



# PAStimes

Phoenix Astronomical Society

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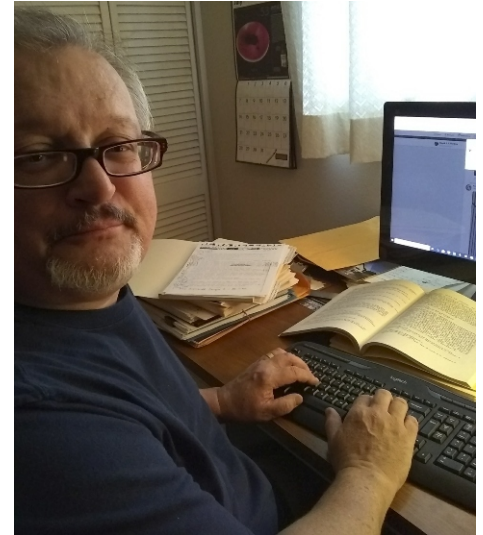
## David Portree to Speak at Oct 3 PAS Meeting

**AFTER TRANQUILITY:** NASA SEEKS A FUTURE AFTER APOLLO 11: The Apollo Program created a \$25-billion space infrastructure with enormous promise. In December 1972, however, American astronauts left the Moon for the last time. Historian David S. F. Portree, formerly with NASA and USGS and now a member of the Lunar Reconnaissance Orbiter team at ASU-Tempe, describes 1960s plans for our future in space and discusses why, after half a century, the promise of Apollo remains unfulfilled.

Mr. David S. F. Portree writes about space missions and projects that did not happen – that is, the great majority of them – on his blog *Spaceflight History* (<http://spaceflighthistory.blogspot.com/>). His books and book-length monographs, all

published by NASA and available free on-line, include *Mir Hardware Heritage* (1995), *Walking to Olympus: An EVA Chronology* (1997), *NASA's Origins and the Dawn of the Space Age* (1998), and *Humans to Mars: Fifty Years of Mission Planning, 1950-2000* (2001). Mr. Portree was an Outreach Educator at Lowell Observatory from 2001 to 2007 and the lunar and planetary Map Librarian, Archivist, and Outreach Educator at the U.S. Geological Survey's Astrogeology Science Center from 2007 to 2017. He is currently (until 1 October) the Science Writer at the Lunar Reconnaissance Orbiter Camera Science Operations Center at ASU in Tempe and is writing his first book in 20 years.

Please See "Oct 3 PAS Meeting" on page 6 for more info about this meeting.



David Portree – the PAS October Guest Speaker. Photo provided by David Portree.

## September 5 PAS Meeting

By Terri, Event Manager

The PAS Meeting of September was nearly a full house in attendance. Patrick Smith was our Guest Speaker for the evening. President Mike opened the meeting at 7:32pm, and at 7:40pm, Patrick began his presentation. Everyone was interested in Patrick's presentation about Citizen Science Projects, especially the one he was talking about the most. He had some great examples, photos, fun things to share, and it was a very informative and enjoyable presentation.

I wish to thank the many attendees who brought snack items. The bottled water was donated/provided by President Mike Marron. Many snacks such as popcorn, cookies, donuts, and more were provided by the various attendees. Thank you all. Snacking is fun, but it is always more fun when many

attendees provide snacks so that there is a variety.

After the guest speaker stopped for a break around 8:19pm, everyone took a 10 minute break and some of the audience departed. Then, Mike took over and did some announcements and we held the raffle which was won by Bruce, and a few other things before turning it back over to the Guest Speaker. Patrick continued with some examples and more info for another half hour, and then Mike took the floor and made more announcements. The meeting closed at about 9:50pm.

Many thanks to Patrick and all he shared with the attendees. Many thanks to everyone who attended, and I do hope to see you all at the October Meeting!!!



Patrick Smith providing a super interesting and fun topic at the September 5th PAS Meeting. Photo by Don Boyd.

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## PAS Upcoming Events for October

By Terri Finch, Event Manager

Check out these and other fun events on the PAS Calendar:

<http://www.pasaz.org/forums/calendar.php>. RSVP where requested to [Events@pasaz.org](mailto:Events@pasaz.org). On the PAS Calendar, "Private" means the event is for PAS members only. If you wish to become a PAS member and attend the private events, please download a membership form here: <http://www.pasaz.org/forums/downloads.php?do=file&id=129>

**Oct 3:** PAS Meeting at PVCC Main Campus in LS-203 at 7pm. More details: <http://www.pasaz.org/forums/calendar.php?do=getinfo&c=2967&day=2019-10-3&c=1>

**Oct 5:** International Observe the Moon

Night Public Star Party at Roadrunner Park in Phoenix. More details on bottom of Page 4 and at this link:

<http://www.pasaz.org/forums/calendar.php?do=getinfo&c=3008&day=2019-10-5>

**Oct 11 & Oct 12:** Star Party at Japanese Friendship Garden. There is admission to get in, but PAS will be providing telescopes to view the Moon, Jupiter and Saturn. More details:

<http://www.pasaz.org/forums/calendar.php?do=getinfo&c=3008&day=2019-10-5>

**Oct 17:** FREE Telescope Workshop at PVCC Main Campus 7pm to 9:30pm in G-147. Bring your telescope and accessories. This is an indoor/outdoor event (weather permitting) and RSVP is required with Terri. No public RSVP's could cancel

this event. More details are here: <http://www.pasaz.org/forums/calendar.php?do=getinfo&c=2981&day=2019-10-17&c=1>

**Oct 24:** Huge Public Star Party at Black Mountain Campus of PVCC from 5:30pm to 9:30pm. More details: <http://www.pasaz.org/forums/calendar.php?do=getinfo&c=2989&day=2019-10-24&c=1>

At the time of completion of this issue of the newsletter, several more events were in the planning stages and could not be listed as "Scheduled" until they are definitely happening. Please see our online calendar for the events that didn't make it into this list: the link is at the top of this article.

## Meeting of the Minds Aug 25

By Terri, Event Manager

The day started with an enjoyable lunch at 11:30am at Sesame Inn attended by 6 PAS Members and 1 Guest. Then, a few of the PAS Members went to the Star Barn to enjoy a new planetarium show.

At 2:30pm, PAS held a Business Meeting in Carefree at President Mike's home. The meeting was 2.5 hours long and many topics were discussed. There were 14 PAS Members who attended this meeting. Many thanks to the 2 members who brought ice cream. Near the end of the meeting, the house was becoming rather hot, and so the ice cream was appreciated. I also wish to thank those who brought drinks and snacks to share.

As the meeting concluded, the next

PAS Meeting of the Minds was set for a time in October. If you want to know the workings of the club and be involved in the planning and future of PAS, you might wish to attend the next Meeting of the Minds (MOM's) - PAS Members only.



*At the end of the Meeting of the Minds, the Sunset drew several of the attendees outdoors to enjoy it. Mike's very tall, and falling Yucca plant was leaning over the sunset. The shadows of the heads are Steve Palmer, William Finch and Mike Marron who were outside with me as I took this photo. Photo by Terri Finch.*

# Star Party at Fountain Hills June 6 & 7

By Mark Johnston

On June 6th, Ted Blank and I, and another astronomer did a public star party in Fountain Hills at Fountain Park last night. Had about 30 people and showed the waxing Moon, Jupiter, M13, Icar, Tau Lyra (carbon star), and the Ring Nebula.

