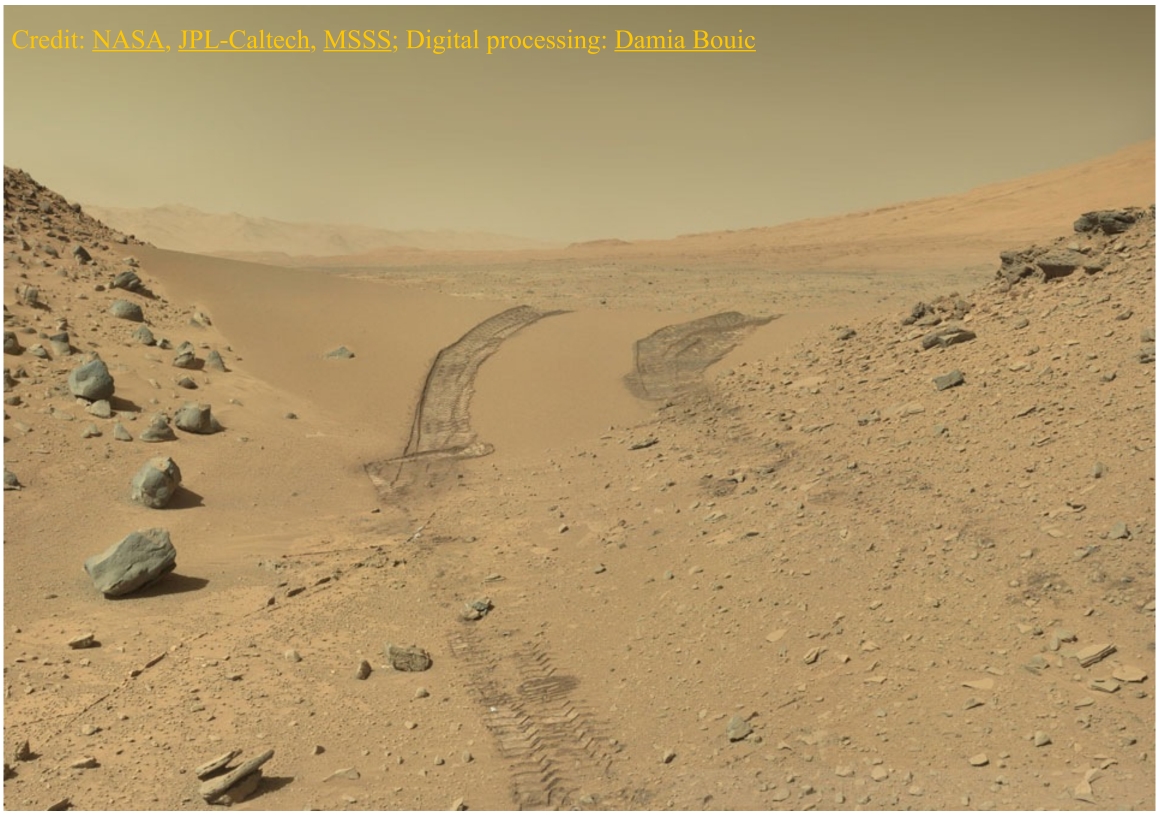
SkyWAAtch



A Dune Buggy

The Curiosity rover is continuing its investigation of the Martian surface in search of makers which would support the present or past existence of rudimentary life on the red planet. The car-sized rover is approaching Mt. Sharp, the central peak of the large crater in which it landed. Life might have shown preference for water that once ran down the Martian mountain. Two weeks ago, to avoid more dangerous and rocky terrain, Curiosity was directed to roll across a one-meter high sand dune that blocked a useful entrance to Mt. Sharp. Just after the short trip over Dingo Gap was successful, the robotic rover took the above image showing the now-traversed sand mound covered with its wheel tracks.

See page 4 for an article on observing Mars.

In This Issue . . .

Events for March 2014

WAA March Lecture

“Lunar Geology - the history of the Moon”
Friday March 7th, 7:30pm
Lienhard Lecture Hall, Pace University
Pleasantville, NY

Mr. Alan Witzgall will describe what we can learn just with our telescopes of the processes that shaped our nearest neighbor, the Moon, and how to recognize features in comparison to that on Earth. He will speak on what the Apollo program taught us, and why we need to go back. Mr. Witzgall will bring samples of terrestrial rocks similar to what has so far been found on the Moon. He will also bring a few (tiny) lunar meteorites from his collection, with a microscope, so the attendees can get up close and personal with Luna!

Mr. Witzgall holds a Bachelor’s degree in Earth Sciences from Kean University. He is an active long-term member of the Amateur Astronomers, Inc. of Cranford, NJ, and is a past president of that organization. He is also active at the New Jersey Astronomical Association in High Bridge, NJ, serving there as its Vice-president. He is currently a Senior optician for ESCO Optics of Oak Ridge, NJ. His career in optics started with building telescopes in his basement during his high school years. In 1977, one of them, a 10-inch reflector, took First Award at Stellafane. Lectures are free and open to the public. Directions and Map.

Upcoming Lectures

Lienhard Lecture Hall,
Pace University Pleasantville, NY

On April 4th, Linda Zimmerman will speak on Astronomical Alignments of Hudson Valley Stone Sites. On May 2nd, Dr. Anze Slosar from Brookhaven Labs will be doing a lecture on “The Mysterious Universe.” Free and open to the public.

Call: 1-877-456-5778 (toll free) for announcements, weather cancellations, or questions. Also, don’t forget to periodically visit the WAA website.

WAA APPAREL

Charlie Gibson will be bringing WAA apparel for sale to WAA meetings. Items include:

- **Caps and Tee Shirts, $10**
- **Short Sleeve Polos,**
- **Navy hoodies for $22.**

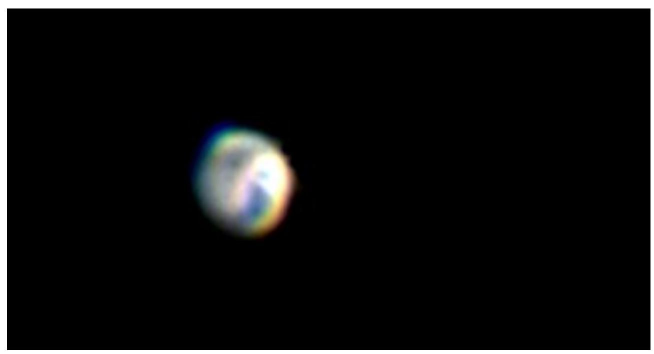
Starway to Heaven

Saturday March 22nd, 7pm.
Meadow Picnic Area,
Ward Pound Ridge Reservation,
Cross River, NY

This is our scheduled Starway to Heaven observing date for March, weather permitting. Free and open to the public. The rain/cloud date is March 29th. **Note**: By attending our star parties you are subject to our rules and expectations as described here.

Renewing Members. . .

John Markowitz - Ossining
Neil Roth - Somers
Pierre-Yves Sonke - Tarrytown
Ruth and Eugene Fischer - Pleasantville
Jim Cobb - Tarrytown
Arumugam Manoharan - Yonkers



Mars Approaches

John Paladini captured this image of Mars through a Celestron 9.25. Note the surface features and slightly gibbous phase.

