

Tele Vue Delites - premium eyepieces with 62° apparent field of view.

Zoom Eyepieces - premium models can be excellent planetary performers, such as Baader Hyperion Mark IV zoom or 3-6mm Nagler Zoom from Tele Vue.

Barlow Lenses



Barlow Lenses

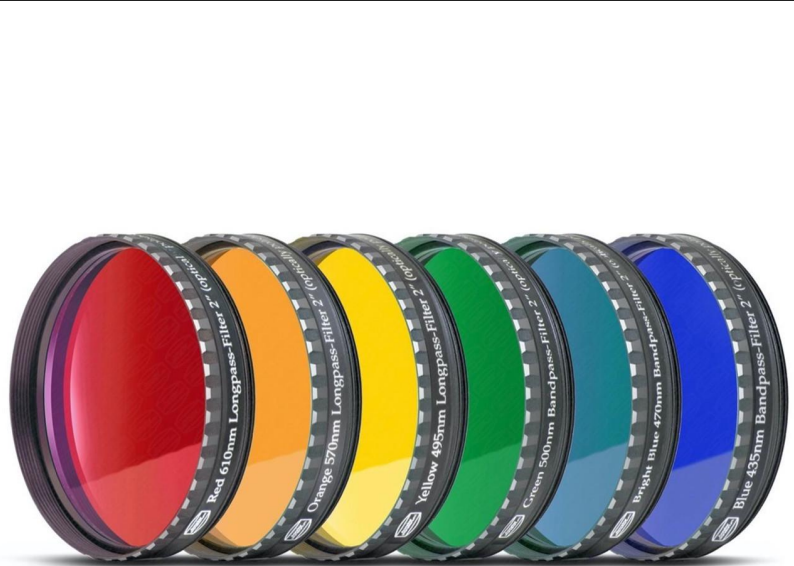
A Barlow is a lens that increases the magnification of an eyepiece.

You can get Barlows in many increments, from 1.5x to 5x. Generally speaking a good 2x or 3x Barlow will serve you well to increase the number of magnifications your eyepiece collection can produce.

A single Barlow lens can effectively double the number of magnifications you have access to if you plan the eyepiece sizes in your collection well.

Cheap Barlows are not appropriate for serious planetary observing because they have cheap glass and are poorly coated, with much internal reflection.

Using Filters - Neutral Density, Polarizing, Colour etc.



Using Filters - Neutral Density or Variable Polarizing

If you find that Mars is just too bright in your telescope to see good detail with good contrast, try using a neutral density filter or variable polarizing filter to cut down the light and enhance contrast.



Using Filters - Colour

Many standard colour filters help with observing features on the Martian surface and in its atmosphere.

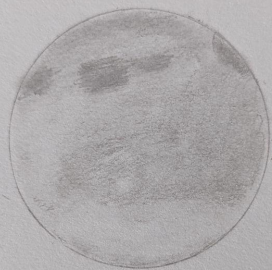
- Orange (#21 or 23A) increases contrast between light and dark features and penetrates hazes and most clouds
- Yellow (#12, #15) can brighten desert regions and darkens bluish and brownish features
- Red (#25, #29) gives maximum contrast of surface features, enhances fine surface details, dust cloud boundaries, and polar cap boundaries
- Light Green (#56) darkens red and blue features, enhances frost patches, surface fogs, and polar caps.
- Blue (#80A, #38A) and deep blue (#47) shows atmospheric clouds, discrete white clouds, limb hazes, equatorial cloud bands, polar cloud hoods, and darkens reddish features.

Using Filters - Specialized

Some companies also produce specialized 'Mars Filters' for general Mars observing that enhance contrast. Examples of these include the Celestron Mars filter and the Baader Contrast Booster filter.



Sketching Mars



Mars
November 2, 2022 21:40
Kitchener, ON
Bausch + Lomb 114 mm Newtonian
7.5 mm Antares Plossl 120X

Sketching Mars

Planetary sketching can be done in black and white or in colour to more accurately represent what we are seeing.

Heavy bond white art paper in a sketch book is recommended.

Good sketching pencils with a variety of darkneses/hardnesses (at least 2H, HB, B, 2B and 4B), along with blending tools are recommended for black and white.

High quality pencil crayons such as Castle Arts, Faber-Castell Polychromos, and Arteza are recommended for colour sketching.

Imaging Mars



Imaging Mars

Getting an excellent image of Mars through a telescope is not an easy task and it is not a task for beginners. Although you might snap an okay photo with a cellphone, quality results take time and experience.

For serious imaging attempts, a dedicated planetary astronomy camera is necessary. It needs a relatively small sensor with small pixels for good resolution and it needs to be matched with a long focal length telescope on a solid mount.

ZWO makes excellent planetary cameras, such as the ASI290-series, ASI224-series, and the ASI462MC camera.

A colour camera works well, but some experienced imagers use monochrome cameras with a set of colour filters and a filter wheel. A TEC-cooled camera is generally not required for planetary imaging.

The ZWO Atmospheric Dispersion Compensator (ADC) can be used to counteract the effect of the atmosphere refracting light of various colours differentially and produce sharper images.

Resources and References

<https://agenaastro.com/articles/observing-articles/mars-observing-guide.html>

<https://agenaastro.com/articles/choosing-a-color-planetary-filter.html>

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<https://skyandtelescope.org/observing/celestial-objects-to-watch/an-observers-guide-to-mars/>

<http://alpo-astronomy.org/marsblog/>

Abel, Paul G. 2013. Visual Lunar and Planetary Astronomy. Springer.