**Ted** adds: Mark and my friend Scott were in Fountain Park last night showing objects to the public. It was a great event!

By Ted Blank, PAS Member

June 7th was another beautiful night for outreach at the Fountain Hills Park showing the public the moon and Jupiter through my telescope!



*This fantastic image of the Moon was taken through Ted's telescope at the Fountain Hills star party, by Ted.*



*Ted with his scope and the beautiful Moon in the background at the June 6 Fountain Hills star party. Photo taken by Ted Blank.*



*Ted provides this photo of his telescope setup with a gentleman through his 6" refractor at the June 7 2019 star party at Fountain Hills*



*At the Fountain Hills Public Star Party on June 6 2019, Mark Johnston is seen with his telescope & Ted Blank provides a telescope for an awesome event. Photo by Mark.*

## What's Up For October?

By Don K. Boyd, PAStimes Editor

| Name           | Date            | Rise         | Set          |
|----------------|-----------------|--------------|--------------|
| <b>Mercury</b> | <b>10-15-19</b> | <b>07:35</b> | <b>18:53</b> |
| <b>Venus</b>   | <b>10-15-19</b> | <b>07:55</b> | <b>18:42</b> |
| Mars           | 10-15-19        | 05:25        | 17:18        |
| <b>Jupiter</b> | <b>10-15-19</b> | <b>11:13</b> | <b>21:08</b> |
| <b>Saturn</b>  | <b>10-15-19</b> | <b>12:56</b> | <b>22:53</b> |
| <b>Uranus</b>  | <b>10-15-19</b> | <b>18:26</b> | <b>07:42</b> |
| <b>Neptune</b> | <b>10-15-19</b> | <b>16:17</b> | <b>03:51</b> |
| <b>Pluto</b>   | <b>10-15-19</b> | <b>13:23</b> | <b>23:21</b> |

All Times Arizona Time

Bold means the object is "visible" in the evening

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## October 15, 2019

**Sunrise: 6:33**

**Sunset: 15:55**



**Q1: October 5**



**Full: October 11**



**Q3: October 21**



**New: October 27**

# Mercury Transit on Nov 11

By Mike Marron, President of PAS

Even though the spectrographic method of finding planets has failed so far, it has the greatest potential of finding all the properties and parameters of stellar systems. Practice with the upcoming Mercury transit. The simplest way is masked spectroscopy that follows Mercury during the transit. This will give an absorption spectrum of Mercury's thin atmosphere and the dust contained within.

Every non-stellar object orbiting a star has passing stellar winds that get focused into compact, well organized magnetotails that contains mineral contaminants of the planets, moons, asteroids or comets that have no protective atmospheres of their own. While atmosphere objects such as the Earth have gassy magnetotails sampled from both the north and south auroral ovals, our high atmospheric dust is also sampled. For instance our magnetotail has a strong sodium signature from the dissociation of salt dust. Even iron and nickel show up in the geomagnetic tail from meteor showers in the polar regions. During lunar eclipses the powerful geomagnetic tail sweeps across the face of the Moon blasting dust into the lunar magnetotail. Observing background stars for the foreground absorption lines of the geomagnetic tail and lunar magnetotail is easier than direct observations during lunar eclipses and can be done during the peak of full moon when this event occurs. From the vantage point of other stars our plasma tail should reveal seasons, polar weather and many more very detailed properties. The gas magnetotails of comets close to the Sun are bright, easily studied and can serve as foundational understanding for all bipolar magnetotails.

A slit spectrogram set up along the trajectory of the transit would show before

first contact a clean solar spectrum, at first contact the absorption lines of Mercury's leading edge would appear. By second contact Mercury is fully backlit by the limb darkened photosphere but after this Mercury's backlit magnetotail appears. Just like a comet the neutral molecular signatures are first seen after second contact, but solar wind disassociation breaks the molecular bonds and the ionic species separate by charge into the north and south string polarities of the magnetotail. Hopefully both string polarities are not visually overlapping during the transit but that depends a lot on the magnetic orientation of Mercury's local solar wind. Magnetotails are faster than the solar wind that created them so look to the blue side of the normal emission spectral wing for each of the magnetotails dark absorption lines. Continue the study of Mercury's magnetotail and ionic disassociations for as long as possible after fourth contact. The plasma tail will slowly drift away from alignment with the solar disk but having a baseline this information can be applied to other stellar spectrums to best measure transits and trailing plasma magnetotails.

The best way to record the transit of Mercury is scanning spectroscopy of the entire photosphere and chromosphere. The polar magnetic flux tubes of Jupiter's moons carry material eroded from each moon into a footprint in both of Jupiter's north and south auroral ovals. You can follow the orbits of each moon around Jupiter by the spectrographic signatures of specific chemicals dumped at each footprint within Jupiter's auroral ovals by each moon's magnetic flux tube. Jupiter is a failed star and plasmas in the vacuum of space often pass through each other so it stands to reason each of the major planets

have flux tubes that connect our auroral ovals to the Sun's circumpolar magnetic rings. Like the magnetotails the flux tubes would carry the eroded ions, but they would rain down onto the Sun's photosphere near polar regions and in the final moments have a receding or be in the red wing of standard spectral emissions as the atoms plunge into the Sun. Scanning the Sun during the transit should show how far behind our visual solar longitude (already 8 1/3 minutes behind due to c) and which latitude Earth's magnetic flux tube footprint falls on the Sun. The absorption lines of Mercury's flux tubes can be tracked before the transit while the final fiery emissions reveal the latitude of the Sun's circumpolar magnetic ring at the photosphere. If we are lucky other planetary flux tubes will be on our visual side but you don't have to wait for a transit to begin to study this. I just want to point out that spectrographically transits are not needed, for if the stellar equator is not visible, look for clues around the stellar poles. A major difference is that we are seeing only one sweep of the magnetotail before it passes the Earth.

Precession and inclinations of planetary orbits can make the transit of jets widely separated in time around stars but once a magnetotail transits our line of sight it tends to stay in our line of sight as it recedes from the star. The effect is widely separated layers of plasma clouds recording the times previous transits had occurred, that because of slight velocity differences show as a series of closely packed faint dark lines.

Please Join PAS at Pinnacle Peak Park for this exciting chance to see the Mercury Transit of Nov 11th. More details: <http://www.pasaz.org/forums/calendar.php?do=getinfo&e=3009&day=2019-11-11&c=1>

## International Observe the Moon Night Oct 5

By Terri Finch, Event Manager

Come join PAS on the evening of October 5, 2019 at Roadrunner Park in Phoenix to view not only the awesome first Quarter Moon, but also Jupiter and Sat-

urn!!! This is a world wide event! It is free and open to the public. Everyone is welcome. We will be set up from 7pm to 9:30pm. Bring the whole family. More details can be found at this link:

<http://www.pasaz.org/forums/calendar.php?do=getinfo&e=3008&day=2019-10-5&c=1> Look for the RED lit telescopes and table. We hope to see you there!

## 'Starscapes' at the North Mountain Visitors Center

October 26 & 27th, 2019

PAS member Nancy Anacker will be displaying/selling her art work 'Starscapes' at the North Mountain Visitors Center Sat-

urday **October 26** and Sunday **October 27** from 8am to 3pm. The address is 12950 N. 7th Street (So. of Thunderbird Rd. on the West side of 7th St.). Nancy's art is in the

show put on by the Northeast Valley Art League (NEVAL), in which she is a member. This is not a PAS event but everyone is welcome to attend for free.

