NIGHTFALL
Huachuca Astronomy Club of Southeastern Arizona

July 2012

President's Notes

Next Meeting: Our next meeting will be July 6 at 7 pm in the Community Room of the Student Union Building in Cochise College. The guest speaker will be Robert Zimmerman, and his talk will be titled "The Universe in a Mirror." Robert Zimmerman is an award-winning science journalist. In addition, he has written four books and more than a hundred articles on the history of space exploration and technology. In 2000, he was co-winner of the David N. Schramm Award, given by the High Energy Astrophysics Division of the American Astronomical Society for Science Journalism, for his essay in THE SCIENCES, "There She Blows," on the 35-year-old astronomical mystery of gamma ray bursts.

Welcome to Kim Rogalski: Since board member Natasha Nichols has stepped down from the board and is moving to Florida, we needed a replacement. Kim Rogalski, a faculty member of Cochise College, has volunteered to serve on the board. The HAC board of directors voted to appoint Kim to our board, and we send him a warm welcome.

HAC Telescope Auction: The Meade 10-inch LX-200 was sold to Duke Glishke. We hope Duke enjoys this scope. We have four other scopes being auctioned, and we'll close out the bidding at our meeting on July 6. We have one bid of $250 for the Celestron NexStar 4-inch. Other scopes awaiting bids are:

The 6" Celestron StarHopper f/8 Dobsonian; it has a cover and two eyepieces. New price $250. We are asking for a starting bid is $100. What a bargain!

The Meade 4.4 in (114 mm) reflector has a Meade equatorial mount with go-to. This is a low end scope, but it would be just right for learning the basics of a go-to scope. It can be purchased new for about $170. Starting bid is $75. You can't find deals like this on the internet!

We have Coulter Odyssey 10-inch Dobsonian. This model is discontinued, but we found one on AstroMart for $600. Starting bid is $250. This is far below any market price, but it needs a little work.

HAC Meeting Schedule for 2013: We will be meeting on the fourth Friday of the month next year. That's generally closest to the full moon. Again, we will meet in the Community Room of the Student Union at Cochise College on the following dates: Jan 25, Feb 22, March 22, April 26, May 24, June 28, July 26, August 23, Sept 27, Oct 25, and Nov 22. The fourth Friday of December is too close to Christmas, so instead of a regular meeting, we will hold a party on December 14 -- location TBD.

Thanks to Tony: We really appreciate that Tony Maslanka has been our meeting refreshments chair for the past years. He's stepping down and we really need a volunteer to help with this.

HAC Board of Directors: We will be holding our elections at the November meeting, and that will be here before you know it. We need a slate of officers published in our newsletter at least 30 days before that meeting, so we need to form a nominating committee. Please let me know if you can serve on the nominating committee.

Clear skies and bright stars,

Bob Gent
President, Huachuca Astronomy Club

Venus Transit Report

Bob Gent

June 5, 2012 is a day some of us will never forget. It was the last Venus Transit for over 105 years! Over the afternoon, it seemed that there were hundreds of visitors at Veteran's Memorial Park. I'd like to thank everyone from HAC who came to help out. We distributed eclipse glasses, gave away our new HAC tri-folds, and much more.

We had a lot of scopes, too. Ken Kirchner brought his new 10 inch Dob, Eric Sundius brought a Celestron SCT, Kim Rogalski brought a nice H-alpha scope, Glen Sanner had his camera with telephoto setup, Robert and Connie Kelher had a wonderful projection system running, and I saw Bob Kepple with a PST. I brought two clock drive equatorial Newtonians. We received many compliments and many people said, "It was really nice for the Huachuca Astronomy Club to share their telescopes for this exciting event." I'd like to thank each of you for helping make this a wonderful event.

My primary scope, the Celestron 8-inch NGT was set up at 31 degrees, 33.335 minutes North, 110 degrees, 16.060 minutes West. From that position, I checked time signals and came up with a first contact of 15:06:30 MST. Also, just before Venus completely entered the sun, I was able to watch aureole using the C8 Newtonian. Unfortunately, it was gone before I could photograph it. I made a sketch that is only an approximation of what I saw. This phenomenon occurs as the atmosphere of Venus refracts sunlight.

