NIGHTFALL
Huachuca Astronomy Club of Southeastern Arizona

January 2013

President's Notes

Next Meeting: The next meeting of the Huachuca Astronomy Club will be on Friday, January 25 at the Cochise College student union building at 7 pm in Sierra Vista, AZ. The guest speaker will be Dean Ketelsen. Dean works at the University of Arizona's Mirror Lab where they are constructing new 8.4 meter diameter mirrors for the Giant Magellan Telescope. He is also working on a unique mirror for the Large Synoptic Survey Telescope. In addition, Dean has worked at the Kitt Peak National Observatory, and he is a past officer of the Tucson Amateur Astronomy Club. Dean is also an accomplished astrophotographer, and he will share his latest astronomical photos and news with us.

We will be awarding a signed Night Sky Observer's Guide, Volume One as a door prize. This meeting is free of charge and open to the general public. For more information, visit www.hacastronomy.org.

Dean Ketelsen giving HAC members a tour of the mirror lab in Tucson at the University of Arizona. Photo by Bob Gent

Please renew your membership. Has another year flown by already? Yes, the 2013 dues are due now. We have included a renewal form in this newsletter, and we ask that you please renew your membership. Your membership supports our many programs including speakers, dark skies, school events, the Astronomical League, HAC scholarships, and so much more. Thank you!

HAC Outreach: I would like to thank HAC Board member Bob Hoover for volunteering to serve as our Outreach coordinator. After any years of outstanding service, Rich Swanson stepped down, and we thank him for all he did for outreach over the past years.

Member Star Parties: Glen and Deanna Sanner hosted the members star party on January 12, and we greatly appreciate their generosity. Ted and Halina Forte have volunteered to host our February 9th star party. We have many other openings the rest of the year, and please let us know if you can host an event.

Public Nights at the Patterson: The next Patterson Observatory public nights are Thursday, January 17, February 14, March 14, April 18, May 16, and June 13. All these events start shortly after sunset, and as always, we appreciate your help. Again this year, we will not be holding any events during July or August due to monsoons.

General meetings: This year, all our meetings except December will be held on the 4th Fridays at Cochise College.

Internet and HAC: I addition to our fantastic website manager by Ken Kirchner, we are now linked in other ways. We would like to thank Robert Kelher for his help managing the HAC and Patterson Facebook pages, and he is also helping us keep updated on the Night Sky Network.

Support from Amazon: Our club continues to receive funds from Amazon.com. A percentage of every Amazon sale that passes through our website is automatically donated back to our club. If you plan of doing online holiday shopping, please use the Amazon link on our website at www.hacastronomy.com.

Clear skies and bright stars,

Bob Gent
President, Huachuca Astronomy Club

HAC Member, Robert Auclair sent this beautiful photo of the Moon and Venus during an early morning a few weeks ago.

Astronomy's Most Important Shape **by Tommy Neyhart**

The most important and dominant shape in astronomy is the ellipse. It shapes orbits of moons around planets, planets around stars, and stars around their galaxies. Even comets who spend the vast bulk of their enigmatic lives traveling in nearly straight lines, orbit the sun in ellipses.

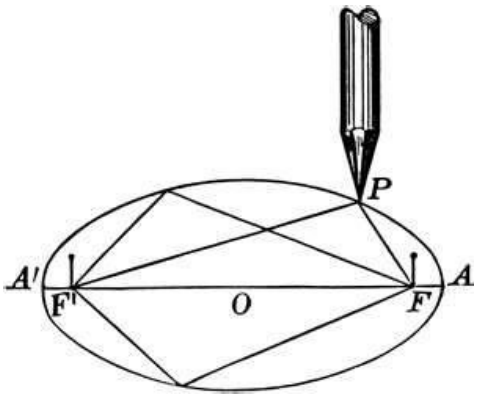
Johannes Kepler in the early 1600's wrote his *Three Laws of Planetary Motion*. His First Law stated:

The orbits of the planets are ellipses, with the sun at one focus of the ellipse.

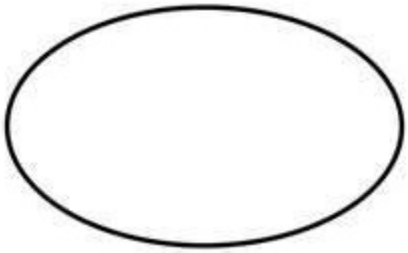
Today, as the steady drumbeat of new exoplanet discoveries flash across our cyber astronomy alert services, and now with the discovery of a comet that hopefully will light up our night skies, two bits of data virtually always accompany the news. The object's average distance from that which it is orbiting as well as its eccentricity usually join other details of the object along side a blurry photo or two.

But how can an "average distance" and an "eccentricity" give us a picture of the orbit in our minds as well as allowing us to derive other important facts?

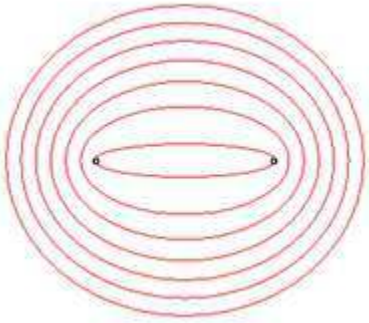
You can draw an ellipse by anchoring a length of string at two points, then letting a portion drape below. Placing a pencil in the loop and tightening it, begin to draw an ellipse, keeping the string taught throughout. The two points that are pinned are referred to as the focus points of the ellipse. See illustration below.