# Seeing the Stars Through my PAS Membership

By Diane Hakala, PAS Member

Thanks so much Terri Finch! I have received so much help from PAS that I am happy to continue as a member of PAS into 2020 and beyond.

Because of you folks, I've fulfilled a childhood passion to finally see the stars through my own scope. I've tried many times, over many years in the past, and have not had much success. I ended up with scopes, and no skills.

I remember the day that you and I arranged for me to bring my Meade 10" SCT to the PAS Telescope workshop at Bookmans. I couldn't focus the scope at all – not even a little. I met Bruce Wurst there, and he diagnosed it in a trice. What a relief to learn that it was a cheap diagonal that had warped. I can still picture Bruce turning up his nose when he first looked at the diagonal. Who knew?

Bruce then came up to my place twice: the first time to show me what I needed; the second to confirm that I had destroyed the corrector when I dropped it the night before.

But sadness only lasted a few more minutes. Surprise, surprise! What did Bruce have in his trunk but an updated version of the same scope! He came back and helped me install the parts. I've been using it ever since. I've even dragged it to Independence Pass, Colorado (12,000 ft), though without much success. The good news is that we got it all put away before the rain.

I've also become very interested in Electronically Assisted Astronomy (EAA), thanks to Ray Adams showing me the Revolution Imager 2 (RI2) at one of the PAS star parties - yet another assist from PAS.

Unlike full-fledged Astrophotography (AP), you can take short exposure videos that can be stacked before your eyes (LiveStack) using SharpCap (\$15 for a year's subscription). Once I figured out how to use the camera – which always takes me 2-3 sessions – I was seeing things like the pics I provided below, which are a pic of exactly what was on the screen at the time. The coyotes have been very patient with me giggling and dancing with every new discovery.

The RI2 saved me from a burgeoning case of aperture fever; I'd called Teeter. But EAA has turned the tide. I've added a ZWO ASI224 and ZWO ASI294 to my arsenal.

The pics of Jupiter and Saturn are my

first attempt with the 224. The planets aren't 'technically' EAA, because they require a bit of post-processing in Autostakkert! and Registax. These were taken without Darks, Flats or any Photo-shop-type programs. There are online videos that show you what to do, and it only takes about 10 minutes, once you figure out how to use the programs.

Another acquisition has been APM 152 ED refractor (a doublet). It's just one of those things I'd always wanted, especially for the (solar system) planets. But what to put it on? I stared at dozens of reviews of various mounts on Cloudy Nights and elsewhere for months. Then, I saw Mark Johnston's mount, a TTS-160 at his NV presentation - a heavy duty Alt/Az that works just fine for EAA, and is light enough for me to set up alone.

By the way, I am done buying scopes. Very happy with what I have now.

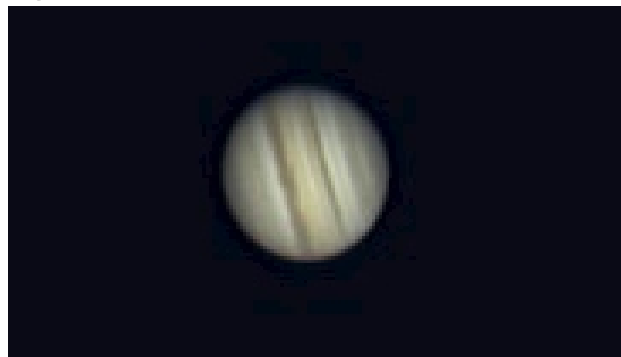
Speaking of Mark Johnston, he generously gave me an evening showing me how to run the mount using my phone with Sky-Fi and SkySafari, not to mention answering a bunch of questions via email.

And of course, there's Sam Insana, who always seems to offer a tidbit here and there, when you least expect it. From him, I've learned what a 'bortle' is, and how to use binoculars to enjoy some DSOs. I have acquired a pair 10x52 binoculars as a result, and am learning how to use them.

I'm also really impressed with how nice and ego-less everyone is at PAS, and so willing to answer my myriad of questions.

As ever Terri, thanks for all you do to keep the club going administratively – it's obviously a lot of work – and I'm so grateful that you are willing to do it. Have a fab week!

Diane – who is Still a Newbie, but Having Fun!



*Jupiter*



*M8 Lagoon Nebula*



*M51 Whirlpool Galaxy*



*These 4 photos are provided by Diane Hakala.  
This photo is of Saturn.*

# My Visit to Griffith and Palomar Observatories

By Mark Johnston, PAS Member

I spent the weekend in the LA area and visited both Griffith and Palomar observatories. While the Griffith is very much an outreach facility, they are doing serious research at Palomar.

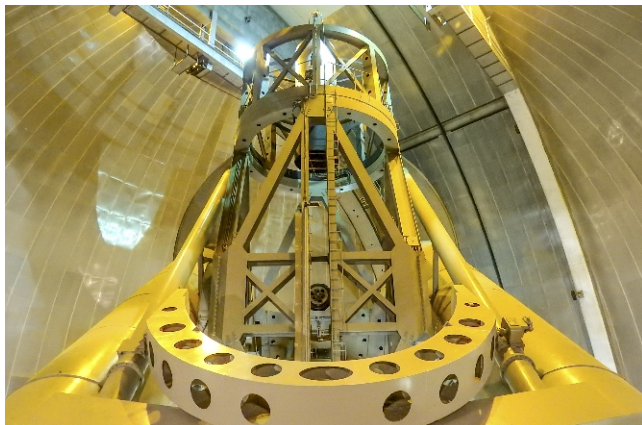
On August 5th, 2017, I had the opportunity to visit Mt. Palomar and tour the 200" Hale Telescope. It was about a 2 hour drive from LA, with the last 45 minutes a beautiful winding road up the mountain to the observatory. Tours of 30 people or less are conducted Saturday and Sunday only at 11 and 1:30. We were up there early to sign in when the gift shop opened at 10:15 and the tour filled up quickly. It was only \$5 which was less than the cost of gas to get there!

The scope saw first light in 1949 and remains the largest telescope in the world with a single solid mirror on an equatorial mount. It has been instrumental in under-

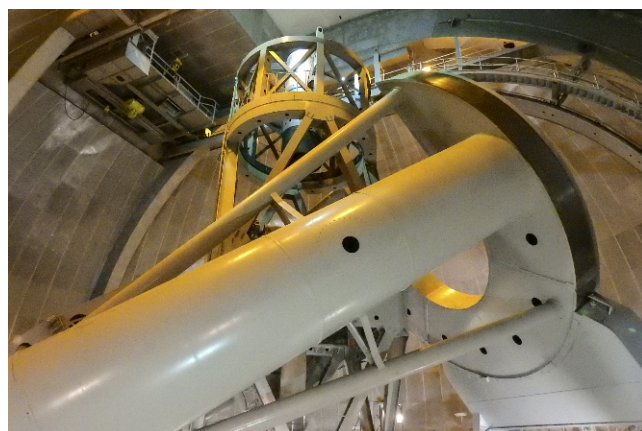
standing the expansion of the universe, dark matter and energy and many other major astronomical discoveries. It is so well balanced it only takes 4 HP motors to turn! I was surprised to learn it uses adaptive optics. I had thought AO required multiple small deformable mirrors, and so wouldn't be retrofittable on a big single cast mirror. But they solved the problem by taking the light from the primary focus and putting it through another set of deformable mirrors and can now achieve resolution close to 0.1 arcseconds.

