NIGHTFALL

A PUBLICATION OF THE HUACHUCA ASTRONOMY CLUB

OCTOBER 2018

PRESIDENT'S NOTES

HAPPY OCTOBER EVERYBODY!

Last year at this time, I was pointing out a comet, C/2017 O1 (ASASSN1), as a binocular object. Well, ASASSN 1 is long gone now, on its way into deep space, reflecting sunlight at a feeble magnitude 21 and not expected to return for more than 8,000 years. This is why I try to point these comets out when I can. We have a very short time to view them, and then they're gone. They are very fleeting things.

So, here is another comet for you all, comet 21P/Giacobini-Zinner (or, just G-Z). This is a different kind of fuzzball. Comet G-Z is a periodic, with a very short orbital period of 6.6 years. It is usually inside the orbit of Jupiter; that's right in our own backyard. The orbit has been stable since it was discovered in 1900, but it is not very bright, ever. This time around, the comet's orbit came very close to earth (.39AU), so we have a favorable passage. And, it got as bright as magnitude 7.5. It is now on its way out but still bright enough to be seen in binoculars if the sky is nice and dark. A 4" to 8" scope should allow you to see it in some detail -- and, yes, its tail too. Next time we have a passage anywhere close to this is September of 2031 (.53AU). So, try to make time to catch it this time. In addition, the G-Z is the parent comet of the Draconid meteor shower. This year the Draconid's are expected to reach peak on October 8. We'll have a new moon allowing us to see the action from a dark site. While we may not see an increase above the average 15 meteors or so an hour, you never know unless you look. The Orionids is the second and better-known meteor shower in October. It usually peaks around October 21 with about 20 meteors an hour.

Comet 21P/Giacobini-Zinner passing M35 (NGC 2168) and NGC 2158 (lower right)
Source: David R. September 9, 2018.

But wait, there is another comet coming into view of reasonable sized telescopes by October: 38P/Stephan-Oterma. This periodic comet takes 38 years to orbit the Sun but that has nothing to do with its name. It was the 38th comet to have its orbital period determined. Discovered in 1867, and last seen in 1980, this October is an opportunity to see what is predicted to be favorable passage 38P, with the comet 5° north of Betelgeuse in Orion at magnitude 10.5 during the first week of October. Late in November, it should peak at around magnitude 9 in Gemini near Castor and Pollux and may be visible in binoculars.

Finally, I would be remiss if I didn't continue to remind you that the planets Mars and Saturn are both still well placed for viewing every clear evening. The planet's disk is still big enough to see detail, the dust storm on Mars has subsided, and surface features are again visible. Saturn's display of rings is always fascinating, even in turbulent seeing and you can usually see five or six of Saturn's moons any night with only a six or eight inch telescope.

As always, get out there and stare!

Welcome our new members

Thomas and Penny Brondum of Sierra Vista joined at the August meeting. Thomas and Penny recently relocated here from Oregon. They own a number of telescopes including an 18" F/3, a 152mm triplet refractor and an 8-inch SCT. Edward Moss of Sierra Vista joined at the September meeting. Ed was the President of his last club and observes with an 8" VC200L and a 102 Vixen ED. Dwight Arnold of Sierra Vista who goes by Mike joined by mail this month. And, our newest members are the Howell's (Heather, Mark, Deven, Makayla and Brandon) from Ft. Huachuca who joined as a military family. Welcome! We are glad you joined!

At the October Meeting

The October Meeting of the Huachuca Astronomy Club will be held in the Student Union community room at Cochise College, 901 Colombo Avenue, Sierra Vista at 7 PM. The guest speaker is Dr. Eric Pearce from the University of Arizona.

