AOH OBSERVER

Feb.-Mar. 2016

The Newsletter of the Astronomers of Humboldt

The Newsletter of the Astronomers of Humboldt is back after a hiatus of several years, and in its latest incarnation is called the "AOH Observer" (the name may change if something more clever arises). Although it has taken a lot of time to put the first issue together, it hasn't been as difficult as I had anticipated. Gathering news stories has been facilitated by the plethora of online resources. Sites such as the "NASA SpacePlace" and the "NightSky Network" (NASA/JPL) provided articles and/or images for this newsletter. I also used public domain images that are available from NASA. I discovered that a few universities were willing to give me permission to reprint articles from their news sites, and one even sent me jpgs of the artwork used in the article. I'm starting to feel like a real journalist.

As great as it is to have access to these outside resources, I feel it is important that the AOH Observer reflects the club's membership. This is your newsletter, and your input is important. To that end, I am inviting AOH members to contribute articles and images to the newsletter. Did you get a new telescope and want to show it off? Are you restoring a classic telescope (Star-Liner, anyone?)? Did you happen to capture Comet Catalina in a photograph and would like to share it? Are you excited about Planet 9 and want to write an article about the possible discovery? Thank you for your support. I'm looking forward to hearing from you all.

Grace Wheeler, Editor-in-Chief

Articles and images can be sent to president@astrohum.org. Your original images can be sent as jpegs, pngs, or tiffs.

AOH Club News/Events

These are exciting times for AOH. During the past year we have renewed our nonprofit corporation status with the State of California and have qualified as a 501(c)3 Nonprofit Organization with the Federal Government. We have received as gifts a Star-Liner 11-inch Cassegrain telescope and a Coulter Odyssey 17.5-inch Dobsonian telescope. These are housed at the Kneeland Observatory, along with CR's 6-inch refractor and 14-inch Schmidt-Cassegrain, both of which we have access to. These are in addition to a number of 4 to 6 inch scopes which belong to the Club and which are available as loaners.

Of course the Club continues to hold public star parties and to do outreach at schools and other youth events.
It has been a rainy winter so far but we are all looking forward to our next cloud-free observing session. I hope to see you there soon. Check the webpage for our schedule of upcoming events

-Contributed by Ken Yanosko.

Officers/Board
January 2016 started the new term for AOH Officers and Board members:

President	Grace Wheeler
Vice President	Ken Yanosko
Secretary	Mark Mueller
Treasurer	Bob Zigler
Past President	Russ Owsley
Board Member	Bernie Christen
Board Member	Greg Deja
Board Member	Dan Eaton
Board Member	Mark Wilson

NASA/JPL Supported Outreach Programs:
In January, the Astronomers of Humboldt became affiliated with two NASA/JPL supported outreach networks: the Night Sky Network (https://nightsky.jpl.nasa.gov) and the “Astronomy Partners Program” which is part of NASA SpacePlace (http://spaceplace.nasa.gov). Find out more about the Night Sky Network on page 5.

It is through the“Astronomy Partners Program” that the AOH Observer will have access to monthly articles written about the science behind the various NASA projects. NASA SpacePlace is an educational and public outreach program whose target audience includes parents, teachers, astronomy club members who do outreach, and of course, kids. For parents and educators, there are classroom activities as well as images that can be downloaded and made into posters and banners (the Galex imaging of the galaxies is one of my favorites). There is a wide variety of children’s activities on the SpacePlace website and this a great resource for getting children involved in science.

(more AOH news on the next page)

AOH Club News/Events

Club Events for February and March 2016

Events for February and March include our monthly Arts Alive appearance at the Gazebo in Old Town Eureka, as well as our monthly gathering to observe in Kneeland. Check for time and dates, as well as for changes in venue at http://www.astrohum.org/upcoming.html

We have a Messier Marathon scheduled for March 8, and this will be our monthly club meeting for March. Be sure to read Mark Mueller's terrific article about preparing for a Messier Marathon on page 12.

AOH Member News

What I did on Martin Luther King Weekend

By Mark Mueller

Last weekend (*MLK holiday weekend*) I went to the San Francisco Bay Area to drop my daughter off at the airport and to visit my parents in San Jose. My dad and I had a great time on Saturday visiting the Hiller Flight Museum and the Moffett Field Historical Society Museum. I like aircraft, and the history of. Afterwards we had lunch and Dad humored me by taking me to Orion Telescope Center in Cupertino. I figured I'd mostly drool all over the telescopes and then head back to my folks' house. Sitting in the back was a 10" Dobsonian Skyline tube with both mirrors, a primary cooling fan, an 8 x 50 spotting scope, and a 2 speed 2" focuser. They wanted $220 for it. Just the focuser was worth this amount. I bought it. Dad helped load it up into his Explorer. I had to remove and partially disassemble the passenger seat of my Miata in order to take it home inside my car. The next step will be to devise a mount for the scope. I hope I can get it together before the next star party!

Editor note: I want to see the picture of Mark getting the scope into the Miata.

Celestial Events in February/March 2016

A comprehensive listing of astronomical events specific for Northern California can be found on the website for the Robert Ferguson Observatory. http://rfo.org/jackscalendar.html

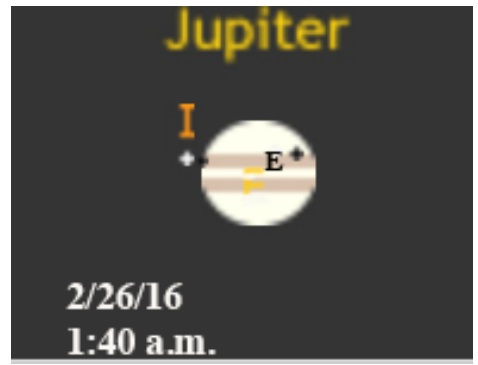
Alignment of Five Planets: Now until February 20th . If you get up 45 minutes before sunrise, you might be able to see the rare planetary lineup of Mercury, Venus, Saturn, Mars, and Jupiter. The last time this happened was in 2006. Mercury is best seen on Feb. 7th when it is at its longest western elongation from the sun. The next quintuple planetary alignment will occur in August 2016, and can be seen in the evening sky. However, this alignment will best be viewed in the southern hemisphere.