Join WAA at NEAF, April 12-13 Rockland Community College, Suffern, NY

NEAF is one of the largest astronomy shows in the world. Besides the many equipment, book and supply vendors there are lectures and, weather cooperating, the Solar Star Party. WAA will again have a booth at NEAF and we hope you will donate an hour or more of your time to help man the booth. Meet and mingle with fellow WAA members and other astronomy enthusiasts from all over the country, express your enthusiasm for our hobby and have a place to leave your stuff. Put NEAF in your calendar now!

Almanac

For March 2014 by Bob Kelly

Mar 1 Mar 8 Mar 16 Mar 23 Mar 30

The highlight of March will be 'not seeing' something. The brightest star in Leo the lion, Regulus, will be briefly blotted out by faint asteroid Erigone passing in front of it just after 2am EDT on March 20th as seen from a narrow band over Bermuda, the New York City area and continuing northwestward into upstate New York. Seeing one of the brightest stars in the sky turn off for up to 14 seconds is a spooky event worth seeing. Timings from many locations of how long Regulus disappears can be used to map the shape of the asteroid. For lots of details, including how to make scientifically useful observations, see http://occultations.org/Regulus2014/. It'll be interesting to see if anybody well away from the predicted path sees a brief disappearance, which could mean a secondary occultation by an undiscovered moon of Erigone.

If you want to see this event, in addition to setting an alarm clock awfully early, you'll need to make sure you won't go out at 2am just to find out you can't see Regulus from where you planned to stand. (Seeing Regulus disappear behind a tree branch or a house definitely does not count!) So, go out some evening earlier in the week and see if you can see the tip of the V in Hyades in Taurus around 8 to 8:30pm EDT. (That's the V above Orion with reddish Aldebaran at the end of one of the arms of the V.) Regulus at 2am will be about a couple of fingerwidths below that spot in the sky, so if you can see that area below the V without obstructions, you should be able to see Regulus from the same spot around the time of the occultation.

Of course, there are many longer-lasting astronomical sights at more reasonable times in March.

The morning sky has a bright spray of planets, with Venus anchoring the scene low in the dawning sky. To its lower left early in the month is Mercury and well to its right is Saturn, and Mars further to the right, giving the early riser up to four planets for inspection.

Mars gets 25% larger this month and looks substantially brighter as we approach for our closest pass in many years in April. Mars rises by the end of evening twilight late in the month, making it more accessible to the prime time observer. A Mars map will help tell apart light colored deserts from the small summertime north polar cap.

Saturn tries to rise earlier this month, with Saturn-rise just before midnight early in March, but getting tossed back to the other side of midnight when daylight time starts on Sunday the 9th. So, it's really still a morning object. Saturn gets 5% larger in March, making a great sight even easier to see.

Venus gets smaller but thicker this month, more like a half-moon than a crescent. It's a little less bright at magnitude minus 4.7, but still standing out low in the southeastern dawn sky. Venus is joined by Mercury, which will be hard to spot lower to the left during the first two weeks of March. By the end of the month, Venus is moving rapidly away from the Earth and gives up its title as the 'closest planet to Earth' to Mars.

Early morning astronomy gets a bit easier with the change to daylight time, with sunrise returning to after 7am, a time more typical to early January, but giving us more time for viewing Venus from east-facing train, bus and elevated subway stations on our way to work.

Jupiter is king of the nighttime, passing high and bright overhead during prime time. It's so high in the sky people with refractor telescopes may find it awkward to get under the eyepiece and look through the telescope pointed almost straight up. But it's a great time to see the giant planet, with its 'great red spot' more prominent this year and four bright moons that occasionally leave their shadows lingering on the planet's face.

A bit late for Olympic ice dancing, 4Vesta and 1Ceres appear to twirl across the sky in Virgo, paired up from now through summer. In July they get within one degree of each other in the sky. Use your imagination to 'see' NASA's Dawn spacecraft as its ion engine putters on its way between the two asteroids. You'll need a good chart of their locations, but it's great if you can track these two large rocks as they brighten to visibility in binoculars moving among the stars of Virgo from week to week. Add to your list of asteroid finds by seeking out 2Pallas, also in binocular range in Hydra.

The International Space Station joins the fun in the morning sky starting on the 11th through the end of the month.

This wouldn't be an almanac column without noting the equinox occurs at 12:57pm EDT on March 20th. Enjoy!

[1] Erigone is from a Greek myth, so when spoken it's divided up as e-RIG-on-e, not er-i-gone, even though since it's making a star disappear, it might be more fun to use the "–gone" version.

Mars Returns

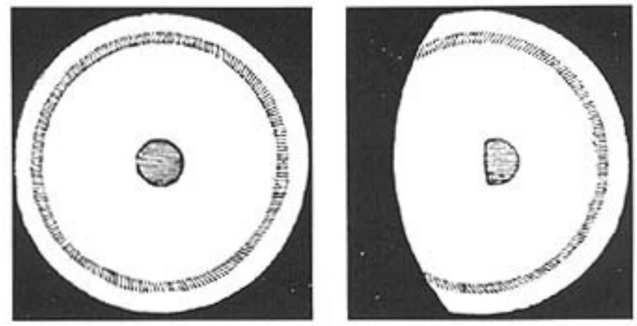
by Larry Faltz

Mars was unfavorably positioned for viewing in 2013, but it is coming into opposition and will be an excellent, if challenging, object in the evening sky throughout the spring, especially in April. It's always a thrill to glimpse surface markings and a polar cap but you have to plan and set up your equipment properly.

A Brief Observing History of Mars

Mars was known to the ancients, of course. Its red color, distinct from the rather bland tint of the four other naked-eye planets, rather naturally provoked an association with blood, war and death. To the Chaldeans it was *Nergal*, the god of the dead and of battles, while in Persia it was *Pahlavani Siphir*, the Celestial Warrior. Its Greek name, *Ares* (Ἄρης), was derived from words for killing, disaster and vengeance. As the Roman God of War, *Mars* was particularly important not only because he could be linked to Roman military achievements but because he played a role in the founding of the city. In one prominent legend, Rhea Silvia, a descendant of the Trojan prince Aeneas (who led the remnants of the Trojan people to Italy, famously told in Virgil's *Aeneid*), was impregnated by the Mars and gave birth to Romulus and Remus, the twins who were eventually to found Rome.

Around 300 BC, Aristotle observed an occultation of Mars by the Moon, and realized that the planet had to be farther away in the celestial sphere. Its heavenly positions were accurately plotted by Tycho Brahe in the late 16th century, but it wasn't until 1609 that Johannes Kepler used Brahe's data to prove that planetary orbits are ellipses, not circles, and thus derive his laws of planetary motion. Mars was observed by Galileo in 1610. He wrote to a friend on December 30, 1610 that "I dare not affirm that I was able to observe the phases of Mars [as he had seen with Venus a few months earlier]; nevertheless, if I am not mistaken, I believe that I have seen that it is not perfectly round." His telescope was not good enough to make out any detail on the surface, but he may have had a glimpse of its gibbous phase as it moved past quadrature. In 1636, Francesco Fontana made the first drawing of Mars, claiming that its disk "was not uniform in color" although it appears it was the poor quality of his optics that was responsible for any surface features he claimed to see, since this mark appears on his drawings of Venus as well. But he did draw its gibbous appearance on August 24, 1638, when the planet was 86% illuminated. The extent of the phase is obviously exaggerated, but probably not just another optical error.



