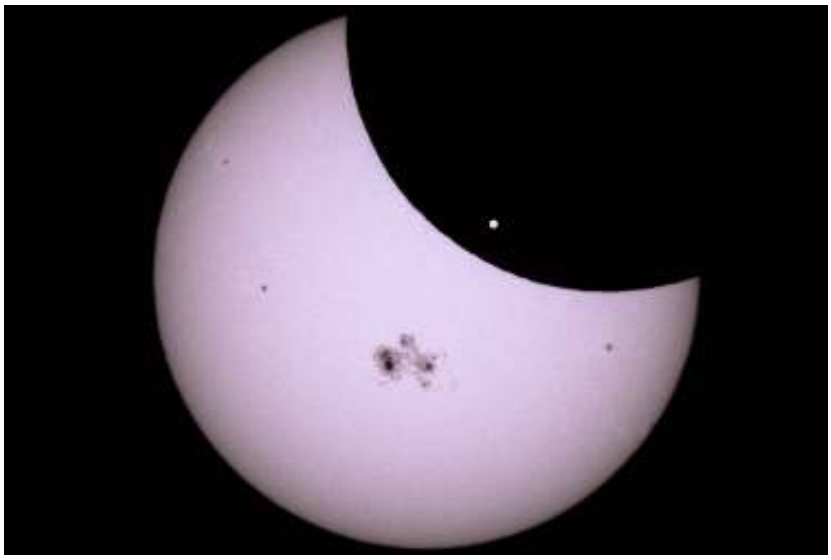
Nightfall

Monthly publication of the Huachuca Astronomy Club

NOVEMBER 2014

President's Notes

My plans for watching the lunar eclipse were clouded out, but we had a wonderful day for the partial solar eclipse. The massive sunspot group AR 2192 put on quite a show as we witnessed a crescent sun. Set up in front of the city library, the solar scopes proved to be very popular. There were large crowds throughout the afternoon. As for the sunspot group, it has proven to have staying power (and raw power as well). Now out of our view as it transitions once again to the far side of the Sun, it was still huge as it approached the limb. We may well still see this group in some form next time around.



This image, taken at the height of the eclipse, is from our own Ed "Crazy Ed" Erbeck Jr. The small speck of white represents the Earth's size. The big sunspot group is AR2192.

But what about November? Well, between cold nights and warm holidays, we have a couple of amazing happenings. The Leonid meteor shower takes place every November, as we pass through the orbital debris of Comet 55P/Tempel-Tuttle, the parent comet of the Leonid meteor shower. This year the peak of the shower is expected from late evening November 17 to the morning of November 18. Expect maybe 10 to 15 bright Leonids an hour during the peak time. The Moon will be a small crescent, so it shouldn't interfere too much.

Even before the Leonid shower, we have a cosmic comet event. The European Space Agency's Rosetta mission will go for a touchdown of its little lander Philae (http://sci.esa.int/rosetta/31445-instruments/), on the surface of Comet 67P/Churyumov–Gerasimenko on 12 November (watch the ESA's mission website for updates: http://www.esa.int/Our_Activities/Space_Science/Rosetta , http://www.nasa.gov/rosetta/). This, to me, is the highlight of its 10-year journey through the Solar System. To travel so long, to match the spin of the comet, and drop a probe to the surface of such a low gravity object amaze. By the way, there should be TV coverage, so keep an eye out.

New Members Corner

We welcome Anne Kochendorfer of Glen Cove NY who is relocating to Sierra Vista. Welcome to the club, we are glad you joined!

Officer Slate for 2015

Officers will be elected at the November meeting

Excerpt from the HAC Constitution: *The Board of Directors shall be elected at the annual business meeting in November by secret ballot for a term of one year. Absentee ballots will be accepted no later than the time of voting at the annual business meeting. In the event that the election ballot for the Board of Directors has no contested positions a simple show of hands shall be made to approve or disapprove the board as nominated. In the event that the elections are delayed, the incumbents shall continue to serve until their successors are elected. The candidate for each office, or candidates for the election of Members-at-Large, receiving the majority vote for each office are to be declared the winner(s). A majority is one more than half of the votes cast. Newly elected members of the board shall take office on December 1st following their election at the November General Meeting.*
The following members are candidates for the 2015 board of directors:

President : David Roemer	Member at large: Gary Grue
Vice President; Chris Ubing	Member at large: Bert Keller
Secretary: Rick Burke	Member at large: Wayne Johnson
Treasurer: Ted Forte	Member at large: Bob Hoover

(assuming David is re-elected, Bob Gent will remain Past President)

Nominations remain open. All regular members are eligible to serve and all voting members (excludes student memberships) are eligible to vote in the election.