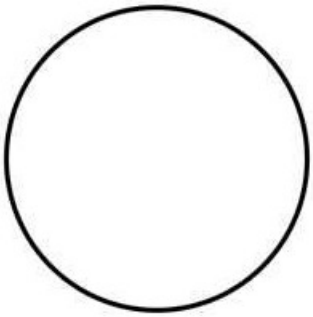
This is how your finished illustration should look:



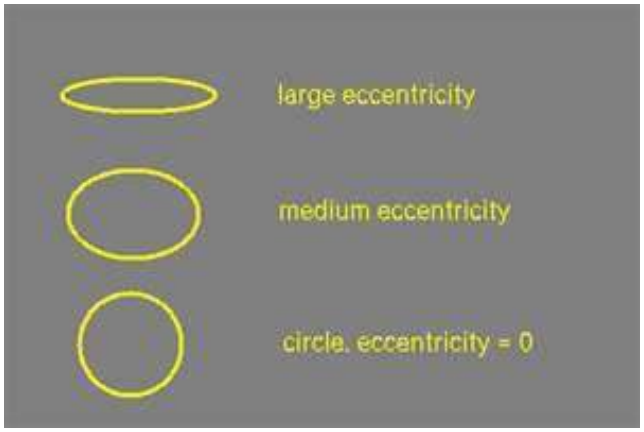
By varying the distances between the anchored points (using the same length of string) you will quickly see that when the anchor points are close together, the ellipse is nearly circular, but as you move them farther and farther apart, the ellipse lengthens and flattens. Ellipses dramatically change with the varying distances of the anchor points as you can see below.

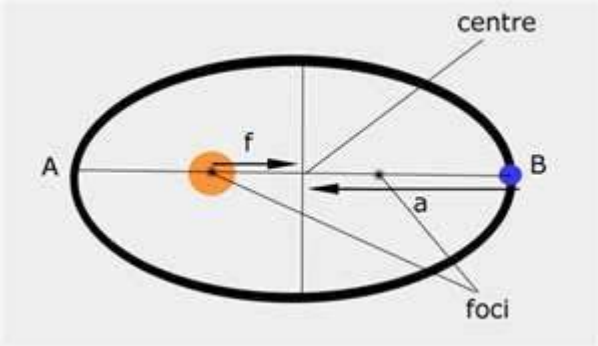


The more the focus points are separated, the flatter and more distended the ellipse will become. Conversely, the closer the points are from each other, the more circular is the ellipse. When the two focus points are one and the same, you no longer have an ellipse, but a circle!



Here is a summary illustration of the three general types of ellipses:





Some Important Terminology

Above is an illustration of an ellipse. The diameter at its widest part (AB) is the *Major Axis*, while the distance across at its narrowest is the *Minor Axis*, as it intersects the major axis at right angles, the point of crossing called the *Center* ("centre"). The point is not only half way between the two *Focus Points* (f) of the ellipse, but also bisects the Major Axis. From the center of the ellipse to either point where the Major Axis touches the outer edge is the *Semi-Major Axis* (a). The Semi-Major Axis, or half the Major Axis, represents an object's average distance from the sun it orbits.

The more stretched or distended the ellipse, the more it is said to be *Eccentric.* The less Eccentric an ellipse, the more circular it is.

Mathematically, the Eccentricity ("e") of an ellipse is found by dividing the distance between the Focus Points by the length of the major axis (2 x Semi-Major Axis).

$$e = (F_1 - F_2) / 2a$$

Eccentricities vary in value between 0.0 and 1.0. When the Focus Points are so close together, they are nearly touching, the Eccentricity is nearly 0.0. When the Focus Points touch, and there is no distance between them, then the eccentricity is 0.00 because the numerator of the ratio is 0. At 0.0 Eccentricity, the shape is a circle. When the ellipse becomes incredibly stretched, as it does with the orbit of a comet, the Eccentricity is nearly 1.0, because the distance between the Focus Points is nearly the same as the length of the Major Axis!

Only one Focus Point (f) houses a sun while the other is vacant and is referred to as the *Empty Focus.*

Given the average distance of the orbiting object from its central star, and the Eccentricity of its orbit, how can the closest distance (*Perihelion*) and the furthest distance (*Aphelion*) be calculated?

Because the Minor Axis divides both the Major Axis and the two Focus Points in half, by finding first half the distance between the two Focus Points, then the length of the Semi-Major Axis (the average distance of the orbiting object to its center) and a distance that is nearly always given, the Perihelion (P) and the Aphelion (A) can be found.

When half the distance between the Focus Points is found, the quantity is first added to the Semi-Major Axis for the Aphelion, then subtracted to find the Perihelion. Mathematically, it can be expressed as:

$P = m - em$
$A = m + em$

where P is the Perihelion, A is the Aphelion, m is the average or mean distance of the orbital to is center, and e is the Eccentricity of the ellipse.

Factoring the two formulas, they render to their simplest state:

$$\mathbf{P = m\,(1 - e)\;A = m\,(1 + e)}$$

EXAMPLE NO. 1 (*Two Exoplanets*): Ironically and coincidentally, two exoplanets are discovered on the same day, each revolving around a different star, and each having exactly the same average distance from their primary sun, 44 million miles, but with different Eccentricities. The first, Exoplanet A, has an Eccentricity of 0.10, while the second, Exoplanet B, has an Eccentricity of 0.70. What are the Perihelions (P) and Aphelions (A) of each?

