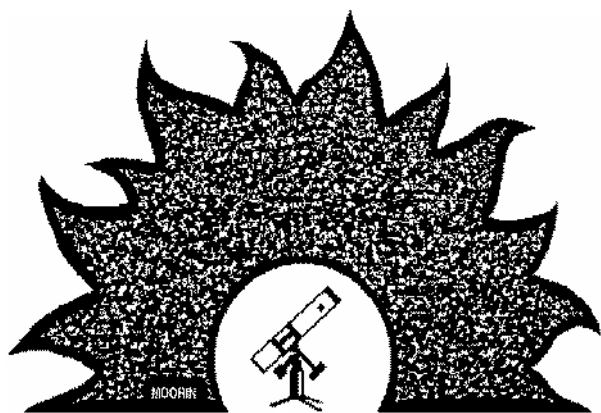




PAStimes

Phoenix Astronomical Society

www.pasaz.org

December 2015

Volume 67 Issue 4

PHOENIX ASTRONOMICAL SOCIETY — ESTABLISHED 1948

John C. Pulis RIP

Date of Birth: Thursday, April 13th, 1922

Date of Death: Monday, November 9th, 2015

John C. Pulis, 93, of Phoenix, AZ, passed away on Monday, November 9, 2015 in Phoenix. He was born in 1922 in Detroit, Michigan, to Lawrence and Phyllis Pulis, the oldest of three children. John joined the military following high school and served in the Army Air Forces (which

became the Air Force in 1947) in World War II. During his service he was on a B24 Bomber crew and survived being shot down.

Following his service in the military, he went to work for Westinghouse in Tool and Die. John was very active in bringing in the union and served as a union rep and mediator. He retired after 40 years.

John married Ruth Seilicka in 1958. They were married for 56 years. John enjoyed...
See John Pulis RIP on page 4



John at a PAS Event for his 90th Birthday Celebration on Sept 15 2012. Photo by Terri Finch.

Bob Ewing to Speak at Dec 2 (Wednesday) PAS Meeting

"Continuation of the Cosmological Distance Scale."

Provided by Bob Ewing

I have been interested in astronomy since I was 6. My older sister taught me how to read Zim and Baker's "Stars" book and taught me the constellations - I was hooked! Later I had the extreme good fortune to attend University of Wisconsin and study astrophysics.

I taught at Portland Community College for many years and then had the further good fortune to be hired to teach at PVCC and join PAS !!



December 2 PAS Meeting on Wednesday

By Terri, Event Manager

Please note the change in day of the week for the December PAS Meeting. It will be held at PVCC on Wednesday Dec 2 in Room LS-204. Many thanks to Jenny for getting us this room to have our meeting!

Make sure to attend for an excellent presentation by PAS and PVCC faculty member Bob Ewing who will talk about the "Continuation of the Cosmological Distance Scale." Bring a snack to share. Bottled

water is provided by the PAS Snack Fund, so make sure you drop something in the Snack Fund box for next meeting's water supply. See you there!

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December 2015 Upcoming Events

By Terri, Event Manager

More events may be added to the Calendar, so check the website for updates at <http://www.pasaz.org/forums/calendar.php>.

Dec 2: PAS Meeting at PVCC in Room LS 204. Come enjoy a wonderful presentation by Bob Ewing. Bring a snack to share. Bottled water provided by PAS Snack Fund. Everyone welcome.

Dec 3: DBG Luminaria Star Party - PAS will provide 4 telescopes for your Evening Sky Viewing Pleasure on clear evenings, or 2 displays (Mike with Meteorites or Kevin with a variety of Displays) for cloudy weather, at the Desert Botanical Gardens on this night from 5:30 to 9:30 for the Luminaria Event. Bring the whole family and visit PAS in the Desert Wildflower Loop Trail, to the right after you enter the Garden. PAS will be at DBG on Dec 3, 4, 5, 6, 10, 11, 12, 13, 16, 17, 18, 19, 20, 21, 22, 23, 26, 27, 28, 29, 30, & 31. More Details: <http://www.pasaz.org/forums/calendar.php?do=getinfo&e=1665&day=2015-12-3&c=1>

Dec 3: School Star Party (Private)

Dec 4: DBG Luminaria Star Party - More Details: <http://www.pasaz.org/forums/calendar.php?do=getinfo&e=1666&day=2015-12-4&c=1>

Dec 5: DBG Luminaria Star Party - More Details: <http://www.pasaz.org/forums/calendar.php?do=getinfo&e=1667&day=2015-12-5&c=1>

Dec 6: DBG Luminaria Star Party -

More Details: <http://www.pasaz.org/forums/calendar.php?do=getinfo&e=1692&day=2015-12-6&c=1>

Dec 7: Conjunction of Moon & Venus

Dec 10: DBG Luminaria Star Party - More Details: <http://www.pasaz.org/forums/calendar.php?do=getinfo&e=1668&day=2015-12-10&c=1>

Dec 10: Public Star Party at BMC 7pm to 10pm More details: <http://www.pasaz.org/forums/calendar.php?do=getinfo&e=1397&day=2015-12-10&c=1>

Dec 11: DBG Luminaria Star Party - More Details: <http://www.pasaz.org/forums/calendar.php?do=getinfo&e=1669&day=2015-12-11&c=1>

Dec 12: DBG Luminaria Star Party - More Details: <http://www.pasaz.org/forums/calendar.php?do=getinfo&e=1670&day=2015-12-12&c=1>

Dec 13: DBG Luminaria Star Party - More Details: <http://www.pasaz.org/forums/calendar.php?do=getinfo&e=1691&day=2015-12-13&c=1>

Dec 13: Geminids Meteor Shower Peak - Naked eye event.

