Nightfall

Monthly publication of the Huachuca Astronomy Club

June 2013

President's Notes

After a very busy April and May, a smaller number of activities are scheduled for June. But you can't beat June in SE Arizona for warm nights, transparent skies, and a plethora of objects to observe - thanks to a summer Milky Way which will rise earlier and earlier as the month wears on. So try to attend the member star party and/or public viewing at the Patterson. At this moment, our speaker for the 28 June meeting is TBA, but that could change at any time. Keep checking the HAC website for updates.

Member Star Party: Our next Member Star Party will be held at Bob & Barb Kepple's DSO Observatory in Palominas starting on Saturday evening, June 8th. We are likely to experience clear skies for this event – the same cannot be said for any given date in July and August – try to attend, it might be some time before we can do it again!

Public Viewing night: The Patterson Observatory at UAS will be open for public observing on Thursday evening 13 June. The days are long, expect it to be dark enough to observe only after 8:00 PM

Next Meeting: Will be held on Friday, 28th June at 7:00 PM at the usual place (the community room of the student union building at Cochise College) We do plan to have a drawing at the end of the meeting for door prizes. This meeting is free of charge and open to the general public. For more information, visit www.hacastronomy.org.

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 any online shopping, please use the "Amazon" link.

Clear skies and bright stars,

Kim Rogalski

President, Huachuca Astronomy Club

New Members Corner

We would like to welcome our newest members; Dr. Jerry Balgie of Sierra Vista, Terry and Rhonda Taylor of Sierra Vista, and Craig Gundy who is relocating from S. Ogden Utah. Welcome to the club, we are glad you joined!

IN MEMORIAM

We regret to report the passing of the Huachuca Astronomy Club's founding member and first elected President, Mr. David Patterson. David passed away on May 30, 2013, just a week short of the 31st anniversary of HAC's first election of officers. We all send our most heartfelt condolences to his wife Helen, his family, and the many friends and admirers he has touched so graciously over the years. He will be fondly remembered at his namesake observatory , the David "Patterson Observatory", located on the campus of the University of Arizona, Sierra Vista.

"*May the light of distant planets, as well as starlight, moonlight, and the unforgettable glow of the Milky Way that David cherished every night of his life continue to grace and be celebrated by thousands at his gift to our community where we can gaze into the vast universe, the Patterson Observatory." - Doug Snyder*

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It is with extreme sadness and profound regret and grief that the family of Neal Galt has announced the passing of Neal on the afternoon of Monday, June 17, 2013. Neal died in the hospital in Tucson, Arizona from complications following surgery earlier this month.

Services are as follows:

On Monday, June 24th, a Visitation period from 5:00 PM to 7:00 PM will be at the Hatfield Funeral Home in Sierra Vista. The address is 832 S. Highway 92.

On Tuesday, June 25th, the Memorial Service will be at the Life In Christ Church at 11:30 AM in Sierra Vista. The address for the church is 2300 Las Brisas Way, and is located at the intersection of Coronado Dr. and Las Brisas Way, just south of the Sierra Vista City Hall.

Burial will be conducted at the Southern Arizona Veteran's Memorial Cemetery in Sierra Vista.

"I know that all of us who had known Neal over the years are still in mourning and disbelief at his unexpected and tragic passing. For the family and for the many, many friends and acquaintances of Neal, we can look back upon the many fond memories we have of him, the smiles that cross our faces in reflecting his enduring sense of humor, and the upward gaze to the heavens to once again glance at a flashing meteor that belongs to the meteor king, Neal. He loved life, and his family, and the Universe, and astronomy."
"May the Minor Planet 68218 (NealGalt) never lose its brilliancy as a beacon of warmth and kindness in our Universe."

Doug and Jean Snyder

HAC Comet Team

By Ted Forte

With comet C/2012 S1 ISON poised to make history, several members of HAC have signed onto the **HAC Comet Team**. The idea was the brainchild of Doug Snyder, who put the call out on HACList, challenging us to capitalize on the media excitement surrounding "the comet of the century". Why not, Doug mused, start off with an early image of the comet taken with the 20-inch RC at the Patterson Observatory and then follow the progress of the comet throughout the year? Even if the comet fizzles, as comets often do, we can reap the benefit of having participated in the expected media frenzy. It might serve to attract new members and highlight our club, but at a minimum, it is sure to offer a fun activity with some exciting potential.