HAC Memberships expire in December

It's not too early to start thinking about renewing your membership in the **Huachuca Astronomy Club.**
Individual: $25 Family $35 Military $20($25 family) Student $10
Don't miss out on all the great benefits of belonging. Fellowship, fun, stars, tours, observing programs, star parties, discounts, engaging speakers, and so much more. Stay a part of it all. Renew your membership, participate, enjoy. And while you're at it, think about serving as an officer of the club or member of the board: **ELECTIONS IN NOVEMBER** for the 2015 slate of club leaders!

November meeting

The November HAC meeting on Nov 14 will be held at 7PM in the community room, Student Union Building, Cochise College Sierra Vista Campus. 901 N. Colombo Avenue. The meeting will feature a talk by NASA Solar System Ambassador Cindy LaRussa. Her talk will focus on the NASA New Frontiers Program which includes the New Horizon, Juno, and OSIRIS-REx missions. Cindy La Russa is a price/cost analyst for DoD in the Tucson area. She is retired from the military after serving 26 years. Cindy has served as president and secretary of the Spokane Astronomical Society and held the position of Vice Chairman of the Northwest Region of the Astronomical League (NWRAL). She is currently the Deep Sky Binocular Coordinator and Southern Skies Binocular Coordinator for the Astronomical League. She has been a Solar System Ambassador sponsored by the Jet Propulsion Laboratory (JPL) since 2002 and a Ambassador for the OSIRIS-REx mission for the past year.

Scheduled HAC events for 2015

HAC general meetings are held monthly on a Friday night at 7PM in the community room of the student union building, Cochise College, Sierra Vista campus 901 North Colombo Avenue subject to its availability. Alternate locations will be announced when necessary. *Public Night* is an outreach event held at the Patterson Observatory on the campus of the University of Arizona, South 1140 North Colombo Avenue, Sierra Vista. Public nights start 30 minutes after sunset. Member Star Parties are held at member's homes and will be announced when volunteers are identified. The MSP holder will announce the start time of the event. All observing events are weather dependent. Watch for event announcements in the Nightfall newsletter, the HAC website, the *HACLIST* Yahoo group, and in the Around Your Town Section of the *Sierra Vista Herald*. Most events are also listed in the *Mountain View News,* and *The Scout*.

January 2, General Meeting; January 17, Member Star Party; January 22, Public Night (6:15 PM)

February 6, General Meeting; February 21, Member Star Party; February 26, Public Night (6:45 PM)

March 6, General Meeting; March 14, Kartchner Star Party, Kartchner Caverns State Park; March 21, Member Star Party (Messier Marathon); March 26; Public Night (7:00 PM)

April 3, General Meeting; April 18, Member Star Party; April 23, Public Night (7:30 PM); April 25, Astronomy Day at Sierra Vista Library (Tentative)

May 1, General Meeting; May 16, Member Star Party; May 21, Public Night (7:45 PM)

June 5, General Meeting; June 13, Member Star Party, June 25, Public Night (8:00 PM)

July 3, General Meeting; (No observing events scheduled)

August 28, General Meeting; (No observing events scheduled)

September 12, Member Star Party; September 17, Public Night (7:00PM); September 25, General Meeting

October 10, Member Star Party: October 15, Public Night (6:30 PM); October 17, Kartchner Star Party/Astronomy Day; October 30, General Meeting

November 14, Member Star Party; November 19, Public Night (5:45 PM); November 27, General Meeting

December 12, Member Star party; December 17, Public Night (6:00 PM); December 18, General Meeting (may be replaced by a Holiday party)

Stars From The Top Of The World!

By HAC Member, MaryFrances Clinton

Sixteen lucky HAC members spent an unforgettable Columbus Weekend Saturday getting to, touring, then returning from the Mount Graham International Observatory near Safford. The entire trip was a series of amazing experiences, far beyond our expectations with each exceeding the one before.

The trip up the mountain was every bit as steep and challenging as advertised. Switchbacks got tighter and narrower, views dropped down straighter and further and sky island tree varieties changed with every mile. The unexpected was the brilliant aspen gold and orange islands gleaming among the mass of green pine branches. The surprise was the perfect waterfall tucked into the tight curve of one of those switchbacks, leaping icy-white from high above us over hundreds of vertical rock feet.