Fontana's sketches of Mars (L: 1636, R: 1638)

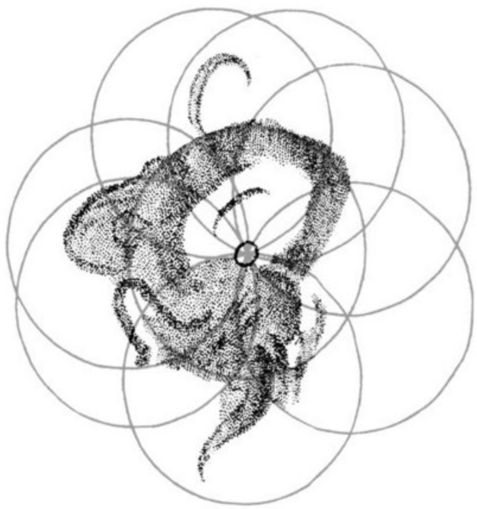
Christiaan Huygens made the first definitive observation of a Martian surface feature, probably Syrtis Major, on November 28, 1659. Although Mars was close to the moon that night, it was more than 17 arc-seconds in diameter, affording a reasonable view in the telescopes that were improved with grinding and polishing techniques of his own invention. The instrument he used to discover Saturn's moon Titan in 1655 was probably similar if not identical to the one he used for Mars. Its thin objective lens, now in the Utrecht University Museum, was 57 mm in diameter had a focal length of 3367 mm, giving a focal ratio of f/59!

The polar cap appears to have first been observed by Gian Domenico Cassini in 1666. Huygens' sketch of Mars in 1672 showed a polar feature in addition to what is more clearly Syrtis Major.

Huygens' sketches of Mars (1659, 1672, 1672)

At the time of his 1659 observations, Huygens employed a micrometer eyepiece of his own design and calculated that Mars' diameter was about 60% of the Earth's (not bad, the actual ratio being 53%). He also estimated the Martian solar day to be 24 hours long, refined in 1666 by Cassini to 24 hours, 40 minutes, very close to the actual value for a solar day of 24 hours, 39 minutes, 35 seconds.

The next great Mars observer was Giacomo Maraldi, a nephew of Cassini, who observed changes in the polar caps and most likely surface clouds. His findings were published in 1719. William Herschel observed favorable oppositions in 1777, 1779, 1781 and 1783 and deduced that the white spots at the poles were accumulations of snow and ice. His meticulous observations from multiple sightings as the planet rotated resulted in the first map of the Martian South Pole.

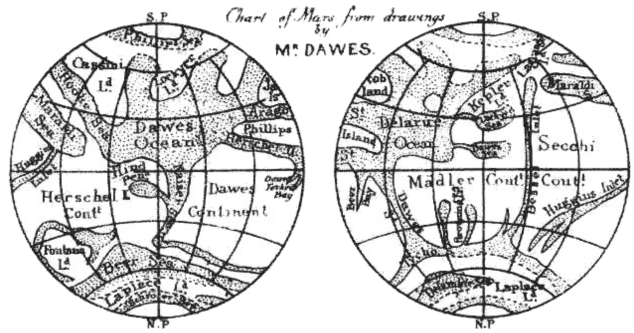


William Herschel's map of the Martian South Pole (1783)

Herschel stated that Mars had an atmosphere, and believed that it was inhabited. He addressed the Royal Society about this in 1784, noting,

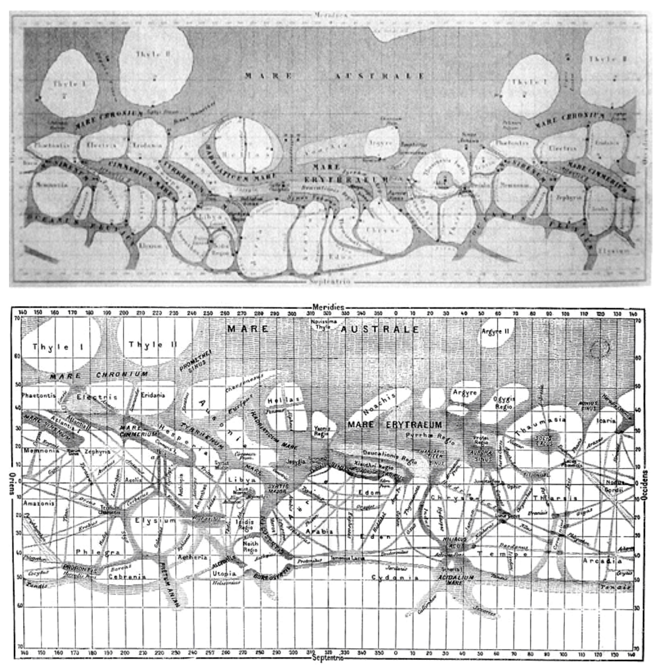
> It appears that this planet is not without considerable atmosphere; for besides the permanent spots on the surface, I have often noticed occasional changes of partial bright belts; and also once a darkish one... These alterations we can hardly ascribe to any other cause than the variable disposition of clouds and vapors floating in the atmosphere of the planet... Mars has a considerable but modest atmosphere, so that its inhabitants probably enjoy a situation in many respects similar to our own.

It was a widely held belief that all extraterrestrial bodies were populated. Huygens described planetary life in a 1698 book, *Cosmotheoros*. Mars, being relatively close to Earth, and with seasonal changes now quite clearly accepted, took on a special focus among observers. As the quality of telescopes improved in the 19th century, many surface maps were made, most notable among them by Wilhelm Beer and J.H. von Mädler in the 1830's, by Father Angelo Secchi in 1858, and in the 1870's by Richard Proctor, based on drawings William Dawes made at the 1864 opposition with an 8" refractor. It was Giovanni Schiaparelli's map of 1878, made from observations with an 8.75" refractor of the close 1877 opposition, which described features he called "canali."



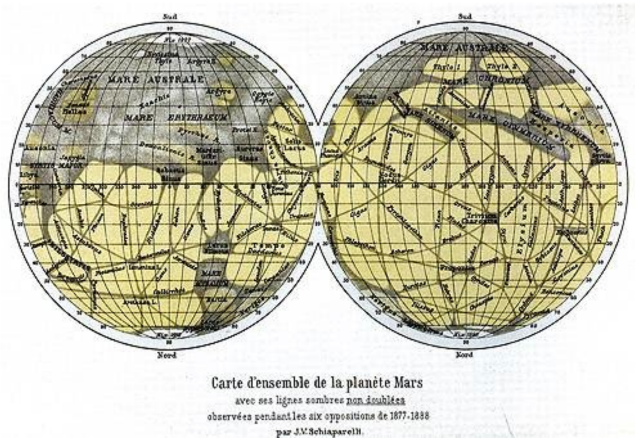
Map by Richard Proctor (1873)

Schiaparelli's did not believe that he was seeing anything other than natural geologic or hydrologic phenomena. In Italian, "canali" are "channels". Schiaparelli, like many others, believed the dark areas were bodies of water and the lines between them merely connecting waterways of natural origin. But in the years following the momentous creation of the Suez Canal (opened in 1869), it was only natural that the English-speaking world took the word "canali" to mean "canals," implying someone made them, and this opened a floodgate of observation and speculation. Another map made by Schiaparelli in 1879 had even straighter lines, thus fueling the fire.