Brief Biography of Dr. Pearce

Dr. Eric Pearce, who joined the Steward Observatory at the University of Arizona in 2016, has primarily focused his research on the development of advanced systems and astronomical techniques specifically optimized to discover, track and characterize artificial earth-orbiting satellites. He came to Tucson from Pasadena, California, where he was the Telescope Group Lead at the Giant Magellan Telescope (GMT). Prior to that assignment, Dr. Pearce spent over 25 years working at the MIT Lincoln Laboratory developing ground-based optical telescope systems for tracking and characterizing satellites for the U.S. Air Force. While at the Lincoln Laboratory, he was the Principal Investigator leading the development of the DARPA-sponsored 3.5M Space Surveillance Telescope (SST). Dr. Pearce has two bachelor's degrees, one in Computer Science and one in Astrophysics, and a Ph. D. in Astrophysics, all from the New Mexico Institute of Mining and Technology. When not behind a telescope, he can be found on his bike, preparing for his next competitive road race.

Abstract of Presentation:

The United States utilizes a worldwide network of telescopes and radar systems to keep track of nearly 5,000 satellites and 14,000 other manmade objects currently in orbit around the Earth. The ongoing ability to discover, track, characterize and maintain custody of these objects is essential to the safe utilization of space for both civilian and military purposes. This mission is called "Space Situational Awareness," or "SSA," and it is the primary responsibility of the U.S. Air Force Space Command.

Academia played an essential role in the early development of American capabilities in this area. In the mid-1950's, driven by the imminent launch of Sputnik, there was an urgent need to develop and deploy a basic capability to detect, track and determine orbits of the first satellites. Early development of ground-based satellite tracking systems was led by a coalition of academic and government organizations to meet this need. Fred Whipple's vision of a world-wide monitoring network ultimately led to development and deployment of a unique astrographic telescope, the Baker-Nunn, to 15 sites around the world and the first data processing center which turned optical observations into real-time data and analysis of future orbits of Sputnik and the other satellites that followed.

Today, the UA and other academic institutions are re-engaging with the SSA community to address the future challenges of maintaining awareness of orbiting satellites and other objects, to educate a new generation of professionals on these critical elements, and to re-examine the capabilities of the astrograph given the modern commercial telescopes and scientific grade cameras available today.

2019 RASC Handbooks and Astronomy Magazine Calendars

The treasurer will be taking orders for the 2019 RASC Handbooks (US Edition) and Astronomy Magazine calendars

The RASC Handbook, published for over 100 years, is an approximately 350-page guide published annually by The Royal Astronomical Society of Canada.

Yearly data in the handbook includes such topics as: rise/set times for sun and moon; eclipses; location of the planets and bright asteroids; periodic comets; times of meteor showers; star occultations by the Moon/asteroids; orbital positions of the brighter satellites for Jupiter and Saturn; and, cycle information of many variable stars.

Recurring data includes such topics as: orbital/physical data on the planets and their satellites; astronomical and physical constants; some optical properties of telescopes/binoculars; information on filters for astronomical observing; light pollution and sky transparency; descriptions of the various systems of specifying time; information on the Sun including sunspots and aurorae; a list of meteorite craters in the US and Canada; advice on using the RASC Handbook for teaching astronomy; information on the Gegenschein and zodiacal light; 40 pages of tables dealing with stars, star clusters, nebulae and galaxies; and, maps of the Moon and the entire stellar sky.

The Deep Space Mysteries 2019 calendar produced by Astronomy Magazine features 12 breathtaking images of stars, planets, galaxies, and other deep space wonders.

Each image is accompanied by an informative, educational essay about the celestial object shown in the image.

Please plan to pay for your purchase at the time you sign up.

RASC Handbook $22.50 (Please pay $23.25 if paying with PayPal) (Regular retail is $28.95)

Astronomy Mag calendar $6.50 (Please pay $6.75 if paying by PayPal) (Regular price $12.95)

You can sign up for these publications at the meeting. (Cash or check made out to Huachuca Astronomy Club). You can also email the treasurer (tedforte511@gmail.com) and pay by PayPal (use the donate button on www.hacastronomy.org). Please be sure to add the extra charge for Pay Pal purchase. When paying by PayPal, you can use your credit card or your PayPal account.

