Nightfall

Monthly publication of the Huachuca Astronomy Club

March 2014

President's Notes

March, time for Messier marathon madness! One night (or two if you need a do over), one hundred and ten objects to view (have we finalized on that number yet?) and so many questions answer. What kind of a telescope will you use? Will it be a big scope, small scope, or binoculars? A twenty inch scope could allow you to see so much you could lose your way in the strings of galaxies east of Leo. A little Tasco 60mm refractor, with a sad objective lens like my first scope can render almost all the objects mostly fuzzy dots but a 100mm binocular should do the trick? A few years ago a friend and I got most of them using Harvard Pennington's book, ***The Year-Round Messier Marathon Field Guide,*** a green laser pointer and a TeleVue 85.

Will you program a robotic scope to slew around from globular to nebula to galaxy or push around a Dobson from right to left with your Telrad to guide you? Will you quickly sketch the objects as you go? I guess you could if you had talent. Or will you work in a team with other observers to verify when you've nabbed them. You could image all of them in beautiful color exposures. How many frames would it take to bracket all the objects using a HyperStar 11, I wonder?

Will you stay in your own backyard with the comforts of home, wander down to the darkness in the center of the valley or find some remote mountain top with low horizons make your stand? Will you use your own memory, a paper map, a book, a computer program or maybe your smart phone to direct you through the race? Will you be doing it for the very first time or for the fortieth? Will you be observing alone or helping out others to see the wonders? Or will you be staying away from all those known faint fuzzies entirely and instead trying to find a real comet?

Whatever formula you plan on using get those eyes limber. Get some time through an eyepiece on your chosen optical magnifier. Practice up before the race. Read about the objects, look at pictures, walk yourself through the list and map out race night. What form of madness will strike you this year?

Our Next Meeting

The March meeting will be held in the Lecture Hall, room 1110 of the Science Building , Cochise College, Sierra Vista Campus on Friday, March 14, 2014 at 7 p.m. The guest speaker, astronomer Dr. G. Grant Williams, the current Director of the MMT Observatory on Mt. Hopkins, will present a program entitled "Supernovae in Any Way, Shape or Form." Supernovae are very energetic and luminous explosions that mark the death of certain types of stars. We might naively assume that stars explode as perfect spheres. However, strictly spherical explosions may not exist. Dr. Williams' research focuses on the study of very evolved high mass stars. There will be a door prize awarded at the end of the meeting; you must be present to win.

To Members and Friends of the Huachuca Astronomy Club:

The City of Sierra Vista is moving ahead to lift a prohibition on digital signs that has existed for years. Apparently, some local businesses have been pushing for digital signs, and a task force has been formed that would modify the current code to allow such LED or digital signs. I am a member of that task force and have expressed an objection to allowing these signs, but I am in a minority.

Opening the doors to digital signs is not a step in the right direction. Signs tend to cutter our scenic beauty. With changing messages on display boards, it would be distracting and ugly to drive through the city. For their size, these signs can consume a lot of energy. For example, some of the larger signs in Phoenix can burn over $2,000 in power each month. Thank goodness, LED signs of this size are not proposed for our area. Also, some cities and towns have permitted digital signs, and owners have forgotten to set dimmer limits at night. This could be a code enforcement challenge and a threat to our night skies.

Perhaps you, too, would not like to see new digital signs? If so, please contact the Mayor and City Council and let them know your thoughts on this. As it now stands, they are hearing from businesses that these digital signs are important to them. If we care about scenic beauty of the area, we must all speak up. I would also ask that you please share this email with friends who live in or near Sierra Vista.

Please send letters to:

Mayor and City Council
City of Sierra Vista
1011 N Coronado Dr
Sierra Vista, AZ 85635

The following link to the mayor and city council web page contains addition contact information:
http://www.sierravistaaz.gov/department/index.php?structureid=2

On a plus side, if the city decides to move ahead and allow digital signs, I have offered to help set standards to control sign brightness. So far, the staff and businesses seem wiling to accept these recommendations to limit light output.

Thank you very much for speaking up on this subject.

Best wishes for the holidays,

Bob Gent, Lt Col, USAF, Ret.
Past President, HAC and
Past President, International Dark-Sky Association

Another way to make your views known is to send a letter to The Sierra Vista Herald:

Send letters to the editor of the Sierra Vista Herald by mail:

102 Fab Avenue, Sierra Vista AZ 85635

or by email: **svhnews@transedge.com**

The survey below asks about how you think the digital sign question should be handled in Cochise County.

