



PAStimes

Phoenix Astronomical Society

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PHOENIX ASTRONOMICAL SOCIETY — ESTABLISHED 1948

Two Spectacular Guest Speakers at February 6th Meeting

Roving Mars: Recent Results from the Mars Science Laboratory Curiosity Rover

Lauren Edgar is a Research Geologist at the USGS Astrogeology Science Center. She earned her bachelor's degree from Dartmouth College in 2007, and a Ph.D. in Geology from the California Institute of Technology in 2013. Prior to the USGS, she was a postdoctoral fellow in the School of Earth and Space Exploration at ASU. Her research aims to understand Martian surface processes through the use of rover and orbital observations and terrestrial field analogs. She uses sedimentology, stratigraphy and geomorphology to infer past processes involving water, wind, ice, and volcanic activity, and to identify potentially habitable environments on Mars. Lauren is an active member of the Mars Science Laboratory Curiosity rover team, and she will be talking about her experience on the mission and the exploration of Gale crater, Mars.

Brent Watson, Additional Speaker at February 6th PAS Meeting

Brent Watson is giving two short presentations to the Phoenix Astronomical Society, the first at the Thursday January 16th meeting and the second at the February 6th meeting. Both of these presentations will be of interest to PAS members especially beginning astronomers and those deciding on a telescope to buy.

Both presentations will be before the 10 minute break.

The January 16 presentation will be on telescopes. Brent writes:

On January 16, we will explore the workings of a telescope. During the presentation we'll talk about some of the arithmetic involved, and the three types of power of a telescope. We will look at a cou-

See "February PAS Meeting" on page 3.



Lauren Edgar is the February Guest Speaker.
Photo provided to PAS by Lauren.

January 16 PAS Meeting in Review

By Terri, Event Manager

The January PAS meeting started out at 7:30pm with a very short meeting greeting and then right on to the guest speaker at 7:38pm. Mike opened the meeting, said a few brief things and gave Brent the floor. Brent had a very interesting, informative presentation that lasted until 9pm. Everyone involved was very attentive. We had an attendance of 37 for the night!

Next, Brent Watson provided an equally interesting and interactive presentation about How Telescopes Work. If you missed this talk, you really need to hear it when PAS reschedules Brent for a future presentation. Brent completed his presentation at

9:47pm.

I wish to thank both of the guest speakers for their fantastic presentations. Both Brent and John had books for sale and a book signing. They also donated a few books for the raffle. The main raffle was won by Brent! A second raffle was won by Roger who took home Brent's book "Overlooked Objects." We had third raffle won by Mike Cawley, which was donated by John, "Uncharged Constellation" and the fourth raffle item was won by Sam who got John's book "Lost Constellations." Those were very awesome items to raffle off and they were most appreciated. Thank you both, Brent and John and for your presenta-

See "January Meeting Review" on page 2.



John Barentine - a Spectacular Guest Speaker
at the January PAS Meeting.
Photo by Don Boyd.

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PAS Upcoming Events for February

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. 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>

Feb 1: Tucson Gem & Mineral Show PAS Field Trip. Lunch meeting with PAS at Electric Park. More details: <http://www.pasaz.org/forums/calendar.php?do=getinfo&e=3076&day=2020-2-1>

Feb 6: PAS Meeting at PVCC Main Campus in **LS-205** at 7pm. More details:

<http://www.pasaz.org/forums/calendar.php?do=getinfo&e=2998&day=2020-2-6&c=1>

Feb 8: Full day of Astronomy Events. Please read about them in the public Forum Thread at this link: <http://www.pasaz.org/forums/showthread.php?t=1411>

Feb 13: Free Telescope Workshop from 7pm to 9:30pm:

<http://www.pasaz.org/forums/calendar.php?do=getinfo&e=2984&day=2020-2-13&c=1>

Feb 20: Huge Public Star Party at

Black Mountain Campus of PVCC from 6:30pm to 9:30pm. More details:

<http://www.pasaz.org/forums/calendar.php?do=getinfo&e=2992&day=2020-2-20&c=1>

Feb 24: Public Star Party in Fountain Hills 5:30 to 8:30pm. More details: <http://www.pasaz.org/forums/calendar.php?do=getinfo&e=3081&day=2020-2-24&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.

January Meeting Review

Continued From page 1
tions!

It was a very good meeting, filled with discussion, information, great presentations and fun people. The time flew by and before we knew it, it was time to depart for the night. Several PAS members and a few guests went to Village Inn after the meeting to socialize. I wish to thank everyone for attending and for the snacks they brought and shared. A few more dollars were added to the Snack Fund to help pay for the upcoming Pizza Party in April. Thank you for your donations.

Looking forward to the February meeting when Brent returns for another mini-presentation about telescopes. You don't want to miss it. See you there!



John Barentine sharing the knowledge of the research done on the mysterious Dark Matter in the Universe. Photo by Terri Finch.



Brent Watson was the 2nd awesome Guest Speaker of the evening. He was sharing info on How Telescopes Work. Photo by Don.

Continued from page 1

February PAS Meeting

ple of examples to get more than a theoretical feel for telescopes. We'll talk about what impedes a telescope and some of the tradeoffs that need to be made when selecting or designing a telescope. My telescope design spreadsheet will be quickly introduced.