Dec 16: DBG Luminaria Star Party - More Details: <http://www.pasaz.org/forums/calendar.php?do=getinfo&e=1671&day=2015-12-16&c=1>

Dec 17: DBG Luminaria Star Party - More Details: <http://www.pasaz.org/forums/calendar.php?do=getinfo&e=1672&day=2015-12-17&c=1>

Dec 18: DBG Luminaria Star Party - More Details: <http://www.pasaz.org/forums/calendar.php?do=getinfo&e=1673&day=2015-12-18&c=1>

Dec 19: DBG Luminaria Star Party - More Details: <http://www.pasaz.org/forums/calendar.php?do=getinfo&e=1674&day=2015-12-19&c=1>

Dec 20: DBG Luminaria Star Party - More Details: <http://www.pasaz.org/forums/calendar.php?do=getinfo&e=1675&day=2015-12-20&c=1>

Dec 21: DBG Luminaria Star Party - More Details: <http://www.pasaz.org/forums/calendar.php?do=getinfo&e=1676&day=2015-12-21&c=1>

Dec 22: DBG Luminaria Star Party - More Details: <http://www.pasaz.org/forums/calendar.php?do=getinfo&e=1677&day=2015-12-22&c=1>

Dec 23: DBG Luminaria Star Party - More Details: <http://www.pasaz.org/forums/calendar.php?do=getinfo&e=1678&day=2015-12-23&c=1>

Dec 26: DBG Luminaria Star Party -
More Details:

<http://www.pasaz.org/forums/calendar.php?do=getinfo&e=1679&day=2015-12-26&c=1>

Dec 27: DBG Luminaria Star Party -
More Details:

<http://www.pasaz.org/forums/calendar.php?do=getinfo&e=1680&day=2015-12-27&c=1>

Dec 28: DBG Luminaria Star Party -
More Details:

<http://www.pasaz.org/forums/calendar.php?do=getinfo&e=1681&day=2015-12-28&c=1>

Dec 29: DBG Luminaria Star Party -
More Details:

<http://www.pasaz.org/forums/calendar.php?do=getinfo&e=1682&day=2015-12-29&c=1>

Dec 30: DBG Luminaria Star Party -
More Details:

<http://www.pasaz.org/forums/calendar.php?do=getinfo&e=1683&day=2015-12-30&c=1>

Dec 31: DBG Luminaria Star Party -
More Details:

<http://www.pasaz.org/forums/calendar.php?do=getinfo&e=1684&day=2015-12-31&c=1>

PRESIDENTIAL CORNER

By Sam Insana, President of the Phoenix Astronomical Society

The Phoenix Astronomical Society has successfully doubled its membership over the last few years. There are many new faces at meetings and star parties - it would be a great idea for everyone in our club to send information to Terri and Don

for the People of PAS section of our Website. A paragraph could reveal your interests in astronomy, your other hobbies, family, educational, or career backgrounds. Also send a photo of yourself so everyone, both PAS members and the pub-

lic can get to know you better. We have had several of our older members pass away during the last year. Don't wait for a celebration of life to share your interesting history. Let us get to know you now.

PAS Swap Meet at December 2 PAS Meeting

By Terri, Event Manager

PAS holds a swap meet every year at the December PAS Meeting. This idea was first created by Jerry Belcher, long time PAS member who passed away in 2014. This year the swap meet will happen like this: One side of the room will be for the swap meet auction. Bring your items and accessories for sale to this side of the room. With each item, include a page that has your item description and everything that goes with the item. On the page, put your

starting bid as the minimum you will accept. The bidding starts when the item gets set up on the table and closes at the end of the meeting, once the sale has been made. If you are going to outbid someone, be sure you are standing near the item at the end of the meeting.

Garage Sale: On the other side of the room will be a garage sale set up. Price your items for sale. Items on this table might be negotiated on price, or you might

like the price and buy it as is. These items may be sold anytime during the evening. You don't have to wait until the end of the evening to make the sale or purchase your item.

Since this is a chance to clean out your closet or get a very good deal on some equipment, please bring cash and be early enough to grab the deals. We hope to see you there. The swap meet is open to everyone - Public Welcome!

Desert Botanical Gardens Luminaria 2015

By Terri, Event Manager

The Phoenix Astronomical Society will be at all 24 Events of 2016 Luminaria at the Desert Botanical Garden. The dates are: Nov 27, 28, Dec 3,4,5,6 10, 11, 12,13,16,17,18,19,20, 21,22, 23 26, 27, 28 29, 30 and 31. As long as skies are clear, we will have 4 telescopes set up for your viewing pleasure along the Wildflower Loop

Trail, which is to the right as you pass the entrance gate. Should weather be an issue, and as long as there isn't a massive rainstorm, PAS will provide two presenters with displays at the entrance of the Wildflower Loop Trail. We look forward to sharing the night sky and our love of astronomy with all who wish to enjoy the

views and the knowledge with us. DBG charges admission to their Luminaria event, but the views provided by PAS through our telescopes are included in your admission price. Please do not touch the telescopes. Come see the beautiful winter night skies with PAS as your portal to the Stars!

2016 Upcoming Events

The 2016 Event line up is fantastic! We have social PAS Music Jam and PAS Social both in January and the Awards Ceremony in April. I'm working with Mike to set up a bunch of events at his home

through Spring 2016. Watch for them to arrive on the calendar and in your email. Also Mike told me he is thinking of doing his Summer Lecture Series for 2016. This will be the best PAS Year ever! Of course,

having the PAS Members at these events will make it that much better for all! See you at the events!

John C. Pulis RIP

Continued from page 1

joyed skating, biking, swimming and electronics. But most of all he loved flying. He liked it so much that he enlisted before he could be drafted in the military so he could choose to be in the Army Air Forces and around airplanes.