Those who attended the public meeting on February 26, filled this survey out, but there were only eight surveys returned. Ted Forte volunteered to distribute and collect these survey forms to try and get a larger sample of opinion.

Ted Forte will print out a number of forms and bring them to the March 27th City Council meeting. He will also bring a number to the March 14 HAC meeting. Ted will collect the completed forms and get them to Beverly Wilson (Director, Planning, Zoning and Building Safety Division Cochise County Community Development Department). Feel free to print the form and bring the completed survey to either of the meetings, or you can email them to Ted at tedforte511 at gmail.com

Cochise County P&Z will benefit greatly from having a large number of these opinion surveys for when they submit their proposed changes to the outdoor lighting code and light pollution codes to the county supervisors. PLEASE HELP by filling one out.

Digital Signs and Light Pollution

Date:

Name:

Address:

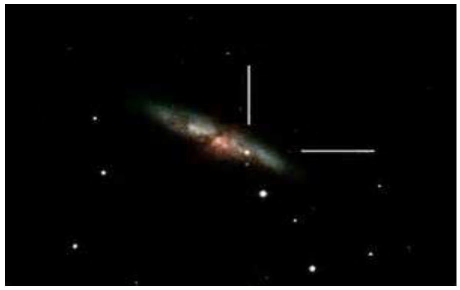
Regarding Digital Signs in Unincorporated Cochise County, do you support:

- ○ A complete ban on digital signs?
- ○ Review and approval by County Staff?
- ○ Review and approval by the Planning and Zoning Commission at a Public Hearing?
- ○ No regulations limiting digital signs?
- ○ Another option? (Please explain below)

Comments:

The Absolute Magnitude of the Supernova In M-82

During our last meeting, there was an excellent presentation of photometry of the supernova in the galaxy M-82. I was curious as to the intrinsic or Absolute Magnitude (“M”) of such a cataclysmic explosion, where the visual or Apparent Magnitude (“m”) peaked at 10.5 (according to data just released by *Sky & Telescope* magazine) from a distance of 13 million light years, or 3,987,730 parsecs (1 parsec = 3.26 light years).



A supernova in the galaxy M-82

I thought the detonation was gargantuan, but I never imagined the results I would calculate.

To calculate the Absolute Magnitude where the distance (“D”) of the object in parsecs and Apparent Magnitude (“m”) are known, I used the formula, M = m -5((log10 D) -1), and substituted in the known values:

M = m -5((log10 D) -1); where m = 10.5, and D = 3,987,730 parsecs.
M = 10.5 -5((log10 3,987,730) -1)
M = 10.5 -5(6.6 -1)
M = 10.5 -5(5.6)
M = 10.5 - 28
M = -17.5

The location of Arcturus

Of all the stars visible to our unaided eye, Arcturus is the third visually brightest having nearly the same Absolute and Apparent magnitudes. This is because it is situated very near to 32.6 light years (10 parsecs), the point where all celestial objects are theoretically placed, and using the *Inverse Square Law of Luminosity*, their Absolute Magnitudes are determined.

For Arcturus, at a distance of 36.7 light years, as you might guess, its Absolute Magnitude is slightly greater than its Visual Magnitude, and it is, - 0.30 vs. - 0.04 (the smaller the number, the brighter the object).

If the supernova in M-82 were placed next to Arcturus, with both objects at 32.6 light years, how many times brighter than Arcturus would it be?

Each magnitude in the brightness scale is 2.512 times brighter than the next. In five magnitudes (for example, 1.0 to 6.0), the factor is 100 times. Shown as a mathematical expression:

$(2.512)^5 = 100$

At its brightest, Venus' Apparent Magnitude is -4.5. It is 100 times brighter than the Southern Hemisphere star, Achernar (Alpha Eridani), with an Apparent Magnitude of +0.50. A star with a magnitude of 2.0 is 2.512 times brighter than a star with a magnitude of 3.0, and 6.31 times brighter than a 4.0 magnitude star.

To determine how many times brighter one object is than another, regardless of the type of magnitude, I use the following formula (means difference, in this case, of magnitudes).

$$= (2.512)^{M1 - M2}$$

Using the above two examples, you can see below how the formula works.