John Hill welcomed us on schedule at the MGIO group of buildings squeezed onto the narrow top of the mountain. John gave us a few minutes to catch our breaths and find our land legs again while we surveyed the different installations and marveled at how close the recent forest fire had edged toward those precious scopes.

Once we'd counted our full sixteen gathered inside, John started our tour by explaining the displays of the enormous complexity of construction required to support and operate the two-ton mirror, currently the worlds largest, built at and now operated by the University of Arizona right here in Arizona. Only John could have pulled out size and weight numbers at such a rate without losing us in the process. HAC members feasted on those numbers, asking questions leading to even more intricate numbers.

Crowding into the huge elevator, we quickly understood the sixteen-people maximum for that tour! Nowhere close to the weight limit needed for the equipment that elevator was built to carry, we still needed to crowd tight and tighter before the elevator door could close. Our first landing was on the maintenance floor. Wider and higher than several combined airplane hangers, we were lost (and thoroughly chilled) inside that huge work-space. John continued to sing out impossible numbers as he showed us the breadth of areas and varieties of equipment needed to break down and repair the complicated and delicate parts of that huge telescope. Last but not least, he pointed out the huge pillar

constructed of solid cement we'd casually walked around and past as we'd entered that maintenance area. It was there, constructed to support the dozens of tons of equipment needed to hold and operate the perfectly formed two-ton mirror of the telescope we were about to go up to the next level to see.

Crowding tight again into the elevator for our journey to the next level, we gratefully appreciated each other's warmth! Stepping off the elevator, John stopped us near that same huge cement column to look at Wheels – a full "bogie" assembly of them. To move that huge, delicate, complicated telescope with its enormous superstructure, it takes everything that concentrated assembly of interconnected heaviest possible wheels can deliver while running on their own circle of rails around that support pillar.

But we hadn't seen anything yet! Walking into that telescope space was plumb absolutely shocking. Our first impression was huge and complicated and high. That impression was quickly replaced with the realization the mirror of the telescope was being tipped toward us for its weekly maintenance. The maintenance we saw in the most detail was a crew member smothered in an arctic-rated parka, lifting herself on an elevated platform she raised from a movable service vehicle to the level of the mirror some thirty or so feet into the air. Arriving, she quickly went to work to replace the nitrogen in each of the cooling elements located on the four quarters of the telescope structure. The first requirement for that job is No Fear Of Heights. Technical expertise and carefully precise movements are very close seconds!

When we could tear our eyes from that feat, we took in an even more amazing sight. The actual telescope mirror, no longer hidden in the depths of its viewing tube, was facing toward us reflecting not the sky but the space we were in. The picture of the sixteen of us gathered tight together in that freezing "ambient temperature" necessary to protect the mirror from temperature changes, nearly lost in the bottom ten percent of the picture with the actual telescope mirror open above us, gives only the barest suggestion of the magnitude of equipment involved in that Mount Graham Worlds Largest Telescope installation!

After watching the telescope mirror begin its amazingly silent return to its operating position, we crowded again into the elevator to gather in the crew quarters kitchen area to eat the dinners we'd each brought with us. John Hill's casual answer to the curious question during our ride down touched one more reality of where we were. Those quilted pads hanging against the elevator walls were "blankets" for protection against the cold –

in case the elevator ever got stuck! After the bitter-cold "ambient" air in the telescope space, we were fully appreciating that warmth right then.

We dove hungrily into our dinners, then stepped outside onto the balcony for the last of the daylight. The sunset "green flash" was the perfect end to an unforgettable day. But ahead was the challenging ride down the mountain in full dark around every one of those steep, tight switchbacks. Kudos to our carpool drivers! They had to call on skill and nerve every minute of every one of those precarious first dozen miles off that mountain.

Much thanks also and first to Wayne Johnson, our own Mr. Galaxy, for tapping into his Benson connections with MGIO's John Hill to arrange that special opportunity for our HAC club members to enjoy a rare private MGIO tour. Big thanks and admiration as well to John Hill for hosting such a knowledgeable, detailed and unusually accessible tour of that amazing world facility right here in Arizona.