Also on sale at the meeting will be tickets for this year's Dine Under the Stars fundraiser to be held adjacent to the Patterson Observatory on October 20 from 6-9 PM. Adult tickets are $50 each and the proceeds go toward supporting the University of Arizona, South students, faculty and staff with scholarships, grants, and awards. Your purchase of a Dine Under the Stars ticket helps Ted (HAC's representative on the University South Foundation's board of directors) fulfill his obligation and remain in good standing with the foundation that owns the Patterson Observatory. Please pay with cash or check payable to "University South Foundation".

Kartchner Star Party

The next Kartchner Star Party will be held on Saturday, October 13, 2018 at Kartchner Caverns State Park in Benson. Weather permitting; we will set up solar telescopes in the bus parking area adjacent to the Discovery Center around noon (feel free to come earlier if you like). There will be a talk in the theater at 5:30 by Dr. Danielle Adams:

"Camels in the Sky: Our Heritage of Arabian Star Lore"

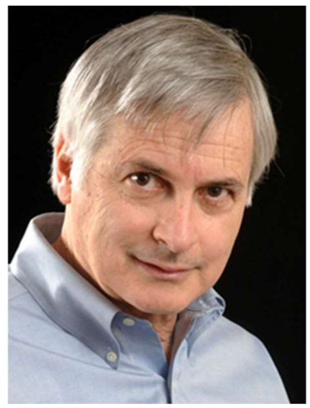
Dr. Danielle Adams, a recent graduate from the School of Middle Eastern and North African Studies at the University of Arizona and NASA Space Grant fellow, will speak about the rich star lore of Arabia as it was more than a thousand years ago. Camels, vultures, goats, wild cows and many other kinds of animals graced the skies of the Arabian Desert, and some of these survive in the star names used by astronomers today. Danielle will especially focus on the stars that are visible in the fall so that visitors can find them after the talk in the park's famously dark sky. Some of these stories can be found on her website, onesky.arizona.edu.

Stargazing commences after dark. HAC members are encouraged to participate by setting up telescopes to share with the public.

Park admission is complementary for our astronomers bringing scopes (just tell the guard at the gate that you are an astronomer setting up for the star party).

Special Appearance by Seth Shostak November 5

The University South Foundation is teaming with the Huachuca Astronomy Club to bring Dr. Seth Shostak of the



SETI institute to Sierra Vista for a special presentation as a community event. Seth's talk will be held on Monday, November 5 at 7 pm in the Student Union at Cochise College.

The foundation and the club are cost-sharing (about 80%-20%) to pay for this special event which will be open to the public free of charge. In addition to paying 20% of the stipend, HAC will treat Dr. Shostak to dinner at the Outback Steak House before the talk. Any HAC member wishing to attend the dinner is welcome (pay as you go) but seating will be limited and it's first come first serve.

Whether you can make it to dinner or not, we hope you will plan to attend this special event and bring your family, friends, and neighbors.

Seth Shostak directs the search for extraterrestrials at the SETI Institute in California—trying to find evidence of intelligent life in space. He is also committed to getting the public, especially young people, excited about astrobiology and science in general.

Seth is the host of "Big Picture Science," the SETI Institute's weekly radio show. The one-hour program uses interviews with leading researchers and lively and intelligent storytelling to tackle such big questions as: What came before the big bang? How does memory work? Will our descendants be human or machine? What's the origin of humor? Big Picture Science can be found in iTunes and other podcast sites.