Schiaparelli's maps of Mars (top 1877, bottom 1879)

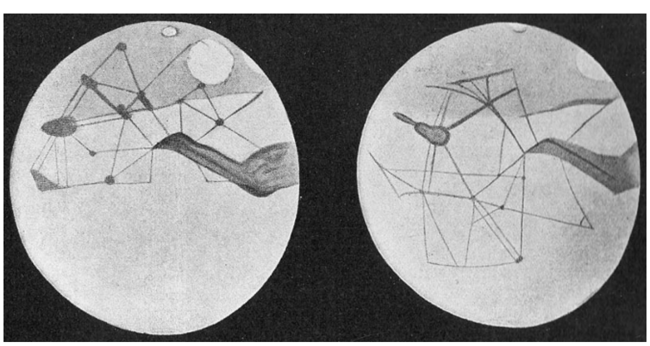
Schiaparelli continued to refine his maps and show them in different projections.



Schiaparelli's map of 1888

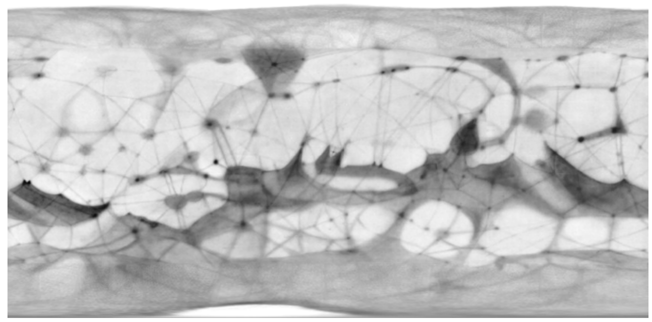
Over the next few decades, several books came out describing the struggle of Martian engineers to move water around an arid and dying planet (why else build canals?), among other fantastic conceptions of possible Martian water-based ecology. "Real" fiction followed shortly thereafter, with H.G. Wells' *War of the Worlds* (1898) and Edgar Rice Burroughs' various Barsoom novels (the first, *A Princess of Mars*, coming in 1912) the most famous of the lot.

What really kept the pot boiling was the belief of a wealthy New Englander, Percival Lowell, in the existence of Martians. Lowell famously built his observatory in Flagstaff, Arizona, in 1894, installing a 24" f/15 Alvin Clark & Sons refractor with which to study the red planet. The scope, historically open for public viewing nearly every clear night of the year (you could even rent it for an evening) just closed for refurbishment after 117 years of continuous service and will reopen in early 2015. Lowell's drawings, presumably accurate because of the fabulous resolution of his instrument, showed straight features that could only have been made by intelligent creatures. They were the water-carrying equivalent of Roman roads.



Two of Lowell's Drawings

Lowell wrote 3 books on Mars and commanded vast public attention, but although most serious observers didn't see straight canals a few did, and a credulous public wanted to believe. Serious scientific opposition hinged on calculations that the surface temperature of Mars was below the freezing point of water and therefore inimical to life, a theory advocated by Alfred Russell Wallace, the English naturalist who had independently come up with the idea of evolution at the same time (1859) as Charles Darwin. In 1909, the then-new 60" reflector at Mt. Wilson showed that there were no straight features on the surface of Mars. Even though subsequent research in the first quarter of the 20th century confirmed that the surface was too cold for life, the possibility of a Martian civilization remained strong in the public's mind. The official US Air Force map of Mars, prepared in 1962 in preparation for the Mariner 4 mission, still showed straight lines connecting the darker areas.

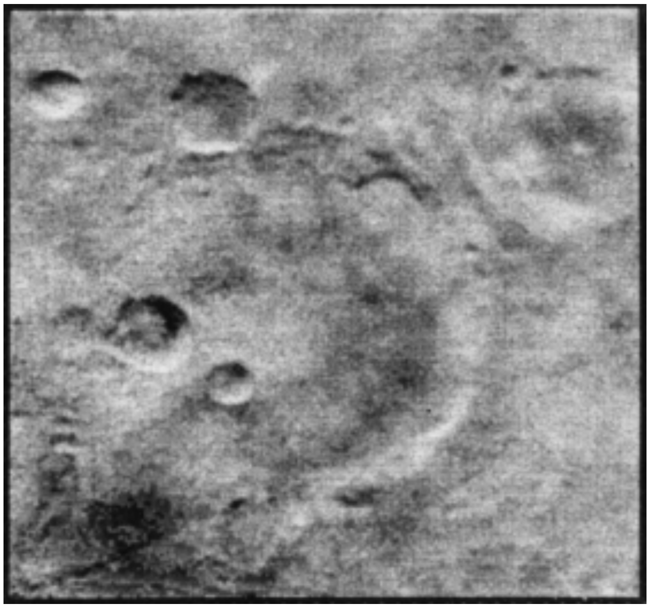


US Air Force Map (1962)

There's a marvelous collection of historic maps of Mars (as well as maps of the Moon and the other planets) at the website of the International Planetary Cartography Database.

In spite of the telescopic evidence and temperature calculations, there was still serious support throughout the first half of the 20th century for the idea that some of the seasonal changes on the Martian surface were due to vegetation. As late as 1963, in his superb book *Watchers of the Skies*, astronomer and space travel enthusiast Willy Ley wrote, "The odds still favor the vegetation theory," which he described as the "majority opinion."

It was not until the flyby of Mariner 4 in 1964 that Mars was confirmed to be a cold, lifeless world. Pretty much overnight, the idea of a Mars hospitable to organic life evaporated. The many subsequent missions, including landings, mobile robotic surveyors and high-resolution orbiting satellites, have given us a vast amount of information about the planet. So far we have failed to find any direct or even indirect evidence of biologic activity. The most life-supporting clue is that there is direct evidence of water on Mars, in the form of hydrated minerals and possibly sub-surface ice and visual evidence consistent with (but not diagnostic of) flowing water, including effluvia that may have recently formed.



Mariner 4 image of the Martian surface

The primary remaining question is whether Mars ever had life. There are a few scientists who hope for a very long shot of discovering a microbiotic form of life in one of the potentially habitable environments somewhere under the Martian surface. We've seen so many images from and of the surface that it's simply not in our consciousness anymore to wish, or fear, to meet Martians. We can view 3-D images, control animated flyovers and even, from time to time, to see near-live transmissions from the Martian surface. Our rovers crawl and dig on the surface and send us chemical and physical analysis of Martian rocks, dirt and atmosphere. And yet, in spite of all of this data and the magnificent views from the surface landers and from orbiters such as HiRISE, there's something profoundly thrilling about even the most fleeting live glimpse of the surface through a telescope.

Mars at Opposition

Mars' year is 686.98 Earth days long. About every 26 months it is in opposition (opposite the sun as seen from the Earth). The next opposition will be on April 8, 2014. Because of the difference in orbital eccentricity (variance from a circle) of the Earth and Mars (Earth's is 0.01687, Mars 0.0934) the distance between the planets at opposition changes from cycle to cycle, varying from 34 million miles to 63 million miles. Optimal oppositions for observing occur when Mars is close to perihelion (closest to the sun). We remember the justly famous August 27, 2003 "perihelic" opposition, when Mars was 25 arc-seconds in diameter. This was the closest approach in 50,000 years (and I bet we'll be getting those spam emails from our uninformed friends for another 50,000 years). This year's opposition is relatively apihelic and so the planet will be only 60% as large as that glorious 2003 opposition. Also, because of the varying speeds of the planets in their orbits, Mars' closest approach (and therefore largest angular diameter) can vary by up to two weeks from the actual date of opposition. In 2014, closest approach will occur on April 14th.