Planets in the Night Sky: Jupiter rises at 8:45 p.m. on February 1, and will continue to rise earlier throughout February and March. Mars and Saturn continue to rise late at night (after midnight) throughout February and March. A calculator for rise time and set time for these planets and of other solar system objects, can be found at http://aa.usno.navy.mil/data/docs/mrst.php

DST Simulations from http://www.skyandtelescope.com/observing/celestial-objects-to-watch/jupiters-moons-javascript-utility/

Moon Phase: rise times given for local time

3rd Qtr	Jan. 31 (00:13)	Mar. 1 (00:50)	Mar. 31 (01:21)
New	Feb. 8 (07:13)	Mar. 8 (06:24)	
1rst Qtr	Feb. 14 (11:04)	Mar. 15 (11:23)	
Full	Feb. 22 (18:17)	Mar. 23 (19:00) **penumbral lunar eclipse)	



Feb. 26: Double Shadow Transit of Jupiter. All times given in PST. (Simulation to the right) On 2/25, Jupiter rises at 6:53 p.m. Europa shadow transit begins at 11:14 p.m. on 2/25. The Io shadow transit starts at 1:37 a.m. on 2/26. The double shadow transit starts at 1:40 a.m. Look quickly! This double transit only lasts about 10 minutes.

Mar.21: Double Shadow Transit of Jupiter. All times given in PDT. (Simulation to the right) On 3/21, Jupiter rises at 6 p.m., Sunset is at 7:30 p.m. Io shadow transit starts at 9:15 p.m.; Europa shadow transit starts at 9:23 p.m. (start of the double transit). Double transit ends at 11:11 p.m.

****March 23: Penumbral Lunar Eclipse**. The eclipse maximum is at 4:47 a.m. To read more about this type of eclipse: http://earthsky.org/space/what-is-a-penumbral-eclipse-of-the-moon

March 28: Double Shadow Transit of Jupiter. All times given in PDT. (Simulation to right) On 3/28, Jupiter rises at 5:30 p.m., Sunset is at 6:30 p.m. Io shadow transit starts at 11:10 p.m.; Europa shadow transit starts at 12:00 a.m on 3/29. At 12 a.m., the double shadow transit begins and lasts for 55 minutes.

The AOH Becomes a Member of the Night Sky Network

The Astronomers of Humboldt joined the “Night Sky Network” in January 2016. The Night Sky Network (NSN) was started in 2004 and is supported by various NASA/JPL programs and is administered by the Astronomical Society of the Pacific (ASP). The purpose of the NSN to provide amateur astronomy clubs with resources which can be used in public outreach. The resources are used to educate the public on the “science, technology, and inspiration” behind NASA projects. This is also an opportunity for the AOH to receive national recognition for our community outreach, while making our presence more visible by being a member of the NSN.

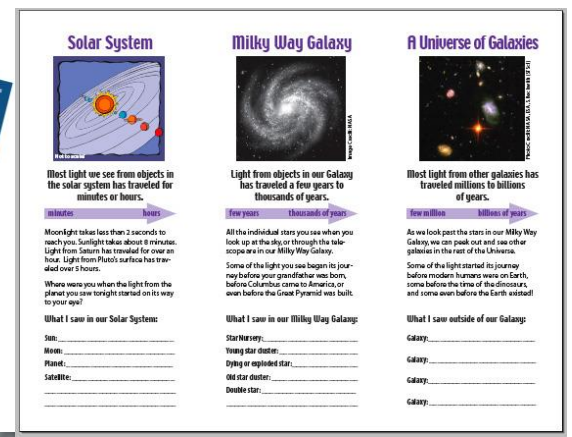
The catalog of NSN outreach resources can be found at http://nightsky.jpl.nasa.gov/download-search.cfm. The outreach resources include toolkits, teaching modules, handouts, images for producing posters and banners, astronomy guides, video lectures, and live/taped teleconferences. The live teleconferences are exciting because they give our club an opportunity to interact with scientists within the NASA and academic communities.

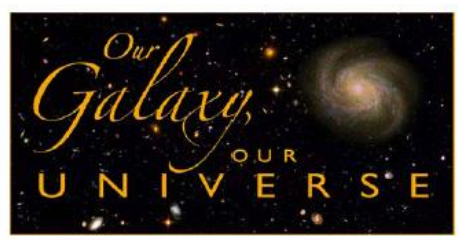
In order to maintain our membership in the NSN, the AOH must log at least 5 public outreach events per year in which NSN toolkits or other outreach resources are used. These are called “NSN outreach events”. Examples of outreach include school visits, public star parties, presentations to the club members, star parties that you host for friends at your home, writing an article for the club’s newsletter. As long as some part of the toolkit or NSN outreach resource is used, that event can be logged as an NSN outreach event. How we use the NSN resources is flexible, and we can definitely customize the use of these resources to fit our outreach needs.

Contributed by Grace Wheeler

The AOH coordinators for the Night Sky Network are Grace Wheeler and Mark Mueller. We are responsible for coordinating NSN events, approving and logging events on our NSN page, and for receiving and distributing the toolkits. To find out more about the NSN and about hosting an NSN event, you can contact Grace at (president @astrohum.org) or Mark Mueller at (secretary@astrohum.org).