Before seeing the calculations, from what you now know about Eccentricities, you could deduce that Exoplanet A's orbit is far more circular than Exoplanet B's, and A's near and far distances vary to a much lesser extent than B's.

Exoplanet A

$P = 44\,(1 - 0.10) = 44\,(0.9) = 39.6$ million miles (just beyond the orbit of Mercury).
$A = 44\,(1 + 0.10) = 44\,(1.1) = 48.4$ million miles (half the distance of the Sun to Earth).

$P = 44\,(1 - 0.70) = 44\,(0.3) = 13.2$ million miles (about one-third distance of the Sun to Mercury).
$A = 44\,(1 + 0.70) = 44\,(1.7) = 74.8$ million miles (just beyond the orbit of Venus).

You can visualize not only the shapes of the orbits but the relative miles involved when comparing distances to the various Solar System planets.

EXAMPLE NO. 2 *(Earth)*: The Earth has an average distance to the Sun of 92,955,888 miles, while its Eccentricity is listed as 0.0167. What is the Earth's closest distance to the Sun during the year and what is the furthest?

$P = m\,(1 - e)$
$A = m\,(1 + e)$

Solve P and A where m = 92,555,888 miles and e = 0.0167.

$P = 92{,}955{,}888\,(1 - 0.0167) = 92.955{,}888\,(0.9833) = 91{,}403{,}525$ miles $A = 92{,}955{,}888\,(1 + 0.0167) = 92.955{,}888\,(1.0167) = 94{,}508{,}251$ miles

EXAMPLE NO. 3 ***(Venus)***: Of all the planets in our Solar System, Venus has the smallest eccentricity at 0.00677323. With an average distance from the Sun of 67,238,055 miles, what is Venus' closest and furthest distance from the Sun during its year?

P = m (1 – e) A =
m (1 + e)

Solve P and A where m = 67,238,055 miles and e = 0.00677323.

P = 67,238,055 (1 – 0.00677323) = 67,238,055 (0.99322677) = 66,782,636 miles A = 67,238,055 (1 + 0.00677323) = 67,238,055 (1.00677323) = 67,693,474 miles

EXAMPLE NO. 4 ***(Mercury)***: Mercury has the largest Eccentricity at 0.20563069. With a Semi-Major Axis of 35,828,319 miles, what is Mercury's Perihelion and Aphelion?

P = m (1 – e) A =
m (1 + e)

Solve P and A where m = 35,828,319 miles and e = 0.20563069.

P = 35,828,319 (1 – 0.20563069) = 35,828,319 (0.79436931) = 28,460,917 miles A = 35,828,319 (1 + 0.20563069) = 35,828,319 (1.20563069) = 43,195,721 miles

The Planets Eccentricities In Order

From smallest eccentricity to the largest, here is the order:

Planet	*Eccentricity*
Venus	0 . 0 0 7
Neptune	0 . 0 0 9
Earth	0 . 0 1 7
Uranus	0 . 0 4 7
Jupiter	0 . 0 4 8
Saturn	0 . 0 5 4
Mars	0 . 0 9 3
Mercury	0.206

Perihelions and Aphelions For All The Planets

Using the two formulas [Perihelion = m(1 – e) and Aphelion = m(1+ e)], the following table shows the closest and furthest points for each of the eight planets.

Planet	*Semi-Major Axis (AU)*	*Semi-Major Axis (miles)*	*Eccentricity*	*Perihelion (mi.)*	*Aphelion (mi.)*
Mercury	0.387	35,828,319	0.206	28,460,584	43,196,055
Venus	0.723	66,949,006	0.007	66,495,092	67,402,920
Earth	1.000	92,555,888	0.017	91,009,279	94,102,497
Mars	1.524	141,028,332	0.093	127,857,696	154,198,968
Jupiter	5.203	481,559,030	0.048	458,251,573	504,866,487
Saturn	9.537	882,705,504	0.054	835,127,677	930,283,331
Uranus	19.189	1,776,054,935	0.047	1,692,118,579	1,859,991,291
Neptune	30.070	2,783,146,297	0.009	2,759,239,070	2,807,053,523

Now familiar with an orbiting body's Semi-Major Axis, there is another use of this important element of data. It is how it relates to a planet's revolution around the Sun in Earth years.

Kepler's Third Law of Planetary Motion

Johannes Kepler's Third Law of Planetary Motion stated:

> *The square of the orbital period ("P") of a planet is directly proportional to the cube of the semi-major axis ("A") of its orbit.*

Mathematically, the formula looks like this:

$$P^2 = A^3$$

Said another way, when you hear of the distance (in miles) of an object's Semi-Major Axis, first divide the number by the distance of 1 AU (92,555,888 miles), cube the result, then find its square root to calculate its period of revolution in years.

Mathematically:

$$P = \sqrt{A^3}$$

EXAMPLE NO. 5: An object is discovered orbiting a Sun-size star 21 light years away. It has a Semi-Major Axis of 409 million miles. How long does it take to make one revolution around its sun?