So, on Monday, May 27, we convened at the Patterson Observatory for the first ISON capture attempt. Tom Kotsiopoulos, Max Mirot, Doug Snyder Gary Grue, Tommy Neyhart , David Roemer and I comprised the team. We installed the SBIG STL 1001E CCD in the 20-inch Ritchie Chrétien telescope and prepared to get an image.

Apparently, there is an astronomy corollary to "Murphy's Law" that states that if there is anything that can go wrong with your telescope, the chances of it going wrong are inversely proportional to the amount of time your target is visible. Since the comet was in Gemini and would only be viewable for an hour or so after dark, the chances of an equipment glitch was almost a certainty.

Missing that comet on our first outing, however, may have proven to be providential. Tom had the ephemeris for the asteroid (285263) 1998 QE2 and we managed to get some good images of that after we corrected the focus problem that prevented our imaging ISON. The asteroid, a PHA (Potentially Hazardous Asteroid) was making its closest approach to Earth that week. This was the closest approach the asteroid will make to Earth for at least the next two centuries. And as it turns out, this asteroid has made the list of targets for the *Target Asteroids* citizen science project and offered us an opportunity to actually make a contribution to our understanding of NEO's. That same week, astronomers using the Goldstone Radio Telescope discovered that there is a small moon orbiting the asteroid. That tiny moon is a good analog for Bennu, the asteroid target for the OSIRIS REx sample return mission. The *Target Asteroids* project is in support of that mission.

On Wednesday, May 29, Doug Snyder, Max Mirot, Tom Kotsiopoulos, Gary Grue, Tommy Neyhart and I met at the observatory to again attempt to capture the comet. Our efforts were rewarded with success and we got our first look at what we hope will be a spectacular comet. The announcement of that image on HACList attracted the attention of Dolores Hill of LPL who congratulated us for capturing ISON and challenged us to join the *Target Asteroids* project and capture 1998 QE2 again.

On Friday of that same week, the night of closest approach, Max Mirot, Bert Kelher and I met at Patterson to get an hour's worth of images of the asteroid. At the same time, Doug Snyder, was getting video images of the asteroid from his Starhaven Observatory. We have since uploaded the asteroid data to the LPL ftp site where it may make some small contribution, but perhaps more significantly, the upload marked HAC as a participant of the *Target Asteroid* project.

We will be following Comet ISON's progress as it rounds the sun and reveals its ultimate fate. And while monitoring that comet we may perhaps make other asteroid observations. I certainly hope so anyway. In time we should get better at collecting and reducing asteroid data.

Do you find the prospect of doing science with the Patterson Observatory to be something you would like to be a part of? Would you too like to wear the **HAC Comet Team** tee shirt? There is room for more participation. We would love to have you. Whether you are good at this sort of thing or a relative novice like me, it really doesn't matter. If you let me know you are interested, I'll make sure you are kept in the loop. Contact me on HAClist or at twforte@powerc.net

Astronomical League Observing Programs - Planetary Nebula

by Ted Forte
(Captured from the HACList)

We are halfway through the year, but less than a quarter of the way through the list. A large number of the planetary nebulae on the PN Program list are best placed in the summer months, right during our monsoon season. So, it will certainly be a challenge to complete the PN program in a single year. The objects best placed for July will be in June skies around midnight and the objects that we can assume to be hiding behind the August clouds will be up in the early morning hours in June. If we enjoy clear skies for most of the month, an observer could knock out all of the summer objects.

Actually, only one object from the planetary nebula program culminates in June so I'll borrow a few objects from July's list for this offering. If you haven't been keeping up, no worries - you can start anytime. Start now and hit all the objects best placed for each month and you'll be more than half way through by the end of September.