Our member page on the Night Sky Network can be found at http://nightsky.jpl.nasa.gov/club-view.cfm?Club_ID=1736





Examples of outreach resources available Through the Night Sky Network

Mars Visits Earth in 2016: The First of Three Perihelic Oppositions

Grace Wheeler

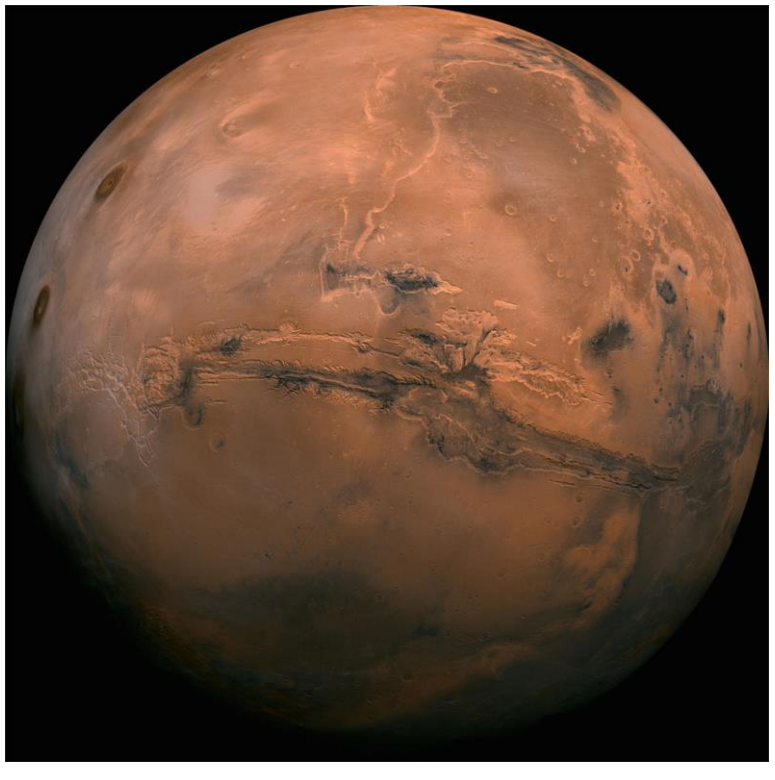


Figure 1. Mosaic of the Valles Marineris hemisphere of Mars projected into point perspective, a view similar to that which one would see from a spacecraft. The distance is 2500 kilometers from the surface of the planet. Credit: NASA/JPL-Caltech

In 2016, Mars will be making its biennial appearance in the night sky as it approaches its spring opposition. For much of the spring and summer of 2015, Mars was swinging behind the sun making the viewing of this planet difficult (Mars' solar conjunction was in June. 2015). For our latitude of 40^{o} N, the apparition of Mars began in early August 2015 when the planet was rising about an hour before dawn. By October, Mars could be seen in the predawn sky alongside Jupiter and Venus. In late March, Mars will rise around midnight, which for those of us who live in Humboldt County, means that Mars won't clear the trees until after 2 a.m (for specific rise times for Mars, and other celestial bodies, go to http://aa.usno.navy.mil/data/docs/mrst.php).

"Once in about every 15 years, a startling visitant makes his appearance upon our midnight skies….. Mars blazes forth against the dark background of space with a splendor that outshines Sirius and rivals the giant Jupiter himself."

Percival Lowell on the perihelic opposition of Mars.

Don't despair if you are not a night owl as Mars will continue to rise earlier each day. An observer watching Mars during this time will notice the planet growing brighter, and with a telescope, will see the disc growing larger. The brightness of Mars will continue to increase throughout the spring and will peak around May 22, the date of Mars' opposition. The opposition of Mars is seen from the perspective of Earth when the Sun, Earth and Mars are in a straight line with Earth in the middle. An observer on Earth will see Mars and the Sun on *opposite* sides of the sky, i.e., as the Sun is setting in the west, Mars is rising in the east. Because Mars is directly opposite the sun, we see the Martian disc as fully illuminated.

It is also around the time of Mars opposition that Earth and Mars have their closest approach for that particular two year cycle. What this means for small telescope operators is that the apparent diameter of Mars becomes large enough so that features such as the polar ice caps can be seen and dark spots like Syrtis Major Planum are defined.

Not All Oppositions are Created Equal

Even though Mars opposition and close approach to Earth occurs every 26 months, the brightness of Mars and the distance between the two planets varies with some years being more “favorable” than others. This is due to the eccentricity of Mars’ elliptical orbit (e=equal to 0.093) which is more “oval” compared to Earth’s nearly circular orbit (e =0.0167). Because of the eccentricity of the Martian orbit, the perihelic (closest point to the sun) and aphelic distance (farthest point from the sun) is a difference of 26 million miles*. Since opposition can occur at any point along the Martian orbit, this will have a bearing on how bright and large Mars appears to the observer on Earth. For instance if opposition occurs when Mars is near aphelion, Mars is farther from the Sun and thus farther from Earth; Mars will not be as bright and the apparent diameter will be small. Conversely, oppositions occurring when Mars is close to perihelion, i.e. close to the Sun and Earth, are considered favorable with respect to brightness and the apparent diameter of Mars.