$= (2.512)^{3.0 - 2.0}$	$= (2.512)^{4.0 - 2.0}$
$= (2.512)^{1.0}$	$= (2.512)^{2.0}$
$= 2.512$	$= 6.31$

Substituting the values of the two Absolute Magnitudes of the supernova and Arcturus in to the formula, the result is simply staggering.

$$= (2.512)^{-0.03 - (-17.5)}$$

$$= (2.512)^{17.2}$$

$$= 7{,}591{,}677$$

But wait! There's a fly in the ointment. Interstellar dust, and lots of it, exists between the supernova and us causing the visual magnitude to be diminished over the span of 13 million light years because of the absorption of light by the dust. Without the interference of dust, the visual magnitude is actually 8.7, or 5 times brighter than 10.5.

Now redoing the calculation using an apparent magnitude of 8.7 yields the revised supernova's true Absolute Magnitude:

M = m -5((log10 D) -1); where m = 8.7, and D = 3,987,730 parsecs.
M = 8.7 -5((log10 3,987,730) -1)
M = 8.7 -5(6.6 -1)
M = 8.7 -5(5.6)
M = 8.7 - 28
M = -19.3

Because of these calculations, the supernova in M-82 is thought to be a type 1a. 1a supernovas all have the same Absolute Magnitude, -19.3! (*Its always fun when one's homespun math matches with the big boys!*)

Now going back to the formula with Arcturus using -19.3 as the supernova's Absolute Magnitude,

$$= (2.512)^{-0.03 - (-19.3)}$$

$$= (2.512)^{19}$$

$$= 39{,}844{,}930$$

The supernova in M-82 is actually 39,844,930 times more intrinsically bright than Arcturus!

Its so incredible that we're comparing an event that took place 13 million years ago when Earth was in the middle of the Miocene Epoch, long before humans first arrived, when Antarctica first separated from Australia and South America, with the light that left Arcturus in 1976, the year that America was celebrating her Bicentennial. But we are. And what other events carried in photons are today screaming our way, still traveling in the void that is intergalactic and interstellar space?

The Apparent Magnitude of our Sun is -26.74, yet it's Absolute Magnitude is 4.83. Theoretically moved from its average distance from Earth of 93 million miles away (about 8 light minutes) where to look at it directly could cause blindness, to 32.6 light years, it would be nearly invisible to the naked eye. Compared to many stars, the Sun's intrinsic brightness is rather paltry.

Before the Sun's Absolute Magnitude is compared to M-82's supernova, let's compare two related objects, the Sun (m = -26.74, M = 4.83) and the Moon (m = -12.74, M = 31.8).

Next to the Moon, the Sun is the second brightest object in the sky. At full phase its Apparent Magnitude is -12.74, yet at 32.6 light years, it would only be detected by the most powerful telescopes:

M = m -5((log10 D) -1); where m = -12.74, and D = 0.0000000123536925 parsecs.
M = -12.74 -5((log10 0.0000000123536925) -1)
M = -12.74 -5(-7.9082032131 -1)
M = -12.74 -5(-8.9082032131)
M = -12.74 + 44.5410160656
M = 31.8010160656

When the Moon's Apparent Magnitude of -12.74 is considered, the Sun is nearly 400,000 times as visually bright, as you can see below on the left, but in terms of intrinsic luminosity, the Sun overwhelms the Moon, being 61,451,085,336 (nearly 61½ billion) times brighter.

Comparing Visual Magnitudes	*Comparing Absolute Magnitudes*
$= (2.512)^{-12.74 - (-26.74)}$	$= (2.512)^{31.8 - 4.83}$
$= (2.512)^{14}$	$= (2.512)^{26.97}$
= 398,359	= 61,451,085,336

Comparing the Absolute Magnitude of the Sun (4.83) to the Absolute Magnitude of M-82's supernova (-19.3), as one would expect, the result is even more inconceivable than Arcturus.

(Get ready to be amazed*!!!*)

$= (2.512)^{4.83 - (-19.3)}$

$= (2.512)^{24.13}$

$= 4{,}492{,}352{,}164$

The supernova in M-82 is nearly 4½ billion times intrinsically brighter than our Sun, or the intrinsic output of a small galaxy!

Here are the results when other stars of interest are theoretically moved to 32.6 light years and their resulting intrinsic brightness is compared to that of the supernova. The Sun is included for reference.