Rising to its highest point in mid June, NGC 5873 is in our skies for about 9 hours each night this month. This tiny 11th magnitude object was discovered in 1883 by Ralph Copeland. It lies in Lupus and makes the apex of a west pointing triangle just a little more than 1.5 degrees tall whose base is defined by Delta and Phi Lupi. It is stellar; you'll have to use an OIII filter to confirm this one. I recommend "blinking" the filter. Hold it between thumb and forefinger and pass it into and out of the light path between your eye and the eyepiece. Our target PN will be less dimmed by the filter and therefore appear to brighten compared to the normal stars in the field of view. Doing this repeatedly will make the PN blink. Don't get discouraged if you find it difficult to perform this blinking exercise, it takes a good deal of practice, and the effect is subtle.

NGC 6026 is also in Lupus. John Herschel added this object to the General Catalog in 1837. The nebula is a bit difficult - I needed to see it in a friend's 25-inch before I could pick it out in my 18. Some observers have spied it in 6-inches of aperture though so don't despair. The central star stands out and is easily seen in modest aperture and is now thought to be binary based on the periodic variability of the star that is consistent with a hot primary irradiating a cooler secondary star. The main difficulty is its low altitude and very mild response to filters. It lies almost due north (3 degrees 50 minutes) of Eta Lupi and 2 degrees 20 minutes ESE of Chi Lupi.

NGC 6058 in Hercules will be perfectly placed during July's new moon but is a good target for June as well. You should detect a central star surrounded by a small disk. Use an OIII or UHC filter to best see the nebula. It is located in Hercules, but you can use the line of stars anchored by Arcturus to locate it; walk from Arcturus NE through Epsilon and Delta Bootis and extend the line about 12 degrees to the PN. It makes the point of a triangle with Sigma and Tau Herculis.

IC 4593 is called the White Eyed Pea, a nickname coined by John H. Mallas (co-author of The Messier Album). While small, it is rather bright and obvious, although easily mistaken for a star in a small scope. It responds well to the OIII filter. If your scope is large enough to see it as a disk, try making it "blink" - stare at the object and the nebula disappears leaving just the central star, use averted vision and the disk is visible. Look for it on the Hercules-Serpens border about 10 degrees SW of Beta Herculis. Williamina Fleming discovered the object in 1907.

Our other Hercules planetary for this month is The Turtle. NGC 6210 is a very interesting planetary that grows in complexity as your aperture increases. With a small scope it is bright and stellar. A larger instrument shows a disk of blue or green with a central star that is sometimes visible (13.7 magnitude). The largest instruments can detect the faint outer halo. Famed double star observer Friedrich Struve discovered the object in 1827. Extend a line SE through Pi and Epsilon Herculis about 8 degrees to locate it.

Our last two entries for this month lie in Scorpius and are some of the most southerly objects on the list. They will be best placed in mid July. During the June new moon, they will reach their best nightly positions just before midnight. You should plan to observe them around then.

NGC 6072 has a multipolar structure, but through a backyard telescope it appears as an irregular disk with a slight central darkening. It's central star is not visible and it responds well to filters. It lies 1 degree and 23 minutes NE of 4th magnitude Theta Lupi along a line defined by two close by 6th magnitude stars that point the way to the planetary.

At declination -40, NGC 6153 will only get about 18 degrees above our horizon. I first logged this object from a location in Maryland at 38 degrees north latitude. Trust me, it's a lot easier from here. I described a small faint disk from Maryland, from here I saw a nice annular ring. The central star is not visible. Filters enhanced the nebula but were not required to see it. Find Zeta and Mu Scorpi (both nice doubles) and using them as the base, imagine a triangle pointing west, with each side about 4.5 degrees. The PN will be in your field of view if you point there.

Good hunting.

Planetaries for June

NGC 5873	He 2-121	Lup	15h13m29.7s	-38°09'57"
NGC 6026	He 2-144	Lup	16h02m00.1s	-34°34'24"
NGC 6058	PN G064.6+48.2	Her	16h04m48.2s	+40°39'29"
IC 4593	White Eyed Pea	Her	16h12m13.3s	+12°02'49"
NGC 6072	PN G342.1+10.8	Sco	16h13m38.0s	-36°15'25"
NGC 6153	He 2-167	Sco	16h32m12.6s	-40°16'39"
NGC 6210	Turtle Nebula	Her	16h44m55.5s	+23°46'59"

High-energy Spy

By Dr. Martin C. Weisskopf

The idea for the Chandra X-Ray Observatory was born only one year after Riccardo Giacconi discovered the first celestial X-ray source other than the Sun. In 1962, he used a sounding rocket to place the experiment above the atmosphere for a few minutes. The sounding rocket was necessary because the atmosphere blocks X-rays. If you want to look at X-ray emissions from objects like stars, galaxies, and clusters of galaxies, your instrument must get above the atmosphere.