Bob Gent, President, Huachuca Astronomy Club

Here's one of my photos at Ingress:

DCO Under New Management

Ted Forte

There is a new set of eyes poised to gather photons in the High Knoll area east of Sierra Vista.

Gary Meyers has relocated to Texas and I have purchased his home and the Desert Coyote Observatory. I also purchased the 30-inch f/4.45 StarSplitter Dobsonian that was the centerpiece of the DCO. I hope to bring new life to the observatory that has been underused the past few years as Gary found himself unable to do much observing. It will take us some time to get up to speed, but eventually Halina and I hope to host a member star party or two.

Besides the 30-inch, the Observatory will also house my 18-inch f/4.5 Obsession Dob and perhaps my 10-inch Orion Intelliscope. The 30 is equipped with a Servo Cat dual axis drive system and is set up for wire-less control from a desktop computer running Megastar. The Obsession is also equipped with a Servo Cat and runs by wireless hand controller. Both scopes use the Argo Navis DTC.

The Desert Coyote will be dedicated entirely to visual observation, which has always been my passion. Among other projects, I enjoy doing the Astronomical League's observing programs and have done about twenty of them. I am the coordinator, by the way, for the A.L.'s Planetary Nebula Program which was created by my other club, The Back Bay Amateur Astronomers.

The Venus transit was the first observation done at my new site. That was not by accident of course; our move plans centered on being here in time for the transit. I was clouded out during the 2004 transit and I was both apprehensive and hopeful that I'd be able to experience this one. So, even though I had to accommodate some moving related chores, I was able to set up right outside my back door. I had my 8-inch SCT outfitted with a full aperture Mylar filter and a PST. I usually mount the PST piggyback on the SCT, but I had forgotten to indicate which of the 100 plus boxes contained my counterweights and had to content myself with the un-driven scope on a tripod.

My plan called for an attempt to see Venus before first contact in the h-alpha scope. But my calculation was off on where Venus would approach the solar disk and not only did I not see Venus approach, I missed the actual moment of first contact. By the time I discovered my error, Venus had made a tiny indentation in the sun.
The event was a real thrill. As with just about everyone, I was impressed with the blackness and the size of Venus' disk. Somehow, photos just didn't prepare me for that. I had seen transits of Mercury but they paled in comparison to this. Perhaps the rarity of the event colors one's perception, but this seemed so much more special. I was disappointed that I could not share the event with those of you that went to the park, but I was not entirely alone. Halina shared the view and there were also a couple of delivery men on site that were thrilled to have a look. Throughout the event, I was in cell phone contact with friends from afar. My son witnessed the transit from Davis California and two very good astronomer friends had a seaside perch in San Francisco. My old club mates in Virginia were set up in two different public locations, and a number of more private sites. The Virginia contingent had clouds for first contact but were fine after that. After about an hour I left the scope occasionally, but I followed the progress of our sister planet until the spectacle was lost to the horizon, making frequent sketches and notes. Was it the eight years of anticipation or the knowledge that I won't live to see another transit that made the experience so powerful?

I'm happy to be here. I hope the Venus transit is just the first of a long string of extraordinary memories.

DCO Under New Management Pictures

Ted Forte

Transit of Venus Report

Cindy Lund

I missed the 2004 Venus transit, and I knew I wouldn't be alive for the 2117 transit, so I made sure to see the 2012 transit. Unfortunately, the transit was on a Wednesday, and I had to work.

I left work at 4:45 and went to pick up my friend Regina. We got to the Veterans' Memorial Park at about 5:20. There were about 7 telescopes set up. A good sized crowd was viewing the transit. Club members were handing out eclipse viewing sunglasses and showing the public the transit in their telescopes. One man had set up his telescope so as to project the sun's image onto a white board.