It is used about 300 nights a year, and the mirror is recoated every 2 years.

That night they were planning to observe active galactic nuclei (super massive black holes). They are also one of the primary scopes for learning more about exoplanets discovered by Kepler. They have the capability of analyzing the spectra of exoplanet atmospheres which impressed me. The visitor center is small but interesting



*The Hale Telescope at Mt Palomar which is a 2 hour drive from L.A. Photos taken by Mark Johnston on Aug 5 2017.*



*200" Hale Telescope*

with a modest gift shop. There is no food on the mountain aside from a vegetarian restaurant, so plan accordingly.

If you find yourself with a free weekend morning in the LA area and can get there early, it's worth the trip!



*Mt Palomar and the dome of the 200" Hale Telescope.*

## October 3 PAS Meeting

By Terri, Event Manager

The October PAS Meeting doors will open at 7pm and there will be 30 minutes of socializing, snacking and setting up for the Guest Speaker. Please bring a snack to share and a friend to the meeting. This meeting is for everyone of all ages. We would love to see you there! Bottled water will be provided by the Snack Fund collected at the previous meeting. So, if you can, donate to next month's snacks and case of bottled water. More details about this meet-

ing are at this link: <http://www.pasaz.org/forums/calendar.php?do=getinfo&e=2967&day=2019-10-3&c=1>

A quick reminder... if you haven't already renewed your membership for 2020, please do so at this meeting (I will bring membership forms) or grab a membership form from this link: <http://www.pasaz.org/forums/downloads.php?do=file&id=129> and bring it with you

to the meeting, or mail it in with your check made out to Phoenix Astronomical Society. The mailing address is on the form. I wish to take a moment to thank everyone who has updated their membership with PAS over the last month.

Looking forward to seeing you at this meeting. If you have a name badge to pick up from me, I will plan to bring them to this meeting. See you there!

## Space Exploration Lecture July 8

By Mark Johnston

Last night I gave a one hour Power-

Point presentation at the Gilbert Public Library entitled, "Space Exploration, Past and

Future". About 50 people attended and I had some good Q&A at the end.

# Tips from the Telescope Nerd:

## "Putting More Arizona in Your Star Photography"

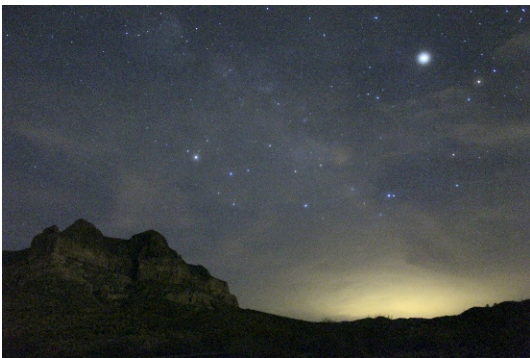
By Will Kalif, PAS Member

The Arizona landscape is famous. There is of course, the Grand Canyon, but there is also countless square miles of desert, interesting rock formations, cacti, wildlife, plant life, and so much more. All of which gives the state a very unique look.

And we as amateur astronomers benefit from another thing that Arizona offers us: amazing night skies. The sky above our state is among the best in the country.

This dark and dry sky enables us to reach further out with our telescopes and get lots of terrific views of deep space objects; and to also take lots of amazing pictures.

But, since we also have the amazing Arizona landscape, I say it is okay to once in a while step back from deep space and just get some larger scene pictures that also include the character of Arizona. This picture of Jupiter and Saturn over Picket Post Mountain is a good example of the Arizona landscape paired nicely with the Arizona sky.



*Jupiter, Saturn, and Sagittarius over Picket Post Mountain*

And you can easily take this type of photography to another level with a technique called "Light Painting". This is where you take a long exposure of the night sky that also includes some landscape and during the exposure, while the camera shutter is open, you use a flashlight to briefly illuminate an object on the ground. In effect you are painting light onto the foreground object. It takes just a little bit of experimentation to get it just right but it is worth the effort.

In this next picture I took a thirty second exposure and during that time I used a flashlight to briefly and quickly light paint the three cacti.



*Three light-painted cacti under the Arizona night sky*

The effect of light painting can be quite profound. It often gives a picture a bit of an ethereal feel. How long have these three cacti stood here, day and night, in the desert, slowly reaching toward the stars?

As residents of Arizona we tend to take the landscape for granted, mostly because we have such magnificent night skies. But it's a treat, particularly to people that live elsewhere in the country, to sometimes see a little bit of the Arizona landscape in night

sky photography. And light painting is a great way to add a special touch to a night sky/landscape photo.

Will Kalif currently resides in Phoenix, is an amateur astronomer and the author of "See it With a Small Telescope". You can learn more about him and his book on his website at [TelescopeNerd.com](http://TelescopeNerd.com). His book is available on Amazon.com here: <https://www.amazon.com/dp/1612437567>

# Desert Botanical Garden Luminaria

## December 2018

By Various Attendees of this event - Review 4 of 6

Part 1 of this review can be found in the February 2019 Newsletter issue on pages 2 & 3, Part 2 is in the March issue on page 4, and Part 3 is in the April issue on page 4. The review continues....

Las Noches de las Luminarias of December 2018 at the Desert Botanical Garden (DBG) had the PAS telescope team of four Telescopes and one presenter each clear night, with variations on cloudy nights that consisted of these wonderful Lumi Team members: Pete Turner, Mark Johnston, Rick Cunningham, Roger Anzini, Ted Blank, Mike Marron, Bruce Wurst, Don Boyd, Sam Insana, Storm Moon, William Finch, Terri Finch with additional help from Vera Stiesmeyer, Ofelia Waters and Jake Von Ruhr.

**Terri** writes: **Dec 12** Wednesday was clear skies. PAS provided 4 telescopes and a presenter at DBG and it was a super successful evening. Mark showed a ton of great things to the patrons: Moon wide field, Moon Plate close up on the crater Plato, Mars, Uranus, Gamma Andromeda (double), Eta Cass (double), Rigel (double), NGC 2169 (XY cluster), Hinds Crimson Star (carbon star in Orion) and Mark adds: Didn't try to count people but would guess over 200 hundred.

I, Terri, started on the Moon, as she

(the Moon) was a super pretty crescent. As it got darker, I saw Saturn and showed it for about 30 minutes before it set behind the top of the Butterfly Pavilion building, then I went back to the Moon. It was nice on this evening to have Mark show the crater Plato up close in his refractor

while I shared an image of the whole Moon so that the patrons could see the Terminator Line from top to bottom and find Plato in my scope. Mark was set up next to me at the Water Tower Overlook. I heard some people requesting to see Orion Nebula, so I moved to Orion for the rest of the evening.

In the notes, Storm, who was the Runner for the night, sent in the group phone text, she noted that at the time I was on the Full Moon, Mark was on Plato, Bruce was

on Andromeda Galaxy and Don was showing Pleiades. We also saw the International Space Station fly over head. And due to the twinkle lights being out (not on) on the trees in the Wildflower Garden, Bruce had a super gorgeous image of the Andromeda Galaxy; the best yet at that



*December 2nd Water Tower Overlook set up with Terri Finch in the background on the left and Storm Moon setting up her scope in the foreground on the right.*

*Photo by William Finch.*

location during this event.