Giacconi's idea was to launch a large diameter (about 1 meter) telescope to bring X-rays to a focus. He wanted to investigate the hazy glow of X-rays that could be seen from all directions throughout the sounding rocket flight. He wanted to find out whether this glow was, in fact, made up of many point-like objects. That is, was the glow actually from millions of X-ray sources in the Universe. Except for the brightest sources from nearby neighbors, the rocket instrument could not distinguish objects within the glow.

Giacconi's vision and the promise and importance of X-ray astronomy was borne out by many sounding rocket flights and, later satellite experiments, all of which provided years-, as opposed to minutes-, worth of data.

By 1980, we knew that X-ray sources exist within all classes of astronomical objects. In many cases, this discovery was completely unexpected. For example, that first source turned out to be a very small star in a binary system with a more normal star. The vast amount of energy needed to produce the X-rays was provided by gravity, which, because of the small star's mass (about equal to the Sun's) and compactness (about 10 km in diameter) would accelerate particles transferred from the normal star to X-ray emitting energies. In 1962, who knew such compact stars (in this case a neutron star) even existed, much less this energy transfer mechanism?

X-ray astronomy grew in importance to the fields of astronomy and astrophysics. The National Academy of Sciences, as part of its "Decadal Survey" released in 1981, recommended as its number one priority for large missions an X-ray observatory along the lines that Giacconi outlined in 1963. This observatory was eventually realized as the Chandra X-Ray Observatory, which launched in 1999.

The Chandra Project is built around a high-resolution X-ray telescope capable of sharply focusing X-rays onto two different X-ray-sensitive cameras. The focusing ability is of the caliber such that one could resolve an X-ray emitting dime at a distance of about 5 kilometers! The building of this major scientific observatory has many stories.

Learn more about Chandra at www.science.nasa.gov/missions/chandra . Take kids on a "Trip to the Land of the Magic Windows" and see the universe in X-rays and other invisible wavelengths of light at spaceplace.nasa.gov/magic-windows.

Dr. Weisskopf is project scientist for NASA's Chandra X-ray Observatory. This article was provided by the Jet Propulsion Laboratory, California Institute of Technology, under a contract with the National Aeronautics and Space Administration.

Caption: *Composite image of DEM L50, a so-called superbubble found in the Large Magellanic Cloud. X-ray data from Chandra is pink, while optical data is red, green, and blue. Superbubbles are created by winds from massive stars and the shock waves produced when the stars explode as supernovas.*

East Stars, Zenith Stars and The Horizontal Pendulum (Part 1)

Since most of us can remember, we've known how to find the North Star, Polaris, using the two end pointer stars of the Big Dipper, Dubhe and Merak. Once located, it can tell us the direction of true north, the time of day, as well as our latitude on Earth.

But few realize that there is an East Star. In fact, there are many.

In my life, I have seen many budding astronomers stretch their arms out to either side and face toward the east. While pointing their left hand at a point on the northern horizon that is directly underneath Polaris, and their right hand at a point on the southern horizon, they proclaim that they are facing due east. But, at best, it's an approximation.

The East Stars

Using our imaginations, let's travel to the Equator. Stars that rise due east of your position on the Celestial Equator (0º latitude), travel to a point directly over your head, called the *zenith*. As every latitude and longitude line on the Earth is projected on to the celestial dome, stars lie on the various lines of latitude called *declination lines*. Stars with a declination of 0º lie on the *Celestial Equator*. One of the most prominent stars to have this distinction with a declination of nearly 0º is the star Mintaka, the rightmost star in the belt of Orion.