1) [Finding its distance in AUs] 409,000,000 / 92,555,888 = 4.42 AU
2) [Cube the AUs] $(4.42)^3 = 86.29$

3) [Square root of the above result] $\sqrt{86.29}$ = **9.29 years**

Below is a table of planetary orbital data highlighting the Semi-Major Axis (in AU's) and the orbital period (in years) of each of the eight planets. As you can see, when the Semi-Major Axis is cubed and the orbital period in Earth's years is squared, according to Kepler's Third Law, the two values are the same!

Planet	*Semi-Major Axis (AU)*	*Orbital Period (yrs)*	*(Semi-Major Axis)³*	*(Orbital Period)²*
Mercury	0.387	0.241	0.058	0.058
Venus	0.723	0.615	0.378	0.378
Earth	1.000	1.000	1.000	1.000
Mars	1.524	1.881	3.538	3.537
Jupiter	5.203	11.863	140.843	140.722
Saturn	9.537	29.447	867.432	867.155
Uranus	19.189	84.017	7,065.730	7,058.830
Neptune	30.070	164.791	27,189.170	27,156.179

NOTE: 1 AU equals the average distance of the Earth from the Sun.

Summary: After learning how to draw an ellipse and some key terminology, and being on the lookout for an object's Semi Major Axis distance and Eccentricity ratio, not only can you now quickly calculate he object's perihelion and aphelion to the central star its orbiting, and the direct correlation between a planet's average distance and its period of revolution, but you can now calculate the number of years it takes to make one revolution around it, all from just two important bits of data.

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Astronomical League Observing Programs

by Ted Forte

Do you enjoy doing Astronomical League observing programs? Are you working on any now? I think a lot of experienced observers ignore the A.L. programs thinking they have little to add to their enjoyment of the sky. Some consider the programs to be just for beginners. Yet, some beginners might think they're not up to the task.

If you've never considered doing one of the Astronomical League observing programs perhaps you are missing a chance to get more from our hobby. After all, if you've ever stood under a starry sky and asked yourself, 'what should I look at?' or if you find that you're looking at the same things over and over again then I think an observing program is just the ticket. Not only do they come with a readymade observing list, they provide a goal to work toward and just might introduce you to a whole new genre of objects.

And, you might learn something new. I know I've learned about the geology of the moon, the physics of solar phenomena, what makes a galaxy 'peculiar', and how to classify star clusters among a host of other things.
I think doing these programs (I've done more than twenty!) has made me a better observer and a more meticulous note taker. I've stretched my skills, pushed my optics, and perfected new techniques along the way. And I had fun doing it! I've also felt a sense of communing with the great astronomers of ages past. Imagine repeating Galileo's discoveries the same way he did or following in the footsteps of the Herschel's.
I count 40 programs listed on the Astronomical League website. From asterisms to variable stars, there is truly something for everyone. Check them out at:
http://www.astroleague.org/al/obsclubs/AlphabeticObservingClubs.html

It's really easy to get started; just pick a program, read the rules, and get out there under the stars. If you want help or need a darker sky or a bigger telescope to do the program, there are several HAC members, including myself, willing and able to assist you. Just post a message on the Haclist Yahoo group or raise your hand at a meeting and we can put you in touch with an experienced HAC member with a dark sky site and observatory.
Just one more thing. As some of you are no doubt aware, I am the creator and coordinator of the League's Planetary Nebula Program. So far, only three HAC members have earned the Planetary Nebula Program award.

I'd be thrilled if more members of my home club were to complete this program. To earn a PNe program basic certificate you need only observe and describe 60 planetary nebulae. Observe all 110 and you earn the advanced award certificate and pin. If you are a member of the HAClist Yahoo group, you can follow my running commentary on the PN program and see my recommendations for where to start in any given month. So what do you say? Are you up to it?

Partnering to Solve Saturn's Mysteries

By Diane K. Fisher

From December 2010 through mid-summer 2011, a giant storm raged in Saturn's northern hemisphere. It was clearly visible not only to NASA's Cassini spacecraft orbiting Saturn, but also astronomers here on Earth—even those watching from their back yards. The storm came as a surprise, since it was about 10 years earlier in Saturn's seasonal cycle than expected from observations of similar storms in the past. Saturn's year is about 30 Earth years. Saturn is tilted on its axis (about 27° to Earth's 23°), causing it to have seasons as Earth does. But even more surprising than the unseasonal storm was the related event that followed.

First, a giant bubble of very warm material broke through the clouds in the region of the now-abated storm, suddenly raising the temperature of Saturn's stratosphere over 150 °F. Accompanying this enormous "burp" was a sudden increase in ethylene gas. It took Cassini's Composite Infrared Spectrometer instrument to detect it.

According to Dr. Scott Edgington, Deputy Project Scientist for Cassini, "Ethylene [C_2H_4] is normally present in only very low concentrations in Saturn's atmosphere and has been very difficult to detect. Although it is a transitional product of the thermochemical processes that normally occur in Saturn's atmosphere, the concentrations detected concurrent with the big 'burp' were 100 times what we would expect."

So what was going on?

Chemical reaction rates vary greatly with the energy available for the process. Saturn's seasonal changes are exaggerated due to the effect of the rings acting as venetian blinds, throwing the northern hemisphere into shade during winter. So when the Sun again reaches the northern hemisphere, the photochemical reactions that take place in the atmosphere can speed up quickly. If not for its rings, Saturn's seasons would vary as predictably as Earth's.