Mark told this joke several times this night: Why don't we see any aliens visiting Earth? It is because they looked at the reviews and saw the Earth has only one Star.

**Dec 13** was clear skies again, so we had 4 telescopes and 1 presenter. I showed the Moon for about half an hour until Saturn was visible for a scant 10 minutes, then I went back to the Moon until the Orion Nebula became visible. Rick set up next to me and he showed a close up of a crater on the Moon, and I showed the whole Moon, and we had a bunch of people saying they had never seen the Moon like this before. Bruce was set up down the Wildflower Garden path and had the Andromeda Galaxy in view, and Pete who was set up further down the path, showed a few different objects during the evening. This is the first night the group text between us worked very well. Plus, it was very cold this night. It is the first night, in my 3 layer dip (that's 3 layers on top and 3 layers of clothing on the bottom) that I needed to put on my jacket. All nights previous to this one, I was able to be in just my 3 layer dip, a scarf or two, no hat, and not have my jacket on at all.

**Dec 14**, Friday was to be cloudy with high thin clouds which means we can probably see the Moon and Mars and some double stars through the clouds. So, after a



*Roger & Storm at the Lumi Event, setting up about 5:15pm looking for the Moon to show to the attendees of this evening's event. The crowd comes in to the telescopes at 5:30pm. Photo by Terri Finch.*

bunch of discussion with the telescope team, it was decided to provide DBG with 3 telescopes and 2 presenters.

**Dec 15**, Saturday was partly cloudy, but not enough to mess up the evening. We showed many great objects, had a great time, the event was sold out (DBG limits patron sales to 2400 in attendance when the event is Sold Out) and it was a constant flow of patrons keeping us super busy and having a great time. Traveller, the band we could hear from our location was doing a wonderful job with their music! We could also hear Yellow Bird (the Native American flute player and storyteller), now and then, from where we were set up. When both played at the same time, that is really something interesting to hear as we are in the middle of the two performers during all of December.

**Dec 16**, Sunday we had the help of Jake as an additional runner and it was much nicer for the runners not to have to be at a scope all night long. We had some cloudiness in the beginning of the event, and then the sky cleared. Then, right at the end of the event, in came a bunch of clouds taking away Orion Nebula, the Moon and the E.T. Cluster. Many thanks to Jake for helping out on this night.

**Dec 17**, Monday we went down to DBG (with 4 telescopes and 1 presenter) with a forecast of clouds when we started, then clear for about 3 hours and then clouds at the end of the event. Instead, what we experienced was a weather situation between overcast and mostly cloudy, plus rain, and a sprinkle, that continued for about 1.5 hours. This was enough to get everyone at DBG scrambling for umbrellas and canopies. I would say that about 150 people came to my scope and saw the Moon. And about 6 people saw Orion Neb-

ula. I only got to show Orion Nebula for about 12 minutes and then it was lost to the clouds for the rest of the night.

Due to not being able to show many objects with the clouds, I found it easier to enjoy a nice conversation with the attendees of this night's event. It was a more relaxed evening for the telescope team.

**Sam** writes: Monday night, Dec 17th, it started drizzling at DBG Lumis. I put my meteorites away and grabbed my umbrella and started singing and dancing "Singing in the Rain". I did about 10 choruses, and about 50 people walked by smiling, laughing, and one woman hugged me and another kissed my cheek, when I got to the part singing, "the sun fills my heart and I'm ready for love". Finally DBG provided me a 10 x 10 foot canopy to cover my meteorites. They did that so I would get my meteorites back on display and probably to stop my singing!!!

**Dec 18**, Tuesday **Terri** writes: PAS provided 4 telescopes and one presenter. Storm and Terri took the night off.

**Mark** writes: Had a good night at Lumi tonight. A lot of 'gasps' when people



*Vera Steismeyer & Sam Insana share meteorites at the December 10th Luminaria night at DBG. Photo provided by Sam.*



*Mike Marron sharing his meteorites with visitors at this evening's event. What a great way to spend New Years Eve, than viewing through telescopes and learning about meteorites. Photo by Terri.*

saw the Moon at high power along the terminator. I also showed Mars, Uranus, NGC 2169, M 42 and Castor. It was a very good night to be at DBG.

To be continued in the next 2 newsletter issues (Nov & Dec of 2019) ....

## Tonto National Monument Star Party April 27

By Mark Johnston

On Saturday, Mike Cawley and I supported the Tonto National Monument Star Party. They were excited to be on the brink of being designated an International Dark Sky Park. I measured an SQM of 21.7 (PVCC BMC campus is 19.4 by comparison). There were about 60 guests. Ranger Crista gave a 30 minute presentation on black holes, and then we showed objects in the sky with our telescopes.

There were some high clouds but they

did not hamper viewing too much. We showed Castor, the Stargate Cluster, M37, M35, the Eskimo Nebula, Markarian's Chain (7 galaxies visible in the field), M87 (the location of the black hole discussed in the talk), Mizar, Sombrero Galaxy, M13, M81 and M82. After the guests left we put Mark's night vision on Mike's 11" SCT and had a beautiful view of M51 with spiral arms clearly visible. The rangers really appreciated our support, and we look forward to supporting future events.



*Mark Johnston set up his scope at Tonto National Monument on Apr 27 2019. Photo provided by Mark.*

# Hidden Hills Star Party March 23, 2018

By Terri, Roger, and Rick

**Roger** writes: Several months before Our Hidden Hills event took place I suggested to Mrs. Rea, my daughter's 5th grade science teacher, that she might want to consider a telescope stargazing event with PAS. It took no more than 10 seconds for Mrs. Rea to become excited about the prospect of a star show for her students. Plans were set forth with the approval of the school office and a date of February 23rd was selected. The event was mainly to be a study of the constellation of Orion and the Great Nebula. I also offered to do an afternoon presentation for her class as a preview of what would be seen during the evening viewing session.

The week of February 23rd came with cloudy, dark skies and cold winds, so a decision was made to postpone the event for a month. The new date, Friday evening March 23rd, had a sad forecast of pending rain or at least cloudy skies. Friday morning March 23 dawned to a valley wide layer of overcast that slowly gave way to the surprise of clearing skies. A vision of new hope quickly gained traction as the Sun broke through the morning gloom. Suddenly, at speeds beyond super luminal the texts began to fly between Terri, Mrs. Rea and myself. The texts began at "well whad-dya think" then "yea maybe " then "Mrs. Rea texts... GO?, Terri texts....GO?, I crossed my fingers, toes and eye-balls.....I pressed GO!!!

The first part of our Hidden Hills event would be my afternoon presentation to both fifth grade classes in one large room. This was to be an event centered on Orion, so for our afternoon event I brought along a 2X4 foot blackboard with the seven main stars of Orion taped in proper position. Additionally, I handed out to each student an Orion star chart with star names and distances in light years of each. I hoped it would go something like this.....