When a star that is located on the Celestial Equator rises, the point on the horizon where it is first seen is due east of your location! Prominent stars with 0º ± 3º declination, are called *East Stars*, lie on or very near the Celestial Equator, and include:

Star's Name	*Dec.*	*+/-*
The Sun (on the two equinoxes)	0.0º	0.0º
Delta Aquilae	3.1º	3.1º
Alpha Aquarii	-0.3º	-0.3º
~~Delta Orionis (*Mintaka*):~~	~~-0.3º~~	~~-0.3º~~
Zeta Virgo	-0.6º	-0.6º
Theta Aquilae	-0.8º	-0.8º
Epsilon Orionis (*Alnilam*)	-1.2º	-1.2º
Gamma Virgo	-1.5º	-1.5º
Zeta Orionis (*Alnitak*)	-1.9º	-1.9º
Eta Orionis	-2.4º	-2.4º
Eta Serpentis	-2.9º	-2.9º

As the Earth's Equator is 90º south of the North Pole, the Celestial Equator is 90º east and 90º west of the point of due north on your horizon.

The Rising Sun and the Solstices and Equinoxes

Knowing where the Celestial Equator intersects the eastern horizon can tell you approximately what month of the year you're currently experiencing. The Sun begins rising north of the Celestial Equator on the Vernal Equinox (in the Spring). It continues progressively rising steady north until the Summer Solstice, where it reaches its farthest northerly point before it reverses its direction. From the Summer Solstice to the Winter Solstice the Sun rises more and more to the south, crossing the Equator at the Autumnal Equinox. At the Winter Solstice it again reverses direction and begins rising steadily north until the Summer Solstice, where the cycle of rising repeats itself. It rises twice each year on the Celestial Equator at the two equinoxes.

We'll elaborate more on all of this later, showing you how to estimate the current date by noting where the Sun rises.

Stars Rise and Set At The Same Location on Your Horizon

"Do the stars of the Celestial Equator rise (and set) at different locations on a person's horizon depending on the time of year?"

If a person is in one location throughout the year, the answer is no. At about 5:00 in the early morning on July 7, Mintaka, the rightmost star in the belt of Orion, rises at the same point on the horizon as it does on November 4 at 9:00 in the evening. Why? Because the North and South Poles of the Earth stay perfectly aligned to one point in the sky (to Polaris, the North Star) during its entire orbit.

The Sun's Movement During That Time

The Sun on July 7th has risen from a point on the horizon far north of the Celestial Equator to a point way south of the Celestial Equator on November 4th, yet the stars of the night sky continue to rise and set at the exact same locations.

West Stars

Stars that rise in the east on the Celestial Equator also set in the west on the Celestial Equator, so a knowledge of the stars that are situated on the Celestial Equator can also help you find true east and west.

Zenith Stars

What is a star's declination that passes directly overhead of your location?

If a star on the celestial dome passes directly through the zenith for an observer on the Equator (0º), and a star located 45º declination is seen at the zenith in Salem, Oregon (latitude 45º), what declination is a star that passes directly overhead in Sierra Vista, Arizona, latitude 31.5º? That's right, the declination of the star is 31.5º. Stars that pass overhead of your location are called *Zenith Stars* and their declination is identical to your latitude on Earth.

Where I lived for many years in Roseburg, Oregon, latitude 43.2º, a very bright star would pass nearly overhead. Deneb (Alpha Cygni), at declination 45.3º, came with about 2º of passing directly overhead at the Zenith. For those living in the state's capitol, Salem, latitude 45º, Deneb did pass directly overhead. From here in Sierra Vista, latitude 31.5º, Deneb passes about 14º north of overhead, or about three times the 5º distance between the Big Dipper's two pointer stars, Dubhe and Merak.

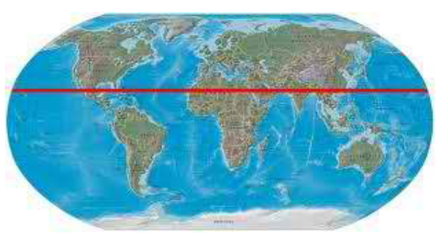
The Same Number of Degrees

As many are aware the number of degrees that Polaris is above the northern horizon is the same number of degrees as your current latitude. Here in Sierra Vista, latitude 31.5º, Polaris is 31.5º above the northern horizon. But also, the number of degrees that Polaris is above the northern horizon is the same number of degrees that Zenith Stars rise north of the Celestial Equator!

When The Sun Becomes An Eastern Star, and a Zenith Star!