My Dad came by at about 6:00. By that time, many people had left and the crowd was smaller in n umbers but not in enthusiasm. Regina, my Dad, and I stayed until 6:30. I made several sketches of the Sun with Venus' silhouette. We talked to several viewers. I brought my notes on the story of Guillaume Hyacinthe le Gentil's expedition to see the transit in 1761, so I told one woman who seemed interested. (le Gentil set off in 1761 but was blown off course and missed the transit. He decided to stay for the next one in 1769, but was clouded out. This drove him to the brink of insanity. He recovered but fever and dysentery delayed his trip home. When he finally returned home after eleven years he found that he had been declared legally dead. His wife had remarried and he had been replaced in the royal academy.)

When I looked at the sun with the sunglasses, I could barely see the silhouette of Venus against the sun. It was a tiny dot in the upper right corner of an orange disk. Through the telescopes I could see sunspots as well. Venus's silhouette was a round disk; bigger than any of the sunspots. I noted that the sunspots were darker in the center and lighter on the outside. A couple of the telescopes were set to show solar prominences. I saw three large prominences, one at 11:00, one at 2:00 and the biggest at 6:00. (This was in a telescope that showed Venus in the lower left)

The Venus transit reminded me just how small we are. Venus is only a little smaller than the Earth, and yet its silhouette was so small against the Sun. And Venus is approximate three times closer than the Sun, so its silhouette is nine times as big as it would be if it were right by the Sun. Venus could fit in an average sunspot, and therefore, Earth could too.

Picture of observers at Veterans Memorial Park by Bob Gent

Solar Eclipse Pictures
Veterans Memorial Park

Howard Day

Travels on the Celestial Sphere

Bob Kepple and Glen Sanner

While trying to finish my quest to complete the Astronomical League's Herschel 400 list, I came upon a very nice triplet of galaxies in Draco, the Dragon. These three galaxies are known as "the Draco Trio." All are about 100 million light years distant. Bob Kepple and I were viewing at my observatory and while Bob was viewing various double stars with the 12.5," I was viewing mostly galaxies with the 18.5". I found NGC 5982 and the rest of the "trio" (NGC 5981 and NGC 5985) all within the same eyepiece field. The three galaxies form a slightly curved row and they all look very different from one another. The galaxy I needed for the Herschel list was 5982 and it is an elliptical galaxy at magnitude 11.1, with a surface brightness of 13.0. It appears the brightest of the galaxies and shows an oval halo stretching ESE-WNW. It has a bright core and a stellar nucleus.

NGC 5981 is an Sc?sp spiral galaxy, extending 2.5' x 0.25' NW-SE as a faint spindle of light with a slightly brighter core. It is the most westerly of the "trio", six minutes west of NGC 5982. NGC 5985 is 13' east of 5982 and appears elongated NNE-SSW 3' x 1.5' with an evenly illuminated halo and a much brighter core.

All together these galaxies in Draco make a fine sight in any sized telescope and since Draco culminates on July 8th at 9PM they are perfectly placed for your observation or imaging. Here is the data on the galaxies:

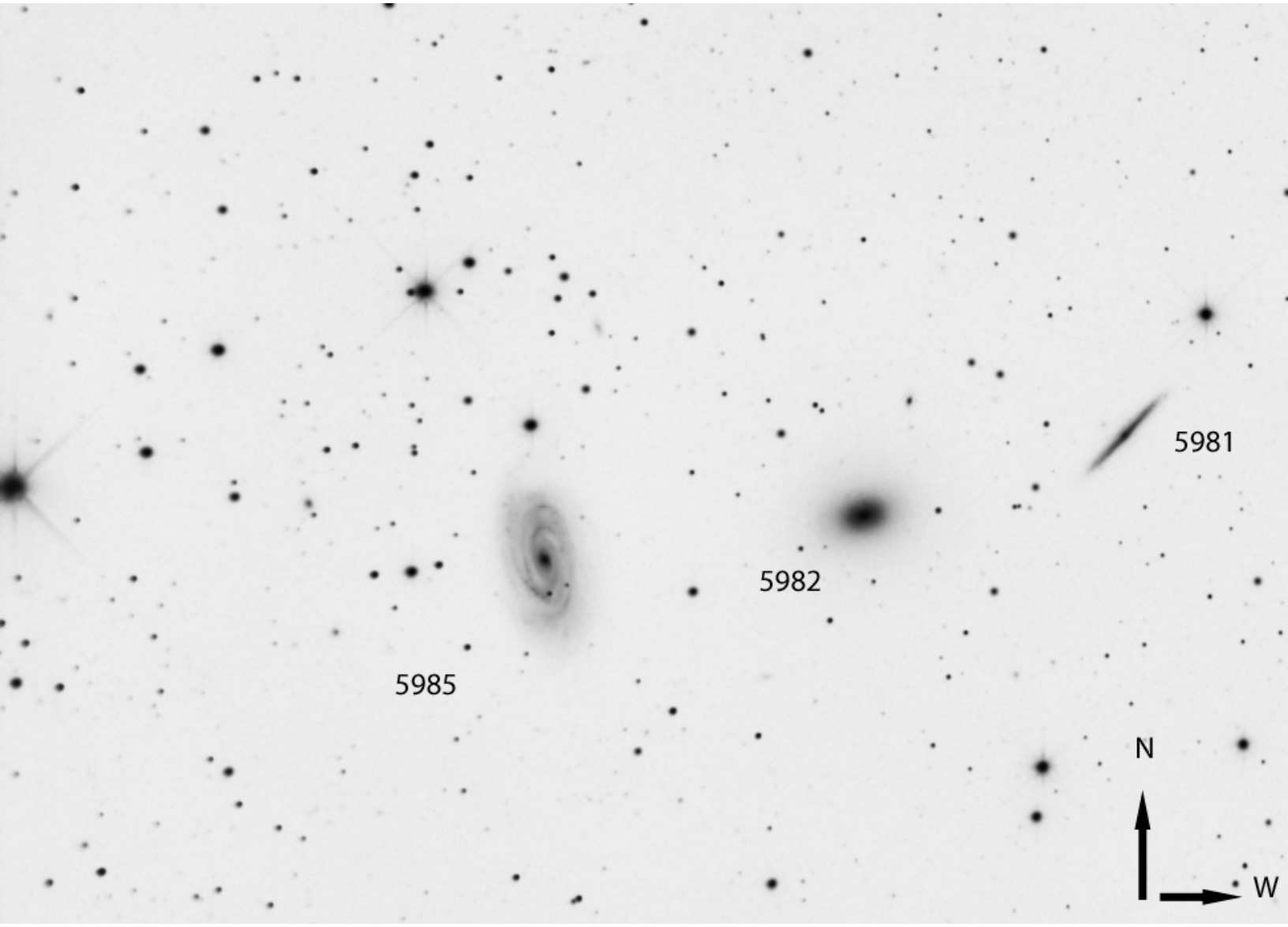
Number	Galaxy Type	Right Ascension	Declination	Size	Magnitude	
NGC 5981	Sc?sp	15h 37.9m	+59° 23'	2.6' x 0.3'	m13.0v	SB 12.6
NGC 5982	E3	15h 38.7m	+59° 21	3.0' x 2.2'	m11.1v	SB 13.0
NGC 5985	SAB(r)bI	15h 39.6m	+59° 20	5.3' x 2.9'	m11.1v	SB13.9

Chart 1: *Declination North of +65°*

Magnitude: 0.0 1.0 2.0 3.0 4.0 5.0 6.0 7.0

Travels on the Celestial Sphere
Picture

Bob Kepple and Glen Sanner



SKY-CALENDAR UPDATE FOR JULY 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.) nor in Eastern Time (E.T.). MST is behind UT by 7 hours.***

July 1 (Sunday): planet Mercury in the evening (western) skies; later this month, it will move closer to the Sun and also lose some of its apparent magnitude. Try to view this tiny 'orb' about a half hour or so after sunset. It will be almost directly west, but just a few degrees north of due west. The elongation from the Sun on this date will be about 26° and its size will only be about 8" (arcseconds).

July 14 (Saturday): Short Period Comet 96P (Machholz) reaches perihelion -
The following three paragraphs are courtesy of astronomer **Carl Hergenrother and his blog site "The Transient Sky" (** http://transientsky.wordpress.com/ **) This article appeared in a June 2012 blog:** "Comet 96P/Machholz is the only comet that may be brighter than 10th magnitude this month. And even then it will only be brighter than 10th magnitude for the last day or two of the month. Next month the comet will be much brighter though it will also be located closer to the Sun.