Twinkle, twinkle, variable star

By Dr. Ethan Siegel

As bright and steady as they appear, the stars in our sky won't shine forever. The steady brilliance of these sources of light is powered by a tumultuous interior, where nuclear processes fuse light elements and isotopes into heavier ones. Because the heavier nuclei up to iron (Fe), have a greater binding energies-per-nucleon, each reaction results in a slight reduction of the star's mass, converting it into energy via Einstein's famous equation relating changes in mass and energy output, $E = mc^2$. Over timescales of tens of thousands of years, that energy migrates to the star's photosphere, where it's emitted out into the universe as starlight.

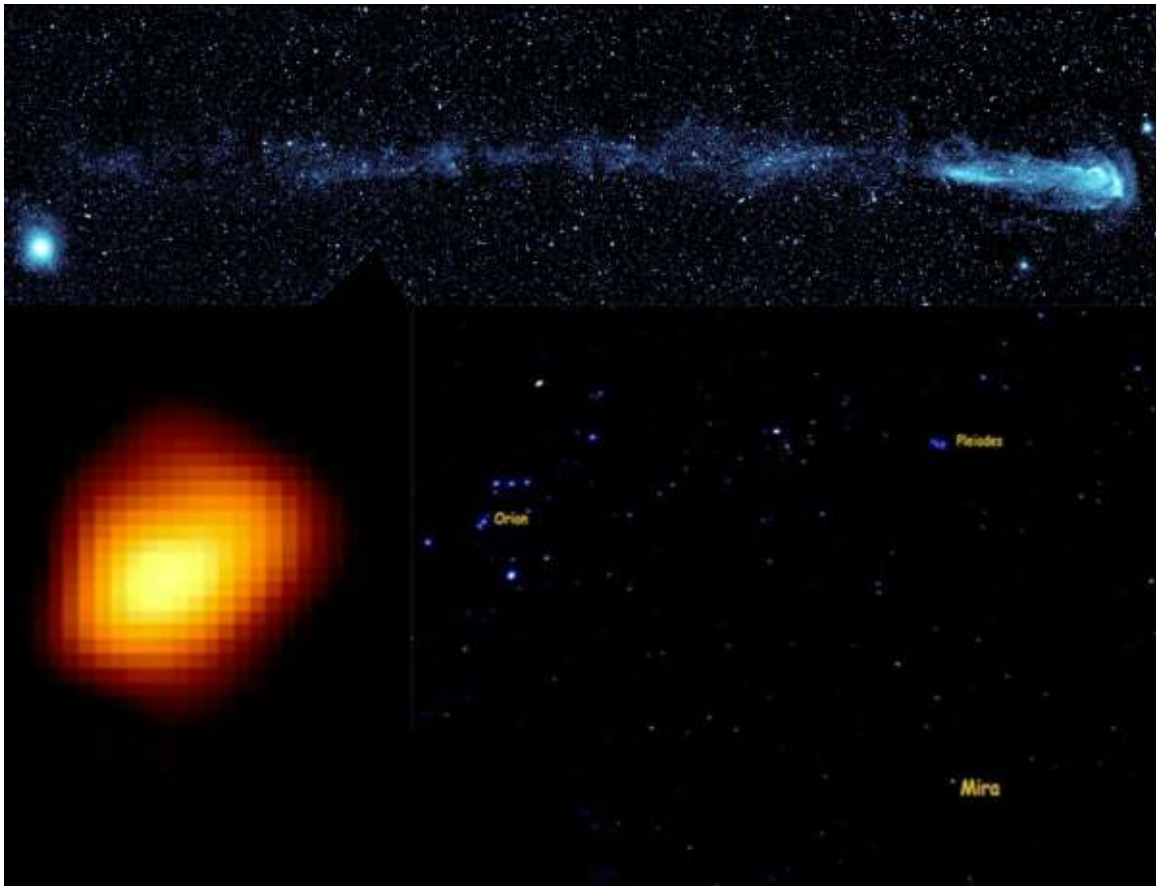
There's only a finite amount of fuel in there, and when stars run out, the interior contracts and heats up, often enabling heavier elements to burn at even higher temperatures, and causing sun-like stars to grow into red giants. Even though the cores of both hydrogen-burning and helium-burning stars have consistent, steady energy outputs, our sun's overall brightness varies by just ~0.1%, while red giants can have their brightness's vary by factors of thousands or more over the course of a single year! In fact, the first periodic or pulsating variable star ever discovered—Mira (omicron Ceti)—behaves exactly in this way.