Twice each year our star, the Sun, becomes an Eastern Star. On the Spring and Autumnal Equinoxes, the Sun is on the Celestial Equator and rises directly to the east of your location and sets directly west, assuming a level horizon. If you were on the equator on either of the two equinoxes, the Sun would not only be an Eastern Star, but a Zenith Star, too, as it would reach the highest point in the sky directly over your head. At that instant, shadows cast on the ground would be minimal, if nonexistent.

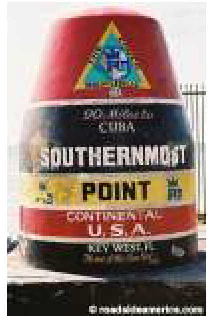
Question: Why won't the Sun ever be a Zenith Star as seen from Sierra Vista?



Answer: The Sun reaches a maximum latitude of 23.5º (The Tropic of Cancer) on the Summer Solstice. An observer in Sierra Vista, latitude 31.5º, is 8.0º too far north for the Sun to pass directly overhead. Unfortunately, the Sun will never be a Zenith Star to an observer in Sierra Vista.

Question: Will the Sun ever be a Zenith Star somewhere in the continental U.S.?

Answer: No. The most southerly location in the continental U.S. is Key West, Florida, latitude 24º33' North. Since the Sun reaches a maximum of 23.5º North during the Summer Solstice, it does not pass directly overhead, missing the mark by less than one degree!



Question: Will the Sun ever be a Zenith Star somewhere in the United States?

Answer: Yes. The most southerly location in the United States is the southern tip of the Big Island, Hawaii, in the Hawaiian Islands. Called Ka Lae, its latitude is 18º55' North. Not only does the Sun pass directly overhead at Ka Lea during the year, but is 4º35' north of overhead at the Summer Solstice.

On the Summer Solstice, the Sun would pass directly over your head if you were on a boat just south of the small island of Necker, in the Hawaiian Islands, which is 430 miles northwest of Honolulu. It's the only place in the United States where this occurs.

The Sun also passes directly overhead on Lake Nasser in Egypt! As you might guess, there is a huge celebration on the lake at the time of the Summer Solstice.

From all of the latitudes in the Northern Hemisphere, in one degree increments, the following table shows the angle the Sun makes with the southern horizon at noon, with you at the vertex, on the solstices and equinoxes. The angle that Polaris makes with the southern horizon is also shown.

Latitude	*Summer Solstice*	*Spring/Fall Equinoxes*	*Winter Solstice*	*Polaris From the Southern Horizon*
North Pole	23.5°	0°	-23.5°	90°
89°	24.5°	1°	-22.5°	91°
88°	25.5°	2°	-21.5°	92°
87°	26.5°	3°	-20.5°	93°
86°	27.5°	4°	-19.5°	94°
85°	28.5°	5°	-18.5°	95°
84°	29.5°	6°	-17.5°	96°
83°	30.5°	7°	-16.5°	97°
82°	31.5°	8°	-15.5°	98°
81°	32.5°	9°	-14.5°	99°
80°	33.5°	10°	-13.5°	100°
79°	34.5°	11°	-12.5°	101°
78°	35.5°	12°	-11.5°	102°
77°	36.5°	13°	-10.5°	103°
76°	37.5°	14°	-9.5°	104°
75°	38.5°	15°	-8.5°	105°
74°	39.5°	16°	-7.5°	106°
73°	40.5°	17°	-6.5°	107°
72°	41.5°	18°	-5.5°	108°
71°	42.5°	19°	-4.5°	109°
70°	43.5°	20°	-3.5°	110°
69°	44.5°	21°	-2.5°	111°
68°	45.5°	22°	-1.5°	112°
67°	46.5°	23°	-0.5°	113°
Arctic Circle	47°	23.5°	0°	113.5°
66°	47.5°	24°	0.5°	114°
65°	48.5°	25°	1.5°	115°
64°	49.5°	26°	2.5°	116°
63°	50.5°	27°	3.5°	117°
62°	51.5°	28°	4.5°	118°
61°	52.5°	29°	5.5°	119°
60°	53.5°	30°	6.5°	120°
59°	54.5°	31°	7.5°	121°
58°	55.5°	32°	8.5°	122°
57°	56.5°	33°	9.5°	123°
56°	57.5°	34°	10.5°	124°
55°	58.5°	35°	11.5°	125°
54°	59.5°	36°	12.5°	126°