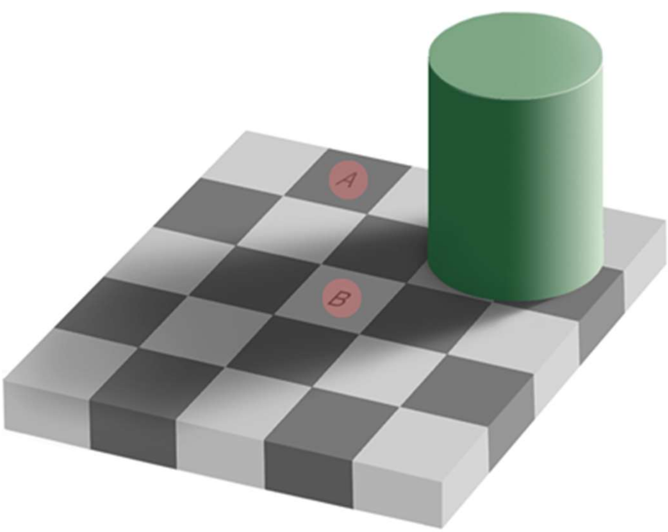
Colors - Part 1

By Alex Woronow

Before I first started researching color, I thought it was a simple topic: Light carries the information about colors in its wavelengths; some of which we humans can see and some of which lies beyond our visual range. That's almost correct, but at such an elementary level that it contains very little in the way of intellectual satisfaction--we (or I) can do better!

Over the next several months, a series of short articles on color will cover a range of topics relevant, largely, to astronomy. Astronomy, of course, is a derivative science, founded upon Physics, Chemistry, Mathematics and Biology. All these fields converge in the study of color, but this series of articles largely will deal with the physics aspects--with scant mathematics and even less chemistry.

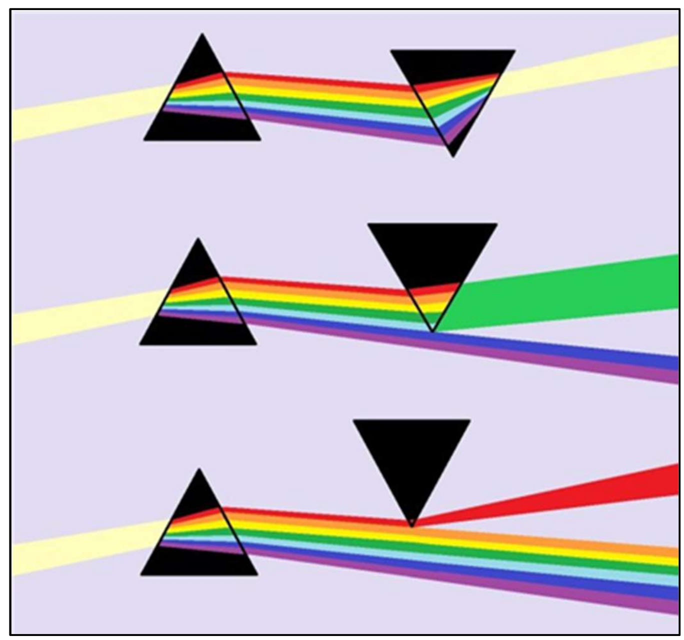
One more thing...being biological critters, I will briefly touch on how our eyes interact with light to perceive colors, hues, tones, luminance, lightness, shades, etc., and what those terms mean. Just as a tease on this topic of physiology, and very relevant to image processing, in the picture below of the checkered shadow illusion, the two squares labeled A and B have exactly the same shade of gray, and the pink circles (they are not eclipses) also share exactly the same shade of pink. Download the picture into an image processing program and use the eyedropper to verify this, if you wish. This illusion exploits our automatic "Color Consistency"--perception adjustments that work to keep colors looking the same in shadow and light, here fooled into failing.



A Brief History

Theories of color, their origins, causes, and perception date back to Early Greece. Aristotle's work, On Colors, (c.300BC) suggested colors were sent from the gods as celestial rays of light and that various colors could be made by mixing black and white. This led to the suggested mixing order shown below:

Aristotle was not the first of the ancients to speculate about color, nor the last. But it was up to Sir Isaac Newton, in his great treatise, Optics, to set the path along a new theory of light and color. The well-known breakthrough occurred when Newton passed a beam of white light through a prism and discovered that the light split into the colors of the rainbow: red, orange, yellow, green, blue, indigo, and violet. Being a scientist of the finest quality, Newton did not simply split white light into its component spectrum, but he showed that the spectrum could be reassembled to a white beam, that reassembling a portion of the spectrum yielded a specific color, and that each component color could not be split further. Here is a representation of his experiments (by Helen Klus):



Newton's work was just a beginning. So much more has been discovered about light and color from the physics of electro-magnetic radiation to the physiology of color perception (and gray-scale perception), to the reproduction of "accurate" colors on substrates and devices.

