NIGHTFALL
Huachuca Astronomy Club of Southeastern Arizona

Newsletter for April 2012

Next Meeting: The Huachuca Astronomy Club will meet at Cochise College on Friday, April 6, 2012 at 7 pm. This meeting will be held in the community room of the Student Union building. Glen Sanner and Bob Kepple will give an update on exploring the wonders of the night sky. I will show some night sky photography using my new HyperStar for the C11. In addition, Doug Snyder will show a video of a recent lunar graze. He was able to capture the light of a star as it moved along the edge of the moon as it passed behind lunar mountains.

Annular Eclipse: Quite a few HAC members plan to attend the annular eclipse in Page, Arizona to be on the centerline. The big day is May 20, and Doug Snyder reserved a block of rooms at the Days Inn Saturday and Sunday night, and currently, these are all spoken for. Other HAC members are staying at the Best Western Arizona Inn. At last report, all hotel rooms in Page are sold out for that weekend. Glen Sanner and David Butler are coordinating car-van-pools for 15. The rest are driving separate from the group with plans for additional destinations before or after the eclipse.

Venus Transit: On June 5, we will be able to watch as the planet Venus moves directly in front of the sun from Sierra Vista. We won't be able to look directly at the transit, so we will need solar telescopes with filters or eclipse glasses. We won't see another transit of Venus for more than 105 years.

Illuminated Billboards: Thanks to all your efforts, the governor vetoed HB 2757! Professional and amateur astronomers, concerned citizens, and those who appreciate the scenic beauty of Arizona wrote many letters and emails to the Governor. She listened to your concerns and vetoed the bill. But we must remain vigilant because our local representatives and Senator Griffin may be promoting illuminated billboards in future sessions.

Clear skies and good observing,

Bob Gent, President, HAC

C11 EdgeHD with HyperStar, a 14 second exposure of the Great Orion Nebula, M42 taken on February 22, 2012 by Bob Gent

Kino: the scientist*

Christopher Corbally, SJ

Vatican Observatory

Padre on Horseback Statue in Tucson

Kino's star-taker

Are you familiar with the equestrian statue of Padre Kino, sculpted by Don Julián Martínez , and of which three bronze casts were made?

These three statues for three centuries, as they were called, were placed in each of Segno, Italy, Tucson, Arizona, and Magdalena, Sonora. A casual passerby might wonder what is represented by the round instrument resting on the left side saddlebag. It has what looks like a cross spanning its diameter. We don't clearly see the rotating sighting arm, the alidade, which would identify the instrument as an astrolabe. This is an early version of a sextant, combining features of a planisphere.

An astrolabe, literally 'star-taker', was used from classical antiquity, through the Islamic Golden Age, and into the European Renaissance for any purpose that involved the positions of the Sun, planets, and stars (Wikipedia 2010). These would include navigation, and hence we can understand the prime purpose of an astrolabe on Kino's travels. He would use it to sight the Sun at noon, determining its height above the horizon. With the help of correction tables for each day of the year, he would then calculate his geographical latitude.

A correction was needed since, when you think of the tilt of the Earth's axis in respect to its orbit around the Sun, the Sun's elevation at noon each day depends on the time of year. In winter the noon Sun is a lot lower than the noon summer Sun. It is precisely that difference which gives us our seasons. At the two equinoxes, and at a zero-point of longitude on the Earth, the noon Sun's elevation is exactly equal to your latitude. As you depart from that longitude zero and from an equinox, the correction increases. On one occasion, March 3, 1702, Kino described the process thus:

At midday we took the altitude of the sun with the astrolabe, and found it to be fifty-two degrees, which, adding to it the six and a half of south declination of that day, made fifty-eight degrees and a half. The complement to ninety degrees is thirty-one degrees and a half, and this was the … geographical latitude in which we found ourselves. (Bolton 1919: 341)

Kino was a skilled observer. Ives (1953) has checked against modern geodetic observations that Kino's error amounted to about only 1/60th of an inch on a 12-inch astrolabe. This also attests that he was a

skilled instrument maker since he most likely made this astrolabe himself;[1] and as an instrument maker he knew how to care for it, and so preserve its accuracy, under desert travel conditions.

Kino's cartography

All this skill with an astrolabe was poured into Kino's navigation and cartography. It is agreed (Ives 1960) that the most famous example of his maps is the "Passo por Tierra a la California." Drawn in 1707, it served even for a couple of centuries. On it were placed the missions and, most significantly, it showed that California, and so Baja California, was not an island but reachable across the Colorado River. This was a hunch of Kino's, first abandoned as a working hypothesis, and later confirmed by his explorations.