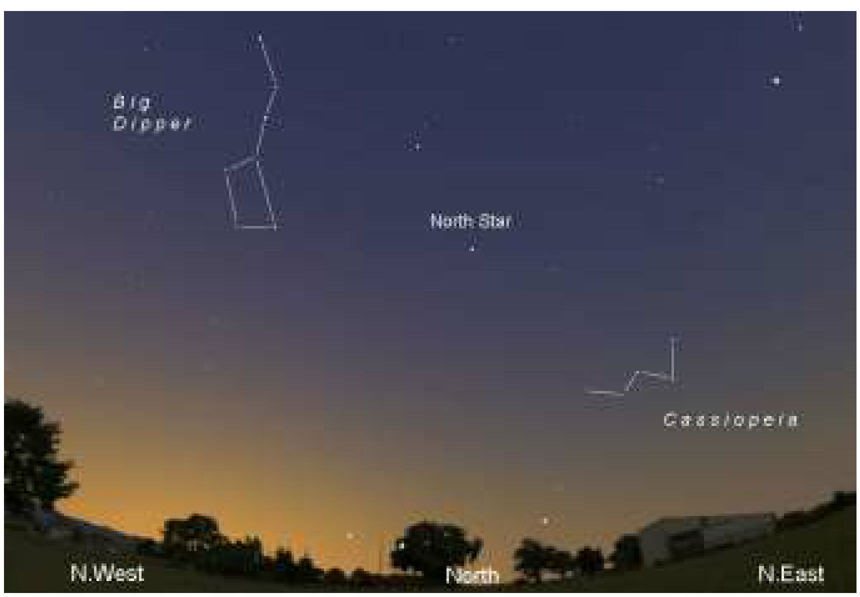
Latitude	*Summer Solstice*	*Spring/Fall Equinoxes*	*Winter Solstice*	*Polaris From the Southern Horizon*
53°	60.5°	37°	13.5°	127°
52°	61.5°	38°	14.5°	128°
51°	62.5°	39°	15.5°	129°
50°	63.5°	40°	16.5°	130°
49°	64.5°	41°	17.5°	131°
48°	65.5°	42°	18.5°	132°
47°	66.5°	43°	19.5°	133°
46°	67.5°	44°	20.5°	134°
45°	68.5°	45°	21.5°	135°
44°	69.5°	46°	22.5°	136°
43°	70.5°	47°	23.5°	137°
42°	71.5°	48°	24.5°	138°
41°	72.5°	49°	25.5°	139°
40°	73.5°	50°	26.5°	140°
39°	74.5°	51°	27.5°	141°
38°	75.5°	52°	28.5°	142°
37°	76.5°	53°	29.5°	143°
36°	77.5°	54°	30.5°	144°
35°	78.5°	55°	31.5°	145°
34°	79.5°	56°	32.5°	146°
33°	80.5°	57°	33.5°	147°
32°	81.5°	58°	34.5°	148°
31.5°	82°	58.5°	35°	148.5°
31°	82.5°	59°	35.5°	149°
30°	83.5°	60°	36.5°	150°
29°	84.5°	61°	37.5°	151°
28°	85.5°	62°	38.5°	152°
27°	86.5°	63°	39.5°	153°
26°	87.5°	64°	40.5°	154°
25°	88.5°	65°	41.5°	155°
24°	89.5°	66°	42.5°	156°
Tropic of Cancer	90°	66.5°	43°	156.5°
23°	90.5°	67°	43.5°	157°
22°	91.5°	68°	44.5°	158°
21°	92.5°	69°	45.5°	159°
20°	93.5°	70°	46.5°	160°
19°	94.5°	71°	47.5°	161°
18°	95.5°	72°	48.5°	162°
17°	96.5°	73°	49.5°	163°
16°	97.5°	74°	50.5°	164°
15°	98.5°	75°	51.5°	165°
14°	99.5°	76°	52.5°	166°