Brent's second presentation on February 6th will be a continuation from his first presentation. It will be on his telescope design spreadsheet. Brent writes:

On February 6th I will present the details of my telescope design spreadsheet. I'll explain each parameter and then plug in different parameters to see how many of them interact and how to make correct choices in telescope design. We'll talk about mirror grinding and testing in a general fashion. This will include testing of existing telescopes using both the Ronchi method and the Star Test.

Both presentations will be of interest to PAS members especially beginning astronomers and those deciding on a telescope to buy.

Some of you may have met Brent at the October 24, 2019 Black Mountain Campus Star Party or at the November 7, 2019 meeting when he was introduced and spoke about his background in astronomy. He provided the following very extensive astronomy biography.

February PAS Meeting

By Terri Finch, Event Manager

Please come join PAS as we welcome

2 wonderful guest speakers to the February Meeting. The meeting room opens at 7pm and we have 30 minutes of set up for the guest speaker, snacking, socializing and then the meeting starts promptly at 7:30pm with a few very brief announcements and then the Main Guest Speaker takes the floor about 7:35-7:40pm. After the Main Guest Speaker, Lauren Edgar, we will have a fantastic second presentation by Brent Watson.

Please read about the January 16th PAS meeting review to find out more about what you missed, if you didn't get the chance to attend the January PAS meeting.

For the February Meeting, please bring a friend to the meeting and bring a snack to share. PAS is collecting for the PAS Snack Fund which will be used to pay for the April Awards Ceremony Pizza party. We would love to have you attend the Pizza Party and enjoy pizza and celebrating those PAS Members who have gone above and beyond to make PAS the fun astronomy club that it is today! Come celebrate with us and donate to the snack fund for more pizza! We hope to see you at the February meeting! Everyone is welcome.

If Pas Is Not in the Planned Room

I need for you to make a note: The January meeting ended up in the room next door to LS-203, which worked out to be LS-201. Several members hung out outside of LS-203 to make sure anyone arriving up to 7:30pm could find the meeting room but many who arrived after 7:30pm were lost. So, if you arrive at LS-205 and another class is in the room PAS is supposed to be in, please, look around on that same floor for PAS to be in a nearby room. I haven't figured out why PAS doesn't have a designated room for the meetings for EVERY month, but for some reason, there was a mix up in the planning of the class that was in the room we were supposed to be in. Highly annoying, but please look around on that same floor before you leave, for the room, or call one of the officers if you don't see PAS there.



Brent Watson is an added Guest Speaker to the February meeting. You don't want to miss his presentation. Photo provided by Brent.

What's Up For February?

By Don K. Boyd, PAStimes Editor

Name	Date	Rise	Set
Mercury	02-15-19	07:51	19:29
Venus	02-15-19	09:09	21:32
Mars	02-15-19	03:51	13:41
Jupiter	02-15-19	03:51	16:28
Saturn	02-15-19	05:39	15:47
Uranus	02-15-19	10:17	23:26
Neptune	02-15-19	08:17	19:49
Pluto	02-15-19	05:32	15:32

All Times Arizona Time

Bold means the object is "visible" in the evening

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February 15, 2020

Sunrise: 7:13

Sunset: 18:13



Q1: February 1



Full: February 09



Q3: February 15



New: February 23

Mercury Transit Nov 11 2019

At various locations

By Terri Finch

Pinnacle Peak Park (PPP): This event was set to happen from 7am when PPP was to open, until 11am when the transit concluded, and we actually set up at 6:30am, and were set up until about 11:10am. The transit ended at 11:01am and there were still people talking to Mike Marron who was set up there with his meteorite collection and he had a crowd the whole time, from the time he arrived at about 8am to 11:10am when Storm and I offered to help him get his stuff back to his vehicle, if he packed up right then.

Also attending this event from PAS was Rick Cunningham with his 8" Dob + solar filter, Sam Insana with his 8" Dob and solar filter, Frank Insana had the PST, and Mark Johnston (the RSVP for this event) had his Lunt Solar Scope. I attended with the PAS table of handouts along with my daughter, Storm Moon.

Not assisting, but attending, was also Kay Freeman and she left about 8:30am. Pete Turner also came, brought donuts for the group, and left about 9:30am.

PPP saw about 150-200 people in attendance. It was cool in the shade, but super warm once the sun was on us. The crowd seemed to enjoy the transit and some of the attendees, like Samuel and Ramen came at the beginning of the transit and stayed until it ended.

Many thanks to my Telescope Team for the wonderful team-work that was experienced at this event. Sam had brought many great visual items which he shared with the public attendees. PAS took in a new PAS Member: Congrats to Kat Murphy for joining PAS at this event!

By Sam Insana, PAS member and a past PAS President

PAS held a Mercury Transit event at Pinnacle Peak Park November 11th, Veterans Day. The next transit won't be until 2032.