Everyone all set now, we buckled up in our seats. Together, 50 students, the three teachers on hand and myself. Our imaginary craft was to take us 1,350 light years to the Orion Nebula and back in less than an hour. The control panel lights only took a moment as they blinked from red to yellow then flashing green. There was a faint hum and a slight shudder, everyone held on to whatever they could grab .....then.... we felt nothing .....just one G..... like sitting in a chair on Earth, were we not flying? It

took me a moment to realize that our ship was actually not really moving at all. The event horizon around this trans-luminal craft was transporting us, spinning it's own worm-hole as we lunged headlong, whisking through the Galaxy. Only a moment later, out of the darkness.....a flash of bright light smeared across the portholes to our left, then darkness again. Wow! I guessed that must have been Sirius, had we already zipped eight light years in what seemed only a moment? Maybe the lady at the rental agency was not kidding when she said this was the ET Sport model, no wonder the seats were so small.

We had calibrated our charts to take us on a close flyby of the seven major stars of Orion, then on to the Great Nebula and back. I was beginning to get a bit concerned that at this speed we might slip past the edge of the galaxy before this thing could even slow down? Suddenly, with just the slightest nudge our ship slowed momentarily, our chart blinked, Bellatrix. We had already flown 243 light years, six stars of Orion to go. Moments later and slightly to our left a brilliant but somehow misty glow of crimson like no human eyes had ever seen engulfed the ships interior.....we checked off Betelgeuse, 427 light years. Ancient Saiph was next at 720 light years. Turning right toward our next target the portholes suddenly auto-tinted to a very dark, deep shade. Behold, at an incredible 60,000 times brighter than the Sun.....773 light years from home, silver-blue Rigel demanded respect like the crown jewel of the heavens. I could not find words to describe what I had just seen and we still had the Belt, the actual Belt of Orion yet to come. Our clever craft had a mind of its own, it skirted above the famous Belt stars as to give us just what we wanted.....a stunning fly over view of the entire trio. My minds eye recalled something.....ah yes, the pyramids of Giza were arranged in exactly the same pattern as Alnitak 815 ly, Mintaka 916ly and the middle belt star Alnilam at 1350 light years distant. A question begged an answer, had Alnilam somehow escaped from the nebula at some point in cosmic time? We had now traveled more than 1,300 of Einstein's mysterious light years in seemingly the blink of an eye.

The major stars of Orion were behind us now and before us lay the Great Nebula spread seemingly in an endless expanse. Thousands of stars gleamed

among and between streaming, silky ribbons of inky orange-pinks, bleached violets, blended blues and shades of color beyond green ever imagined. None of us were prepared to depart the spell-binding beauty on display in every direction. However, the deal was, I would get everyone back before the final bell rang. Indeed, our Milky Way Galaxy held more wonders than the Human mind could begin explain or even grasp. Sadly, our intrepid ship smoothly turned for home getting us back safely and on time. Sorry Albert.....we only had an hour to get there and back before the bell rang.

So, with my afternoon presentation now completed our PAS ground team consisting of Terri, Storm, Bruce, Sam, Rick, William and myself began arriving for our evening program. Our Hidden Hills telescope viewing location would be the smooth surface of the basketball courts. Next to the basketball courts are picnic tables under a ramada where Sam setup his collection of meteorites for everyone to view and discover.

Our wonderful liaison and hostess, Mrs. Joy Rea, greeted our team about 5:45 PM with everything we needed. A welcome variety of pizza, cookies, cool water and juices was enjoyed as we relaxed under Sam's ramada.

Scopes at the ready now and Sam's space rocks spread for display. Terri, Storm and William had an information table set up for everyone to visit. Terri and Rick fine tuned their scopes as skies appeared ready for an evening of fair viewing. The last light of day fading, students, parents and siblings began to join us with inquisitive smiles. Telescope tutorials were explained all around as the first distant lights of the evening, the Moon and Venus brightened. A line quickly formed at Storm's scope for a fine view of the Moon and Bruce presented a bright, glowing Venus as his first object. I joined Bruce on Venus while waiting for skies to darken a bit more hoping the Great Nebula would soon be visible. As darkness deepened, the stars of Orion began to appear, I swung the 16 inch scope toward the sword of the Hunter and set the fine focus sharply on the Great Nebula. For most students and parents one step of the ladder was just the right level for the eyepiece, little brothers and sisters braved several steps to get a good look at the nebula. During our two hour

event several objects were viewed through our five telescopes. Our PAS sky tours team loves sharing our scopes and knowledge with anyone interested in our fantastic Cosmos. We are already looking forward to next seasons event, until then, good health and clear skies to all.

Our turnout was one of the best school events ever, about one hundred very interested students and parents came out to join us. Among the observers were both fifth grade teachers, Mrs. Rea and her family and Mr. Botello with his entire family. I want to say a special Thank You to both of these wonderful teachers on behalf of my daughter Sonya and myself, they have made a real difference in Sonya's life. Thank You so very much.

**Terri** writes: Attending this event were several PAStimes Star Tour members who made this event a great success. I had my 8" scope, Storm Moon brought her 8" scope, Roger Anzini attended with his 16" scope, Sam Insana brought a most awesome display of meteorites, we had William Finch as a helper for set up, take down and to take over my scope so I could do Q&A with the kids, Bruce Wurst was there with his 12" scope, and Rick Cunningham has his 8" Dob. It was a great collection of telescopes at this event.

The week before this event, Sam, Terri and Roger were monitoring the weather for this night. It didn't look hopeful. It looked like we were going to have 100% cloud cover right up until the morning of the event, in which the weather forecast said it would be clear enough to have the event. So, everyone involved in this event, including the fantastic Teacher: Joy Rae, were monitoring their emails to find out if the event would happen or be cancelled. We had the event.

The skies were partially cloudy, with high thin clouds. There was a slight breeze

for some of the evening and the clouds didn't get in the way of Orion Nebula or the Moon, which I showed through my telescope. I believe Storm was on the Moon the whole night. I heard Bruce say he was on M103 and Roger had Orion Nebula for a while as well.

The evening began at 5:30 when Roger, Storm and I arrived and met with Joy who had the pizza and drinks set up on one of the picnic tables. As we started moving our equipment to the basketball courts, the other scopes arrived, so we all stopped set up and had a nice dinner of pizza, bottled water, and Roger treated us to cream soda. Then we did a set up of the scopes. The event was scheduled to be from 6:45 to 8:45, but Joy noticed a few people waiting around to come look through the scopes, and I had told her that since we were starting before dark, several of us could talk about how we set up our scopes, or talk about the differences in the scopes, while we were setting up and waiting on the North Star to come out that night, for aligning.

So, about 6:30, a crowd started to form, so Roger took the lead and talked about his scope, how it works, what to do when you get to his scope to look through it, and then, since Bruce was nearby, he talked about the Schmidt Cassegrain scope set up. When he finished, I started doing Q&A until it got dark enough to find Venus. So, all of us showed Venus for a little while, and the Moon was above us and Storm took the Moon for a while. Once it became dark, we did our alignments and the event was a success.

After I got my scope aligned, I had put it on Venus, until Venus went behind a building, and then I put my scope on Orion Nebula and asked William to work my scope. While he did that, I walked around talking about the ISS, and doing Q&A with the kids. The ISS was due to fly over about

8:12pm. Sam was set up away from the scopes but under lighting so his meteorites could be seen. He helped spread the word to everyone that at 8:12pm, watch for the ISS to fly over. About 8:10, we did a countdown and started watching for the arrival of ISS. It showed up later than 8:12, but it was a wonderful sight to see. It wasn't bright at first, but grew in brightness in the 6 minute long show it put on. Everyone was ecstatic about seeing it!