Still, I have not touched upon the actual origin of light and color. In astronomy we encounter physical origins of color such as black-body radiation and emission from excited atoms of hydrogen, oxygen, nitrogen, sulfur, and so forth. But the world of radiation also includes bioluminescence (think jellyfish), Triboluminescence (hit a piece of the mineral quartz with a hammer or rub two pieces together and it generates a flash of light), Electroluminescence (e.g., LED) and others (see here). Most of the latter light generators are, as for now anyway, not of central interest to astronomers, amateur or otherwise. But the former two certainly are!

Origin of Light

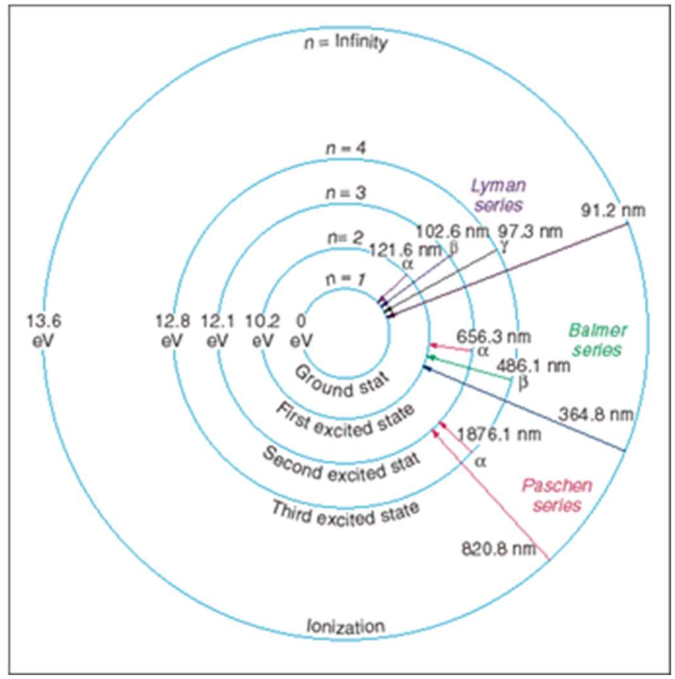
Light arises when a system changes its energy content to a lower value. The "systems" of most interest in astronomy are atoms and molecules. For instance, the electron around a hydrogen atom has a ground state orbital--the lowest energy "orbit" around its nucleus. The electron has a negative charge and the nucleus, proton, has a positive charge. They attract each other. When the electron is in the orbital closest to the nucleus, it is in its "ground state," experiencing the strongest pull from the nucleus. To move the electron to a higher orbital, we must exert energy--which is imparted to the electron. Left to its own devices, that excited electron will eventually decay to, or resume, its ground state. When it does so, it gives back that energy that originally lifted it out of that state. It gives it back in the form of an electromagnetic wave--LIGHT.

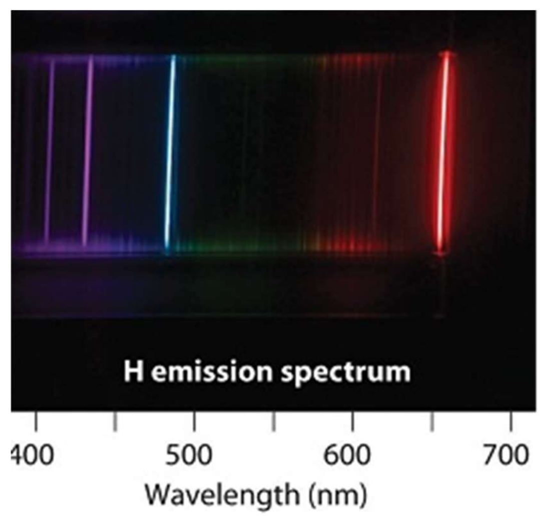
Excitation of the electron to a higher-energy orbital might occur through a collision (say with another hydrogen electron) or by adsorbing a quantum of light. An electron can be excited to a degree that it no longer is bound to its atom and it becomes a free electron. When those electrons fall to a lower state of excitement they radiate away the difference in their before and after energies. The color of that radiated light depends on the energy according to the simple equation