Frank Insana had a PST to show Mercury and a solar flare in H Alpha. I had my 8 inch Newtonian reflector to show Mercury with a white light glass filter. Mark Johnston, who organized the event, had his Lunt solar refractor which showed solar prominences, Mercury, and granulations on the Sun. Rick Cunningham had his 8 inch Dob with a white solar filter and showed Mercury's transit. Terri and Storm staffed

the PAS table and had interested people sign up for future info, and one person, Kat, was signed up as a new PAS member. Mike had his meteorites. Pete came by with donuts, a lifesaver. Most of us were at the Pinnacle Peak Park for 5 hours from around 6:45 am to 11:45 am. About 200 people stopped by and looked at the Mercury Transit as they were on their way to a hike or on their way back. I also had material from Sky and Telescope on the transit, material on the Sun, material on Mercury, solar glasses, and a holographic solar card showing a large prominence. Everyone enjoyed the event. Some people took photos of the transit through telescope eyepieces.

Our PAS website had the correct info on the time being from 7:30 am to 11 am. Pinnacle Peak Park also had the correct info. But for some reason, Google Map, when visited to find out how to get there said the event was at 11:42 am, 30 minutes after it was over!!

Some people showed up just as we were leaving so some of us stayed a few minutes to explain the event and to let them know we had no idea how the Google Map mistake happened.

By Mark Johnston at Pinnacle Peak Park

"After some early concern about clouds, they melted away and we had great weather for the Mercury Transit at Pinnacle Peak Park. Mark, Sam, Frank, and Rick manned telescopes while

Terri and Storm greeted people at the PAS table and Mike fascinated passersby with his meteorite collection!



Rick Cunningham set up and ready to show the Sun through a safely filtered 8" Dob. Photo by Terri Finch.



Mark Johnston standing with his Lunt Solar Scope & Pete Turner in the background at the Mercury Transit event of Nov 11, 2019 at Pinnacle Peak Park at about 7:20am in the morning. Photo by Terri.

We estimate at least 200 visitors and we had great views of Mercury and some solar activity on the Sun. Got at least one new PAS member and several interested to

learn more about the club. Lots of amazed people at the eyepiece, with a new appreciation of our tiny place in the cosmos."

By Ted Blank

Fountain Hills: We had a hundred or more people stop by, it was great.

By Rich Marmon

Litchfield Park: In the days before Nov 11, I was keeping my fingers crossed for clear skies while I practiced shooting the Sun for the Mercury Transit. I recently purchased a Nikon P900 camera specifically for getting good shots of the Moon and Sun. It has a 2000 mm built-in power zoom lens that turned out to be perfect for this purpose and is really reasonably priced. I have some really great shots of the Moon using it. When I woke up on Nov 11 and saw the clear sky I knew it would be a good day. I shot the photos from my backyard in Litchfield Park, starting from when the Sun rose above neighboring houses. The transit started before sunrise so my photo series started when Mercury was about 1/4 of the way across the Sun. I shot photos every 10 minutes or so (on a tripod, of course) and have a nice series that shows the progression of the transit, including one where Mercury was just falling off the Sun at the end of the transit. I was lucky to catch that one just right. I tried two different solar filters - first using mylar material that shows the Sun as an orange orb and then using a ND 100000 neutral density filter that shows the Sun as white. After looking at my test shots I liked the ND filter best because I got much higher contrast between the Sun and Mercury. The P900 can do some processing that resulted in the shots you see here, which have a pretty pleasing hue and good contrast. I particularly like the close-up shot - that telephoto lens is awesome! After the transit was over I reviewed my photos and was pretty pleased, which is a good thing since I won't get another chance at this until I'm 102 - when I probably won't be able to hold a camera anymore.

Ringside Seat for a Mercury Transit

By Leah Sapir

On November 11, 2019, we celebrated Veterans Day with a transit of Mercury.

What in the world is a transit?

The planets Venus and Mercury are closer to the sun than we are, so from time to time we see them crossing the face of the sun. But this is a somewhat rare occurrence. Venus transits occur in pairs, 8 years

apart, once in about 120 years. The most recent Venus transits were in 2004 and 2012. The previous ones were in 1874 and 1882, and the next ones will be in 2117 and 2125.

Mercury circles the sun more quickly, so its transits are more frequent - about 14 per century.

But the question is - why don't we see a transit every time the inner planets orbit the sun?

The answer is that even though the sun and planets are approximately in the same plane, the orbit of each planet is tilted by a few degrees relative to the others. For example, relative to the plane of Earth's orbit, the orbit of Venus is tilted by 3.4 degrees, and the orbit of Mercury by 7 degrees. Since the sun takes up only about 1/2 of a degree in the sky, this means that most of the time when Venus or Mercury passes between us and the sun, the inner planet will appear to pass either above or below the sun, rather than crossing right in front of it.

For each planet, there are only two points in its orbit, called "nodes", where the plane of the planet's orbit intersects that of Earth. If the planet happens to be between the Earth and sun when it passes through one of these nodes, then the Earth, sun, and planet will be lined up in a straight line, and a transit will be visible from the daytime side of the Earth.

The Earth passes through the nodes of its orbit with Mercury around May 10 and November 10 of every year; so a Mercury transit can happen only on or near those dates.

During a transit, we can see the inner planet as a small black dot crossing the sun's bright surface. Of course, this requires a special filter to protect our eyes from being damaged by the sun's rays. PAS held a public viewing of the recent Mercury transit using filtered telescopes.