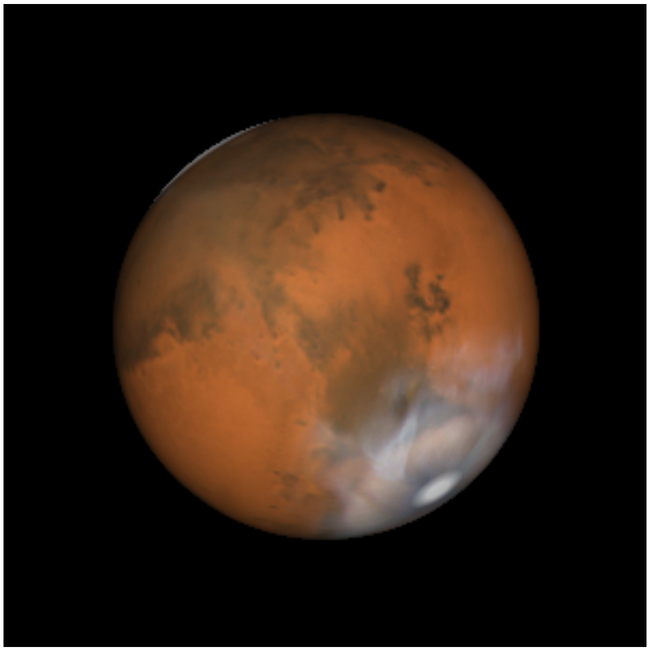
On that date Mars will be 15.2" in diameter, at a distance of 0.617 astronomical units from Earth shining at magnitude -1.4. It will be in Virgo, but only 7 degrees from the full moon, which might cause a slight glare problem in many telescopes. But for a week before and after, its diameter will still be at least 15" and will be easier to observe. Another limiting factor in this year's opposition is that Mars' position on the ecliptic puts it fairly low in the sky, close to Porrima in the constellation Virgo, at an altitude of about 43 degrees.

Observing Mars

Observing detail on a planetary or lunar surface is dependent on "seeing", the degree to which the wavefront of the object is disturbed by variances in the refractive index of the atmosphere. Earth's atmosphere is never at thermal equilibrium: there's constant variation in the temperature over both small and large distances, and both high and low-level winds further mix things up. The more atmosphere you have to look through, the worse it is, which is why objects near the horizon lose detail and why research telescopes are sited on mountaintops. Unless you plan to travel this April (I recommend the Visitor's Information Center on Mauna Kea at 9,300' elevation, which has observing every night through scopes as large as 16"), you'll have to make do with local conditions. To optimize your viewing, you'll need three things: good optics, accurate collimation, and patience.

Obviously you will have to use fairly high magnification to get a look at surface features. I've found that 200-250x is about all that our local skies can support, although on a (rare) night of superb seeing you might be able to boost it up to 300x or even higher. Remember the general rule of thumb is that you can use up to 50x per inch of aperture if you have excellent optics, but less with a Schmidt-Cassegrain, whose large central obstruction reduces detail contrast. Once you reach the limit of the seeing, you can make the planet bigger with a higher magnification, but you won't see any more detail.

If you have a reflector or an SCT, collimation is critical. Even a small deviation from optimal collimation will soften detail. Newtonian reflectors and Dobsonians are optimally collimated with a laser: it's much easier than using a star. For SCT's, although there are several ways to collimate using a laser or artificial star, you can collimate in the field using Polaris and a high power eyepiece. Make sure your scope is cooled to ambient temperature to reduce internal heat plumes. If you observe through a diagonal, leave it in the optical train when collimating. Refractors generally don't need to be collimated, although a few high-end scopes do have collimation screws on their lens mounts.

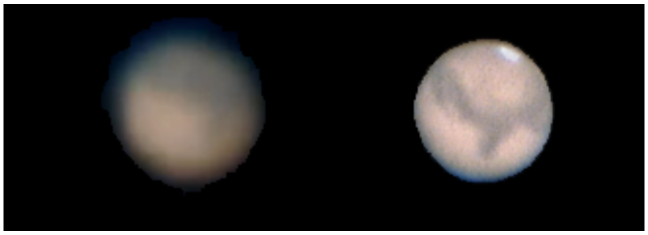


Computer-generated image of Mars at opposition in 2014

Once you've sighted and focused the planet, you have to look, look some more and then keep on looking. The image will only be stable for fleeting moments amid the atmospheric chaos. But those moments are precious, and you should be able to make out surface markings or at least the polar cap. An orange filter helps the contrast, and I usually use one for Mars. In 2010, Mars was visible at WAA's outreach event for the Scarsdale third-graders at Quaker Ridge School on Weaver Street. I got it in the field at 222x with my 8" SCT and used an orange filter. I brought an observing chair for the viewers and sat next to the scope in another chair. As each person came up to the scope, I told them, "Our atmosphere is unstable and you need to be patient…keep looking at the planet…if you keep looking, the image will clear for an instant and you'll see the polar cap and the surface…keep looking at it." I kept chanting this mantra, and after an interval of perhaps 20-30 seconds each viewer, child or adult, excitedly burst out "I see it!" It was one of the most rewarding outreach programs that I've participated in. Obviously, tracking the planet with a motorized mount will allow you to concentrate on observing. I also find a binoviewer to be helpful for planetary observing. Since you avoid having to strain to keep one eye shut your eyes will be more relaxed.

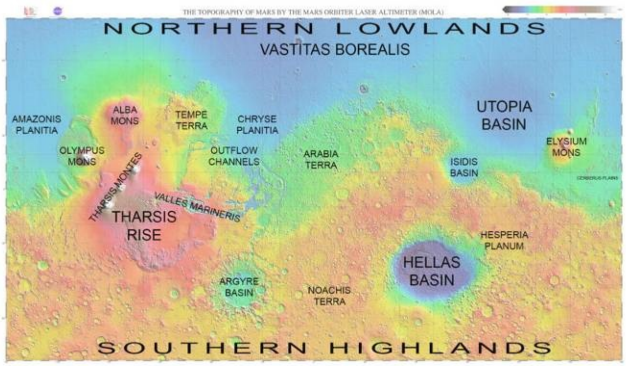
Like Earth, Mars is tilted relative to its orbit by around 25.2 degrees (another Herschel discovery) and so it has seasons just like ours. They last longer, of course, since its orbit is so much bigger. Martian seasons are out of sync with Earth's because its axis doesn't point at Polaris but towards Deneb. In spring 2014 in our area it will be winter in Mars' southern hemisphere and summer in the north. The North Polar Cap should be fairly easy to detect, being favorably pointed towards Earth although it will have retreated somewhat from its maximum extent during the prior Martian winter.

Most decent telescopes, even small refractors, can show Syrtis Major, the large dark area covering the southern hemisphere. It might be possible to glimpse the South Polar Cap at the edge of the planet if its extent grows sufficiently.



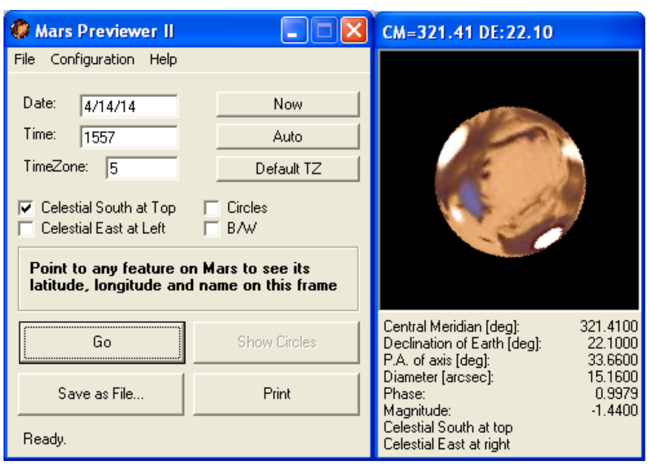
L: Crummy seeing, small scope. R: Spectacular seeing, large scope

How do you know what you're looking at? You can use one of the Mercator projection maps that are commonly available in astronomy books, but they are often too detailed for telescopic use. The Internet has a vast array of images from orbiters on several web sites, including NASA Interactive Maps and a trove of information is posted on the Mars Odyssey mission web site at the University of Arizona. This site apparently contains every image ever downloaded from Mars, as far back as Viking! A nice article by Emily Lackdawalla on the Planetary Society's web site shows the history of photo-composite maps of Mars taken from space.