Energy = hv & Wavelength = c/v

where h is Plank's Constant, v (Nu) is the frequency of the emitted light and c is the speed of light. So, as wavelength becomes longer--redder--the energy of the photon decreases.

Let's look briefly at the energies of hydrogen orbitals and where that ever-present Hα emission arises. The diagram of the hydrogen atom's energy states (below) show many of the orbitals (blue) and their energy levels relative to the ground-state orbital. Hα radiation occurs when an electron falls from the second excited state to the first excited state. This transition, downward into the first excited state, is a member of the "Balmer Series." Examples of other series, the "Lyman Series" and "Paschen Series" are also illustrated. In the lower figure, the Hα emission line is at the right--red, as we have come to appreciate.





Narrow-band images collected by amateurs and professionals alike usually utilize Hα, OIII, and SII filters. The Roman numerals after the O (oxygen) and S (sulfur) indicate how many electrons have been completely dissociated from the atoms, leaving behind an ion. Strangely, the convention is that the number of I's is one more than the number of electrons freed which also equals the charge on the ion. Therefore, the OIII ion is missing 2 electrons and has a charge on the remaining ion of -2e.

The atomic structures of elements other than hydrogen are far more complex, with many orbitals and subshells. Subsequently, the available transitions are many! One historic consequence of this complexity arose when OIII was first observed in a planetary nebula in 1927. It was thought to be a new element because the transition that yields this color light from doubly-ionized oxygen is a "forbidden transition" (a quantum-mechanics thing and, obviously, a misnomer). The new element was named Nebulium. OOPS!

Next Discussion

Not totally settled until I actually write it, but I expect to discuss some of the elementary aspects of color stars as black-body radiators, from coolish red stars to very hot blue stars. I leave you with this question, if there are red stars and blue stars, why are there no intermediate-color, green stars? Stay tuned.

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Space Place Article October 2018

Observe the Moon

By Jane Houston Jones and Jessica Stoller-Conrad

This year's International Observe the Moon Night is on Oct. 20. Look for astronomy clubs and science centers in your area inviting you to view the Moon at their star parties that evening!

On Oct. 20, the 11-day-old waxing gibbous Moon will rise in the late afternoon and set before dawn. Sunlight will reveal most of the lunar surface and the Moon will be visible all night long. You can observe the Moon's features whether you're observing with the unaided eye, through binoculars or through a telescope.

Here are a few of the Moon's features you might spot on the evening of October 20:

Sinus Iridum—Latin for "Bay of Rainbows"—is the little half circle visible on the western side of the Moon near the lunar terminator—the line between light and dark. Another feature, the Jura Mountains, ring the Moon's western edge. You can see them catch the morning Sun.

Just south of the Sinus Iridum you can see a large, flat plain called the Mare Imbrium. This feature is called a mare—Latin for "sea"—because early astronomers mistook it for a sea on Moon's surface. Because the Moon will be approaching full, the large craters Copernicus and Tycho will also take center stage.

Copernicus is 58 miles (93 kilometers) across. Although its impact crater rays—seen as lines leading out from the crater—will be much more visible at Full Moon, you will still be able to see them on October 20. Tycho, on the other hand, lies in a field of craters near the southern edge of the visible surface of the Moon. At 53 miles (85 kilometers) across, it's a little smaller than Copernicus. However, its massive ray system spans more than 932 miles (1500 kilometers)!