The transits so far this century have been: Nov 8, 2006, which was visible in Phoenix from beginning to end; followed by May 9, 2016 and Nov 11, 2019, which

started a bit before the Phoenix sunrise and were therefore visible in Phoenix from sunrise to end. The next upcoming transits will be on Nov 13, 2032 and Nov 7, 2039, but they won't be visible from Phoenix. How-



PAS Table of handouts at the Mercury Transit event of Nov 11, 2019 with Pete in the background.



Storm Moon is seen sitting at the PAS table at Pinnacle Peak Park. Another Mercury Transit will not happen again until 2032.

Photo by Terri.

ever, you can mark your calendar for May 7, 2049, when the transit will again be visible in Phoenix from sunrise to end. For the transit of Nov 9, 2052, just a bit of it will be visible at sunrise from Phoenix. And if you wait patiently till May 10, 2062 and Nov 11, 2065, the whole transit will be visible in Phoenix from beginning to end. (If you're not that patient, you can travel to Europe for the transits of 2032 and 2039, since that side of the Earth will be facing the sun during the transit.)

Fun vocabulary word! This situation of three celestial objects lined up in a straight line is called "syzygy" (pronounced siz-a-jee). Try that in your next Scrabble game! ☺

For a great NASA video of the recent transit, see: <https://tinyurl.com/mtransit2019>



*There's a line at Sam Insana's 8" telescope to view the Mercury Transit.
Photo by Terri.*



Mark's scope, and Mark walking towards Rick's scope and Rick, with Sam's scope and Sam in the background. Photo by Terri.



On the right, Mark Johnston looking through Rick's scope, and in the background, Frank Insana in front of Sam's white scope, with Sam finding the Sun for the gentleman. Photo by Terri.



The crowd had many great quesitons. Some of them stayed for the whole event. Photo by Terri.



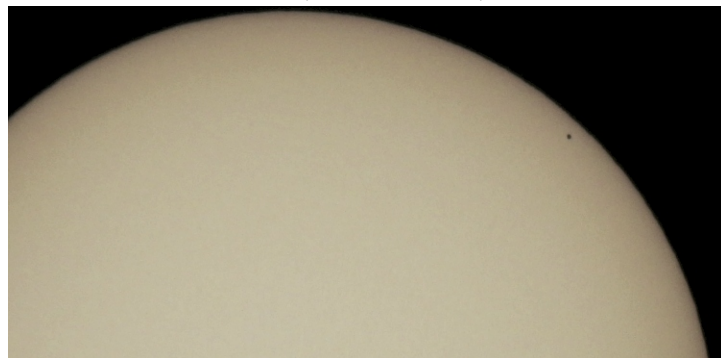
From the PAS table, we look across to the mountain in the background and find Mike Marron sharing his meteorites with the folks who came to enjoy a hike at Pinnacle Peak Park on Nov 11. Photo by Terri.



Storm Moon, Terri Finch and Mike Marron at Pinnacle Peak Park for the Nov 11 Mercury Transit. Photo by Sam Insana.



The little black dot of Mercury is on the Sun at about the center. Photo provided to PAS by Richard Marmon.



Mercury near the limb of the Sun. Photo taken by Richard Marmon with his Nikon P-900 from his backyard in Litchfield Park.



Ted Blank took some great photos of the crowd at the Mercury Transit in Fountain Hills.



Ted is seen in this photo standing behind his telescope talking with the crowd about the Mercury Transit. Photo by Ted.



Besides the Mercury Transit, this date was also Veterans Day. Lisa Levey provides this awesome photo that she took at Pinnacle Peak Park (PPP) on Nov 11th. Lisa is one of the many PPP volunteer rangers.



Lisa Levey provides this photo with Rick and his scope, then Frank with a pair of solar filtered binoculars, and then Sam and his scope in the back.



Mike Marron is at his Meteorite table and behind Terri Finch who is next to the PAS table. Photo taken by Lisa Levey on Nov 11th.



Mark had the most steady crowd of the 4 telescopes, the PAS table and Mike's meteorites on this day. Photo shared with PAS by Lisa Levey.

Star Party at Foothills Library Feb 24

NOT a PAS event, but PAS Members and the Public are invited.

Address 19055 N 57th Ave Glendale AZ 85308.

Time of event is 5:30pm to 8:30pm with telescope set up at 4:30pm.

There will be a few telescopes at the

Foothills Library in Cave Creek February 24th.

RSVP to attend and help at this event with Bruce Arlen of the Cave Creek Dark Sky Initiative at info@cavecreekdarksky.com.

PAS Members and Public attendees,

please RSVP with Bruce directly at the above email address.

Watch the link below for additional details and changes to this event: <http://www.pasaz.org/forums/calendar.php?do=getinfo&c=3081&day=2020-2-24&c=1>

All Day Astronomy Events Feb 8

Have you ever thought to yourself... "I wish there was more Astronomy in my day, instead of just the evening star party."

PAS has the next Big Event day set up for your enjoyment.