Ernest Burrus (1991) has gathered a wealth of information about Kino's cartography. In his exposition I find two important points. The first is obvious: the quality of Kino's maps was progressive as a later version succeeded an earlier one. So his 1707 map was a result of careful work accumulated over successive expeditions. Kino was, in this sense, a perfectionist.[2] The second point concerns the goal of this perfectionism: Kino made maps not just so that he and others might get around the new territory of the Pimeria, but that the maps might accurately show where the people lived (1991: 327). His maps are crowded with settlements; they are geographical in an ethnographic rather than physical sense. So his purpose in achieving cartographical excellence was to further the evangelization of the people to whom he and his Jesuit companions had been sent. There was a fire behind Kino's high level of skill, the flame of the Holy Spirit in religious terms, which had lit and driven his every step in becoming a missionary.

Kino's astronomy and the Great Comet

This motivation seems important as we return to thinking about Kino as an astronomer. He did seem to have a natural curiosity about the world around him. He was also of a strong mathematical bent. We know this from his being offered the chair of mathematics at the University of Ingolstadt by the Duke of Bavaria. Kino's professorship was brief since he preferred to be a missioner. Still, we find that his natural curiosity prompted him to observe a comet while he was waiting for a ship to the New World.

This was the Great Comet that appeared in November 1680 and is known after its discoverer as Kirch's Comet. Kino saw this first in Sevilla, observed it in Cádiz, and continued to see it from on board ship to Veracruz until the comet faded from his sight in February 1681, seven weeks after its first appearance for Kino.

Soon after Kino's arrival in Mexico City, he was encouraged by friends to write about this great comet. His little book of 56 pages and 10 chapters, "*Exposición Astronómica de el Cometa*," was published in October 1681 with the approval of the Church authorities in Mexico and then Rome. Its contents are well described – and discussed – by Ellen Shaffer (1952), on whom I base the following summary.

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[1] Paula Findlen (2004:331) writes: "... he spent part of his time in Seville in 1679 making "various mathematical instruments of small size in order to meet the needs of clerics," in imitation of the ones he had seen in Ingolstadt ..."

[2] Perhaps it is curious that, while Kino was meticulous about the accuracy of his geographical latitudes, he seemed content with copying longitudes from standard maps, most of which reckoned the standard meridian as passing through the Canary Islands (Burrus XXXX, p.328). I suspect that Kino accepted his limitations; more accurate longitudes, before the advent of the chronometer, were not feasible for him.

The science in this book starts with a folding celestial map tracing the path of the comet through the sky "with what, to the casual observer, would seem to be scientific accuracy" (1952:59). It continues with a discussion as to the nature of comets, which Kino felt were "exhalations of clouds, rivers, and seas of the terrestrial globe and that they come from evaporations of the planets – a belief which, he says, is held by his fellow Jesuit, the learned Father Athanasius Kircher" (1952:60). Then Kino discussed the length of time the comet appeared in relation to the appearances of other famous comets. He described the rapid movement of the comet through the sky in its brief seven weeks. Kino, now becoming the mathematician, used principles of perspective and geometry to discuss the apparent and actual positions of the comet, and he computed the distance to the comet at about 3 million miles away.[3] He compared and contrasted this comet with others, considered its size as huge from the length of time nightly that it was visible, and discussed the atmosphere of the body of the comet.

In the final, tenth chapter of his book Kino tackled what the comet portended. This, what he considered its most important aspect, crowned his preceding scientific approach to the comet. While a comet is a beautiful object, since at least Roman times they were taken as a sign of ill-omen. When a comet appeared, misfortune was about to happen to someone prominent. Kino even considered whether the number of comets, including those not noticed, might tally with the number of deceased notables. That was why Kino, when urged to write this book, started it with the wish that the comet would be to the viceroy of Mexico City, the Conde de Paredes, "the happy messenger of your good fortune." The cover of his book showed the image of Our Lady of Guadalupe and it ended with a simple dedication to the same Virgin. Her protection no doubt would make effective this good wish to the Conde and to Kino's other patrons such as the Duchess of Aveiro, to whom he wrote from Cadiz in reassurance even as the comet had just appeared.