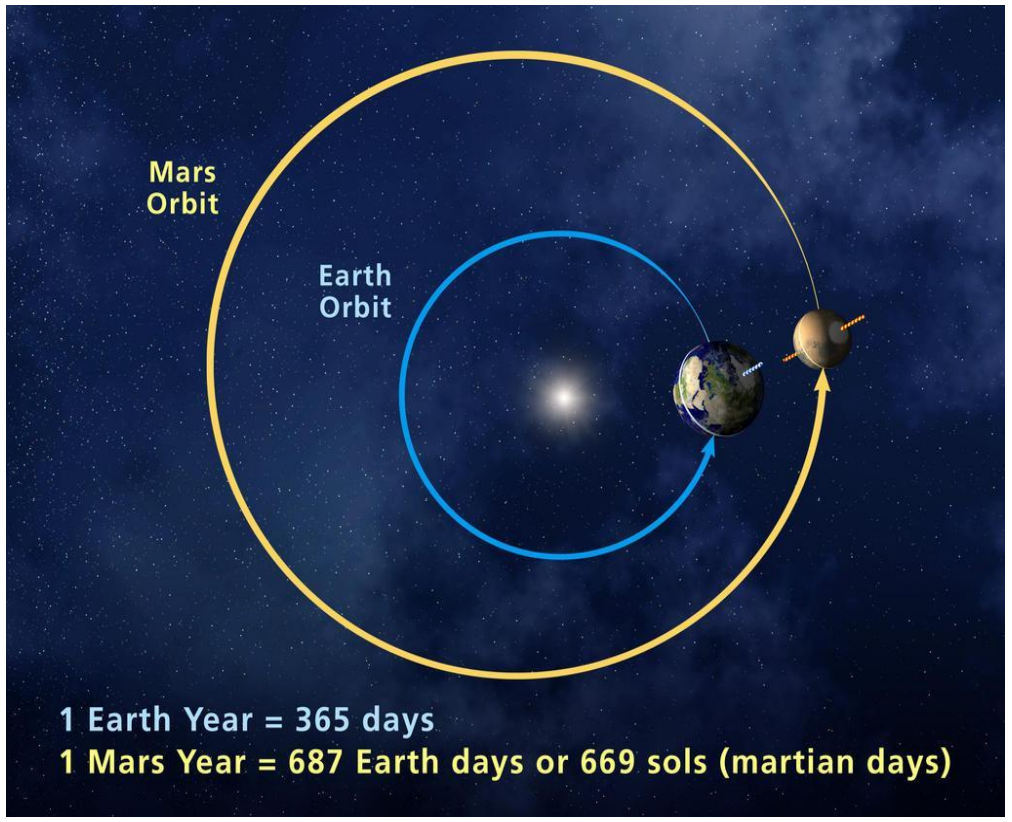


Figure 2. The orbits of Mars and Earth. The Martian orbit has a high eccentricity and is more oval than the Earth’s more circular orbit. Every 26 months, an opposition occurs where the Earth comes between directly between the Sun and Mars. Image Credit: NASA/JPL

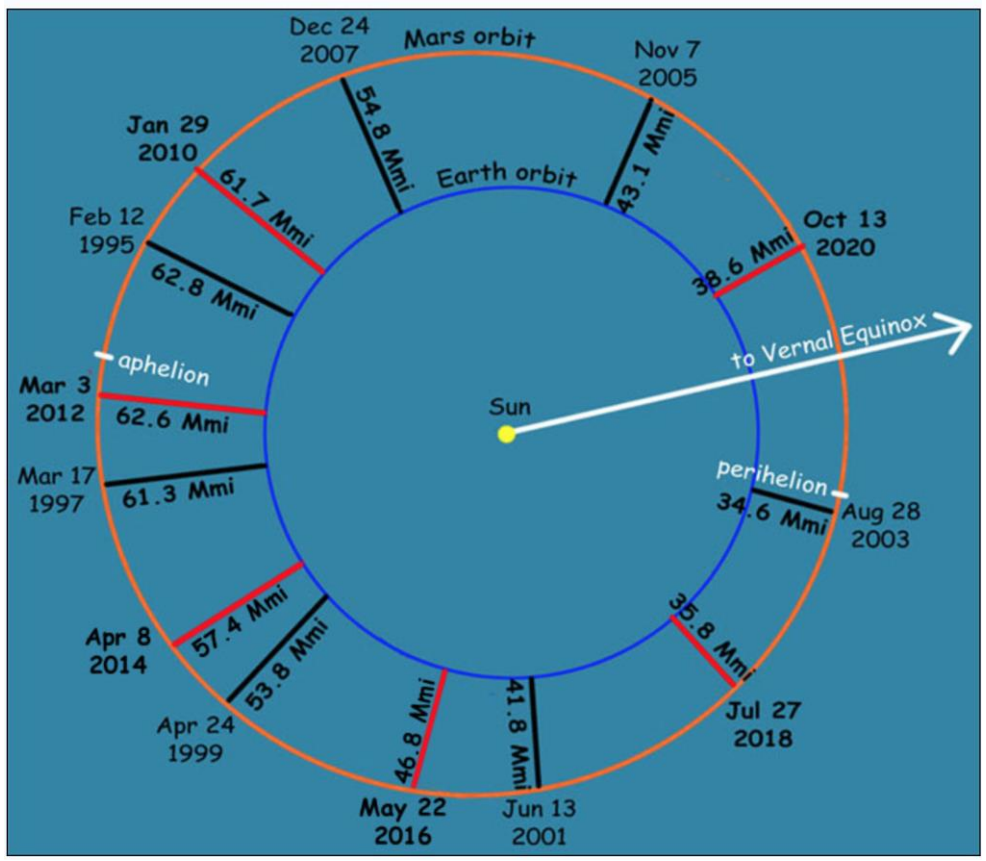


Figure 3. Oppositions occurring between 1995 to 2020. The distance between Mars and Earth at opposition is a function of whether opposition occurred near perihelion or aphelion. Oppositions occurring in 1995-1999 are in black, and those occurring after 2001 are in black

Blue = Earth orbit, Orange = Mars orbit. The distance between Earth and Mars is given in (M)illions miles.