There are many types of variable stars, including Cepheids, RR Lyrae, cataclysmic variables and more, but it's the Mira-type variables that give us a glimpse into our Sun's likely future. In general, the cores of stars burn through their fuel in a very consistent fashion, but in the case of pulsating variable stars the outer layers of stellar atmospheres vary. Initially heating up and expanding, they overshoot equilibrium, reach a maximum size, cool, then often forming neutral molecules that behave as light-blocking dust, with the dust then falling back to the star, ionizing and starting the whole process over again. This temporarily neutral dust absorbs the visible light from the star and re-emits it, but as infrared radiation, which is invisible to our eyes. In the case of Mira (and many red giants), it's Titanium Monoxide (TiO) that causes it to dim so severely, from a maximum magnitude of +2 or +3 (clearly visible to the naked eye) to a minimum of +9 or +10, requiring a telescope (and an experienced observer) to find!

Visible in the constellation of Cetus during the fall-and-winter from the Northern Hemisphere, Mira is presently at magnitude +7 and headed towards its minimum, but will reach its maximum brightness again in May of next year and every 332 days thereafter. Shockingly, Mira contains a huge, 13 light-year-long tail -- visible only in the UV -- that it leaves as it rockets through the interstellar medium at 130 km/sec! Look for it in your skies all winter long, and contribute your results to the AAVSO (American Association of Variable Star Observers) International Database to help study its long-term behavior!

Check out some cool images and simulated animations of Mira here:
http://www.nasa.gov/mission_pages/galex/20070815/v.html

Kids can learn all about Mira at NASA's Space Place:
http://spaceplace.nasa.gov/mira/en/



Images credit: NASA's Galaxy Evolution Explorer (GALEX) spacecraft, of Mira and its tail in UV light (top); Margarita Karovska (Harvard-Smithsonian CfA) / NASA's Hubble Space Telescope image of Mira, with the distortions revealing the presence of a binary companion (lower left); public domain image of Orion, the Pleiades and Mira (near maximum brightness) by Brocken Inaglory of Wikimedia Commons under CC-BY-SA-3.0 (lower right).

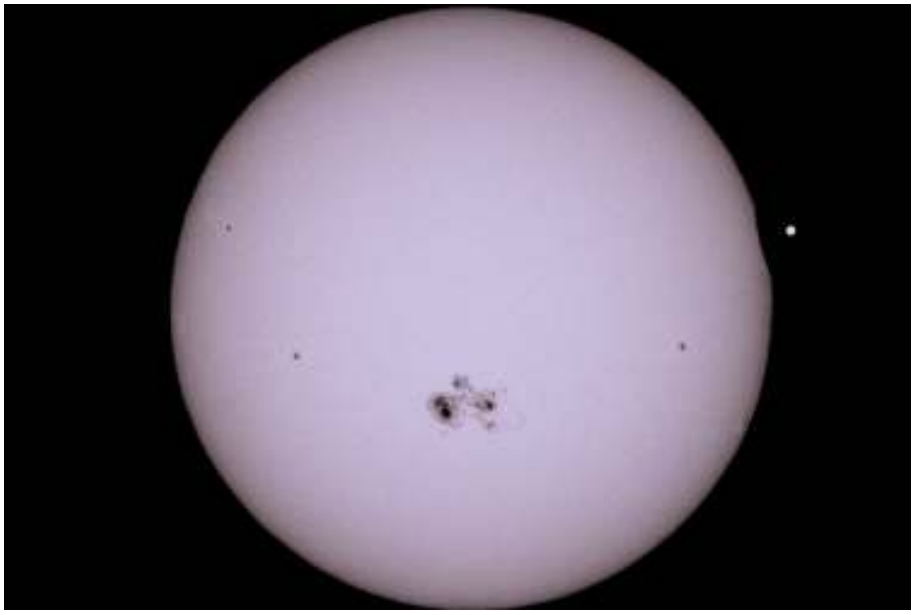
SVPO Star Party Wrap Up - By Wayne (Mr. Galaxy)

Thanks to Ted and Rick for trying to get the telescopes in the roll-off room of the SPVO operational. We had a series of problems (like a blown circuit breaker whose box we had to search for high and low that supplied power to the roll-off roof , a lost hand control paddle on one telescope, and another telescope that would not polar align). Despite those problems, the weather mostly cooperated for the dozen attendees. We had a beautiful sunset and a wonderful view of the setting two-day old crescent moon through my 20x100 binoculars. After having a surprisingly successful and delicious potluck with nearly no duplication of dishes (and only one Max the moocher) despite little coordination, I opened the 20-inch Maksutov telescope in the large dome and we were able to view a number of deepsky objects including the famous double-double star, epsilon Lyrae, the nice globular clusters, M13 and M15, the Andromeda Galaxy (M31), and we caught the infamous "Blue Snowball" planetary nebula, NGC 7662, just as the clouds were starting to move in more permanently. A pleasant time was had by most of us!