Much of the discussion about Kino's *Exposición* treats of the bitter reaction to it by Don Carlos de Sigüenza y Góngora, holder of the Chair of Astrology and Mathematics at the Royal and Pontifical University of Mexico. In a pamphlet published early in 1681, *Manifesto Philosophico*, Sigüenza had taken the remarkably modern view that comets exerted no influence on human affairs and so sought to reassure *his* readers, particularly his patroness, the viceroy's wife, that they had nothing to fear from any superstition about comets. For a professor of astrology, this was a bold, scientific position. One can contrast Kino's traditional, doom-and-gloom view, which he said was patent to everybody, "unless there be some dull wits who cannot perceive it." Though Kino and Sigüenza started as scholarly friends, Kino's presentation of his *Exposición* to Sigüenza on the day he set off from Mexico for California was perceived as a direct personal attack and provoked Sigüenza to respond with a book aimed in the title and throughout equally directly at Kino and his superstitions.

Kino as scientist and believer

All this makes a sensational story, worthy of any late 17th century tabloids and entertainingly presented in the accounts of Bolton (1936:77-83) and Shaffer (1952). Here I prefer to reflect on what Kino's *Exposición* means in terms of his being a scientist. From a modern vantage point it must bring us some disappointment in our hero. Here was someone laden with the baggage of a medieval European

[3] This distance presumes 2.6 miles to the Spanish league.

approach to comets and unable to shake it off despite discussions with the New World, no-nonsense representative of modern science, Sigüenza.

Perhaps this reluctance was due to Kino's respect for his mentors in Innsbruck, such as the Jesuit Fathers Adam Aigenler and Wolfgang Leinberer, and for their authorities, such as the Rome -based Father Athanasius Kircher.[4] In other aspects of science, particularly as applied to cartography, their wisdom was to stand him in very good stead. It was Aigenler's "general map of the entire terrestrial world" that depicted California as a peninsular (Burrus 1991:328), later to be confirmed by Kino's circumspect, scientific demonstration.

Shaffer (1952:68-69) brings out another aspect of Kino's reluctance to shake off the traditional view of comets. It arose from his faith that God sends us signs in nature to inspire us or to bring us to "the fear of the Lord". This faith is both traditional and part of the daily experience of people today. Of course, modern science tells us clearly, as professors of Introductory Astronomy to non-science majors will stress, that there is no physical influence or force of the planets and stars on us. Just because planets, for instance, become aligned on one side of the Sun, there will be no significant effect from them on the Sun's radiative output and so on us. Such crude "astrology" is out; and yet some clearing of the night sky, allowing a sight of the Moon and stars, can bring a sense of confirmation and affirmation to us, even today (or tonight!). For many, even though they may not call themselves believers, God does "speak" through nature.

Conclusions for science and religion

Pope John Paul II, in a Letter to Father George Coyne, then Director of the Vatican Observatory, on the occasion of a study week sponsored by the Holy See, wrote concerning an exploration of the true relationship between science and religion.

Science can purify religion from error and superstition; religion can purify science from idolatry and false absolutes. Each can draw the other into a wider world, a world in which both can flourish. (1988)

We have the advantage of some three centuries since Kino for discovering that there are no irreconcilable differences between science and religion. This was sensed by Kino and expressed in his *Exposición* with respect to comets in the only way in which, despite the medieval trappings that were criticized by Sigüenza, he knew how. This also seems to have been sensed by his contemporary, a scholar with a marked interest in science, Sor Juana Inéz de la Cruz. Her sonnet in praise of Kino, given with a translation in the box, ends: "…Eusebio soberano, les dio luz a las Luces celestials."

This reference to light and Lights recalls another Pope, our contemporary Benedict XVI (2010), speaking on the Incarnation of the Word of God:

The light of this truth is revealed to those who receive it in faith, for it is a mystery of love. Only those who are open to love are enveloped in the light of Christmas… If the truth were a mere mathematical

[4] Paula Findlen implies that Kircher could have changed his mind about comets, while "Kino had misused Kircher and misread the *Itinerarium exstaticum*." (2004:332)

formula, in some sense it would impose itself by its own power. But if Truth is Love, it calls for faith, for the "yes" of our hearts.

Kino was well attuned to this Truth and to this Love. So, when we picture him on his horse and with the astrolabe, let us leave aside the superstitions arising from his discussion of a Christmas comet. Rather let us see in his approach to the science of astronomy, as used in cartography, that we have a model for discovering in a practical way how science can be at the service of faith, while not becoming distorted by faith, and rather be brought to fullness in truth by faith.