Image Credit:
http://cseligman.com/text/planets/marsoppositions.htm

* Earth: the difference between aphelion and perihelion is 4 million miles

Predicting Favorable Oppositions: 2016 to 2020

The perihelic oppositions have a synodic period of 15.8 years. These oppositions occur as a series of three consecutive perihelic oppositions which are then followed by 3-4 consecutive aphelic opposition (see table to the right). As a rule of thumb, there is 15 years between one set of perihelic oppositions to the next. Based on that, it is possible to predict whether an upcoming opposition will be favorable or not.

The perihelic opposition of August 28, 2003 was of historic significance as it was the closest approach that Mars had made in 50,000 years. The next time Mars and Earth will be this close will be in August 28, 2287. For the present opposition, 2016 marks the beginning of three successive perihelic oppositions with 2018 being the most favorable since 2003 (note the 15 year interval since 2003). Even if this year's El Nino threatens to "wash" out the 2016 Mars opposition we still have a chance to watch even better encounters in 2018 and 2020.

Oppositions of Mars, 1995 - 2037

Date of Opposition	Date of Closest Encounter	Closest Distance (AUs / Millions of Miles)
Feb 12 1995	Feb 11 1995	0.67569 / 62.8
Mar 17 1997	Mar 20 1997	0.65938 / 61.3
Apr 24 1999	May 01 1999	0.57846 / 53.8
Jun 13 2001	Jun 21 2001	0.45017 / 41.8
*Aug 28 2003	Aug 27 2003	0.37272 / 34.6
Nov 07 2005	Oct 30 2005	0.46406 / 43.1
Dec 24 2007	Dec 18 2007	0.58935 / 54.8
Jan 29 2010	Jan 27 2010	0.66398 / 61.7
Mar 03 2012	Mar 05 2012	0.67368 / 62.6
Apr 08 2014	Apr 14 2014	0.61756 / 57.4
May 22 2016	May 30 2016	0.50321 / 46.8
**Jul 27 2018	Jul 31 2018	0.38496 / 35.8
Oct 13 2020	Oct 06 2020	0.41492 / 38.6
Dec 08 2022	Dec 01 2022	0.54447 / 50.6
Jan 16 2025	Jan 12 2025	0.64228 / 59.7
Feb 19 2027	Feb 20 2027	0.67792 / 63.0
Mar 25 2029	Mar 29 2029	0.64722 / 60.2
May 04 2031	May 12 2031	0.55336 / 51.4
Jun 27 2033	Jul 05 2033	0.42302 / 39.3
Sep 15 2035	Sep 11 2035	0.38041 / 35.4
Nov 19 2037	Nov 11 2037	0.49358 / 45.9

Figure 4: Perihelic Oppositions are highlighted in yellow. These oppositions occur in a series of 3 consecutive perihelic oppositions, and are separated by 3 to 4 consecutive aphelic oppositions.

Table Credit:
http://cseligman.com/text/planets/marsoppositions.htm

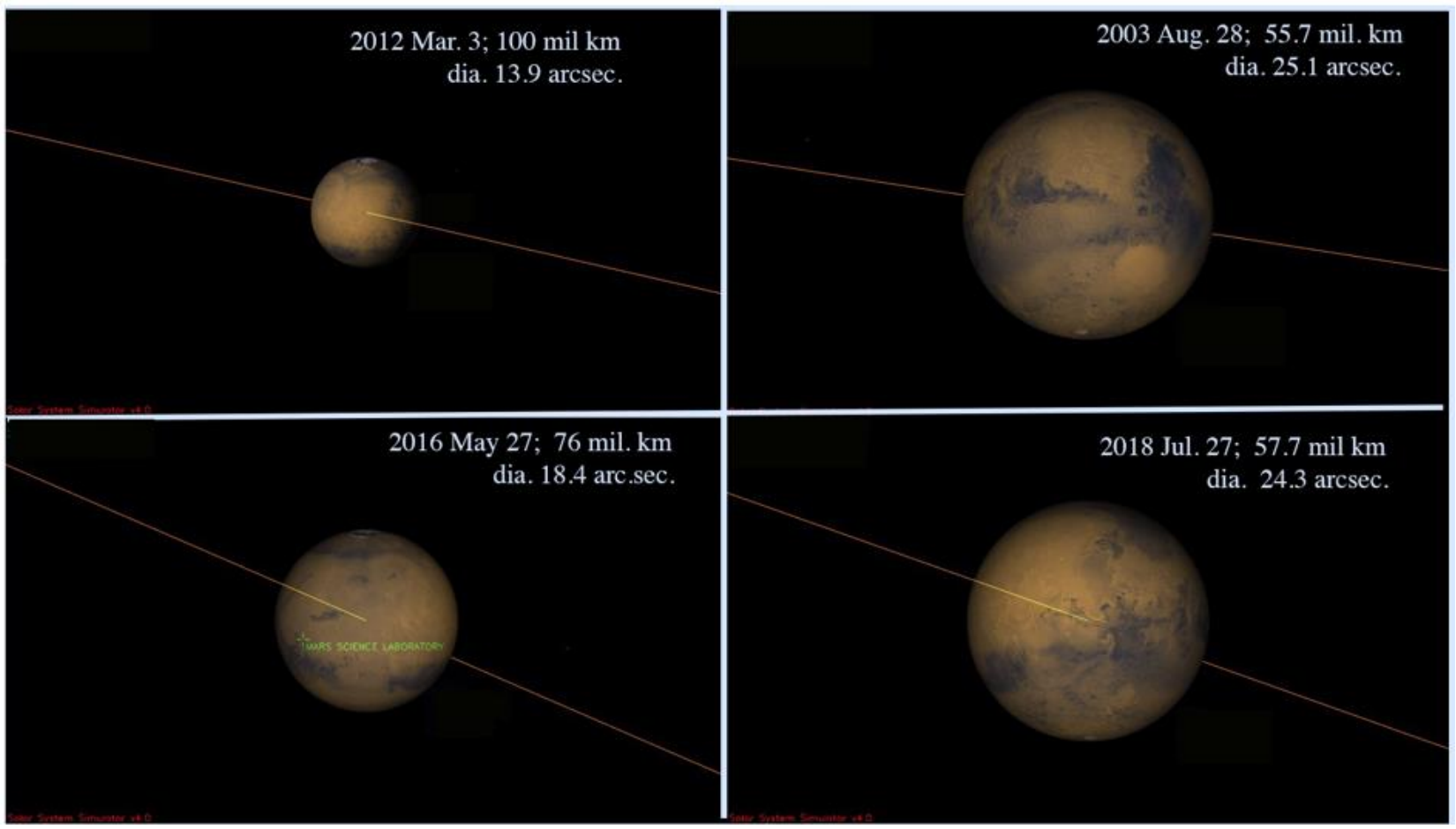
Note: The date of opposition and the date of closest approach between Mars and Earth are offset by a few days to week. This has to do with the eccentric of orbits of Earth and Mars. If the orbits of Mars and Earth were perfectly circular, then the date of opposition and date of closest approach would be the same.