After the ISS went by, the crowd started leaving, but I pulled a few people over to my scope to show them a Purple Moon. At 8:45, we packed it up.

I wish to thank my Telescope Team for helping to make this a super event. Joy was thrilled and PAS plans to do another event at this school in Fall 2018. Thanks to Joy for having PAS at her school. The principal was checking it out, as well. I took a bunch of pictures for the Teacher to use on the school website and I have included them here, at this link for your enjoyment:

**Rick** writes: I showed Venus, M-42, M-43, Mizor double and Pollux double. The ISS also was visible at 8:07 for several minutes. After the ISS passover the event quickly ended. Estimating 50-70 people during the evening, a good mix of parents and students.

**Sam** writes: March 23rd, I attended the PAS star party at Hidden Hills elementary school. While other PAS members handled their telescopes, I set up and ran the meteorite demonstrations. I had 20 meteorites, 2 tektites, charts, posters, and other items to show the students, parents and faculty. About 70 people came by my table to talk and check out the items.

Please see revised article in the May 2018 issue of PAStimes Newsletter on page 6. Enjoy!

## Full Moon Hike May 18

By Mark Johnston, PAS Member

**Mark** writes: It was a full house (30 people) and I pointed out the brighter constellations, talked about the Moon, and about the challenges of getting to Mars.

**Terri**, Event Manager adds: This event was held at Pinnacle Peak Park and requires an RSVP to attend. Mark has several more of these hikes on the PAS Calendar for which PAS Members are invited to attend (with proper RSVP to the Park Service).

These are not PAS events, but PAS Members are invited. Here are the dates of the future Full Moon Hikes at Pinnacle Peak Park you may wish to attend In 2019:

at 8:00p.m. Monday, June 17, at 6:45p.m. Friday, Sept. 13, at 6:15p.m. Sunday, Oct. 13, at 5:45p.m. Tuesday, Nov. 12, at 5:30p.m. Wednesday, Dec. 11 and at 5:30p.m. Thursday, Dec. 12. See the PAS online Calendar to RSVP or go to

<https://www.scottsdaleaz.gov/parks/p.urs-and-events>

[.urs-and-events](#)

RVSP required. Max 30 participants.

**Mark** adds: For each hike, at sunset we hike up to GrandView, and I give a talk about the night sky, the Moon, show constellations with my laser, and discuss what's new in astronomy. Then we hike back down by moonlight. Weather Permitting, it is a great way to see the city and night sky on a fun hike up Pinnacle Peak.



# Find Strange Uranus in Aries

David Prosper

Most of the planets in our solar system are bright and easily spotted in our night skies. The exceptions are the ice giant planets: Uranus and Neptune. These worlds are so distant and dim that binoculars or telescopes are almost always needed to see them. A great time to search for Uranus is during its opposition on October 28, since the planet is up almost the entire night and at its brightest for the year.

Search for Uranus in the space beneath the stars of Aries the Ram and above Cetus the Whale. These constellations are found west of more prominent Taurus the Bull and Pleiades star cluster. You can also use the Moon as a guide! Uranus will be just a few degrees north of the Moon the night of October 14, close enough to fit both objects into the same binocular field of view. However, it will be much easier to see dim Uranus

by moving the bright Moon just out of sight. If you're using a telescope, zoom in as much as possible once you find Uranus; 100x magnification and greater will reveal its small greenish disc, while background stars will remain points.

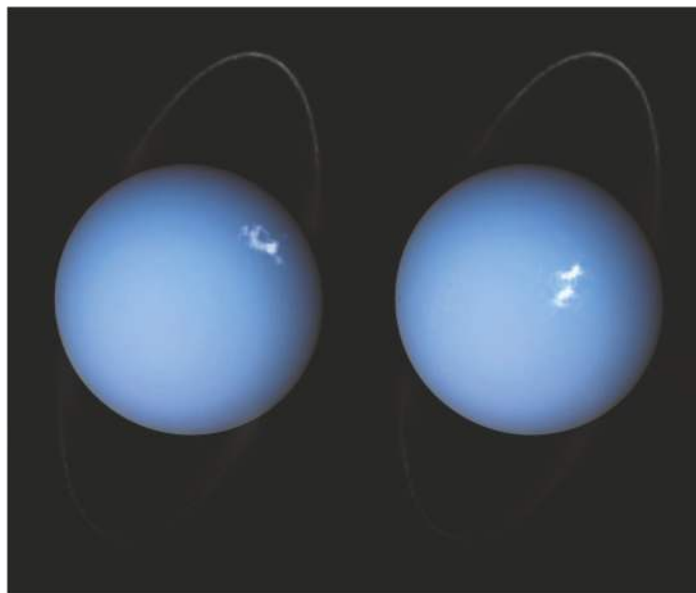
Try this observing trick from a dark sky location. Find Uranus with your telescope or binoculars, then look with your unaided eyes at the patch of sky where your equipment is aimed. Do you see a faint star where Uranus should be? That's not a star; you're actually seeing Uranus with your naked eye! The ice giant is just bright enough near opposition - magnitude 5.7 - to be visible to observers under clear dark skies. It's easier to see this ghostly planet unaided after first using an instrument to spot it, sort of like "training wheels" for your eyes. Try this technique with other objects as you observe, and you'll be amazed at what your eyes can pick out.

By the way, you've spotted the first planet discovered in the modern era! William Herschel discovered Uranus via telescope in 1781, and Johan Bode confirmed its status as a planet two years later. NASA's Voyager 2 is the only spacecraft to visit this strange world, with a brief flyby in 1986. It revealed a strange, severely tilted planetary system possessing faint dark rings, dozens of moons, and eerily featureless cloud tops. Subsequent observations of Uranus from powerful telescopes like Hubble and Keck showed its blank face was temporary, as powerful storms were spotted, caused by dramatic seasonal changes during its 84-year orbit. Uranus's wildly variable seasons result from a massive collision billions of years ago that tipped the planet to its side.

Discover more about NASA's current and future missions of exploration of the distant solar system and beyond at [nasa.gov](https://nasa.gov)



The path of Uranus in October is indicated by an arrow; its position on October 14 is circled. The wide dashed circle approximates the field of view from binoculars or a finderscope. Image created with assistance from Stellarium.



Composite images taken of Uranus in 2012 and 2014 by the Hubble Space Telescope, showcasing its rings and auroras. More at [bit.ly/uranusauroras](https://bit.ly/uranusauroras) Credit: ESA/Hubble & NASA, L. Lamy / Observatoire de Paris

## Star Party at Pinnacle Peak May 3

By Mark Johnston

I did a star party at Pinnacle Peak park on Friday. Full house with 25 guests. Ob-

served Iota Cancer, Castor, Stargate cluster, M37, M13, M81, M82, Mizar/Alcor, M104, and Markarian's Chain. Also did

some double star research on 52 Herc after the group left.