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Sonnet
by
Sor Juana Inés de la Cruz

Praising the knowledge of Father Eusebio Kino on the occasion of the publication of his book on the comet of 1680 [1]

Although heaven's pure light is bright,
bright the moon and bright the stars,
and bright are the fleeting lightening flashes that are
borne by the air and sped by fire;

even though lightening is bright, its laborious production
costs the wind a thousand discords, and the flash
produced in its path is a dreadful light
in a gloomy blackness;

all dull human knowledge
is obscure without mortal
plumage being able to be, with proud flight,

Icaros-like in rational discourses,
until yours, superb Eusebio,
you brought light to the celestial Lights.

✍✍✍✍✍✍✍✍✍✍✍✍

✍✍✍✍✍✍✍✍✍✍✍✍

Soneto
por
Sor Juana Inés de la Cruz

Aplaude la ciencia del Padre Eusebio Kino que escribió del cometa del año 1680[1]

Aunque es clara del Cielo la luz pura,
clara la Luna y claras las Estrellas,
y claras las efímeras centellas
que el aire eleva y el incendio apura;

aunque es el rayo claro, cuya dura
producción cuesta al viento mil querellas, y el relámpago
que hizo de sus huellas medrosa luz en la tiniebla
obscura;

todo el conocimiento torpe humano
se estuvo obscuro sin que las mortales
plumas pudiesen ser, con vuelo ufano,

Icaros de discursos racionales,
hasta que el tuyo, Eusebio soberano,
les dio luz a las Luces celestials.

✍✍✍✍✍✍✍✍✍✍✍✍

[1] Sor Juana Inés de la Cruz, *Obras Completas* (Editorial

Translated by Fred McAninch. The original Spanish sonnet can be found in *Sor Juana Inés de la Cruz, Obras Completas*, (Editorial Porrúa, S.A., 1972) 163.

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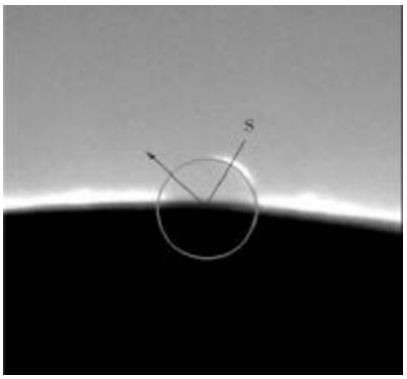


Europlanet Press Release, **5 March 2012**:

Counting down to the Transit of Venus

Europlanet Outreach Office, anita.heward@europlanet-eu.org

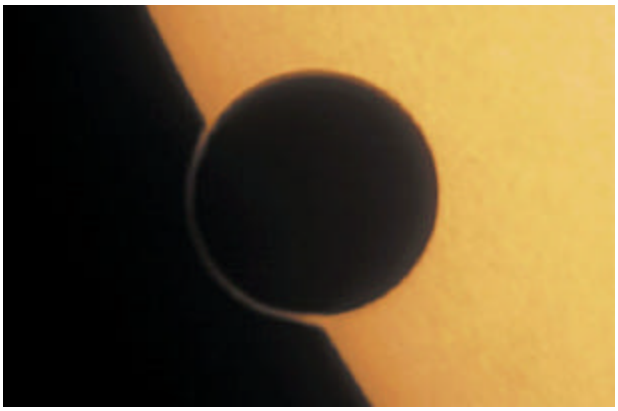
Three months before the last transit of Venus this century, scientists are gathering at the Paris Observatory to finalize their observation plans in a workshop supported by the Europlanet Research Infrastructure and the EGIDE/PHC Sakura Program.

The transit of Venus on 5-6 June 2012 will give scientists two important opportunities for science: firstly, to use Venus as an example of a transiting exoplanet. Astronomers will use the transit to test the techniques they have developed to analyze the composition, structure and dynamics of exoplanetary atmospheres. Secondly, they will be able to make simultaneous Earth- and space-based observations of Venus's atmosphere. These joint observations will give new insights into the complex middle layer of Venus's atmosphere, a key to understanding the climatology of our sister planet.

'This transit of Venus will be the last of our lifetime and will give a unique opportunity to closely observe an Earth-like planet passing in front of a Sun-like star,' said Dr Thomas Widemann of the Observatoire de Paris, who is co-organizer of the workshop.