Looking back: The 2014 Opposition

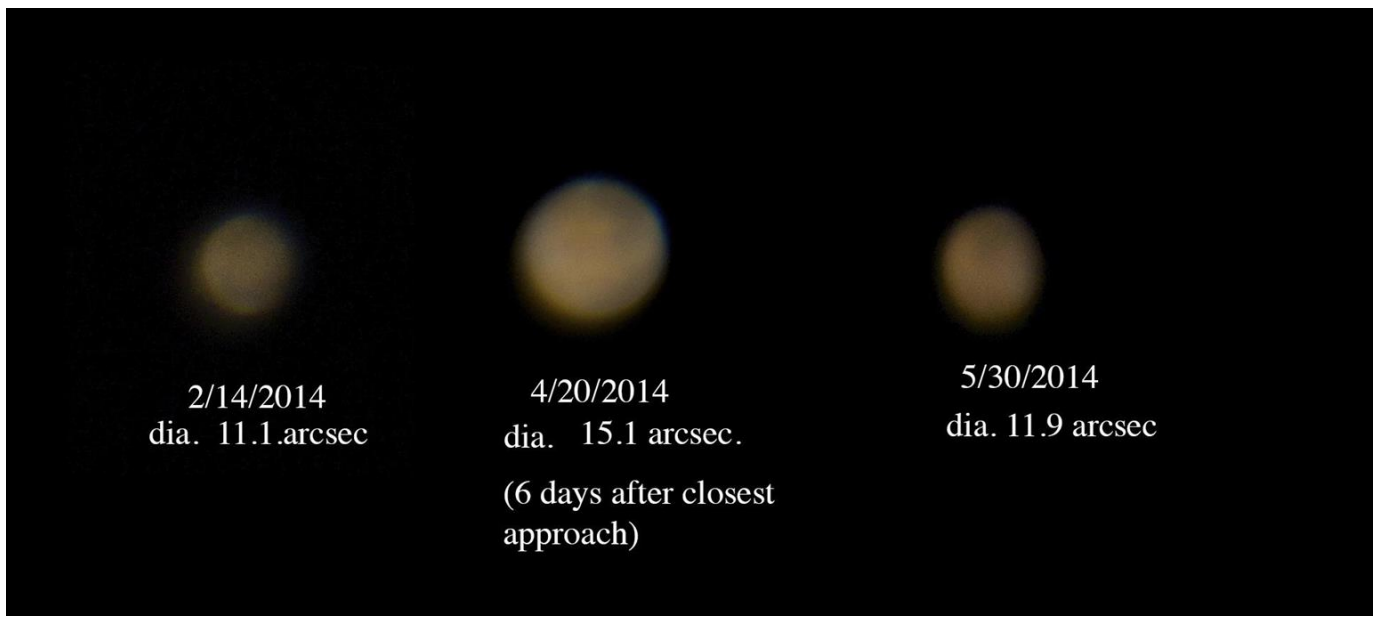
The last opposition of Mars was in 2014 and it was considered to be "middling" (now I know why). Still, this was the first opposition that I had viewed telescopically, so it was exciting nonetheless. Armed with an 8 inch Schmidt-Cassegrain, and a Pentax Q-7 (a point and shoot camera with interchangeable lenses), I watched Mars journey across the sky for much of late fall of 2013 into early summer of 2014. My telescope setup wasn't fussy so I was able to buildup and breakdown quickly between rainstorms. The images I got of Mars were decent enough for a fledgling backyard astronomer. It was satisfying to witness the daily transformation of Mars from a barely visible red dot to a bright red object as brilliant as Sirius. The results of my efforts are shown on the following page (below the JPL-generated simulations). And yes, I'm excited about 2016.

References:

http://mars.nasa.gov/allaboutmars/nightsky/opposition/
http://science.nasa.gov/science-news/science-at-nasa/2014/28mar_opposition/
http://cseligman.com/text/planets/marsoppositions.htm
http://www.nakedeyeplanets.com/mars.htm



Computer simulation of how Mars would look through a large telescope (FOV 1.2 arc minutes) on various dates of oppositions with distance of closest approach given in million km. The March 3,2012 opposition occurred near Mars' aphelion and the diameter of Mars was 55% of maximum. The August 28, 2003 opposition occurred close to perihelion and Mars diameter was 100% of maximum. The upcoming 2016 and 2018 are predicted to be perihelic oppositions, and the diameter of Mars will be 73% and 96% of maximum, respectively.
Simulation of Mars was done on the "Solar System Simulator" at http://space.jpl.nasa.gov.