# Black Mountain Campus April 25

By Terri Finch, Event Manager

This was a fun event. PAS received about 50 public RSVP's but Mike and I saw only a few come indoors. Mike Marron set up at a table inside the Aquila Building with his meteorites. Since he had also just discovered the Cave Creek Crater, he was sharing that info with everyone. I set up indoors with Storm Moon at the PAS table. I provided Q&A but only 4 kids came by to do Q&A with me. I was expecting so many more kids to come inside and win a prize for answering my astronomy questions. Indoors, Frank Otsuka also provided two older laptops for the public to use to play with a very fun, free to download program "Stellarium." Storm and I watched his computers while he went outdoors and set up his telescope. Don Boyd had attended in order to be my minion for the evening. Thank you, Don. Paul Facuna and Bob Ewing helped direct traffic on the ramp down to the Astronomy Observing deck. And a surprise visit from Paul and Cheryl Schmidtk

was very nice!

Attending outdoors was Frank Otsuka with his 8" scope, Sam Insana had his 8" scope, Ray Adams brought his 10" dob, Mike Cawley had his 8" telescope, Mark Johnston was there with a 5.5" telescope, Calvin Vance brought his 6" scope and Eric Steinberg attended with his 22" scope.

The evening concluded around 9:30pm and after Storm and I packed up the PAS table, we helped the last few vehicles off of the Observing Deck to help Matt Hall, the Security Officer of PVCC BMC get done quicker and go home sooner that evening.

Many thanks to all the PAS Members who participated, attended, brought scopes and other fun stuff for the public, and was there to enjoy the evening. It was cloudy earlier in the evening but I heard it cleared up later. Looking for-

ward to the next BMC Star Party on Oct 24, 2019. See you there!



*Inside at Black Mountain Campus for the Apr 25th star party, Mike is seen sharing his meteorite collection with everyone who will stop by and chat with him. Mike's enthusiasm is contagious. Photo by Don Boyd.*



*Storm Moon & Terri Finch are seen at the PAS Table inside the Aquila Building at BMC. Photo taken by Don.*



*This is a fantastic evening photo of a cactus at BMC Aquila Observing Deck and the constellation of Orion beyond it. Photo taken by Will Kalif.*



*Outdoors of the Aquila building on the Astronomy Observing Deck facing west are the telescopes setting up for this evenings' event. The white scope on the left is Sam Insana's 8" telescope, at the back of this photo, we see the dome housing the 14" SCT that belongs to PVCC, at the back right, against the white SUV is Eric Steinberg's 22" telescope with the black shroud, Mark Johnston is up his 5.5" long white refractor, and then we have the black 6" scope belonging to Frank Otsuka. Several more telescopes arrived and set up for this event (not pictured here). This fantastic photo was taken by Will Kalif.*

## Independence Eve Star Party

By Leah Sapir

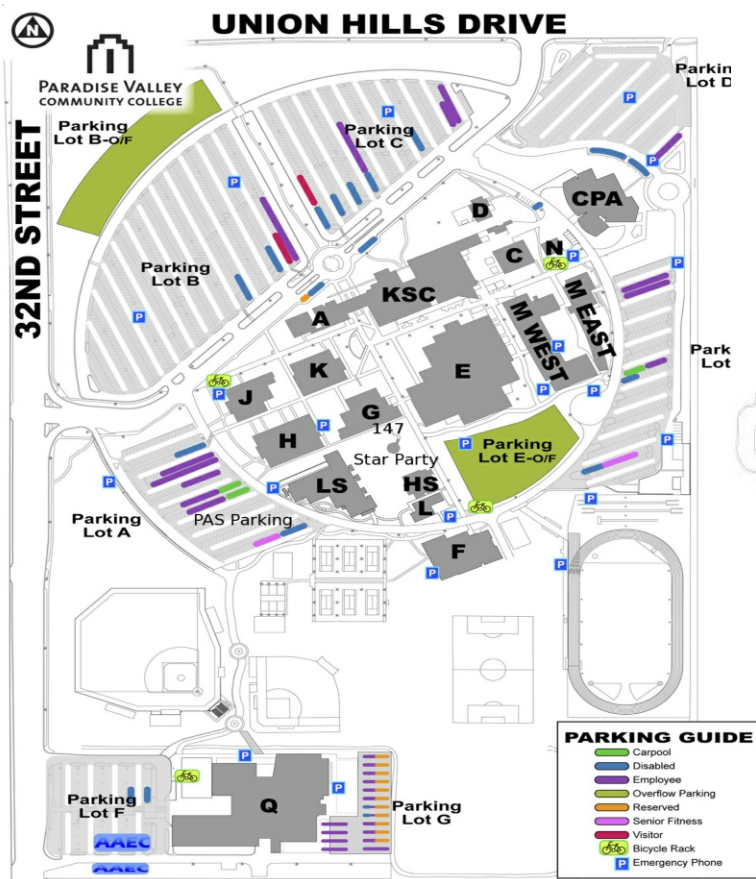
The city of Carefree cancelled the fireworks display that had been planned for Wednesday night July 3, 2019, but the beautiful clear sky that night was more interesting anyway. The new moon set at 8:50 pm, only an hour after sunset, leaving a dark, cloudless sky. Mike Marron, our

host, had generously opened the star party to the public, and we had several guests: Casey, who brought a telescope; and Patty with her young grandson George. Participating PAS members were Mike, Don Boyd, Paul Facuna, and myself. I gave our guests a constellation tour with my laser pointer, and we also looked at several ob-

jects though my 6" dob and 12x50 binoculars. Objects observed included Jupiter and its moons, Albireo, the Lagoon Nebula and star cluster, open clusters M6, M7 and M11, and globular cluster M4. Toward midnight, clouds started to move in, so we called it a night. A good time was had by all!

## Map of PVCC Main Location

18401 N. 32nd Street | Phoenix, AZ 85032



## Map of PVCC Black Mountain

34250 N. 60th Street | Scottsdale, AZ 85266



## 2019 PAS GUEST SPEAKER LINE-UP

By Terri Finch, Event Manager [Events@pasaz.org](mailto:Events@pasaz.org)

PAS Meetings are held at PVCC Main Campus on the first Thursday of the month in Room: LS-203 unless otherwise noted. Do you have an idea for a guest speaker? Email Terri Finch, Paul Facuna, or Mike Marron for the details (their email addresses are at the top of page 2 in this newsletter).

Here are the next scheduled guest speakers at PAS:

**Nov 1:** Ted Blank "New Horizons"

**Dec 6:** Vincenzo Cataldo, Topic: Planetary Volcanism

**Jan 17, 2020:** Mark Johnston, Topic: Exoplanet

More information at:

<http://www.pasaz.org/index.php?pageid=meetings>

## October 2019

| Sunday | Monday | Tuesday | Wednesday | Thursday                                 | Friday                                      | Saturday                                    |
|--------|--------|---------|-----------|------------------------------------------|---------------------------------------------|---------------------------------------------|
|        |        | 1       | 2         | 3<br><i>PAS Meeting</i>                  | 4                                           | 5<br><i>Public Star Party</i>               |
| 6      | 7      | 8       | 9         | 10                                       | 11<br><i>Japanese Garden<br/>Star Party</i> | 12<br><i>Japanese Garden<br/>Star Party</i> |
| 13     | 14     | 15      | 16        | 17<br><i>Free Telescope<br/>Workshop</i> | 18                                          | 19                                          |
| 20     | 21     | 22      | 23        | 24<br><i>Public Star Party</i>           | 25                                          | 26                                          |
| 27     | 28     | 29      | 30        | 31                                       |                                             |                                             |