Feb 8th has 4 events, back to back, happening in the Cave Creek / Carefree area of North Phoenix. Start your day with a

10am lunch with PAS Members at Harold's Steakhouse,

12pm there's a private tour at Grace Fredricks Museum,

3pm is a Planetarium show in Cave Creek

6pm is a potluck, star party, and Social gathering in Carefree.

RSVP is required for each of the 4

activities on this date, individually and to specific Persons of Contact who are managing those events. More details about each event can be found here complete with RSVP links: <http://www.pasaz.org/forums/showthread.php?t=1411>

Come enjoy the day with PAS. Everyone welcome, all ages.

Cruise Presentation Nov 23

By Mark Johnston, PAS Member

I gave five 45 minute talks recently on a cruise from Sydney to Auckland on the Celebrity Solstice. My talks were on "Is there Intelligent Life Beyond the Earth?", "Wonders of the Solar System", "Looking Back in Time in Astronomy", "Space Exploration, Past and Future", and "UFOs, Fact or Fiction?". I spoke to about 1,000 guests, and also spent some time in the evenings, pointing out the Southern Cross, Alpha Centauri, and the brighter planets. It was a great opportunity to share my love for astronomy and educate the public.



Mark Johnston provided this wonderful photo of the astronomy presentations he provided on a cruise ship.

PVCC Free Telescope Workshop Dec 12

By Terri, Event Manager

This was a wonderful evening to have a telescope workshop. The temperature was a bit chilly, but okay to be outdoors for a little while, until the chill set in. But, the sky was mostly clear.

The evening began with two RSVP's and they both attended. Mark Savan and his wife Shelly attended to find out what telescope to purchase. Stu Brackney (PAS Meeting Host), myself and Peter Jones gave advice on telescopes. We also had Rob Straney and his son Jack bring their Gskyer 70400 scope to find out how to use it, new in the box. So, William Finch assisted them for the evening.

Since everyone showed up on time

(after Stu had found Mark, Shelly and Peter looking for G-147) we began earlier than we normally do, before 7:30pm.

William assisted Rob by talking about how his telescope works, and inspecting all the really fun accessories that came with the telescope. They took the telescope outdoors around 8:15pm and William helped Rob find the Moon through his telescope. This night was the Full Moon, so finding the moon was easy, but focusing on the moon through a telescope can be challenging for the uninitiated.

The class ran until about 8:45pm and then everyone was pleased with the help they received and left. I wish to thank the RSVP's who attended. Welcome returning

PAS Member Peter Jones!!! And I'd like to thank Peter and Stu for all the wonderful advice shared with Mark and Shelly. The next few Free Telescope Workshops at PVCC will be on Jan 30, Feb 13, and Apr 9, 2020. Put in your RSVP now with me at Events@pasaz.org.

Rob adds: Just wanted to thank you guys again for teaching me how to set up my telescope. It's really cool of you to offer your services like that. I was all jazzed to use it Saturday night but, alas, the clouds had other plans. Anyway, I'd love to attend some of the PAS events. I'll keep an eye on the events listing. Hope to see y'all soon. Sincerely, Rob Straney

BMC Star Party Nov 18

By Terri, Event Manager

Yes, you read that correctly. This event was on a Monday evening. So, this event was scheduled for Thursday Nov 21 at Black Mountain Campus, but the forecast for the whole week of Nov 18 was for rain, clouds and a cold front to hit Phoenix. So, Sam Insana decided to reschedule the event. He asked Jenny Neujoy about the change, then got confirmation from Jenny and Loretta Mondragon to do it. So, there we were... at Black Mountain Campus of PVCC on a Monday evening.

So, the evening started with a lot of clouds. This led me to believe we should have cancelled. Several PAS members asked me if we really wanted to have this star party with all these clouds. But, by 7:30pm, the clouds had blown away and it was clear skies. Around 8:30pm, everyone was headed home, including the telescopes. The star party was scheduled to run to 9:30pm but didn't this time. Once the public left, it was time to pack up.

Attending this event was Roger Anzini with his 16" Dob. One gentleman, Kraig Tolliver, spent quite some time talking to Roger and picking his brain. Kraig reported how awesome it was to learn so much from Roger. We also had Chartelle Willets attend and enjoy the evening. Carolyn Speed came with her son and husband, and they enjoyed talking to Mike about the meteorites. From PAS we had Mike Marron, who brought his meteorites and his girlfriend, Ofelia Waters. Ted Blank brought a nice telescope, Rick Cunningham was there with his 8" scope, and I manned the PAS table. We had a total of 5 telescopes which also included Ray Adams and Sam Insana along with his son Frank, who brought Frank's 16" Dob. Many thanks to Sam for the weather updates for the evening, and to Ron Walker for directing the traffic onto the observing deck. Frank Otsuka came and brought a telescope but also had a laptop with Stellarium on it, and a tablet. He left the tablet and laptop with me at the PAS table so people could play with Stellarium. Some more PAS members who showed up at this event were Bruce Wurst who helped me at the PAS table, Bob Ewing who brought some friends with him, Kim Hollingsworth and Mel McClure. It was not the biggest turnout at this event, but it was a nice number of attendees and interested folk who were pleased with the very short lines. I would estimate about 75 in attendance from the public. Many thanks to all the PAS members who helped out. Looking forward to the next

event like this in January 2020.