But there may be another cycle going on besides the seasonal one. Computer models are based on expected reaction rates for the temperatures and pressures in Saturn's atmosphere, explains Edgington. However, it is very difficult to validate those models here on Earth. Setting up a lab to replicate conditions on Saturn is not easy!

Also contributing to the apparent mystery is the fact that haze on Saturn often obscures the view of storms below. Only once in a while do storms punch through the hazes. Astronomers may have previously missed large storms, thus failing to notice any non-seasonal patterns.
As for atmospheric events that are visible to Earth-bound telescopes, Edgington is particularly grateful for non-professional astronomers. While these astronomers are free to watch a planet continuously over long periods and record their finding in photographs, Cassini and its several science instruments must be shared with other scientists. Observation time on Cassini is planned more than six months in advance, making it difficult to immediately train it on the unexpected. That's where the volunteer astronomers come in, keeping a continuous watch on the changes taking place on Saturn.

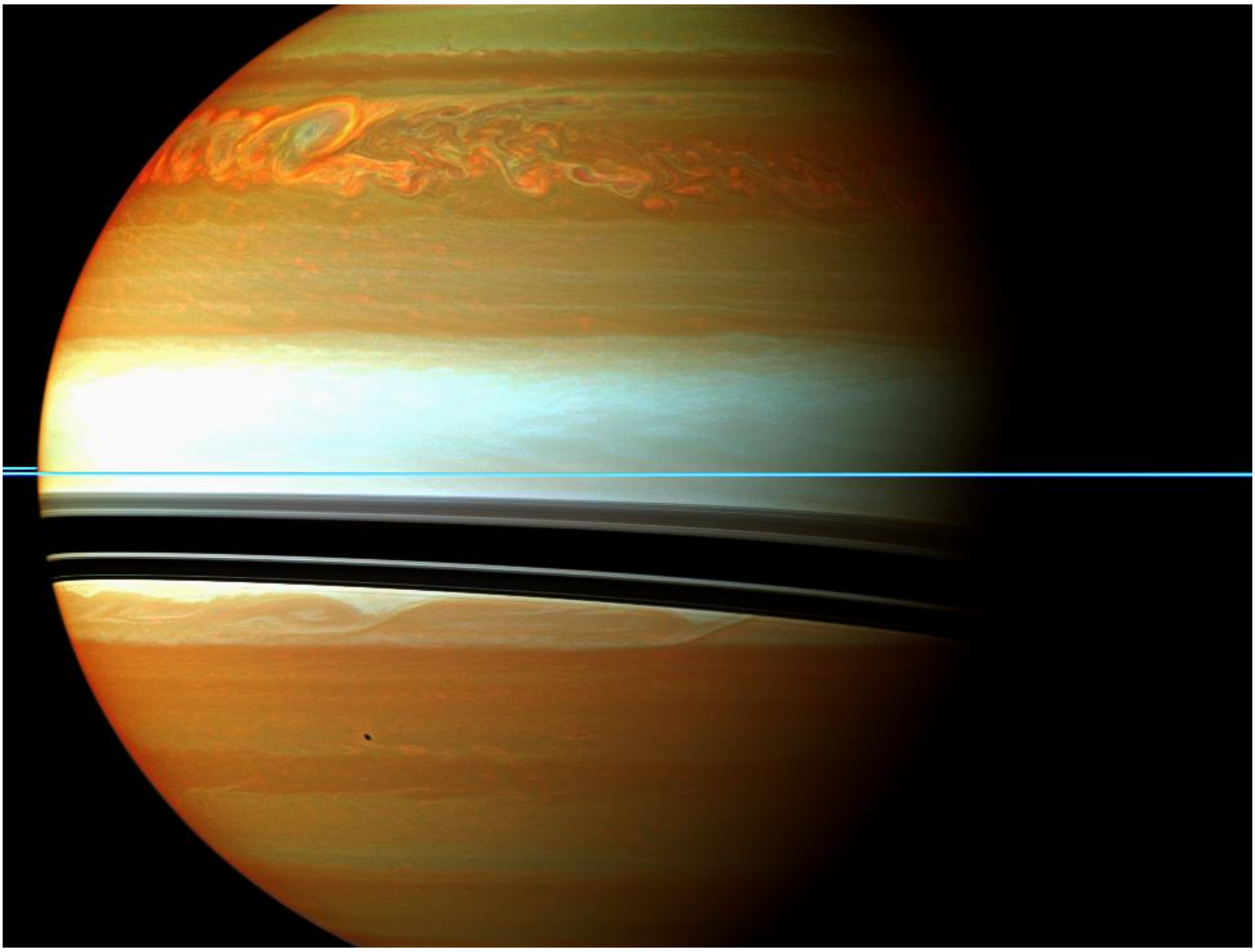
Edgington says, "Astronomy is one of those fields of study where amateurs can contribute as much as professionals."

Go to http://saturn.jpl.nasa.gov/ to read about the latest Cassini discoveries. For kids, The space Place has lots of ways to explore Saturn at http://spaceplace.nasa.gov/search/cassini/.

This article was provided by the Jet Propulsion Laboratory, California Institute of Technology, under a contract with the National Aeronautics and Space Administration.