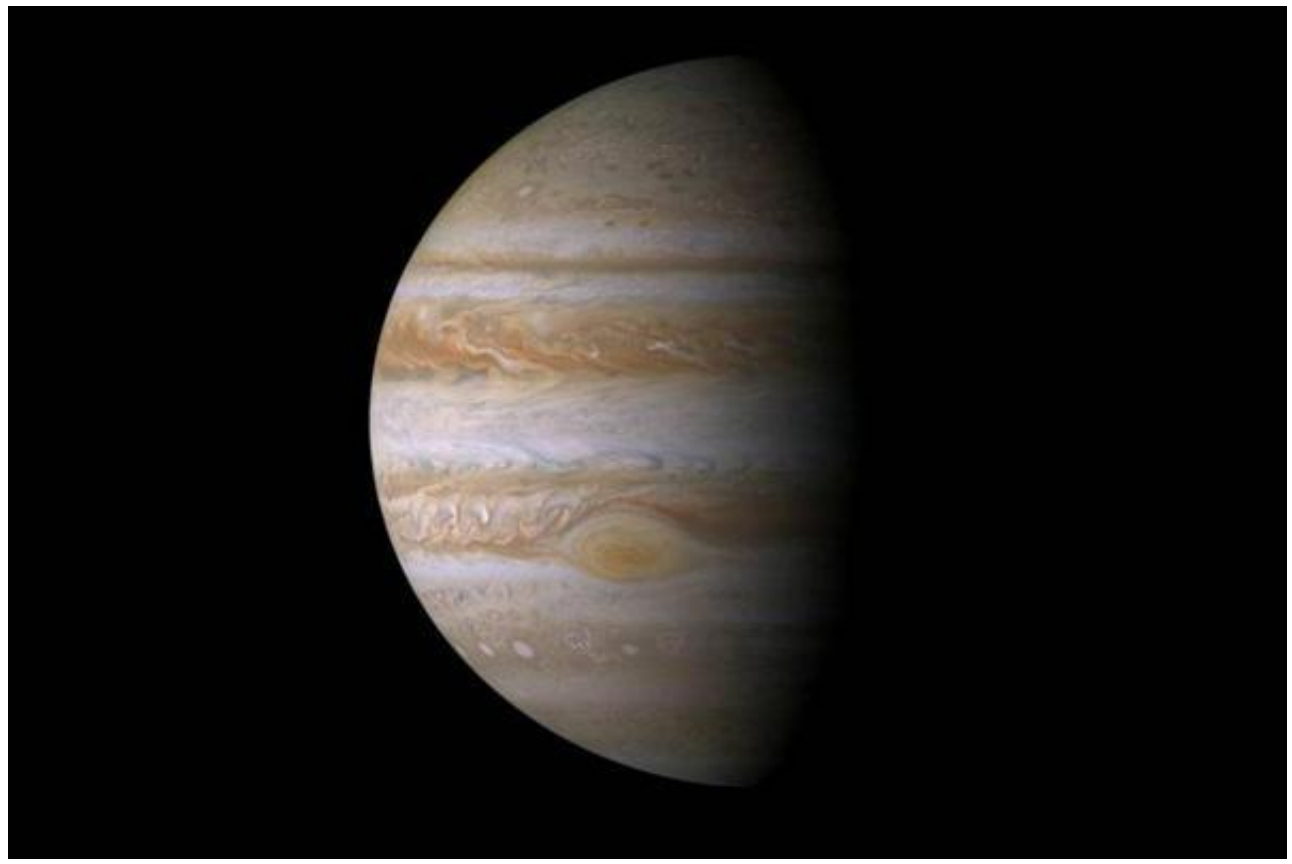
2014 Opposition: Mars appearance through an 8 inch Schmidt-Cassegrain. Disk size determination was from http://aa.usno.navy.mil/data/docs/diskmap.php.
Image Credit: G.Wheeler

Reprinted with permission from U of T News

Who kicked a giant planet out of our Solar System 4 billion years ago? We're looking at you, Jupiter

New research shows Saturn not likely culprit, U of T astrophysicists say

Sean Bettam



Don't be fooled by Jupiter's romantic exterior (image courtesy NASA/JPL/Space Science Institute)

It’s like something out of an interplanetary chess game. Or maybe our Solar System playground during recess. Astrophysicists at the University of Toronto have found that a close encounter with Jupiter about four billion years ago may have resulted in another planet’s ejection from the Solar System altogether. The existence of a fifth giant gas planet at the time of the Solar System’s formation – in addition to Jupiter, Saturn, Uranus and Neptune that we know of today – was first proposed in 2011. But if it did exist, how did it get pushed out?

For years, scientists have suspected the ouster was either Saturn or Jupiter.

“Our evidence points to Jupiter,” said **Ryan Cloutier**, a PhD candidate in U of T’s department of astronomy and astrophysics and the lead author of a new study published in *The Astrophysical Journal*.

Planet ejections occur as a result of a close planetary encounter in which one of the objects accelerates so much that it breaks free from the massive gravitational pull of the Sun. However, earlier studies which proposed that giant planets could possibly eject one another did not consider the effect such violent encounters would have on minor bodies, such as the known moons of the giant planets, and their orbits.

So Cloutier and his colleagues turned their attention to moons and orbits, developing computer simulations based on the modern-day trajectories of Callisto and Iapetus, the regular moons orbiting around Jupiter and Saturn respectively. They then measured the likelihood of each one producing its current orbit in the event that its host planet was responsible for ejecting the hypothetical planet, an incident which would have caused significant disturbance to each moon's original orbit.

"Ultimately, we found that Jupiter is capable of ejecting the fifth giant planet while retaining a moon with the orbit of Callisto," said Cloutier, who is also a graduate fellow at the Centre for Planetary Sciences at the University of Toronto Scarborough. "On the other hand, it would have been very difficult for Saturn to do so because Iapetus would have been excessively unsettled, resulting in an orbit that is difficult to reconcile with its current trajectory."