Star	*M*	*Intrinsic Factor*
Alpha Centauri	4.3	2,757,169,004
Antares	-5.2	436,794
Betelgeuse	-6.02	205,239
Polaris	-3.63	1,854,845
Rigel	-7.02	81,704
Sirius	1.42	194,270,491
Sun	*4.83*	*4,492,352,164*
Vega	0.6	91,283,175

Sorting the data by Absolute Magnitude (M), yields the following:

Star	*M*	*Intrinsic Factor*
Sun	*4.83*	*4,492,352,164*
Alpha Centauri	4.3	2,757,169,004
Sirius	1.42	194,270,491
Vega	0.6	91,283,175
Polaris	-3.63	1,854,845
Antares	-5.2	436,794
Betelgeuse	-6.02	205,239
Rigel	-7.02	81,704

If you have a star in mind that you'd like to see how it measures up to the supernova in intrinsic brightness, please let me know.

When a massive star like the one in the galaxy M-82 detonates at a distance of 13 million light years, and registers a visual magnitude of 10.5, or 8.7 with the removal of the factor of Interstellar Dust, the event barely shows itself in a moderate-sized amateur telescope. But when we pause and calculate the math, then reflect, it is an outburst no one can begin to fathom.

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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!

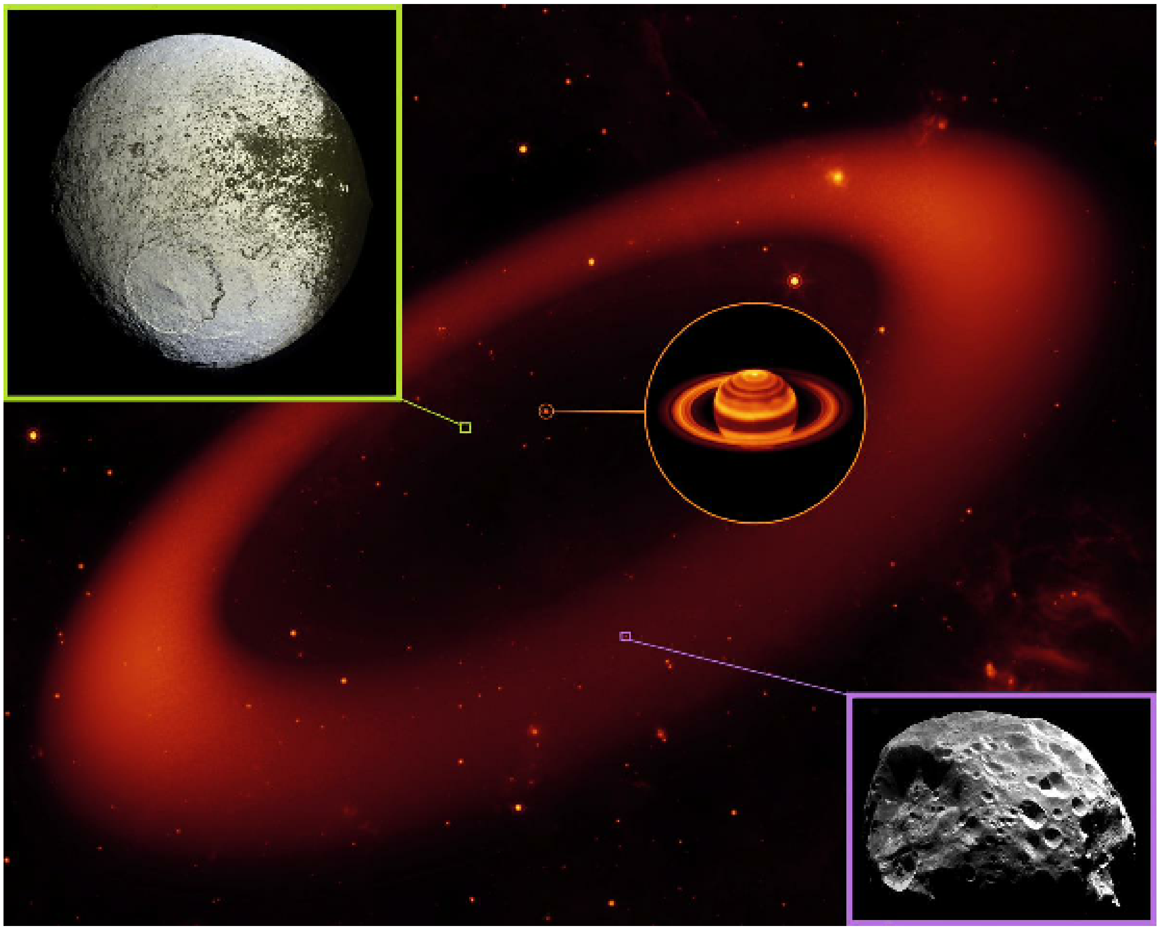
In fact, the darkness of the leading side is comparable to coal, while the rest of Iapetus is as white as thick sea ice. Iapetus is the most distant of all of Saturn's large moons, with an average orbital distance of 3.5 million km, but the culprit of the mysterious dark side is *four times* as distant: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