He is survived by his wife Ruth; sons John L Pulis and Michael Pulis; 3 grandchildren, Ryan, Martin, and Brianne (Eric) Thompson

He was preceded in death by his parents, his brother Louis, and sister Mary. The official Obituary notice can be seen here:

<http://www.obitsforlife.com/obituary/1197668/PULIS-JOHN.php>

Sam writes: I knew John for almost 10 years. He was a host at our PAS meetings and always had interesting things to say. His discussions ranged from flying remote control model airplanes to his own World War II experiences in the Army Air Corps, flying in bombers over the Pacific. He was shot down several times but always managed to survive. I remember helping to throw John a 90th birthday party at Mike's house during a star party with potluck. Although John was in great shape physically and mentally, he started to cry when he read the birthday card everyone signed with all the nice things everyone wrote. At his 90th birthday party John mentioned he loved to play the accordion, especially Polkas. I suggested that since I played some instruments and so did Terri, that we form a little jam session. Terri put it together, but unfortunately at that time John's health began a rapid decline. Although we have had several years of jam sessions, John was never able to attend. My wife Vera, son Frank and I visited John several times in a



Dinner at DV Airport Restaurant after the Funeral for the "Celebration of Life" of John Pulis, Nov 17, 2015. Photo by Kevin Harcey.

nursing home over the last few years. His memory of the distant past, like WW II, was remarkable. However, he had real trouble remembering anything over the last few years. We will all miss this kind man. Sam Insana, PAS President

Here's a letter written by **Frank Insana** to John Pulis Feb 2008.

'Hey John Pulis, I hope you enjoy the book that I have meant to give you now for over a year. You have always been one of the great mentors of my life. You have opened my mind, faith, and health into a vast new form of thinking, hope, and happiness since the day we first met. I wish that every person in my generation could meet you because you would be a great inspiration to all of them just as you were to me. To me you are also a naturalist; a person who questions every aspect of life, thinks things through, tries to imagine what life

was like in the past rather than just moving with the flow of robots into the future. Sincerely, Naturalist Frank Insana.'

Terri Finch writes: John was a great asset to the club and a dedicated Host, always greeting attendees cheerfully. He especially took time with new people to explain the workings of the club and what we have to offer. John's enthusiasm for PAS was contagious and is one of the many reasons I chose to belong to PAS, rather than other clubs in the area. He was always genuinely happy to see me at the meetings. His lovely wife Ruth and I have been friends since I first met her. Though John missed the first ever PAS Music Jam, each year since, we honor him by holding the Jam and enjoying the music he would have loved to be part of. He will be greatly missed.



John Pulis's Funeral Nov 17, 2015. Photo provided by Sam Insana.



We will miss John. He was a great friend. Photo by Sam.

PAS Meeting November 4

By Terri, Event Manager

This meeting started with a very nice meal at Deer Valley Airport Restaurant attended by William and Terri Finch, Sam Insana, Peter Turner, Guest Speaker Dennis Young and Ted Blank.

Sam opened the meeting at 7:30 with a few brief items including introducing the officers, welcoming new member Denis Robertson and presenting the "Events Manager" badge to Terri Finch. We then turned the night over to Dennis Young. Dennis started out with his Astro-Scenic-Photography. He had some great stories to go along with his thought provoking presentation and some really great images to share with the group. His second topic was a series of videos on light pollution, commercial trips to space and a flyby of Saturn. His third topic was his newly designed telescope - a 12" REFRACTOR! Normally such a beast would be enormous and very heavy, but through Dennis' clever and balanced design, including a folded, off axis light path, the unit can be carried in a car and assembled fairly quickly. The scope also presents the eyepiece at a comfortable viewing position regardless of elevation. Many members commented af-

terward about how excellent a presentation it was and several asked that we have Dennis back for another presentation in the future. There were 21 people in attendance, and 3 more who came after the meeting started

Many thanks to everyone who provided snacks at the meeting and for those of you who purchased Year in Space Calendars. Welcome to new member Denis! See you at the next PAS meeting on Wednesday Dec 2 in LS-204 for a fantastic presentation about the Cosmological Distance Scale!



President Sam Insana gives Terri Finch the PAS Position Badge for Events Manager at the November 4 PAS Meeting.
Photo taken by Don **Boyd**.



The Scope being assembled. Photo by Terri Finch.



*Dennis Young gave a very extensive presentation on his Astro-Scenic-Photography.
Photo taken by Don.*



*There's a magnified Dennis down the end of this awesome scope.
Photo by Sam Insana.*



Dennis assembled his newest home-made telescope at this meeting. It was really something awesome to see. Photo taken by Don Boyd.

2016 Guest Speaker Line-up

By Terri, Event Manager

Many thanks to Sam Insana, President of PAS, for finding several of the guest speakers for the Spring 2016 guest speaker line up. We have these upcoming PAS Meetings with some fantastic guest speakers:

Jan 14: Alex Vrenios (PAS Member)

“Radio Astronomy”

Feb 4: Ted Blank (Sam’s Guest Speaker) “Occultation Research”

Mar 3: David Williams (Terri’s Guest Speaker) “Year of the Dwarf Planet”

Apr 7: Elliott Rachlin (Eric’s Guest

Speaker) “ISS Telescope System”

May 5: Dan Heim (Sam’s Guest Speaker) “Light Pollution”

We hope to see you at these interesting PAS meetings and the other fun events we have lined up for 2016.

Preparing for the PAS Music Jam Jan 16

By Terri, Event Manager

Dust off that old accordion, flute, guitar, keyboard and come join PAS for the annual PAS Music Jam, in honor of John Pulis (RIP). This year’s members-only event will be held in January 2016. More details on location, times, potluck, etc. will be on line, in the Private Calendar at this link:

<http://www.pasaz.org/forums/calendar.php?do=getinfo&e=1542&day=2016-116&c=1>

We will have a nice potluck and then the jam will begin shortly after. You must

attend the Wednesday Dec 2nd PAS meeting to get a copy of the music we will be playing from. Ed Wurst will have the copies (or Terri Finch, in Ed’s absence - he hurt his hip recently and isn’t getting around that well). Please return the music book at the end of the jam so we have it for next year’s jam.