The findings are reported in a paper titled "Could Jupiter or Saturn have ejected a fifth giant planet?" published in the November 1 issue of *The Astrophysical Journal*.

Sean Bettam is a writer with the Faculty of Arts & Science at the University of Toronto
Posted Thursday, October 29, 2015

Editor's Note: Is the newly-discovered Planet Nine the planet that Jupiter ejected from the Solar System? More of that in our next issue of the AOH Observer.

Messier Half Marathon

By Mark Mueller

This March, if weather cooperates, Astronomers of Humboldt will host a Messier Marathon. A Messier Marathon entails staying up all night looking for all 110 Messier objects. What is a Messier (pronounced Messee-ay) object you might ask? Messier objects are deep sky objects i.e. not objects in our solar system, like nebulae, galaxies, open and globular star clusters. I enjoy looking at these. They are so beautiful. But Messier cataloged them because he was not interested in them. He was interested in finding comets and so he cataloged things that looked like comets (in a crappy old 18th century telescope) but weren't comets so that he would know not to spend any effort on them.

In a Messier Marathon astronomers set up before sunset and start looking for Messier objects in the west just after sunset and search the sky moving towards the eastern horizon just before sunrise. If you are super organized and are good at identifying the different objects, you might be able to see all 110 Messier objects. Of course it helps if the weather holds out all night. Ahh but that the is drama of astronomy in Humboldt County!

I have been to several Messier Marathons, all of them at Kneeland Airport and hosted by The Astronomers of Humboldt. I have not yet seen all of the Messier objects in a Marathon. Russ Owsley, club president, supplied us with a search sequence list compiled by Hartmut Frommert, using the work of Don Machholz. I am guessing that these lists are compiled by considering the brightness of objects, and the darkness of the sky near sunset and sunrise, and by their locations in the sky and efficiency of movement of the telescope in between when the sky is dark. I am going to make another guess that these search lists might differ depending on the type of telescope that you are searching with: Dobsonian, goto, or manual equatorial mount. Part of the reason I have not seen all of the Messier objects in one Marathon is that I get tired and go home around midnight or 1 AM. So I guess I have done a Messier Half Marathon.

There is a bit of that competitive thing going on, but mostly a lot of cooperation and collaboration. I guess it is the three “C”s. We enjoy looking at objects through each other's telescopes, admiring how some find certain things so easily. I remember a couple of years ago admiring how Grace and Don Wheeler worked so well together making sure they had properly identified galaxies in the Virgo Cluster.

Consider bringing some snacks and beverages. Hot tea is great to have. Also dress warm. It's a long time to be out. This is an event where you won't need sunscreen. There will be several of us that know what we are doing to various degrees. So you can always get help. We usually have plenty of telescopes and are happy to share views and work with others who don't have a telescope. My experience is that it is especially fun to have someone to share the view with and to double check just what it is that is in the view. So come up the hill and celebrate astronomy and look at some of the coolest sights to see through a modern telescope!

References:

http://astrored.net/messier/xtra/marathon/marathon.html

https://en.wikipedia.org/wiki/List_of_Messier_objects

http://www.astras-stargate.com/holdm.htmxj

The Loneliest Galaxy In The Universe

By Ethan Siegel

Our greatest, largest-scale surveys of the universe have given us an unprecedented view of cosmic structure extending for tens of billions of light years. With the combined effects of normal matter, dark matter, dark energy, neutrinos and radiation all affecting how matter clumps, collapses and separates over time, the great cosmic web we see is in tremendous agreement with our best theories: the Big Bang and General Relativity. Yet this understanding was only possible because of the pioneering work of Edwin Hubble, who identified a large number of galaxies outside of our own, correctly measured their distance (following the work of Vesto Slipher's work measuring their redshifts), and discovered the expanding universe.

But what if the Milky Way weren't located in one of the "strands" of the great cosmic web, where galaxies are plentiful and ubiquitous in many different directions? What if, instead, we were located in one of the great "voids" separating the vast majority of galaxies? It would've taken telescopes and imaging technology far more advanced than Hubble had at his disposal to even detect a single galaxy beyond our own, much less dozens, hundreds or millions, like we have today. While the nearest galaxies to us are only a few million light years distant, there are voids so large that a galaxy located at the center of one might not see another for a hundred times that distance.

While we've readily learned about our place in the universe from observing what's around us, not everyone is as fortunate. In particular, the galaxy MCG+01-02-015 has

not a single known galaxy around it for a hundred million light years in all directions. Were you to draw a sphere around the Milky Way with a radius of 100 million light years, we'd find hundreds of thousands of galaxies. But not MCG+01-02-015; it's the loneliest galaxy ever discovered. Our Milky Way, like most galaxies, has been built up by mergers and accretions of many other galaxies over billions of years, having acquired stars and gas from a slew of our former neighbors. But an isolated galaxy like this one has only the matter it was born with to call its own.

Edwin Hubble made his universe-changing discovery using telescope technology from 1917, yet he would have found absolutely zero other galaxies at all were we situated at MCG+01-02-015's location. The first visible galaxy wouldn't have shown up until we had 1960s-level technology, and who knows if we'd have continued looking? If we were such a lonely galaxy, would we have given up the search, and concluded that our galaxy encompassed all of existence? Or would we have continued peering deeper into the void, eventually discovering our unusual location in a vast, expanding universe? For the inhabitants of the loneliest galaxy, we can only hope that they didn't give up the search, and discovered the entire universe.

Image credit: ESA/Hubble & NASA and N. Gorin (STScI); Acknowledgement: Judy Schmidt, of the loneliest void galaxy in the known: MCG+01-02-015.