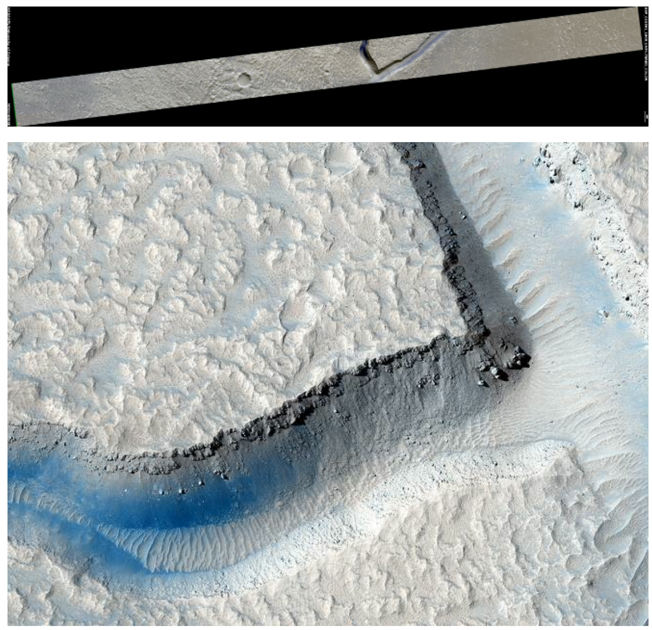
Topographic map based on the Mars Orbiter Laser Altimeter

But these maps are not very useful for amateurs with small, portable instruments who get a mere glimpse of color variations on the surface. A small program, Mars Previewer II, is available for download from the Sky & Telescope web site. The program displays a small image of the planet at whatever time you choose. You can hover the mouse over a feature and it will report its identity and planetary coordinates. It's an old program, based on the ephemeris of Mars published in 1990 by S&T's Roger Sinnott, but it works well enough. When I downloaded this program, unzipped it and ran the Setup program (on a Windows XP machine), it gave me an error that said there was a missing *dll* file. I clicked "Ignore" and the program installed and ran well except for the "Auto" function. You can save the image for the time you will be viewing (although it is not annotated), label it yourself and bring it to the telescope.



There are also apps for smartphones. I have one called Mars Globe, a freeware app for iOS that allows you to rotate the planet and zoom it. Surface features are labeled and details are given if you tap on the text. You can select the false color topographic background based on the Mars Orbiter Laser Altimeter data or a plain natural color view. There are a large number of other options and information that this free app gives you, including lots of Mars-related links to sites such as HiRISE, THEMIS, Mars Express and half a dozen others. This would be an optimal way to identify features at the telescope.

Although I encourage you to view Mars with your own eyes this spring, on a cloudy night check out the spectacular High Resolution Imaging Science Experiment (HiRISE) with over 30,000 (and growing) astonishing high resolution images, some of them presented for 3-D viewing as anaglyphs which you can look at right on your monitor with those 3-D glasses that you saved after seeing *Avatar*. The camera, aboard the Mars Reconnaissance Orbiter, records a continuous swath 20,000 pixels wide from an altitude of 300 km, from which detailed images are made. Here's a recent image, with a thumbnail of the original swath on top (rotated 90 degrees clockwise).



HiRISE image of part of Echus Chasma, acquired 9/25/13. Objects as small as 162 cm (around 5½ feet) across can be resolved on this image.

If you do any of your own planetary photography of Mars at this opposition, be sure to submit your images to the Sky*WAA*tch newsletter.

Westchester
Amateur Astronomers

A Homemade Leveling Platform for a 12-inch Dobsonian—First Light Report

by Woody Umanoff

I purchased my first major telescope last winter, theOrion XX12, a 12-inch truss-tube Dobsonian. I decided against the go-to version because I wanted to find objects myself. I thought about the push-to (Intelliscope) version, but some owners reported difficulties reading the narrow controller screen, as well as operational difficulties, especially in cold weather. That left the other main option I had read about to assist finding objects: installing an azimuth setting circle and digital inclinometer for altitude readings.

There have been many very nice setting circle installations for Dobsonians. Most of these involved placing the azimuth scale between the upper base and groundboard and cutting a notch or hole out of the upper base to permit reading the scale. Some of these projects worked well for object location, but others apparently not as well, probably for a number of different reasons. The addition of leveling feet to the base in one project posted on the web seemed to improve the accuracy of this system and struck me as being an important feature.

The Orion XX12 base is nicely finished and has a circular top and triangular groundboard. I was reluctant to cut into the base of my brand-new scope. I thought that doing so might weaken it over time and leave it more exposed to moisture. So I decided to leave the base intact and to construct a platform to which the azimuth ring and leveling feet would be attached and on which the telescope base would be placed. I purchased plywood at Home Depot. I then cut out a 27-inch diameter circle from the plywood square. The circular platform would project 2 inches from underneath the telescope base. I sanded the circle and edged it with a strip of black kitchen border vinyl, cut to approximately 1-inch width and glued around the edge of the circle. I then primed and painted the circle black. I also purchased three 8-inch steel brackets, 3/8th-inch diameter coarse-threaded steel rod, threaded nuts to match the rod, three 3-inch diameter pancake-type electrical boxes for the leveling feet, assorted screws for attaching the brackets holding the leveling feet to the bottom of the platform, a bubble level, two pipe fittings for the pointer holder, an approximately 3mm diameter steel rod (to be cut and bent for the pointer), and 3 3-pronged type plastic knobs with a 3/8-inch threaded metal insert to match the threaded rod (available online from Grainger). I found a local sheet metal shop to help me to help me weld the 3/8-inch coarse-thread rod couplers to the brackets (to support the threaded rod) as well as to bend the steel brackets precisely. They also cut a 2-inch wide aluminum ring, which I mounted around the outer circumference of the platform, to serve as the base for the azimuth scale (setting circle).

Leveling platform

After reading about setting circles on the web, I decided to use the website www.settingcircles.com. The software on this site is quite customizable, although learning to use it takes some practice. A modest fee is required if you want to design a different configuration from the standard circles (*e.g.* with scale markings starting from the interior of the circle and degree numbers around the outside circumference). Rob Willett, the owner of the site, was very helpful in providing support. After finally configuring the circle the way I wanted it, I had it printed on a 30-inch square sheet of vinyl for greater durability. I cut the setting circle from the vinyl sheet and glued it using contact cement onto the aluminum ring, which had been previously screwed on to the wooden platform.