You can attend the music jam to play an instrument, to sing, to play rhythm or to just enjoy the music. For the last couple years we have had Sam on trumpet and keyboard, Eric on bass guitar and recorders,

Terri on guitar, mandolin and keyboards, Ed on accordion, Bruce on banjo. We’ve had some great singing voices of Ora and Darlene. Come make music with PAS!

This night is not a great night for a star party, however if you don’t mind a 1st quarter Moon in the night sky, then bring your telescope and we can have an observing session too. More details about this event will be in the January newsletter. Hope to see you there!

Mini Presentations in 2016 at PAS

By Terri, Event Manager

Have you wanted to do a presentation for PAS but didn’t think you would fill 1.5 to 2 hours as our professional guest speakers often do? PAS has several “mini” presentation dates for which you can sign up, letting me know how long it is so we can fill a meeting with several smaller presentations done by PAS members (or anyone wishing to give a presentation that is under

60 minutes long). We try to fit as many as possible into the schedule to fill that evening with some great topics. The next two dates PAS has for mini-presentations will be Feb 28, 2016 and Sept 1, 2016. If you wish to do a presentation at one of these meetings, sign up today. The spaces are filling up fast and I’d like to have room to fit your presentation into the schedule.

Email me today with a topic, a teaser paragraph about your presentation and the length of your presentation and let me get you scheduled. Thanks to everyone who has participated in this type of PAS meeting in the past. Looking forward to a series of great mini- presentations.

Updating PASaz.org Website

By Terri, Event Manager

PAS has had some changes in officers, membership and other club information since the last major update to the website. We have formed a Website Committee to figure out what needs to be updated and get it done. If you are a current PAS member

and would like to be on the People of PAS page, send a photo and paragraph similar to what you see others post there to me, Events@pasaz.org, before the end of the year. The plan is to have the People of PAS page updated by the beginning of 2016.

After that, we will tackle other pages needing to be updated with the help of anyone who wishes to assist. Thank you for your submissions.

2016 Year in Space Calendar Order

By Terri, Event Manager

The 2016 Year in Space calendar has been ordered. Many thanks to the seven members who ordered them. The plan is to

deliver them at the December 2nd PAS Meeting. Those who ordered a calendar, watch your email for a notice that they have

arrived and are ready to be delivered or picked up. Have an astronomical 2016!



Our Solar System Is *Almost* Normal, But Not Quite

by Ethan Siegel

It was just over 20 years ago that the very first exoplanet was found and confirmed to be orbiting a star not so different from our own sun. Fast forward to the present day, and the stellar wobble method, wherein the gravitational tug of a planet perturbs a star's motion, has been surpassed in success by the transit method, wherein a planet transits across the disk of its parent star, blocking a portion of its light in a periodic fashion. Thanks to these methods and NASA's Kepler spacecraft, we've identified many thousands of candidate planets, with nearly 2,000 of them having been confirmed, and their masses and densities measured.

The gas giants found in our solar system actually turn out to be remarkably typical: Jupiter-mass planets are very common, with less-massive and more-massive giants both extremely common. Saturn—the least dense world in our solar system—is actually of a fairly typical density for a gas giant world. It turns out that

there are many planets out there with Saturn's density or less. The rocky worlds are a little harder to quantify, because our methods and missions are much better at finding higher-mass planets than low-mass ones. Nevertheless, the lowest mass planets found are comparable to Earth and Venus, and range from just as dense to slightly less dense. We also find that we fall right into the middle of the "bell curve" for how old planetary systems are: we're definitely typical in that regard.

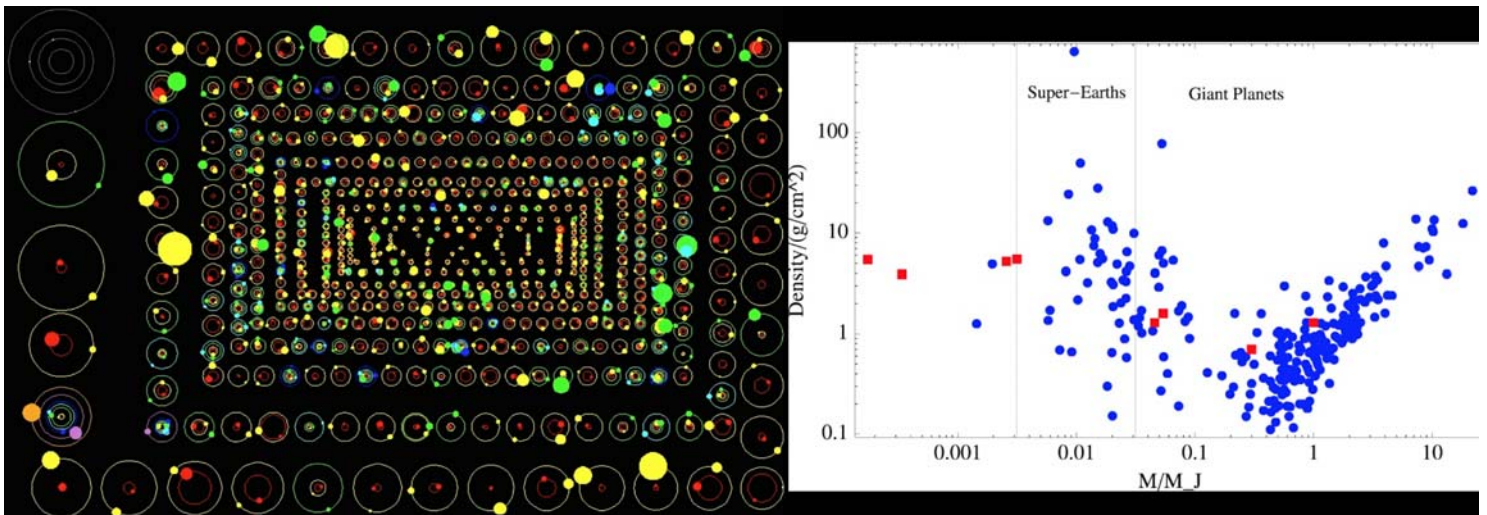
But there are a few big surprises, which is to say there are three major ways our solar system is an outlier among the planets we've observed:

- All our solar system's planets are significantly farther out than the average distance for exoplanets around their stars. More than half of the planets we've discovered are closer to their star than Mercury is to ours, which might be a selection effect (closer planets are

easier to find), but it might indicate a way our star is unusual: being devoid of very close-in planets.

- All eight of our solar system's planets' orbits are highly circular, with even the eccentric Mars and Mercury only having a few percent deviation from a perfect circle. But most exoplanets have significant eccentricities, which could indicate something unusual about us.
- And finally, one of the most common classes of exoplanet—a super-Earth or mini-Neptune, with 1.5-to-10 times the mass of Earth—is completely missing from our solar system.

Until we develop the technology to probe for lower-mass planets at even greater distances around other star systems, we won't truly know for certain how unusual we really are!



NASA / Kepler Dan Fabricky (L), of a selection of the known Kepler exoplanets; Rebecca G. Martin and Mario Livio (2015) ApJ 810, 105 (R), of 287 confirmed exoplanets relative to our eight solar system planets.

Westwind School Star Party Nov 10

By Earl DeLong

The weather was nice. We provided 2 telescopes and to displays for their Fall Festival. There was a large crowd. We set up at the rear of the field near the baseball

diamond. When the festival started a large inflatable slide was opened near our telescopes. This help block the floodlights but also hid us from the crowd. We did not

have many people stop to observe through the telescope. Light pollution was very high at this location. The Mexican food was good.

Astro Tech: The Equation of Time, Part 1

by Alex Vrenios

Noon is the time of day when one expects the Sun to be at its highest point in the sky. (The phrase “high noon” describes it best.) But when the clock strikes noon, it’s noon everywhere across the timezone. Surely, the Sun can’t be at its highest point in the sky from everyone’s perspective in that time zone.

Luckily, there is a refinement to that concept which is to calculate the exact time that the Sun should be highest in the sky where you happen to be within the time zone. We’ll call this time of day your “clock noon”. Unfortunately, the Sun is still not always at its highest point at that time of day, either: the desired result is to know the exact time of day when the Sun is actually at its highest point in the sky each day. Let’s call that “local noon”.

Local noon and clock noon almost always happen at slightly different times of day. Knowing exactly how much difference is beneficial when using a sundial. It may also be useful to a sailor who is on the open sea, trying to determine longitude. From a purely scientific viewpoint, understanding these concepts can give you an insight into how our Sun-Earth system behaves.

Sometimes local noon comes before clock noon (the Sun is highest before the clock says it’s supposed to be), and sometimes the Sun gets to its highest point after clock noon. These differences are predictable. They are caused by two phenomena: the Earth’s 23.5 degree tilt on its axis, and the Earth’s slightly elliptical orbit. Together these two properties cause the Sun to appear highest in the sky either earlier or later than clock noon, depending on the day of the year.

The graphic representation of these time differences is called the Equation of Time. Okay - you’re right. A graph is not exactly an equation, but that’s what the people who study such things at the Analemma Society call it.

What, you didn’t know there was an Analemma Society? (See analemma.org.) Their primary interest is, as expected, the analemma: the locus of points describing the positions of the Sun at local noon (a sort of asymmetric figure eight, made popular by a year-long multiple exposure photograph by Dennis Di Cicco, back in the 1970s.) Secondly, they boast several unique designs for a sundial and have near reverence for The Equation of Time (EoT)

curve. (Figure 1.)

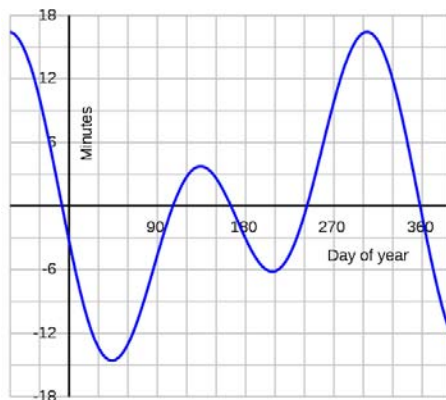


Figure 1. Equation of Time Curve

For example, when the clock time (your clock noon) says it’s noontime, is the Sun still east of the highest point in the sky (late), or west of it (early)? If the Sun is exactly at its highest point in the sky when the clock says it’s time, it’s neither early, nor late; it’s exactly on time, corresponding to a point on the horizontal line through the center of the plot. This happens only four times a year.

As stated earlier, this curve is a function of two very important physical properties of the Earth as it moves along in its orbit: the eccentricity, or how elliptical its orbit is, and the obliquity, or how much the Earth’s axis is tilted from being perpendicular to the plane of its orbit. Actually the EoT curve is the sum of the two curves that represent the eccentricity and the obliquity, but the determination of those curves is beyond the scope of this article.

We can ignore the eccentricity and obliquity curves and still get a representation of the EoT from observational data, which is what this article is all about. Nevertheless, the data must be collected over a full year and we will have to plot a point that corresponds to the exact position of the Sun at our clock noon every few days, when the Sun is highest in the sky. Finding the exact time of our clock noon time is the first task.