Roger adds: Not a great number of people last night, but enough to stay busy because people hung around asking questions longer. I showed Saturn, Ring Nebula, M13, ET Cluster and the Pleiades through my 16" Dob. I had very nice visitors and lots of fun.

Ted sends this review: I was using a 9.25" SCT, and was able to show Saturn and Jupiter to those who arrived early. Jupiter had 4 moons all on one side, and Saturn's moon Titan was easily visible. Later in the night I switched to the Andromeda Galaxy and the double star Albireo, based on where the clouds were least intrusive. I was also able to show several people the Pleiades in binoculars, which I believe gives the best view of that cluster with the exception of Roger's short focal length William Optics refractor, in which it was just stunning with pinpoint stars!

Sam writes: My son Frank Insana and I used Frank's 16 inch Dobsonian telescope to show Venus, Jupiter, Saturn, M57 Ring Nebula, M32 Andromeda galaxy, M110 galaxy, M27 Dumbbell Nebula, Epsilon Lyra double star, Gamma Andromeda double star, and the Fairy Ring double stars in Cygnus.

Even though there were a lot of high clouds, most objects looked fair to very good, but M27 Dumbbell planetary nebula looked poor, while M57 Ring planetary nebula looked good. The double stars looked very good. There were only about 24 guests who observed, probably because of the cloud cover.

Rick writes: Last night I showed the



BMC Observing Deck behind the Aquila Building where many telescopes set up for the public to view the night sky.

Photo provided by Jake O'Riley.



The public and many members attended this Star Party and enjoyed the views in the cool brisk air. Photo by Jake O'Riley.

Double Cluster, M45, M72, NGC457 ET, NGC4563 Cat Eye, M92, M32 and M110 in one view and single, M12, M13, Venus, Jupiter, Saturn, and tried unsuccessfully to split Vega-Alpha Lyrae.

Carolyn Speed shares: Hi, Terri, We enjoyed the star party very much. Our grandson, Dash, was excited to see the planets and stars through the telescopes and to talk with the "meteor man". He loves to meet new people and seems to have a definite interest in astronomy. When you talk with your folks who were there, please thank them for their patience in explaining things to him, and us too! It was thrilling. Happy Thanksgiving, Carolyn, Jim, Joe & Dash Speed



Betelgeuse and the Crab Nebula: Stellar Death and Rebirth

David Prosper

What happens when a star dies? Stargazers are paying close attention to the red giant star **Betelgeuse** since it recently dimmed in brightness, causing speculation that it may soon end in a brilliant supernova. While it likely won't explode quite yet, we can preview its fate by observing the nearby **Crab Nebula**.

Betelgeuse, despite its recent dimming, is still easy to find as the red-hued shoulder star of Orion. A known variable star, Betelgeuse usually competes for the position of the brightest star in Orion with brilliant blue-white Rigel, but recently its brightness has faded to below that of nearby Aldebaran, in Taurus. Betelgeuse is a young star, estimated to be a few million years old, but due to its giant size it leads a fast and furious life. This massive star, known as a supergiant, exhausted the hydrogen fuel in its core and began to fuse helium instead, which caused the outer layers of the star to cool and swell dramatically in size. Betelgeuse is one of the only stars for which we have any kind of detailed surface observations due to its huge size –

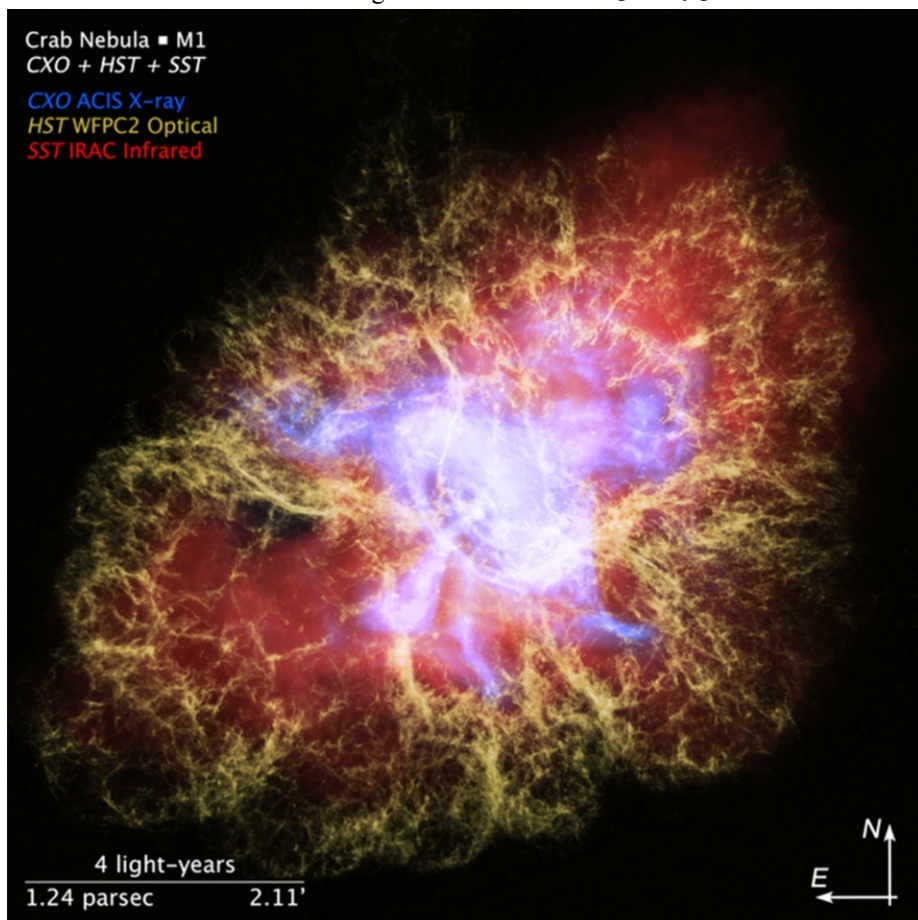
somewhere between the diameter of the orbits of Mars and Jupiter - and relatively close distance of about 642 light-years. Betelgeuse is also a “runaway star,” with its remarkable speed possibly triggered by merging with a smaller companion star. If that is the case, Betelgeuse may actually have millions of years left! So, Betelgeuse may not explode soon after all; or it might explode tomorrow! We have much more to learn about this intriguing star.