And if you're very observant on the 20th, you'll be able to check off all six of the Apollo lunar landing site locations, too!

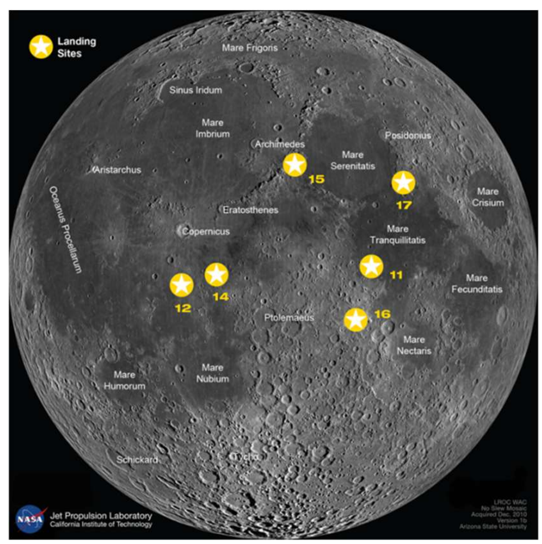
In addition to the Moon, we'll be able to observe two meteor showers this month: the Orionids and the Southern Taurids. Although both will have low rates of meteors, they'll be visible in the same part of the sky.

The Orionids peak on Oct. 21, but they are active from Oct. 16 to Oct. 30. Start looking at about 10 p.m. and you can continue to look until 5 a.m. With the bright moonlight you may see only five to 10 swift and faint Orionids per hour.

If you see a slow, bright meteor, that's from the Taurid meteor shower. The Taurids radiate from the nearby constellation Taurus, the Bull. Taurids are active from Sept. 10 through Nov. 20, so you may see both a slow Taurid and a fast Orionid piercing your sky this month. You'll be lucky to see five Taurids per hour on the peak night of Oct. 10.

You can also still catch the great lineup of bright planets in October, with Jupiter, Saturn and Mars lining up with the Moon again this month. And early birds can even catch Venus just before dawn!

You can find out more about International Observe the Moon Night at https://moon.nasa.gov/observe.



Caption: This image shows some of the features you might see if you closely observe the Moon. The stars represent the six Apollo landing sites on the Moon. Credit: NASA/GSFC/Arizona State University (modified by NASA/JPL-Caltech)

Pictures from HAC Members

Mars by David Roemer

NGC 7662 Blue Snowball by David Roemer

Comet 64P Swift Gehrels by David Roemer

IC1396A Elephant's Trunk Nebula by Richard Pattie

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HAC Oct - Nov Calendar of Events

SU	MO	TU	WE	TH	FR	SA
30	1 Oct	2 7:37 PM	3	4	5	6 **Member Star Party**
7	8 8:47 PM Draconid Meteors	9 Draconid Meteors	10	11 **Patterson Public Night 6:30 PM**	12 **HAC Meeting Student Union**	13 **Kartchner Star Party noon to 9 PM**
14	15	16 11:02 AM	17 **Veritas School at Patterson**	18	19	20 **Dine Under the Stars @ Patterson Obs** Orionid meteors
21 Orionid meteors	22 Orionid meteors	23 **Ft. Huachuca Home school grp @ P.O.** Uranus Opposition	24 9:45 AM	25	26	27
28	29 Challenge II Group at Patterson 6 PM	30	31 9:40 AM	1 Nov	2	3 Member Star party
4	5 **Seth Shostak talk: Student Union 7 PM**	6 	7 9:02 AM	8	9 **HAC Meeting Student Union**	10
11 	12	13	14	15 7:54 AM **Patterson Public Night 6 PM**	16 Leonid Meteors	17 Leonid Meteors
18 Leonid Meteors	19	20	21	22 	23 10:39 PM (Thursday)	24
25	26	27	28	29 5:19 PM	30	

All event times MST. Join Haclist to keep up to date with all of the Huachuca Astronomy Club events
Send an email to: haclist-subscribe@yahoogroups.com