Image below provided by NASA:

This false-colored Cassini image of Saturn was taken in near-infrared light on January 12, 2011. Red and orange show clouds deep in the atmosphere. Yellow and green are intermediate clouds. White and blue are high clouds and haze. The rings appear as a thin, blue horizontal line.



ARIZONA SKY-CALENDAR UPDATE FOR FEBRUARY 2013

by Doug Snyder (C/2002 E2)

Note: Unless otherwise noted, all dates and times are shown in Arizona's Mountain Standard Time – NOT in Universal Time (U.T.) nor in Eastern Time (E.T.). MST is behind UT by 7 hours.

HIGHLIGHT for February: **Mercury and Mars close on Feb. 8**:
These two planets are within ½ degree of each other in the evening sky towards the west and with Mercury just to the north of Mars. Look for this pairing shortly after sunset, as both planets will be low in the west and don't 'stay up' too long themselves. Mercury will be at magnitude -1.0 and Mars at +1.2
What may be a second Highlight for the month is the pass of a small NEA (Near Earth Asteroid) on Friday, Feb. 15. This event is covered in more detail a few lines down.

Wednesday, Feb. 6: planetary conjunction: Mars, Mercury and Neptune close, in western skies, shortly before sunset. In Aquarius – good luck viewing this conjunction! Mars is 'on-top' with Mercury and Neptune side-by-side just below Mars.

Saturday, Feb. 9: HAC member star party: Where ever this event is held, it will probably get underway at about 6 pm or 6:30 pm. As of this writing, it is possible that the star party will be at the 'Desert Coyote Observatory' (DCO), located north of Hwy. 90 and just east of Sierra Vista – VERY dark skies! We thank our host in advance!

Sunday, Feb. 10: New Moon; this is the start of lunation #1115

Thursday, Feb. 14: Astronomy Night (Public) at Patterson Observatory: This outreach event is becoming quite popular in the community, and Sierra Vista metro area astronomers are encouraged to lend their support by attending and sharing their knowledge and love of the Arizona night skies! There will be a very nice 18% illuminated crescent Moon that evening. And probably more celestial wonders!

Friday, Feb. 15: Fly-by of NEA 2012 DA14 (Telescopic event): This object, estimated to be only about 50 meters in diameter (155 ft.), is predicted to come within about 18,000 miles of the Earth's surface. At its closest approach (favoring the night skies of Eastern Europe, then into Asia), it may reach 8th magnitude. But for our local Arizona skies, its passage through the northern sky constellations of Ursa Major, Draco, Camelopardalis and Ursa Minor, the magnitude will have decreased down to 11th, 12th, and 13th, as well as its velocity through space (a max. of near ¾ of a degree per MINUTE!). A favorable time for our Arizona viewing is from about 7pm on Feb. 15 (NEA in Camelopardalis at mag. 12) to about 5am on Feb. 16 (NEA in Draco at mag. 14). To acquire your own ephemeris, I recommend visiting the JPL Horizon's web interface at: http://ssd.jpl.nasa.gov/horizons.cgi?s_time=1#top and using your location coordinates (or use your observatory code, which I always use mine [code 925]). The February 2013 Sky & Telescope issue has a informative article regarding this NEA on page 51.

Saturday, Feb. 16: Mercury reaches Greatest Elongation East (18.1° from Sun) at 2pm, and its angular size in the evening western skies is 7" (arc-seconds).

Friday, Feb. 22: HAC General Meeting: This gets underway at 7 pm, and the meeting place is the Student Union room at Cochise College.

Wednesday, Feb. 27: A two-week period of the Zodiacal Light begins in the western evening skies after twilight. This can be a noticeable soft pyramid of 'whitish light' with its base near the horizon.

Reminder: There are ALWAYS exciting and unusual sky phenomena happening in our visible universe whether WE know it or see it; make your discovery tonight! These Arizona updates are just a fraction of observable sky events! Your feedback is always welcome. THANK YOU & CLEAR SKIES UNTIL NEXT MONTH – Doug (starhaven@palominas.com)

Huachuca Astronomy Club – Board of Directors

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

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2013—ARIZONA's Astronomically Handy Sky Calendar from Doug Snyder & the H.A.C.—2013

ARIZONA Observers SKY EVENTS Calendar for 2013 —All Times shown are MOUNTAIN STANDARD TIME*

January 2013

HIGHLITE1: Moon & Jupiter on 21st
HL2(month)**: Saturn's Rings open to 18°**
Note: **HAC** = **H**uachuca **A**stronomy **C**lub

03 Th Quadrantids Meteor Shower - unfavorable year due to Moon light!
04 Fr ☾ Last Quarter Moon 2058 hrs.
11 Fr ● **NEW MOON** 1244 hrs.(lunation#1114)
12 Sa **HAC** Member **S**tar **P**arty (S.P.)
17 Th **HAC** Pub. S.P.;P.O.; SS@1743h.
18 Fr ☽ First Quarter Moon 1645 hrs.
21 Mo MOON & Jupiter v. close, 2000h
25 Fr **HAC Meeting**, Cochise College, 1900 hrs
26 Sa ○ Full Moon, 2138 hrs.
29 Tu Zodiacal Lt. in W., pm, next two weeks after evening twilight.