'Corot, Kepler have confronted us with the discoveries of more and more super-earth sized planets. Venus and Earth are sister planets, yet Venus evolved in a dramatic, different way. If Venus were an extrasolar transiting planet, what would we learn about its physical characteristics? What would we miss or misinterpret? We will use Venus transit observations to characterize the spectral signature of Venus, and test the detection limits of gases in the atmosphere,' said Widemann.

The transit also gives a rare opportunity to study the atmosphere of Venus from Earth. As Venus appears to make contact with the edge of the Sun's disk, it becomes outlined by a thin arc of light, called the aureole. This aureole is caused by light refracted through Venus's atmosphere and is 10-100 times fainter than the visible surface of the Sun. The brightness and thickness of the aureole depends on the density and temperature of the atmosphere and the altitude of the atmospheric layers above Venus's cloud tops.



Although the aureole was first reported by observers in 1761, the transit in 2004 was the first time it could be photographed. The results of these observations are published the March issue of the journal Icarus.

'We didn't know until 2004 that the aureole could **be easily observed and had science value.' said Dr** Paolo Tanga of Laboratoire Lagrange, Observatoire de la Côte d'Azur, who led the study. 'From three sets of observations in 2004 we have been able to build up a model of the aureole for the first time.'

Spatially resolved observations along the curve of the aureole will allow the scientists to work out whether atmospheric phenomena observed by Venus Express, which has been orbiting Venus since 2006, are associated with variations in time or are dependent on latitude.

Widemann explained, 'We need ground-based observations to understand the rapid variations we see in Venus Express data. At the time of the transit, we can simultaneously measure the temperature structure at all latitudes from pole to pole, along the terminator, and allow a detailed comparison with Venus Express measurements.'

Tanga, Widemann and colleagues are building a set of eight coronographs, each working in a different wavelength, to monitor the aureole during the June transit. The coronographs, assembled in OCA, will be used in locations around the world where the transit will be most observable (Svalbard in Europe, The Far East, the US West Coast and Australia). The observations will be compared with data from other ground-based observatories, as well as Venus Express and the Hubble Space Telescope.

'The transits are an interesting marker of mankind's technological advances,' said Widemann. 'In the eighteenth century, pendulum clock allowed accurate timings during a Venus transit – to measure the Astronomical Unit. In the 19th century, we had a new tool in photography. In the 21st century, we are able to observe the phenomenon from space and from Earth at the same time. It would be interesting to know what tools will be available in the 22nd century!'

How I got Interested in Astronomy

by

Cindy Lund, Editor of Nightfall

I have been interested in astronomy since I was in preschool. My interest did not begin with looking at the night sky, but with books. My parents got me hundreds of children's books and many were on astronomy. I read them with my parents. My mom says I liked reading the books and looking at pictures of the planets and reading about them.

The first astronomical event I remember is when Voyager II got to Neptune in 1989. I had learned about the nine planets. I knew that Mercury, Venus, Earth, and Mars were the small, inner, rocky planets, while Jupiter, Saturn, Uranus, and Neptune were the gas giants and Pluto (then considered a planet) was the smallest of all. I also knew that Jupiter, Saturn, and Uranus, i.e., all the gas giants except Neptune, were known to have rings and several moons each. Neptune had only two known moons and was not known to have rings. I guessed that since the other gas giants had rings and lots of moons that Neptune did too. It turned out I was right. Neptune has four rings and eight known moons. I also learned it had a storm called the Great Dark Spot. The first astronomical event I remember observing was the partial solar eclipse in 1991. I had read about solar and lunar eclipses so I knew what was taking place; the moon going between the sun and the earth. I also knew not to look directly at the eclipse. I remember being at my friend Kim's house, looking at the silhouettes of the sun which were cast by the gaps between tree leaves acting as lenses by diffraction. I think I also made a pinhole box and viewed the eclipse with it.

I learned more about astronomy as I got older. I subscribed to Odyssey Magazine, which was at the time all about astronomy. When I was 11, I read A Brief History of Time, the first of many books I read on Cosmology which became my favorite subset of Astronomy.

I learned about the Big Bang and the expansion of the universe. At the time, scientists had determined that the universe was between 8 and 20 billion years old. According to then current theory, the universe was either positively curved, flat or negatively curved, depending on how much matter was in it. If it was negatively curved or flat it would expand forever, if it was positively curved it would collapse. Scientists were trying to find how fast the universe was slowing down. I remember the discovery that the universe was not slowing down but was actually speeding up. This was totally unexpected. I liked how it answered old questions but raised new ones. What is Dark Energy? I also remember when the WMAP results came in and we learned the shape and age of the universe. The universe, at least the part we can see, is flat and 13.7 billion years old.