Latitude	*Summer Solstice*	*Spring/Fall Equinoxes*	*Winter Solstice*	*Polaris From the Southern Horizon*
13°	100.5°	77°	53.5°	167°
12°	101.5°	78°	54.5°	168°
11°	102.5°	79°	55.5°	169°
10°	103.5°	80°	56.5°	170°
9°	104.5°	81°	57.5°	171°
8°	105.5°	82°	58.5°	172°
7°	106.5°	83°	59.5°	173°
6°	107.5°	84°	60.5°	174°
5°	108.5°	85°	61.5°	175°
4°	109.5°	86°	62.5°	176°
3°	110.5°	87°	63.5°	177°
2°	111.5°	88°	64.5°	178°
1°	112.5°	89°	65.5°	179°
Equator	113.5°	90°	66.5°	180°

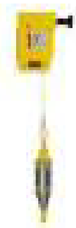
North Pole = 90°
Arctic Circle = 66.5°
Sierra Vista = 31.5°
Tropic of Cancer =23.5°
Equator = 0°

Sierra Vista

Darkness



If you lined up a plumb bob so it pointed to a building, mountain feature, or tree on your northern horizon directly underneath Polaris, it is referred to as *Plumb Bob North* (in the above illustration, it is point on the right side of the large round tree on the horizon).



The previously mentioned star, Mintaka, rises 90º east of Plumb Bob North on the Celestial Equator.

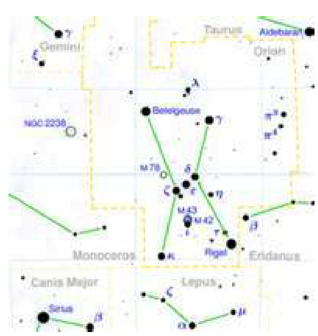
Cardinal south is 180º, or on the opposite horizon, from Plumb Bob North.

Starting at Plumb Bob North, what amount of degrees to the east would a star rise andpass through zenith if you are in Sierra Vista? If a star with a declination of 31.5º north rises 31.5º north of the point where the Celestial Equator intersects the horizon, then it will rise at a point 58.5º (90.0º - 31.5º = 58.5º) east of Plumb Bob North.

The brightest star with a declination of 31.5º ± 3º is Castor (Alpha Geminorum). Its declination is 31.9º, just 0.4º north of zenith (31.5º).

Here is a list of other prominent stars that could be considered Zenith Stars (31.5º ± 3º):

Star's Name	*Dec.*	+/-
~~Beta Cygni (*Albireo*)~~	~~28.0º~~	~~-3.5º~~
Beta Pegasi	28.1º	-3.4º
Alpha Andromedae	29.1º	-2.4º
Eta Pegasi	30.2º	-1.3º
Zeta Cygni	30.2º	-1.3º
Delta Andromedae	30.9º	-0.6º
Zeta Hurculis	31.6º	0.1º
Zeta Persei	31.9º	0.4º
Gamma Lyrae	32.7º	1.2º
Iota Aurigae	33.2º	1.7º
Epsilon Cygni	34.0º	2.5º



Orion's Belt and the Celestial Equator

Watching Alpha Canis Minoris, Procyon (declination 5.2º) rise in the eastern sky is very interesting. It rises in the east 5.2º to the left, or north, of the Celestial Equator, a distance equal to that between the two pointer stars of the Big Dipper, Dubhe and Merak.

Questions: You are in Brownsville, Texas, latitude 26º north, enjoying the night sky.

(a) How many degrees to the east of Plum Bob North will the Celestial Equator intersect your horizon?

(b) What will the declination be of stars that pass directly overhead (zenith)?

(c) How many degrees north of the equator will a star rise on the eastern horizon and pass directly overhead?

(d) How many degrees east of Plumb Bob north will a star rise on your horizon and cross your zenith?

(e) True or False: East Stars are the same for everyone, regardless of their viewing location .

(f) True or False: Zenith Stars are the same for everyone, regardless of their viewing location.

Answers:

(a) 90.0º	(d) 64.0º
(b) 26.0º	(e) True.
(c) 26.0º	(f) False.

To be continued next month in Part 2 . . .

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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: ■(Gamma) Delphinids?
04 Tu Venus in **M35**, pm, low in NW
08 Sa ● **NEW MOON** 0856 hrs.
HAC Member S.P.
11 Tu **Meteors-**■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