The Earth can be divided into 24 equal sections by vertical lines called lines of longitude. The Earth rotates almost exactly once every 24 hours. Therefore, every one of these 15-degree sections can be said to correspond to an hour of the day. (This is an approximation, but it is close enough for our purposes.)

Time zones are, in many cases, politi-

cal, following the borders of US states, or zigzagging around islands where convenient. Let’s ignore all that for our purposes and claim that each of these 24 lines of longitude is the edge of a time zone and that when it’s 12 noon on one of these lines, it’s 1pm at the next line to the east and 11am at the next line to the west. The problem is that when it’s 12 noon at one line, it’s 12 noon everywhere in that time zone. Not to worry, though, we can interpolate (find the value of a point on a line between two points of known value) to find the exact time of a clock noon anywhere on the planet.

My home in north-central Phoenix is at 112 Degrees 2’ 58” west longitude. The two “hour” lines of longitude to my east and west are at 105 degrees and 120 degrees, respectively. So I’m in between them. Let’s find out exactly where I am, relative to them both.

Using 60 minutes per hour and a 15-degree time zone, we calculate $(112.05 - 105) * (60 / 15) = 7.05 * 4 = 28.2$ minutes

Therefore, clock noon at my house is at 12:28:12 pm. That is exactly when I must take each data point marking the actual position of the Sun in the sky.

I need to build an apparatus to help me get each solar position in the form of altitude and azimuth.

One solution is to construct a bread-box-sized apparatus, open at the back end. (Be sure the open end is large enough for your hand while it’s holding a pencil as shown in Figure 2.) Tape a piece of paper to the inside floor and drill a small hole in a slanted front piece. Align the longer ends of the apparatus to true north and south and, at exactly clock noon, place a dot on the paper where the Sun shines through the hole and makes a bright spot on the paper. Be careful to align it properly along north and south before you take each data point.

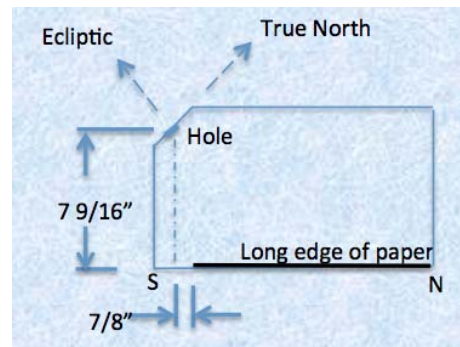


Figure 2. Apparatus side view diagram

Here is a photo of the apparatus in operation. It shows the open end, the paper taped to the inside floor and the single spot of sunlight coming through the tiny hole in the front. (Figure 3.)

Next month we'll take a close look at the raw data points and process them into a set of data we can use to plot our data-driven Equation of Time curve. -To be continued...



Figure 3. Apparatus ready to acquire a data point

The Party of the Year - PAS Social Jan 30

By Terri, Event Manager

This year's event will be terrific. We have some new ideas for fun activities and are working on prizes for the winners. I'm also open to suggestions you might have for things to do at the event. The potluck will be at 5:30; the party festivities start at 7pm. More details will become available in the January issue and at the Private Calendar link [here: http://www.pasaz.org/forums/calendar.php?do=getinfo&e=1748&day=2016-1-30&c=1](http://www.pasaz.org/forums/calendar.php?do=getinfo&e=1748&day=2016-1-30&c=1).

This is a PAS Members ONLY event - if you aren't a current PAS member, join prior to this date and come enjoy the fun. This is an event for the whole family. What's cool about this year's event is that it is on a dark sky night, so after the activi-

ties conclude indoors, we can go outdoors and do some viewing. If you have a scope, bring it along but leave it in the car until all activities are done, unless you want to draw people out during the activities. In that case, let me know so I can announce what objects you are showing.

We hope to have a great attendance with lots of good food to share. We will be celebrating a birthday at this event, so come prepared to save a little room for the birthday cake. The birthday boy better attend the event!

While you are out Christmas shopping this month, be on the lookout for a \$20 gift to wrap and disguise for the White Dwarf Gift Exchange. The gift should be astronomy related and something you would love

to win at this game. For example, if you found an eyepiece for \$20, that would be an awesome gift to include in this game. The total value of your gift must be \$20, but it can be made up of more than one item per box. Please remember, you need to have a gift to put into the game to play the game. No gift, you don't play. Wrap it shiny so we fight over it!

And bring your dart throwing arm with you, as we will have another challenge with the dart board this year. Feel free to bring your own special darts and if you have an extra dart board around your house, bring it along to help speed up the game.

I look forward to seeing you at this year's "Party of the Year!"

PAStimes Star Tours Meeting Oct 29

By Terri, Event Manager

This was a very productive meeting. I'd like to thank those who attended: William and Terri Finch, Sam Insana, Kevin Witts, Peter Turner, Dewell Howell, Rick Cunningham, Roger Anzini, Mike Marron, Don Boyd, Storm Sallas (over Skype), Bruce Wurst and Howard Moneta.

Since last year's event occasioned some issues and misunderstandings, the main purpose of this meeting was to go over the rules and expectations for the upcoming 24 DBG Luminaria events, making things clear ahead of time. The topics discussed for the Lumi events were 1) dress Code, 2) what the scopes do at the event, 3) what the runners do at the event, 4) how we get paid, 5) weather issues, such as bumping scopes if necessary and in what order

6) backup scopes and what they are expected to do, 7) the time DBG will let us know by if the event is canceled due to weather and the time we should have the weather forecast out to the Lumi Team with the decision of who is attending that night, 8) preparing of objects to look at before going to the event, 9) General PAS business cards, and 10) parking permits.

We then had a brief discussion, per Sam, about the Star Tours rotation list, followed by a quick rundown of general Star Tours info for events other than the Luminaria. Those topics were: 1) updates to the booking docs and the change in fees PAS is charging for events, 2) solar and evening or solar and presentation events, 3) two backup scopes needed for every event

in case one can't make it, 4) always RSVP every event as Yes, No or Maybe to help me make a decision on who to contact for an emergency replacement, should no backup scopes be signed up.