The final component was the pointer assembly for the setting circle. I had the sheet metal shop bend a small piece of aluminum to fit around and under the edge of the upper circular portion of the telescope base. The brass plumbing fitting was epoxied to this aluminum plate to hold the pointer. I cut a strip of adhesive-backed foam insulation to fit inside the bend of the aluminum plate so that it fit snugly around the edge of the telescope base, yet allowed the plate to slide in either direction to make calibration (or zeroing) of the azimuth coordinate easy to do. The pointer was just a 3 mm steel rod which I cut to size, bent, primed, and painted. The leveling platform (27 inches in diameter) was designed to extend only 2 inches beyond the telescope base, in order to avoid impeding access to the telescope by the platform or its leveling feet. Due to this configuration there was only a short horizontal distance between the pointer and the setting circle, but about 3 inches of vertical distance to reach the azimuth scale. Therefore the pointer configuration was more vertical than horizontal.

Azimuth pointer on telescope base

I level the platform using the leveling feet with a bubble level placed on the telescope base. I use a Wixey digital angle meter (inclinometer) magnetically attached to the telescope upper tube assembly for the altitude readings. I use the Skeye app on my cell phone to provide real-time alt-azimuth coordinates for astronomical objects.

What's different about this setup is that I haven't modified the original telescope base, as is often done. It just sits on top of the platform, which weighs about 15 pounds and is easily portable. Another major advantage over more commonly seen setting circle installations is that the leveling feet are part of the platform. This platform design could be modified to fit any large Dobsonian. I would be happy to provide more details on the platform construction and to suggest improvements that could be made on the basic design for anyone interested. I am very happy with the finish and durability of the platform, especially for a homemade project. The commercially-available Halo leveling platform certainly seems like a good alternative. However it is only available for certain Dobsonian sizes and makes, primarily Apertura, which leaves Orion and other telescope owners (especially truss tube designs) out of the picture.

So, how does this push-to system perform in the field? The first occasion for using the platform was in the early fall. I set up on the front lawn, which is far from an ideal location due to neighboring house lights and street lamps. From this location I have a very good westerly view, good southerly view, fair northerly view, and poor easterly view due to rising land and tree obstruction. The moon was about two-thirds full and high in the southern sky. I had placed the shroud on the telescope, the 35 mm Deep View eyepiece (42x) in the focuser, and “zeroed” the setting circle on Polaris. I then slewed the scope to Vega, brought up the coordinates for Vega from the Skeye app, and verified that the setting circle and Wixey readings were within half a degree of the Skeye coordinates. There was some fluctuation of the altitude readings in response to small vertical movements of the telescope, but a few seconds after the vertical movement the reading settled down. Now came the first real test: I looked for a target in the southwest part of the sky on Skeye app, and found M25 (Sagittarius Star Cloud). I adjusted the scope to the indicated azimuth and altitude settings and saw a diffuse star cloud in the eyepiece with some brighter stars spread across the field of view in the foreground. I can’t say for certain that I was looking at M25 because I had never seen it before, but the view of the star field was impressive. The next two Messier targets, the numbers for which I failed to record, were open clusters in the western part of the sky. I was not able to locate either in the eyepiece. I wasn’t sure if there was a problem with the push-to system or whether the sky was not dark enough to see these objects.

The second test of the system was about two weeks later, on a very clear night with no moon at the time of viewing. My son and I set the scope up in our backyard, away from the street lights, and with the same views as from the front lawn. We started with the 35 mm eyepiece. After “zeroing” the azimuth setting on Polaris and calibrating the readings on Vega we were ready to go. We picked a target in the west, M11 (Wild Duck Cluster), and moved the scope to the match the settings given by Skeye. In the eyepiece was a beautiful, finely-grained cluster with some brighter stars in the foreground. The cluster showed more detail and sparkled with the ES 82 degree 18mm eyepiece (83x). The next target, to the northwest, was M29 (Cooling Tower Cluster). After adjusting the scope to the required azimuth and altitude, a widely spread star field appeared in the 35 mm eyepiece. I wasn’t certain whether this was the target, partly because I hadn’t seen this cluster before and also because the neighboring fields of view didn’t look very different from the original field of view. The next target was high in the sky and slightly to the east but just above the tree line, M31, and it appeared big, bright, and beautiful right in the middle of the 35 mm eyepiece. The next target was in the west, M57 (Ring Nebula), and to my disappointment, was not to be found, even after panning the area around the original field of view. I thought afterwards that I might have tried panning using 83x. The final target was also in the west, M27 (Dumbbell Nebula), and it appeared, amazingly, in the eyepiece as a diffuse irregularly shaped grey cloud against the darker star field. This was my first view of M27. At 83x it appeared larger but not much more detailed, and the UHC filter didn't improve the image either.

The third use of the platform was in December. I started setting up in the back yard just before dark in hopes of seeing Venus through this scope for the first time. Unfortunately, when I finally got set up, Venus had fallen just below the roofline of my neighbor's house. But the stars were beckoning in a gorgeous, moonless sky. I decided to try again for M57 (Ring Nebula) which had eluded me on three previous attempts. I had done my homework since then and knew where to find it. I had a hard time finding the parallelogram of stars on which M57 resides with binoculars (7 x 50mm). It was a cold night, and I hadn't calibrated the Wixey correctly due to my rushing to see Venus, so my altitude reading was off compared to the coordinates from Skeye. I started panning systematically through that area of the sky with the 18mm eyepiece. I finally saw a greyish, somewhat diffuse ring appear. Some fine adjustment of the focus made it a little clearer, but the image still seemed somewhat dim. Using a 10mm Plossl made the image worse. A UHC filter on the 18mm made the image slightly but noticeably clearer. I could make out the nebula's central hole but could not see a central star, which, at about 15th magnitude, should be near the visual threshold of my 12-inch Dobs. I was thrilled to have finally located it, and studied the neighboring stars between the nebula and Vega. I was eventually able start from Vega and work my way back to M57.

I next tried to find a galaxy in the Skeye database which was also located high in the western sky, but was unable to see it. M31 and M110 were bright and gorgeous, in the same field of view in the 18mm eyepiece. M31 seemed particularly elongated, with the central bulge quite bright, but the rest of the galaxy a diffuse cloud, gradually dimming in opposite directions for quite a large distance in the 18mm. M110 was a smaller, concentrated fuzzy ball. Jupiter and its four moons were very bright, with the planet's two central bands easily seen with both the 35mm and 18mm eyepieces. But the other bands and more detail on Jupiter were lacking—perhaps because of its brightness or possibly due to collimation issues. M42 was spectacular and bright against the darker background. The second most exciting find of the night for me was M33 (Triangulum Galaxy). I knew that it would not be easy to find due to low surface brightness and wasn't expecting to see it. But using the coordinates from Skeye to put me in the right region of the sky, and then careful panning with the 18mm eyepiece, brought me to a spot that had a very diffuse milkiness compared to the background. It was at the limit of my vision, and I had to continue panning around it, past it, and back again to convince myself that I was actually seeing a milky "cloud" rather than the background sky. But there was no doubt that I was seeing something distinct from that background, since each time I could just make out a central brighter milkiness which diffused somewhat in all directions before merging with sky. Very exciting! At this point I had been outside in 20-degree weather for several hours. My feet and hands were cold. Reluctantly, but happily, I packed things up for the night.

All in all, I am very pleased with the performance of this system. It is quite portable, rugged, and easy to set up and use. I am finding most of the targets I select. I realize certain targets can be difficult to see if the conditions aren't ideal, even if the scope is correctly positioned. In fact, with a database of unfamiliar targets literally in the palm of your hand, it would be easy to pick some that could be more challenging than observing conditions would warrant. On the other hand, there may be many other parameters, from use of the software on my Android phone to adjustment of the pointer to the physical conditions of the setup that could throw off the exact positioning of the scope. I'm excited to have added a simple yet effective navigation system as part of my telescope setup. I'm looking forward to more use of the leveling platform and Wixey combination in the coming months as weather and time permits, and should get a better sense of how to optimize the system with more experience.