The **Crab Nebula** (M1) is relatively close to Betelgeuse in the sky, in the nearby constellation of Taurus. Its ghostly, spidery gas clouds result from a massive explosion; a supernova observed by astronomers in 1054! A backyard telescope allows you to see some details, but only advanced telescopes reveal the rapidly spinning neutron star found in its center: the last stellar remnant from that cataclysmic event. These gas clouds were created during the giant star's violent demise and expand ever outward to enrich the universe with heavy elements like silicon, iron, and nickel. These element-rich clouds are like a cosmic fertilizer, making rocky planets like our own Earth

possible. Supernova also send out powerful shock waves that help trigger star formation. In fact, if it wasn't for a long-ago supernova, our solar system - along with all of us - wouldn't exist! You can learn much more about the Crab Nebula and its neutron star in a new video from NASA's Universe of Learning, created from observations by the Great Observatories of Hubble, Chandra, and Spitzer: bit.ly/CrabNebulaVisual

Our last three articles covered the life cycle of stars from observing two neighboring constellations: Orion and Taurus! Our stargazing took us to the “baby stars” found in the stellar nursery of the Orion Nebula, onwards to the teenage stars of the Pleiades and young adult stars of the Hyades, and ended with dying Betelgeuse and the stellar corpse of the Crab Nebula. Want to know more about the life cycle of stars? Explore stellar evolution with “The Lives of Stars” activity and handout: bit.ly/starlifeanddeath

Check out NASA's most up to date observations of supernova and their remains at nasa.gov



This image of the Crab Nebula combines X-ray observations from Chandra, optical observations from Hubble, and infrared observations from Spitzer to reveal intricate detail. Notice how the violent energy radiates out from the rapidly spinning neutron star in the center of the nebula (also known as a pulsar) and heats up the surrounding gas. More about this incredible “pulsar wind nebula” can be found at bit.ly/Crab3D Credit: NASA, ESA, F. Summers, J. Olmsted, L. Hustak, J. DePasquale and G.

Bacon (STScI), N. Wolk (CfA), and R. Hurt (Caltech/IPAC)

Asteroid Occultation Timing Event for Nasa Lucy Mission

By Sam Insana, PAS member

Saturday night, December 28th, PAS members Ted Blank, Sam Insana, Kimberly (Kim) Hollingsworth & Melody (Mel) McClure, and Bob Ewing participated in the occultation event to help collect data on the asteroid Leucus. It is a Trojan asteroid near Jupiter, where NASA will be sending a spacecraft to investigate a few years from now on the Lucy mission. There were several other amateur astronomers who also participated.

Ted Blank put on a training session, made videos, distributed detail instructions, distributed the equipment including 8 inch telescopes, cameras, laptops, gps, etc., and helped in many other ways. Ted and Peggy Yeargain and two guys that were new to this staffed two stations north of New River. Kimberly and Sam staffed a station 3 miles west of New River. Bob and Mel staffed a station in Carefree at Mike Maron's house.

This was the first time Bob, Mel, and Kim had ever done an occultation timing and they did a great job. There was a lot of work involved setting up the telescope, collimating, using hand controllers to align two stars and then align a PAE star for insurance, and then locating the target star.

Data recorded included longitude, latitude, altitude, universal time, temperature, wind, humidity, and of course the video of the asteroid occulting a 10.9 magnitude star. We each took a 10 minute video of the less than two second event, to make sure we captured it. The data from over a dozen different scopes is then combined and analyzed to help determine the size, shape, rotation, speed, and distance of the asteroid.

Kim (who had never done this before) and Sam (who was used to the drift method and not handset goto during occultations) had trouble with the handset and had to telephone Ted, Bob, Mel and others to get suggestions. The goto had not taken the scope to the exact star, so Sam moved the field of view around for 15 minutes trying to locate the star. Kim finally pointed to the laptop screen and said she thought we



Sam Insana provided this photo of Kim at her first occultation timing event. She was freezing, but very excited to assist.