It was a very productive meeting. We opened at 7:20 and were done by 9pm. Thank you all for sticking to the topic of discussion and helping this meeting conclude early. Thanks also to all who brought snacks to share, and to the PAS Snack Fund for providing the case of water. We will set another Star Tours meeting soon. Watch for the announcement. To see the full review of what we discussed, visit the Private Forums at [this link: http://www.pasaz.org/forums/showthread.php?t=1005](http://www.pasaz.org/forums/showthread.php?t=1005)

Star Party in Carefree July 11

(Continued from page 3 of Sept 2015 Issue)

Alex Vrenios writes: Diane and I enjoyed the potluck and discussions of everything from the Dr. Who family to the Very Large Array in New Mexico. At around 7 pm, we began a business meeting that lasted until just about 8 (Meeting minutes are available from the Secretary). That done, those who brought them set up their scopes. I didn't believe it would get so clear so I left mine home. Globulars seemed to be the evening fare and I saw M3, M4 and M5 for perhaps the first time. Oh, I've "seen" them from my backyard, but it's a fuzzy blob in

my skies. In Eric's 22" scope they are truly a wonder to behold. Tons of stars glittering blue and white, just like looking at a photo.

Peter Turner writes: The star party at Mike's on July 11th had five scopes participating. The seeing was good with nice views of the Milky Way. Everyone seemed to focus on different objects so we had an opportunity to see a variety of things. Of particular note was Howard Moneta's view of Saturn. We counted five moons, which is the most that I've had the opportunity to view. Eric Steinberg was able to show

many DSOs, with the view of the Veil Nebula of particular interest.

I was able to find several Messier objects (M4, M22 and M28) that I had not viewed through my scope previously. I also was able to see NGC 6544, which was much fainter than the Messier objects even at 338 magnification. In viewing Saturn, about three hours after Howard, I was only able to see two moons. It may be because of the aperture difference or it may have been because some of the moons were behind the planet by then.

CTCA Sept 9

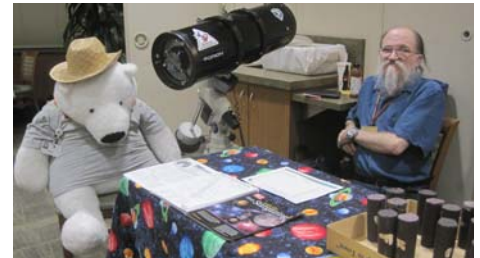
By Terri, Event Manager

It was a very cloudy evening. Don Boyd asked Storm Sallas, Terri Finch and Kevin Witts to join him at this event. We set up indoors, in the cafe. At the main PAS Table, Terri, Storm and Don sat. Don had set up his telescope near the table. Nearby, Kevin set up a nice display with his Meteorites. We had a few people stop by to talk with us. We had a great event. Dinner was awesome. Thank you, Don, for inviting Storm and me to attend.



Kevin, looking through a microscope at a meteorite fragment, with Don in the background, at the PAS Tables, set up for CTCA patients to swing by and enjoy a look at what we had to offer on a very cloudy Sept 9 event.

Photo by Terri.



Don & a Bear named Victor, were seen at the CTCA Star Party. The event moved indoors due to thick cloud cover. Don put his telescope on display, Storm helped me set up a nice display with interactive astronomy activities, and Kevin brought his Meteorites. Photo by Terri.



Rick Cunningham at Mike's home in Carefree, with his scope on Aug 10, 2013. Rick is a PAS-times Star Tour Member. Photo by Terri Finch.



Kevin set up a very extensive, awesome looking table of Meteorites at the CTCA event of Sept 9. Victoria is seen sitting at the table marveling over this fantastic display. She was very interested in what Kevin was sharing with her. Photo by Terri.

PVCC Telescope Workshop Sept 24

By Terri, Event Manager

We had a great turnout for this event. Many nice folks attended to find out how to use their telescopes and we had lots of PAS members to assist them.

Attending from PAS were: William and Terri Finch, Dewell Howell, Rodney Fong, Kevin Witts, Mike Marron, Howard Moneta and Don Boyd. Thanks!

From the public Bill Powell came to

find out about a telescope he was thinking of buying. We did some research online with and for him and concluded it was a fairly good purchase, which he made a few days later. Pete Chartrand brought his Meade Autostar 90mm, and George Sabo came as did Caleb to find out what telescope to purchase. Ann D. came with her Orion 10013 Goto 80 refractor and was assisted by Kevin. Andy attended but didn't

bring his 10" Orion Intelliscope. He chatted with the teachers and listened to what we had to offer.

Many thanks to Casey Durand for giving PAS access to G-147 to hold this event. Jenny and Dave were ill and could not be there to open the doors, so Casey came to our rescue. It was a very productive evening that ended by 9pm. Thank you all for attending!