This comet has one of the smallest perihelion distances of any short-period comet at 0.12 AU. For this go-around, the comet will reach perihelion on July 14. During June it will only be visible from the Southern Hemisphere. Northerners will get their chance towards the end of July. At the start of June, it will be located 1.19 AU from the Sun and 1.17 AU from Earth. Though rapidly brightening it will still only be a faint magnitude 14. By the end of the month the comet will have brightened to magnitude 10 or a little brighter. It will close out the month at a distance of 0.55 AU from the Sun and 0.95 AU from Earth.

Don Machholz first spotted 96P back on May 12, 1986 at magnitude 9.7. Though the comet can get very bright (up to magnitude -2) it is always located too close to the Sun for observation when that bright. By the time the comet has moved far enough from the Sun for easy observations it will have faded to 8th or 9th magnitude. It currently takes ~5.3 years to orbit the Sun."
For a current 'finder chart' of this comet's journey, please visit this link: http://www.aerith.net/comet/catalog/0096P/2012.html ; note that for the later days of July, it can be found (hopefully!) near the constellations of Gemini and then later, Lynx and Leo Minor.

July 18 (Wednesday): **New Moon**, 9:25 pm; note that this is the start of 'lunation 1108'.

July 21st & July 28th (both fall on a Saturday): Double Shadow Transit events of Galilean Moons; on 7/21, a short double shadow transit visible with Europa & Io starting at 3:54am – this double-shadow transit event will only last 4 or 5 minutes. For the 7/28 event also involving Europa & Io, it commences at 4:46am and becomes a 'single' shadow (Io's) at 5:33am. These are the double shadow transit events favorable for viewing in Arizona in July.

July 28th (Saturday): S.(south) δ Aquarid Meteors peak (20/hr.); unfavorable year, 78% moonlight interference; expected peak is on Saturday afternoon MST.

Remember: There are ALWAYS exciting and unusual sky phenomena happening in our 'visible universe' whether WE know it or see it; CAN you discover some? These updates are just a fraction of observable sky events! THANK YOU & CLEAR SKIES UNTIL NEXT MONTH – Doug

A Big Dark-Sky Giveaway

Enter the International Dark-Sky Association's Dark-sky Giveaway for an astronomically grand prize— a set of eight TeleVue Ethos eyepieces valued at $5,665, generously donated by Televue Optics. To enter this contest, you must be an IDA member before the entry closeout date of August 31, 2012. If you are not a member, joining is easy and the cost of a one-year membership is only $35.00. To join or renew your membership, visit www.darksky.org and select the "Join" tab at the top of the webpage. You can also join by calling the IDA office at (520) 293-3198. Entering to win is also a breeze. Visit darksky.org/giveaway where you can fill out the entry form online and read the official rules.

Your membership in IDA is critical in helping fight light pollution, and it helps to support IDA's many programs. Through the International Dark Sky Places program, IDA and its partners certify locations with exceptional nightscapes as International Dark Sky Communities, International Dark Sky Parks, and International Dark Sky Reserves. The Dark Sky Parks and Protected Area Program currently works with national parks to help them utilize quality outdoor lighting. IDA's new Suburban Outreach Sites project partners with astronomy clubs to establish accessible programs for kids and their parents. These programs help IDA to engage communities and to raise awareness and ultimately "to preserve and protect the nighttime environment and our heritage of dark skies through environmentally responsible outdoor lighting." IDA members make a big difference in their communities and around the world.

Make sure you enter the Dark-Sky Giveaway by the deadline and good luck! The winner will be announced at the Pacific Astronomy and Telescope Show in September 2012, but you do not need to attend PATS to win.

Bob Gent
Past president, IDA Board of Directors

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President: Bob Gent
Vice President: Glen Sanner
Secretary: Bob Hoover
Treasurer: Bob Kepple

Members at Large:
Keith Mullen
Doug Snyder
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www.hacastronomy.com -- A great place to visit!

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

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 η-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. δ– 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 (ε) 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