Members' Eclipse Photos

Bob Gent - Eclipse with large spot

Eclipse viewing



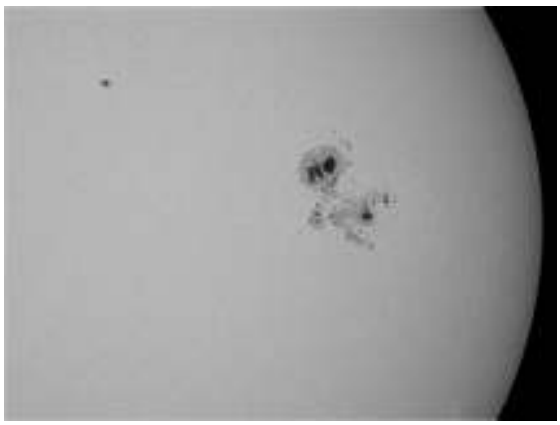
Ed Erbeck Jr. - First Contact

Members' Photos

David Roemer - Comet sliding Spring1

David Roemer - Comet sliding Spring2

Rick Burke - Helix Nebula



David Roemer - Sunspot AR1292

Huachuca Astronomy Club – Board of Directors

Officers:

President: David Roemer Vice President: Chris Ubing

Secretary: Rick Burke Treasurer: Ted Forte

Members at Large:

Bob Hoover Wayne Johnson

Gary Grue Bert Kelher

Past President: Bob Gent

www.hacastronomy.com -- A great place to visit!

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http://www.farpointastro.com/
http://starizona.com/

FOR SALE: Mirror Blank. 13 7/8" diameter by 4 1/2" thick. Pyrex Glass with no scratches or bubbles. Very Rare - Perfect for doing a large binocular. $75.00
Contact Rob Shernick at (520) 458-6790 or by email at nuvolari_p3@q.com

FOR SALE: Meade Starfinder 8" Reflector Telescope. Will Sell at a very reasonable price. Included are a Telrad Finder, Filters, and additional Lenses.
Please contact Mr. Jim Moses at (520) 803-0913 or at email <jjmoses2@gmail.com>

FOR SALE: Celestron Celestar 8 inch S/C Deluxe - $1200. Will also sell pieces individually
Contact Rhonda and Terry Taylor at (520) 366-2378 or by email at <twrl2@yahoo.com>
Or See Craigslist at at http://sierravista.craigslist.org/bar/4523742100.html

FOR SALE: Older Optical Guidance Systems 12.5" f/9 Ritchey-Chretian telescope. Very good Paul Jones ceramic optics, Robofocus secondary focuser, will include Takahashi collimating telescope. Some of the image through the scope are at Mshadephotography.com.
Contact Mike J. Shade at mshade@q.com

FOR SALE: A friend back east has an unused Obsession mirror cell for a 25-inch scope for sale. (See photo) he's asking $500 and estimates that it would cost about $75 to ship it. If anyone is interested, respond and I'll put you in touch with him.
Contact Ted Forte at <tedforte511@gmail.com>

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2014–Astronomically Handy Sky Calendar from Doug Snyder & the H.A.C.–2014

ARIZONA Observers SKY EVENTS Calendar for 2014 –All Times shown are MOUNTAIN STANDARD TIME*

JULY 2014

HIGHLITE: Due to Monsoons, no scheduled observing events

03 Th Earth at aphelion,1700 hrs.; 1.016 AU
04 Fr Pluto at opposition, 0100 hrs.; mag. 14.1, distance 32.5 AU
05 Sa ☽ First Quarter Moon 0500 hrs.
07 Mo Saturn within 1.5° of 76% Moon; 2030 hrs.
11 Fr **HAC Meeting,** Cochise College, 7 pm
12 Sa ○ Full Moon 0426 hrs.
12 Sa Mercury G_Elong. W. (21°); morning 'star' in East, mag. +0.4; reaches mag. 0.0 on July 15
18 Fr ☾ Last Quarter Moon 1909 hrs.
26 Sa ● **NEW MOON** 1543 hrs.
29 Tu **Delta Aquarids** Meteor Shower Pk. at 0200 hrs.; rate may approach 20 per hour, some persistent trains.
30 We Alpha Capricornids Meteors– weak, slow moving, but yellowish fireballs can be photogenic; best rate of 5/hour?