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Westchester
Amateur Astronomers

A Two-Toned Wonder from the Saturnian Outskirts

by Dr. Ethan Siegel

Although Saturn has been known as long as humans have been watching the night sky, it's only since the invention of the telescope that we've learned about the rings and moons of this giant, gaseous world. You might know that the largest of Saturn's moons is Titan, the second largest moon in the entire Solar System, discovered by Christiaan Huygens in 1655. It was just 16 years later, in 1671, that Giovanni Cassini (for whom the famed division in Saturn's rings—and the NASA mission now in orbit there—is named) discovered the second of Saturn's moons: Iapetus. Unlike Titan, Iapetus could only be seen when it was on the west side of Saturn, leading Cassini to correctly conclude that not only was Iapetus tidally locked to Saturn, but that its trailing hemisphere was intrinsically brighter than its darker, leading hemisphere. This has very much been confirmed in modern times!

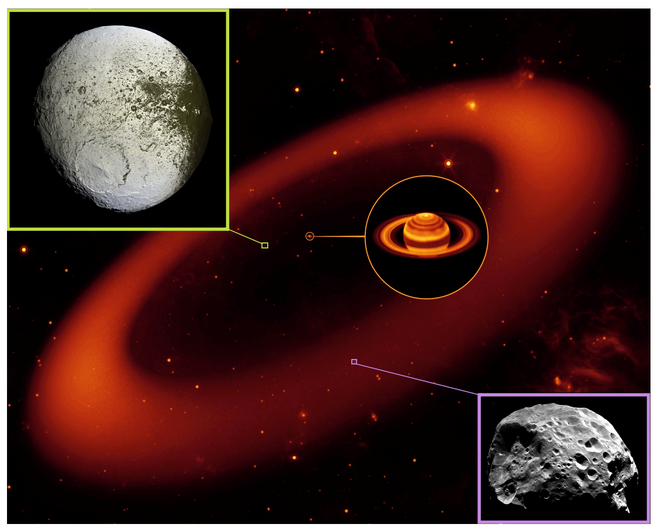
In fact, the darkness of the leading side is comparable to coal, while the rest of Iapetus is as white as thick sea ice. Iapetus is the most distant of all of Saturn's large moons, with an average orbital distance of 3.5 million km, but the culprit of the mysterious dark side is *four times* as distant: Saturn's remote, captured moon, the dark, heavily cratered Phoebe!

Orbiting Saturn in retrograde, or the opposite direction to Saturn's rotation and most of its other Moons, Phoebe most probably originated in the Kuiper Belt, migrating inwards and eventually succumbing to gravitational capture. Due to its orbit, Phoebe is constantly bombarded by micrometeoroid-sized (and larger) objects, responsible for not only its dented and cavity-riddled surface, but also for a huge, diffuse ring of dust grains spanning *quadrillions* of cubic kilometers! The presence of the "Phoebe Ring" was only discovered in 2009, by NASA's infrared-sensitive Spitzer Space Telescope. As the Phoebe Ring's dust grains absorb and re-emit solar radiation, they spiral inwards towards Saturn, where they smash into Iapetus—orbiting in the opposite direction—like bugs on a highway windshield. Was the dark, leading edge of Iapetus due to it being plastered with material from Phoebe? Did those impacts erode the bright surface layer away, revealing a darker substrate?

In reality, the dark particles picked up by Iapetus aren't enough to explain the incredible brightness differences alone, but they absorb and retain *just enough* extra heat from the Sun during Iapetus' day to sublimate the ice around it, which resolidifies preferentially on the trailing side, lightening it even further. So it's not just a thin, dark layer from an alien moon that turns Iapetus dark; it's the fact that surface ice sublimates and can no longer reform atop the leading side that darkens it so severely over time. And that story—only confirmed by observations in the last few years—is the reason for the one-of-a-kind appearance of Saturn's incredible two-toned moon, Iapetus!

Learn more about Iapetus here: http://saturn.jpl.nasa.gov/science/moons/iapetus.

Kids can learn more about Saturn's rings at NASA's Space Place: http://spaceplace.nasa.gov/saturn-rings.



Images credit: Saturn & the Phoebe Ring (middle) - NASA / JPL-Caltech / Keck; Iapetus (top left) - NASA / JPL / Space Science Institute / Cassini Imaging Team; Phoebe (bottom right) - NASA / ESA / JPL / Space Science Institute / Cassini Imaging Team.

Westchester Amateur Astronomers

Some Suggested Sci-Fi Novels
by Sharon Gould

I love to read astronomy and science fictions books. I have read so many but I consider these my favorites. Here is a list with a brief summary of each book. Hope you enjoy them. All of these authors have written many other interesting books if you happen to have already read these.

Moonfall by Jack McDevitt

In the 21st century America has established a Moonbase , also the first Mars voyage to be led by a woman preparing to leave for the planet . Around this time an amateur astronomer has discovered a sun grazing Comet named Tomikios heading straight for our Moon. All of the Moonbase must be evacuated. Also what will happen to Earth if the Moon is hit.This is a thrilling story I think you will enjoy.

Shiva Descending by Gregory Benford and William Rotster

This book is about a 30 billion ton comet about to strike the Earth. They call it The Swarm and it is comprised of meteors and asteroids 50,000 miles across. This Swarm has been traveling through the vast expanse of space since the formation of the solar system. The first strike hits Biskra, near Tunisia. There is no escape for our planet. This book is 400 pages long and I did not want to put it down.

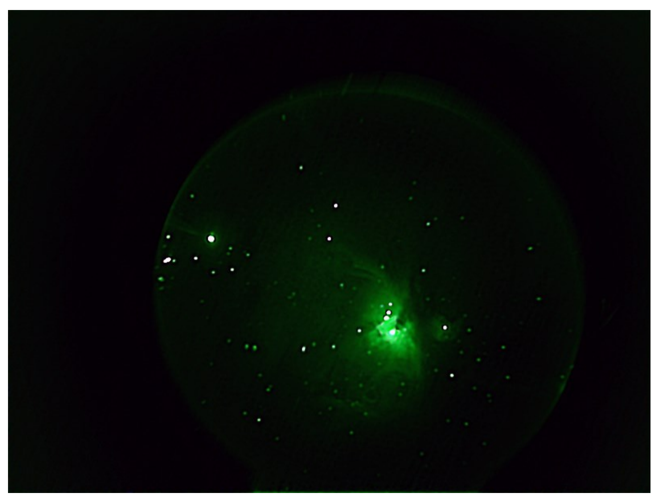
Footfall by Larry Niven and Jerry Pournelle

Footfall is about objects heading directly from Saturn toward planet Earth. This was discovered by accident by astronomers using telescopes at Mauna Kea. This is a true Aliens from Outer Space book and very exciting. They do reach our planet and life as we knew it is gone.

Astrophotos

Jupiter

Rick Bria captured this image of Jupiter on January 10, 2014 at the Mary Aloysia Hardey Observatory at Convent of the Sacred Heart. He used a 16” LX200 telescope with a Canon DSLR camera in movie crop mode. The resultant data was processed in RegiStax6 and Photoshop software.



M42

John Paladini captured this image of M42, the Orion nebula, through a webcam.