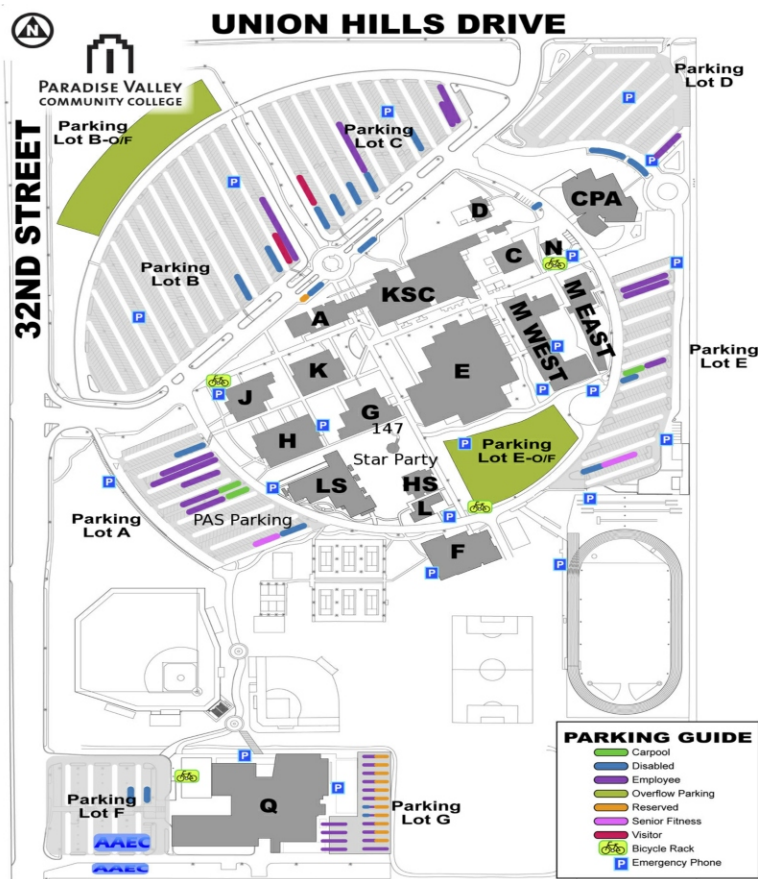
found the target star just about six minutes before the expected occultation. She was right and one minute later Kim and Sam started recording the target star just in the nick of time. Ted and Peggy got an occultation recording of .8 seconds. Bob and Mel also recorded the event. It was a cold night but very exciting and productive. If other members of PAS would like to get involved with the citizen science project of occultation timings, contact PAS member Ted Blank.



Live stack of Bubble Nebula from PVCC's 14" Celestron taken at the January 23rd PAS star party at Black Mountain Campus of PVCC. Photo provided by Jenny Neujoy, PVCC Astronomy Instructor..

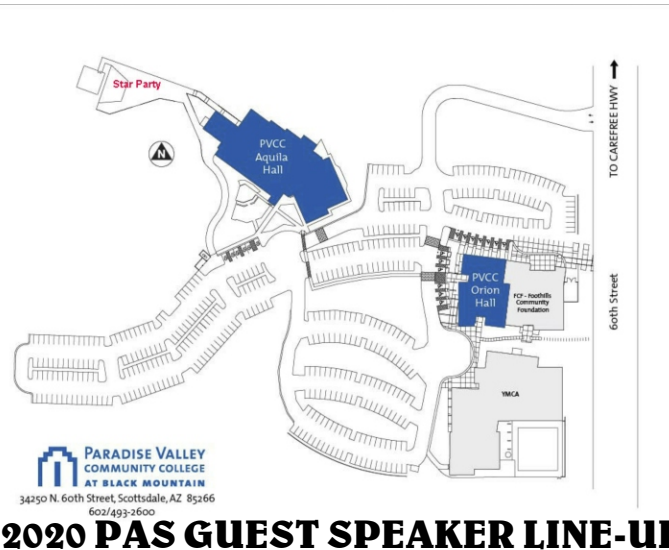
Map of PVCC Main Location

18401 N. 32nd Street | Phoenix, AZ 85032



Map of PVCC Black Mountain

34250 N. 60th Street | Scottsdale, AZ 85266



2020 PAS GUEST SPEAKER LINE-UP

By Terri Finch, Event Manager Events@pasaz.org

PAS Meetings are held at PVCC Main Campus on the first Thursday of the month in Room: **LS-205** 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:

Mar 4: Michael Line, Topic: The Diversity of Extra-Solar Worlds

Apr 2: Eric Steinberg, Topic: The Physics of Chernobyl

May 7: Vincent Cataldo, Topic: Planetary Science

More information at:

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

February 2020

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
						1
2	3	4	5	6 <i>PAS Meeting</i>	7	8 <i>All day Public Astronomy Events</i>
9	10	11	12	13 <i>Telescope Workshop</i>	14	15
16	17	18	19	20 <i>Public Star Party</i>	21	22
23	24 <i>Public Star Party</i>	25	26	27	28	29