July (first-half): C/2012 K1; evening hrs. in LEO; mag 7?

AUGUST 2014

HIGHLITE: Monsoon Season; Choose your own Highlite !

03 Su ☽ First Quarter Moon 1751 hrs.
08 Fr **HAC Meeting,** Cochise College, 7 pm
10 Su ○ Full Moon 1110 hrs; **largest** of 2014
12>13 Tu>We Perseid Meteor Shower Pk. at 1700 hrs. on the 12th; v. unfavorable due to strong moonlight; rates can be high as 90/hour under dark skies
17 Su **Conjunction:** Venus/Jupiter within 1.0° and close to Beehive cluster; 0500 hrs.; But very low in the ENE skies; closest planet-planet conjunction of 2014
17 Su ☾ Last Quarter Moon 0527 hrs.
24 Su Comet Siding Spring (C/2013 A1) at opposition, 1800 hrs.; may collide with MARS in mid-October !
25 Mo ● **NEW MOON** 0714 hrs.
29 Fr Neptune at opposition, 0800 hrs.; mag. +7.8; distance 29 AU; size 2.4"
31 Su Moon/Saturn/Mars within 5° circle; Moon will be at about 35%; 2000 hrs.

SEPTEMBER 2014

HIGHLITE: Comet Possibilities

01 Mo Aurigid Meteor Shower; peak after midnight of Aug. 31 and into morning of Sept.01; fast and many are bright ; low hourly rate (5) but may outburst
02 Tu ☽ First Quarter Moon 0412 hrs.
08 Mo ○ Full Moon 1839 hrs; Harvest Moon
12 Fr **HAC Meeting,** Cochise College, 7 pm
15 Mo ☾ Last Quarter Moon 1906 hrs.
20 Sa **Kartchner Caverns/HAC S.P.,** dusk
21 Su Zodiacal Light in east before morning twilight for next two weeks
22 Mo **Autumnal Equinox** 1929 hrs.
23 Tu ● **NEW MOON** 2315 hrs.
25 Th **HAC** Public S.P.; P.O.; SS@1813 hrs.
27 Sa **Saturn** within 2° of 14% Moon, low in the WSW, 2000 hrs.

Comet Possibilities for September 2014
C/2013 A1:v.low in S., early evening;9/17>9/30 (Siding Spring); encounter MARS on 10/19
C/2012 K1: low in E., early morning; 9/1>9/30
C/2013 V5: low in E., morning; 9/1>9/13

OCTOBER 2014

HIGHLITES: MARS & COMET; 1 LUNAR ECLIPSE & 1 SOLAR ECLIPSE IN SAME MONTH !

01 We ☽ First Quarter Moon 1233 hrs.
04 Sa **NATIONAL ASTRONOMY DAY** **HAC** opens Patterson Observatory for Public Exhibits and Viewing
07 Tu Uranus at opposition, 1400 hrs.
08 We ○ Full Moon 0351 hrs.
08 We **TOTAL LUNAR ECLIPSE** Start: 0117hrs., End: shortly after moonset at 0630 hrs.; Totality: 0328 h. to 0423 hrs.
09 Th Draconids Meteor Shower; unfavorable due to bright Moonlight
10 Fr S. Taurids Meteor Shower; Pk. 0500h.
10 Fr **HAC Meeting,** Cochise College, 7 pm
15 We ☾ Last Quarter Moon 1213 hrs.
19 Su **Comet Siding Spring** (C/2013 A1) **Close** Encounter/Graze with **MARS!**
20 Mo Zodiacal Light in East before morning twilight for next two weeks
21 Tu **Orionid Meteor Shower**; v. favorable; Swift, some bright, rate about 20+/hr.
23 Th ● **NEW MOON** 1457 hrs.
23 Th Partial **Solar ECLIPSE,** Start:1430 hrs. End: 1648 hrs.; max: 1543 hrs.(29.3%) **HAC** viewing at S.V. City Library, 1 pm
25 Sa **HAC** Member S.P.
30 Th **HAC** Public S.P.; P.O.; SS@1733
30 Th ☽ First Quarter Moon 1949 hrs.