February 2013

HIGHLITE: Merc. & Mars close on Feb. 8th
03 Su ☾ Last Quarter Moon 0656 hrs.
09 Sa **HAC** Member **S**tar **P**arty (S.P.)
10 Su ● **NEW MOON** 0020 hrs.
14 Th **HAC** Pub. S.P.; P.O.; SS@1808hrs.
15 Fr **NEA** 2012 DA14; to mag.12 in evening hrs.; size= 57meters; visit spaceweather.com
16 Sa Merc. evening planet in W., 7"
17 Su ☽ First Quarter Moon 1331 hrs.
22 Fr **HAC Meeting,** Cochise College
25 Mo ○ Full Moon 1326 hrs.
27 We Zodiacal Lt. in W., pm, next two weeks after evening twilight

March 2013

HIGHLITE: Messier Marathon S.P.
04 Mo ☾ Last Quarter Moon 1453 hrs.
09 Sa **HAC Messier Marathon S.P.**
09 Sa **Comet Pan-Starrs** (C/2011 L4); 2100hrs, at Perihelion—Mag. 0?
11 Mo ● **NEW MOON** 1251 hrs.
14 Th **HAC** Pub. S.P.; P.O.; SS@1829h.
16 Sa **KartchnerCavernsStatePark**SP.
17 Su Moon&Jup. close;1900hrs; 1.4°
19 Tu ☽ First Quarter Moon 1027 hrs.
20 We **Vernal Equinox**, 0402 hrs.
22 Fr **HAC Meeting,** Cochise College
27 We ○ Full Moon 0227 hrs.
31 Su Merc. morning planet in E. size 9" Easter Sunday

April 2013

HIGHLITE: Saturn Opposition, 4/28
HL2: Comet Pan-Starrs (early in month & bright?)
02 Tu ☾ Last Quarter Moon, 2137 hrs.
06 Sa **HAC** Member S.P.
10 We ● **NEW MOON** 0235 hrs.
14 Su Jupiter within 4° of crescent Moon
18 Th ☽ First Quarter Moon 0531 hrs.
Th **HAC** Pub. S.P.; P.O.; SS@1852h.
20 Sa **ASTRONOMY DAY—Global**
22 Mo Lyrid Meteors—v. unfavorable due to moonlight; peak 0400?
25 Th ○ Full Moon, 1257 hrs.
26 Fr **HAC Meeting,** Cochise College
28 Su Saturn at **Opposition,** 0100 hrs. mag. +0.1, size 18.8", 8.82 AU

May 2013

HIGHLITE: Merc., Venus, Jup. Conjunction!
02 Th ☾ Last Quarter Moon, 0414 hrs.
05 & 06 Su & Mo **η Aquarid Meteors**; favorable; pk@4am each morning; possibly 40 per hr.
09 Th ● **NEW MOON** 1728 hrs.
11 Sa **HAC** Member S.P.
16 Th **HAC** Pub. S.P.; P.O.; SS@1912hrs.
17 Fr ☽ First Quarter Moon 2134 hrs.
24 Fr ○ Full Moon, 2125 hrs. very shallow penumbral Lunar Eclipse, 1.5%; mostly undetectable, starts at 2053hrs.
24 Fr **HAC Meeting,** Cochise College
24-29 Planetary Conjunction, **best** of 2013;evening twilight line up of Merc.,Venus,Jup.;26th is !!
31 Fr ☾ Last Quarter Moon, 1158 hrs.

June 2013

HIGHLITE: [redacted](Gamma) Delphinids?
04 Tu Venus in **M35**, pm, low in NW
08 Sa ● **NEW MOON** 0856 hrs.
HAC Member S.P.
11 Tu **Meteors-[redacted]**Del.; 0100-dawn? v. favorable year, activity is ??
12 We Merc. G. Elong. 24°, pm planet
13 Th **HAC** Pub. S.P.; P.O.; SS@1927hrs.
16 Su ☽ First Quarter Moon 1024 hrs.
20 Th Merc. 2° S. of Venus, pm
20 Th Summer **Solstice** 2204 hrs.
23 Su ○ Full Moon,0432h.largest of 2013
28 Fr **HAC Meeting,** Cochise College
29 Sa ☾ Last Quarter Moon, 2153 hrs.

July 2013

HIGHLITE: Mars, Jup., Merc., am, E., July **22nd**
01 Mo Pluto at Opposition,1800 hrs.
06 Fr Moon/Mars close; . low in E.,0430h.
08 Mo ● **NEW MOON** 0014 hrs.
15 Mo ☽ First Quarter Moon 2018 hrs.
22 Mo ○ Full Moon, 1116 hrs.
26 Fr **HAC Meeting,** Cochise College
29 Mo ☾ Last Quarter Moon, 1043 hrs.
29-30 Mo-Tu: **Meteors:** Delta(δ)Aquarids; am hrs.; favorable year

August 2013

HIGHLITE1: Perseid Meteor Shower
HL2: Moon/Planet pairings, am! & pm during month
06 Tu ● **NEW MOON** 1451 hrs
11-13 Su-Tu; **Perseids**; Pk. am of 12th; fast, bright
14 We ☽ First Quarter Moon 0356 hrs.
20 Tu ○ Full Moon, 1845 hrs.
23 Fr **HAC Meeting,** Cochise College
26 Mo **Neptune** at Opposition, 1900 hrs.
28 We ☾ Last Quarter Moon, 0235 hrs.