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

ARIZONA Observers SKY EVENTS Calendar for 2014 —All Times listed are MOUNTAIN STANDARD

JANUARY 2014

HIGHLITES:

Quadrantid Meteors
Jupiter at Opposition

01 We ● **NEW MOON** 0414 hrs. (MST)
03 Fr **QUADRANTIDS** Meteor Shower very favorable; view after midnight; radiant near constellation Bootes; possible hourly rate of up to 120
04 Sa Earth at perihelion 0500hrs.; 0.983 A.U.
04 Sa **HAC** Member Star Party (S.P.)
05 Su JUPITER AT OPPOSITION 1400 hrs.; Mag. –2.7 distance=4.2 AU size=47”
07 Tu ☽ First Quarter Moon 2040 hrs.
09 Th **HAC** Public S.P.; P.O.;SS@ 1735 hrs.
10 Fr **HAC Meeting,** Cochise College 7pm
15 We ○ Full Moon 2153 hrs.; smallest of 2014
23 Th ☾ Last Quarter Moon 2220 hr
25 Sa Saturn 1.2° north of Moon, 0535 hrs.
30 Th ● **NEW MOON** 1439 hrs.; lunation 1127
31 Fr Mercury G_ Elong. East (18⊠0300 h., view as ‘evening’ star in western sky 1/2 hour after sunset; mag. –0.7

Jupiter’s Galilean Moons—January 2014
There are no double-transit events this month, but satellite Callisto has four encounters with its mother planet (local dates and times):
1/11:1944 hrs. Occultation Disappearance
1/12: 0044 hrs. Eclipse Reappearance
1/20: 0438 hrs. Transit Ingress
1/28: 1854 hrs. Eclipse Reappearance
Note:**HAC=H**uachuca **A**stronomy **C**lub

FEBRUARY 2014

HIGHLITES:

Venus at its brightest,
Callisto’s Shadow on Jupiter

01 Sa **HAC** Member S.P.
06 Th ☽ First Quarter Moon 1221 hrs.
Double Shadow Transit, Jupiter; 0323 hrs. (Europa & Callisto); rare
HAC Public S.P.; P.O.;SS@ 1800 hrs.
07 Fr Alpha Centaurid Meteors, Pk. 2305 hrs. Radiant point in southern hemisphere
11 Tu Venus greatest magnitude: -4.6, 1600h.
14 Fr ○ Full Moon 1654 hrs.
HAC Meeting, Cochise College 7pm
15 Sa Venus at greatest illumination, mag.-4.9; morning ‘star’ in southeast sky
17 Mo Zodiacal Light in the west for next two weeks following evening twilight
19 We Spica (star) within 2.5° of Moon,0500 h.
22 Sa ☾ Last Quarter Moon 1016 hrs.
26 We Venus within 6° of Moon, 0500 hrs.

Long Period Variable Stars– Feb. 2014
Verify with www.aavso.org ;listed are stars <u>brighter than mag. 8 at max.: period in days (d);date is predicted epoch max.</u>

0228-13;U Cet;7.5>12.6;235d;Feb.10
1811+36;W Lyr;7.9>12.2;196d;Feb.17
1901+08;R Aql;6.1>11.5;267d; Feb.15
2044-05;T Aqr;7.7>13.1;202d; Feb. 04

MARCH 2014

HIGHLITES:

Kartchner Caverns S.P.(22)
Messier Marathon?(29)

01 Sa ● **NEW MOON** 0100 hrs.
01 Sa **HAC** Member S.P.
06 Th **HAC** Public S.P.; P.O.; SS@1823 hrs.
08 Sa ☽ First Quarter Moon 0628 hrs.
14 Fr Mercury G_Elong. W. (28°); morning ‘star’ in twilight to the east
14 Fr **HAC Meeting,** Cochise College 7pm
16 Su ○ Full Moon 1010 hrs.
18 Tu Zodiacal Light in the west for next two two weeks following evening twilight
20 Th **Vernal Equinox** 0957 hrs.
21 Fr Saturn close (north) to Moon
22 Sa **Kartchner Caverns S.P. ;**1830 hrs.
23 Su ☾ Last Quarter Moon 1847 hrs.
29 Sa **HAC Messier Marathon**-Proposed This date 110 objects should be visible
30 Su ● **NEW MOON** 1146 hrs.