NOVEMBER 2014

HIGHLITE: METEORS & FIREBALLS

01 Sa Mercury at G_Elong. W.(19°), 0600 hrs.; **best** morning apparition of 2014, east
06 Th C/2012 K1 (PanSTARRS) at (2nd) opposition, 2000 hrs., in Pictor; possibly will or will have brightened to mag. 6
06 Th ○ Full Moon 1523 hrs.
11 Tu North Taurids Meteor Shower; rate of about 5/hr; waning 77% moon & bright
14 Fr **HAC Meeting,** Cochise College, 7 pm
14 Fr ☾ Last Quarter Moon 0816 hrs.
17>18 Mo>Tu **Leonid Meteor Shower** Peak at 1500 hrs on 17th; view pm hrs on 17th into am hours on 18th; about 20% moon; fast meteors & bright; a good number leave persistent 'trails' ; no 'storm' has been predicted, but do you remember 2001? Some of us do. WOW.
20 Th **HAC** Public S.P.; P.O.; SS@1720 hrs.
22 Sa ● **NEW MOON** 0532 hrs.
22 Sa **HAC** Member S.P.
29 Sa ☽ First Quarter Moon 0306 hrs.

Comet Of The Month—An Observing and Imaging Challenge for C/2012 K1 (PanSTARRS)
Throughout November, this comet will remain VERY low near our southern horizon and reside in these constellations: Pictor, Dorado, Phoenix, Reticulum, Horologium, and Eridanus, but may reach mag. 6 this month. Close encounter with Globular Cluster NGC1261 on 11/13; good luck!

DECEMBER 2014

HIGHLITE: GEMINID METEOR SHOWER

06 Sa ○ Full Moon 0527 hrs.
12 Fr **HAC Meeting,** Cochise College, 7 pm
13 Sa **Geminid** Meteor Shower Pk. Favorable Year, but with 50% moon; Pk. 0500 hrs. Saturday am; hourly rate can be as high as 120/hr.; mostly bright, few leaving 'trains';12/14 (Sunday) morning activity is possible also; Parent body is asteroid 3200 Phaethon (1.5 year orbit); radiant is near Castor
14 Su ☾ Last Quarter Moon 0551 hrs.
15 Mo **Dbl. Shadow Transit**, J. ; 2312 hrs. (Europa & Io); Note: At 0025 hrs. on 12/16, **both** Europa & Io will be in the process of transiting Jupiter! See 'em?
18 Th **HAC** Public S.P.; P.O.; SS@1721 hrs.
20 Sa **HAC** Member S.P.
21 Su Winter Solstice, 1603 hrs.
21 Su ● **NEW MOON** 1836 hrs..
22 Mo Ursids Meteor Shower Pk. 1300 hrs.; good date, but poor peak timing; (favors northern Asia); radiant is near β Ursa Minor (Kokab); rate is about 10/hour; faint, with a few fireballs. Parent comet is 8P Tuttle
25 Th *MERRY CHRISTMAS TO ALL !*
28 Su ☽ First Quarter Moon 1132 hrs.
28 Su Conjunction of Moon and Uranus; 2245 hrs.; less than 1.0° apart; first quarter Moon and mag. 5.8 Uranus

HAPPY NEW YEAR !

*Times/Dates= ARIZONA Mountain STANDARD Time (NO DST; UT-7hrs); **updates/ details,** see: www.hacastronomy.com or http://skycalendar.blackskies.org;
Abbr: Tr=Transit; Pk=Peak; Merc=Mercury; E=East W=West; S=South; N=North; J, Jup.=Jupiter; V=Venus; v. = very; "=arc seconds; SS=SunSet; S.P.=Star Party; h., hrs.=hours (24 hour time system); MP=Minor Planet; MS=Moon Set; MR=Moon Rise; wks=weeks; Lt=Light; pm=evening; @=at; Pub.=Public ; NEA= **N**ear **E**arth **A**steroid; am=morning; mag.=magnitude; **meteor dates reflect predicted Peak Morning, but Moon may still be present; P.O.=Patterson Observatory; ; dbl=double; I=Io; Eu=Europa; G=Ganymede; C=Callisto; UT=Universal Time; **bold text=**possibly a promising/worthy event, activity or object; G_Elong=Greatest Elongation; AU=Astronomical Unit(93 million miles); °= degrees; *compiler*: **Doug Snyder**(C/2002 E2, MP15512,starhaven@me.com); V1.1.2014