My Dad (Greg) and I joined the Huachuca Astronomy Club around the time I graduated from Buena High School in 2002. At first I just went to the meetings and the star parties, but in 2006 I decided to start keeping a record of my observations. I continue to expand my knowledge about astronomy, primarily through the club and additional readings.

SKY-CALENDAR UPDATE FOR APRIL 2012

Doug Snyder

Note: Unless otherwise noted, all dates and times are shown in Arizona's Mountain Standard Time – NOT in Universal Time (U.T.). MST is behind UT by 7 hours.

APRIL 03 (Tuesday): Venus approaching the Pleiades (M45 in Taurus); high in the western evening sky, it is within 0.5° south of the stars Alcyone and Pleione. Also, for the first part of April, Venus maintains its visibility for up to four hours after sunset. During the latter part of the month, that is down to about 3.5 hours or less.

APRIL 06 (Friday): Full Moon occurs at 12:19 pm; some have named this full moon the 'Pink' moon; once it rises, it will be situated between the star Spica and the planet Saturn.

APRIL 15 (Sunday): Saturn at opposition at 11am; its magnitude is +0.2, the light travel time is 73 minutes, and its distance from Earth is 8.72 AU (or about 810 million miles). The globe of Saturn is only about 19 arc-seconds in width, but with the ring system included, this planetary system expands out to about 43" (arc-seconds). Opposition is a prime time to view or to show others this most beautiful solar system show-piece.

Saturn and Titan as seen by Cassini

APRIL 18 (Wednesday): Mercury at greatest elongation W., 27°; a morning planet and only about 8" (arc-seconds) in size.

APRIL 21 (Saturday): New Moon at 0019 hrs. BTW, that's nineteen minutes past midnight on Saturday, April 21, 2012. This is the beginning of lunation 1105. FWIW.

APRIL 21 / APRIL 22 (Saturday / Sunday): LYRID's Meteor Shower: Great ! No Moon interference. Okay, for this shower, pay attention for it from the late evening of April 21 until dawn on April 22. The radian point for this meteor shower is very nearly the bright star Vega and the peak may occur around 10 pm local time, which favors the east coast and the Atlantic region! But stay alert all night if the skies are clear and follow the constellation Lyra across the sky. You may witness from 10 to 20 meteors per hour, and sometimes there are 'surges' of meteoric activity towards dawn on the 22nd. They tend to be fast, bright, and also sometimes leave trails. Take Photos! The parent comet for this shower is believed to be Comet C/1861 G1 Thatcher, a regular visitor to the inner solar system. The activity from this historic shower has been traced back 2600 years, longer than any other shower.

APRIL 30 (Monday): Venus reaches its greatest illuminate d extent; magnitude -4.7 and as a waning crescent only 27% illuminated.

ADDITIONAL UPDATES: **Supernova** discovery – A new SN was discovered on March 16 on the outskirts of the spiral galaxy M95 in the constellation Leo. The SN has been designated **SN 2012aw** and was reported to be at magnitude 13, and brightening.

Sky Calendar for 2012 – Arizona sky phenomena; be sure you have a copy for the remainder of the year. One is included with this newsletter. Also, you can download a PDF version from http://skycalendar.blackskies.org/

Remember: There is ALWAYS something happening `up there' whether we know it or not; CAN you discover it? These updates are just a fraction of observable sky events! CLEAR SKIES UNTIL NEXT MONTH – Doug Snyder

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Contacting the Nightfall Newsletter Editor: You can reach the newsletter editor, Cindy Lund, at phone: (520) 456-4817 or email: alund@juno.com

To request a school or special event, please contact the HAC outreach events coordinator: Rich Swanson, telegeek-64@cox.net

2012—ARIZONA's Astronomically Handy Sky Calendar from Doug Snyder—2012
ARIZONA SKY PHENOMENA Calendar—
All Times shown are MOUNTAIN STANDARD TIME*

January 2012
HIGHLITE: Shadow Transits on Jup.