September 2013

HIGHLITE: Moon&Venus close, pm, 8th
03 Tu Zodiacal Lt. in E., am, next two weeks before twilight.
05 Th ● **NEW MOON** 0436 hrs.
12 Th ☽ First Quarter Moon 1008 hrs.
HAC Public S.P., P.O.;SS@1830hrs.
19 Th ○ Full Moon (Harvest), 0413 hrs.
22 Su Fall **Equinox**,1344 h. (Aurora?)
26 Th ☾ Last Quarter Moon, 2055 hrs.
27 Fr **HAC Meeting,** Cochise College

October 2013

HIGHLITE: Jup. Dbl Shadow Transits (3) 17th, 18th, 26th; details online
03 Th Zodiacal Lt. in E.,am, next two wks.
Uranus at Opposition, 0700 hrs.
04 Fr ● **NEW MOON** 1734 hrs.
HAC Member S.P.
05 Sa **Kartchner Caverns StatePark** S.P.
10 Th **HAC** Public S.P., P.O.;SS@1755hrs.
11 Fr ☽ First Quarter Moon 0402 hrs.
12 Sa **Astronomy Day** (Autumn)
18 Fr ○ Full Moon,1638h.; Lunar eclipse @MR
25 Fr **HAC Meeting,** Cochise College
26 Sa ☾ Last Quarter Moon, 1640 hrs.

November 2013

HIGHLITE: Comet ISON (C/2012 S1) !!!! ???
01 Fr Venus G. Elong. E.(47°),0100hrs., **pm** planet
02 Sa **HAC** Member S.P.
Jup., dbl. Shadow Tr., 0414hrs., I & Eu;
03 Su ● **NEW MOON** 0550 hrs.
05 Tu S. Taurid meteors Pk., 0400 hrs.; favorable;
07 Th **HAC** Public S.P., P.O.; SS@1727 hrs.
09 Sa ☽ First Quarter Moon 2257 hrs.
17 Su ○ Full Moon, 0816 hrs.; Merc. **am** planet
22 Fr **HAC Meeting,** Cochise College
25 Mo ☾ Last Quarter Moon, 1228 hrs.
28 Th **Comet ISON**, **Perihelion** @ 1600hrs.
30 Sa **HAC** Member S.P. (for **December**)

December 2013

HIGHLITE: Comet ISON ??? !!!!
02 Mo ● **NEW MOON** 1722 hrs.
06 Fr Venus@greatest illumination, mag. -4.9, 26% illuminated, size 41"
09 Mo ☽ First Quarter Moon 1008 hrs.
12 Th **HAC** Public S.P., P.O.;SS@1714h.
13 Fr Geminid Meteors Pk. 2300h., fair?
14 Sa **HAC Meeting/XMAS Party**
17 Tu○ Full Moon,0413h.(smallest 2013)
21 Sa Winter **Solstice,** 1011 hrs.
22 Su Ursid Meteors Pk., 0700 hrs.
25 We ☾ Last Quarter Moon, 0648 hrs.
26 Th **C/ISON:** closest to Earth, 0300h.

*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; ; 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; dbl= double; AU=Astronomical Unit; °= degrees; *compiler*: **Doug Snyder** (C/2002 E2, MP15512); V1.1.2013

Huachuca Astronomy Club (HAC) of Southeastern Arizona
MEMBERSHIP AND RENEWAL APPLICATION

(Please print and fill in all information)

Date of Application: _____

Name(s): _____

Mailing Address: _____

_____

Telephone: _____

E-mail: _____

May we publish any of the following information on the Web site (please circle **Yes** or **No**):

Name **Yes / No**
City **Yes / No**
E-mail Address **Yes / No**

Memberships in HAC are for the calendar year and are pro-rated quarterly for new members.

Please CIRCLE your choice below:

Renewal	New Jan - Mar	New Apr - Jun	New Jul - Sep	New Oct - Dec	Membership Type
$25.00	$25.00	$17.50	$10.00	$7.50	Individual
$35.00	$35.00	$26.00	$17.00	$9.00	Family
$10.00	$10.00	$7.00	$4.00	$3.00	Student*
$20.00	$20.00	$14.00	$8.00	$6.00	Military
$25.00	$25.00	$17.50	$10.00	$7.50	Military Family

*Student memberships are for an individual who is enrolled in full time educational coursework; they do not have voting privileges.

MAKE CHECKS OUT TO**: Huachuca Astronomy Club**
Bring this form to a meeting or mail to:
HAC, P.O. Box 922, Sierra Vista, AZ 85636

Upon joining, you are entitled to a New Member Packet, as explained on our Web site. If you are a resident of Cochise County, we request that you pick up your packet at the first meeting you are able to attend. If currently residing outside of the county, we will mail you the packet.

There are five types of **membership** as follows: Regular, Student, Family, and Military. A Regular membership is for one individual, and has voting privileges. Family memberships shall include two adults and their children under the age of 18, who shall enjoy the privileges of the club including the right to vote (two votes per Family membership). Military memberships are for active duty members of the Army, Navy, Air Force, Marines, or Coast Guard. Military and Military Family memberships have identical voting privileges as Regular and Family memberships.

If and when interested, see the Web site for information about the Huachuca Astronomy Club's ***Sky & Telescope*** and ***Astronomy*** magazine's subscription plans.

QUESTIONS? Please send email to: treasurer@hacastronomy.com

Web site: http://www.hacastronomy.com

v3.1> *Revised 01/23/11*