Possible Favorable Periodic Comets—
<u>Reaching Perihelion March 2014</u>
Obtain elements/ephemerides at www.minorplanetcenter.net; listed dates/times are in UT (to retain MPC accuracy)
P/2007 H3 (Garradd); Mar 01.23;1.8 AU
P/2008 A2 (LINEAR); Mar 03.40; 1.3 AU
52P (Harrington-Abell); Mar 07.54; 1.8 AU
290P/1998 U3(Jager); Mar 12.57; 2.15 AU
117P/Helin-Roman-Alu; Mar 27.16; 3.0 AU

APRIL 2014

HIGHLITE: **Total Lunar Eclipse (1 of 2 in 2014)**

03 Th **HAC** Public S.P.; P.O.; SS@1841 hrs.
07 Mo ☽ First Quarter Moon 0132 hrs.
08 Tu MARS at opposition, 1400 hrs.
09 We Comet 124P (Mrkos) at perihelion 0738 hrs.; perihelion distance 1.6 AU
11 Fr **HAC Meeting,** Cochise College 7pm
12 Sa Asteroid 4 Vesta at opposition 2200hrs.
14 Mo Mars closest approach, 0600 hrs.; 0.62 AU from Earth, mag. –1.5; Size:15.2 arc-seconds
14>15 (Mo>Tu): **Total Lunar Eclipse** 2157 hrs. (14th) to 0337 h.(15th) Total from 0010h. to 0124h. (15th)
15 Tu ○ Full Moon 0043 hrs.
17 Th Saturn close (north) to Moon, 0000h.
22 Tu ☾ Last Quarter Moon 0053 hrs.
23 We **Lyrid Meteor Shower,** Pk. 1045 h.; some 46% moon; view on 23rd am
26 Sa **HAC** Member S.P.
28 Tu ● **NEW MOON** 2315 hrs.

MAY 2014

HIGHLITE: **Astronomy Day & Saturn at opposition, May 10**

01 Th **HAC** Public S.P.; P.O.; SS@1900 hrs.
1 Th Mercury @ perihelion; evening star, mag. –1.6; view WNW at dusk
6 Tu **Eta Aquarid Meteor Shower**, Pk@ 0100 hrs.;40% Moon; rate 60+?
06 Tu ☽ First Quarter Moon 2016 hrs.
09 Fr **HAC Meeting,** Cochise College 7pm
10 Sa **NATIONAL ASTRONOMY DAY** (**HAC** event at Sierra Vista City Library)
10 Sa **Saturn** at opposition, 1100 hrs.; mag. +0.1, 8.9 AU from Earth, total size of 42.4” (planet itself 18.7”)
14 We ○ Full Moon 1217 hrs.
21 We ☾ Last Quarter Moon 0600 hrs.
24 Sa **NEW** Meteor Shower? Predicted strong peak from Midnight to 0100 on am of 24th; radiant in Camelopardalis; from Comet 209P/LINEAR; best of 2014?
28 We ● **NEW MOON** 1141 hrs.
31 Sa **HAC** Member S.P.

JUNE 2014

HIGHLITE:

Venus/Moon Conjunction (photo-op?)

05 Th **HAC** Public S.P.; P.O.;SS@1923 hrs.
☽ First Quarter Moon 1340 hrs.
12 Th ○ Full Moon 2112 hrs.
13 Fr **HAC Meeting,** Cochise College 7pm
19 Th ☾ Last Quarter Moon 1140 hrs.
21 Sa **Summer Solstice** 0351 hrs.
24 Tu Conjunction of crescent 7% Moon and Venus; 0518 to ENE
27 Fr June Bootids Meteor Shower; overhead to dawn on 27th; may show outburst
27 Fr ● **NEW MOON** 0109 hrs.
28 Sa **HAC** Member S.P.

Long Period Variable Stars–June 2014
Verify with www.aavso.org ;listed are stars <u>brighter than mag. 8 at max.: period in days (d);date is predicted epoch max.</u>

1946+32; x Cyg; 5.2>13.4; 407d; Jun 24
1432+27; R Boo; 7.2>12.3; 223d; Jun 21

*Times/Dates= ARIZONA Mountain STANDARD Time (MST; 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/noteworthy 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

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