01 Su New Year's Day; HNY2012 !
03 Tu Dbl. Shadow Tr., 2327hrs.,G&Eu
Quadrantid Meteors Pk@2400h.
view a.m. of 4th**; an 80%
moon sets just after 0300 hrs.
09 Mo ☽ Full Moon 0031 hrs.
10 Tu Dbl.Shadow Tr., 2326hrs., Eu&G
11 We Comet P/2006 T1(Levy); mag.7?;
perihelion@2343 hrs, 1.0074AU
16 Mo Spica 2°N. of Moon, 0100 hrs.
☽ Last Quarter Moon 0209 hrs.
21 Sa Mars at mag.-0.3, size 10.7"
23 Mo ☽ **NEW MOON** 0040 hrs.
30 Mo ☽ First Quarter Moon 2110 hrs.

February 2012
HIGHLITE: C/2009 P1 Garradd

03 Fr **Comet Garradd,** 0.5° from
M92 Globular in Hercules, 3am
07 Tu ☽ Full Moon 1454 hrs.
09 Th Venus 0.3° N. of Uranus, pm;
mag. –4.1 & +5.9; size: 16",
3.4"; eyepiece recommended
10 Fr Zodiacal Lt. in W., pm, next
2 weeks; after twilight.
14 Tu ☽ Last Quarter Moon 1005 hrs.
21 Tu ☽ **NEW MOON** 1535 hrs.
25 Sa Venus 3° S. of waxing Moon
26 Su Jup. 4° S. of Moon, pm
29 We ☽ First Quarter Moon 1822 hrs.
Leap-day: 2012 has 366 days

March 2012
HIGHLITE: Planetary Arrangements

03 Sa Mars @**opposition**, 1335 hrs.,
size at 13.9", mag. –1.2
05 Mo Mars closest to Earth, 1000hrs
Merc. evening planet in W., 7°
08 Th ☽ Full Moon 0239 hrs.
10 Sa Zodiacal Lt. in W., pm, next
2 weeks; after twilight
14 We ☽ Last Quarter Moon 1826 hrs.
19 Mo Vernal **Equinox**, 2214 hrs.
22 Th ☽ **NEW MOON** 0738 hrs.
Dbl. Shadow Tr., 1935hrs., I&G
27 Tu Venus G_Elong. E., 46°, in
western sky after sunset
30 Fr ☽ First Quarter Moon 1241 hrs.

April 2012
HIGHLITES: Saturn, Lyrid Meteors

03 Tu **Venus** 0.5° S. of M45 (Pleiades)
in early evening, western skies
06 Fr ☽ Full Moon 1219 hrs.
13 Fr ☽ Last Quarter Moon 0350 hrs.
15 Su **Saturn**@ **opposition**, 1100hrs
18 We Merc. morning planet in E., 8°
21 Sa ☽ **NEW MOON** 0019 hrs.
Lyrid Meteors, Pk 2200hrs.
28 Sa **Astronomy Day #1 2012**
29 Su ☽ First Quarter Moon 0259 hrs
30 Mo Venus at brightest mag., –4.7

May 2012
HIGHLITE: Annular Solar Eclipse

05 Sa ?-Aquarid Meteors; unfavorable
year due to moon; pk.1200hrs.
☽ Full Moon 2036 hrs.; largest
in 2012
12 Sa ☽ Last Quarter Moon 1447 hrs.
20 Su ☽ **NEW MOON** 1648 hrs.
Annular Solar Eclipse; best
Arizona site: near city of Page;
low altitude Sun; starts at
1724 hrs., max. at 1834 hrs.
28 Mo ☽ First Quarter Moon 1317 hrs.

June 2012
HIGHLITE: Solar Transit of Venus

04 Mo Partial Lunar Eclipse; penumbra
starts 0148 hrs.; partial at
0259 hrs; partial ends 0506 hrs
☽ Full Moon 0412 hrs.
05 Tu **Transit of Venus**; start at
1510 hrs.; still in progress at
sunset at 1916 hrs.
11 Mo ☽ Last Quarter Moon 0342 hrs.
19 Tu ☽ **NEW MOON** 0803 hrs.
20 We Summer Solstice, 1607 hrs.
26 Tu ☽ First Quarter Moon 2031 hrs.

July 2012
HIGHLITE: Jupiter's Morning Light

01 Su Merc., west sky, pm twilight, mag.
+0.4, size 8.1"
03 Tu ☽ Full Moon 1152 hrs.
10 Tu ☽ Last Quarter Moon 1849 hrs.
12 Th Venus, am, brightest mag., -4.7
14 Sa Comet 96P/Machholz, Perihelion
18 We ☽ **NEW MOON** 2125 hrs.
21 Sa Dbl.Shadow Tr., 0354hrs, Eu & I
26 Th ☽ First Quarter Moon 0157 hrs.
28 Sa Dbl.Shadow Tr., 0446hrs, Eu & I
29 Su S. d– Aquarid meteors Pk. in am,
unfavorable year, 78%Moon
30 Mo Jupiter, am, size 36", mag. –2.1

August 2012
HIGHLITE: Perseid Meteor Shower

01 We ☽ Full Moon 2028 hrs. 09 Th ☽
Last Quarter Moon 1156 hrs.
12 Su **PERSEID** Meteors: **favorable!**
View pm 11th & am 12th
13 Mo Dbl.Shadow Tr., 0348hrs., I & G
Occultation of Venus by
the Moon; near 1340 hrs.
16 Th Merc. morning planet in E., 8°
17 Fr ☽ **NEW MOON** 0855 hrs.
24 Fr Neptune @ Opposition,0600h.
mag.+7.8, size 2.3", 29AU
☽ First Quarter Moon 0654 hrs.
31 Fr ☽ Full Moon (**2nd**) 0659 hrs.

September 2012
HIGHLITE: Northern Lights in AZ ?

08 Sa ☽ Last Quarter Moon 0616 hrs.
12 We Epsilon (e) Eridanids Meteors
peak near 0600hrs; favorable
14 Fr Zodiacal Lt. in E., am, next 2
weeks before twilight
15 Sa ☽ **NEW MOON** 1911 hrs
Alert For aurora activity
before, during & after Equinox
22 Sa **Autumn Equinox** 0749 hrs.
☽ First Quarter Moon 1241 hrs.
29 Sa Uranus @ opposition, 0000hrs.
mag. +5.7, size 3.7", distance
19.1 AU from Earth
☽ Full Moon 1241 hrs.

October 2012
HIGHLITE: Meteor Showers (3)

03 We Venus/Regulus Appulse—one
of the best for 2012; E., 0500hrs
08 Mo ☽ Last Quarter Moon 0034hrs
Draconids Meteors: 0300 to dawn
10 We **S. Taurids** Meteors: favorable!
13 Sa Zodiacal Lt., E., am, next 2 wks.
15 Mo ☽ **NEW MOON** 0503 hrs.
21 Su **Orionids** Meteors: v. favorable!
☽ First Quarter Moon 2033 hrs.
29 Mo ☽ Full Moon 1250 hrs.

November 2012
HIGHLITE: LEONID Meteor Shower

06 Tu ☽ Last Quarter Moon,1736hrs.
12 Mo **N. Taurids** Meteors, 0400h.
13 Tu ☽ **NEW MOON** 1509 hrs.
17 Sa **Leonid Meteors!** First of 2
Pks., 0200hrs.; v. favorable
19 Mo 2nd **Leonid** pk. possible 2400h.
20 Tu ☽ First Quarter Moon 0732 hrs.
27 Tu Venus/Saturn Conjunction! E.,
am, 0630hrs., 0.6° separation
28 We ☽ Full Moon 0747 hrs.

December 2012
HIGHLITE: GEMINID Meteor Shower

02 Su JUPITER @ Opposition, 1900 h.
04 Tu Merc. morning planet in E., 7.4°
06 Th ☽ Last Quarter Moon 0832 hrs.
13 Th ☽ **NEW MOON** 0142 hrs.
GEMINIDS Pk: 0500 hrs.;
Very Favorable for 2012
19 We ☽ First Quarter Moon 2220 hrs.
21 Th Solstice (Winter) 0412 hrs.
22 Fr **Ursid** Meteors Pk., 0100 hrs.
28 Fr ☽ Full Moon 0322 hrs.

*Times/Dates= ARIZONA MountainStandardTime (UT-7hrs), NO DST; **updates/ details,** see**:** http://skycalendar.blackskies.org;
Abbr: Tr=Transit; Pk=Peak; Merc=Mercury; E=East W=West; S=South; N=North; J, Jup.=Jupiter; V=Venus; "=arc seconds;
h., hrs.=hours (24 hour time system); MP=Minor Planet; MS=Moon Set; wks=weeks; Lt=Light; pm=evening; v.= very
am=morning; mag.=magnitude; **meteor shower dates reflect predicted Peak Morning, but Moon may still be present;
I=Io; Eu=Europa; G=Ganymede; C=Callisto; UT=Universal Time; **bold text=**possibly a promising/worthy event or activity;
G_Elong=Greatest Elongation; dbl= double; AU=Astronomical Unit; compiler: Doug Snyder (C/2002 E2, MP15512); V2.0.2012