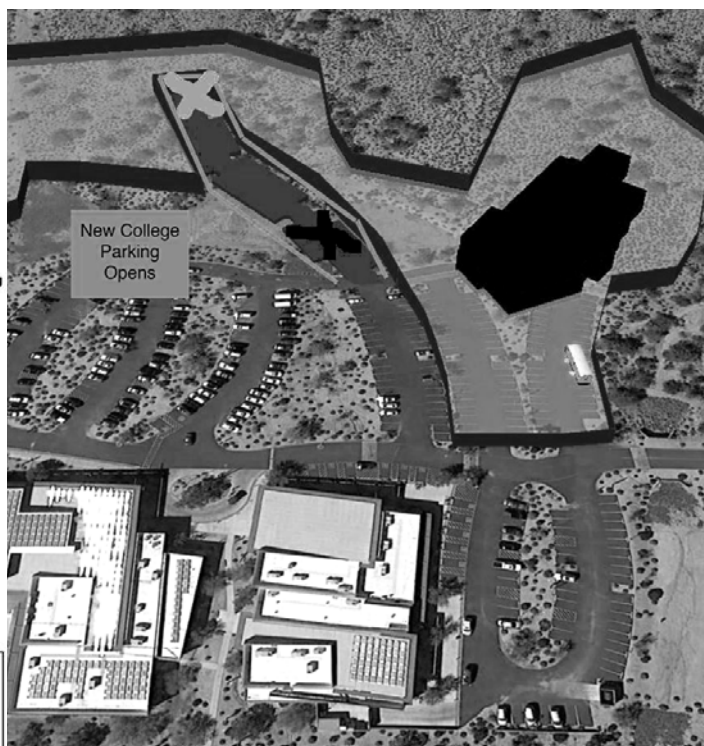
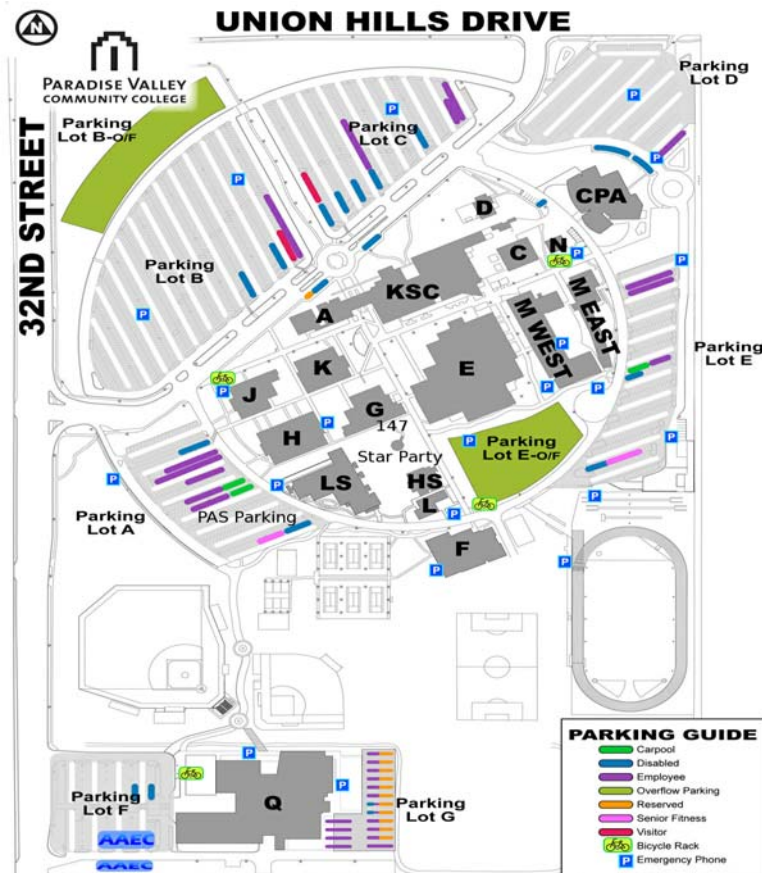
Map of PVCC Main Location

18401 N. 32nd Street | Phoenix, AZ 85032

Black Mountain Campus of PVCC

60th Street and Carefree Hwy

34250 North 60th Street, Scottsdale, AZ 85266



The lighter X is Scope set up. The dark X is PAS Parking.

December 2015

Sun	Mon	Tue	Wed	Thu	Fri	Sat
		1	2 PAS Meeting	3 School Star Party (Private) DBG Luminaria Star Party	4 DBG Luminaria Star Party	5 DBG Luminaria Star Party
6 DBG Luminaria Star Party	7	8	9	10 DBG Luminaria Star Party Public Star Party at BMC	11 DBG Luminaria Star Party	12 DBG Luminaria Star Party
13 DBG Luminaria Star Party Geminids Meteor Shower Peak	14	15	16 DBG Luminaria Star Party	17 DBG Luminaria Star Party	18 DBG Luminaria Star Party	19 DBG Luminaria Star Party
20 DBG Luminaria Star Party	21 DBG Luminaria Star Party	22 DBG Luminaria Star Party	23 DBG Luminaria Star Party	24	25	26 DBG Luminaria Star Party
27 DBG Luminaria Star Party	28 DBG Luminaria Star Party	29 DBG Luminaria Star Party	30 DBG Luminaria Star Party	31 DBG Luminaria Star Party		

Don Boyd
PAStimes Editor
3039 W Peoria Ave 102-188
Phoenix AZ 85029

To:

2015 PAS GUEST SPEAKER LINE-UP

By Terri, Event Coordinator, Events@pasaz.org
These meetings are held on Thursdays in Room LS-204, unless otherwise noted.
Do you have an idea for a Guest Speaker? Email me the details. Here are the scheduled Guest Speakers at PAS:
<http://www.pasaz.org/index.php?pageid=meetings>
Jan 14: Alex Vrenios: "Radio Astronomy"
Feb 4: Ted Blank: "Getting Started as a 'Citizen Scientist' with Occultation Timing"
Feb 25: Special Meeting
Mar 3: David Williams: "Year of the Dwarf Planet: Dawn at Ceres and new Horizons at Pluto"

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Meetup.com - <http://www.meetup.com/Phoenix-Astronomical-Society/>

What's Up For December?

By Rod Sutter, PAS Past President

Planets

Name	Date	Rise	Set
Mercury	12-15-15	08:40	18:19
Venus	12-15-15	04:09	15:01
Mars	12-15-15	02:21	13:51
Jupiter	12-15-15	12:14	12:39
Saturn	12-15-15	06:17	14:29
Uranus	12-15-15	13:35	02:14
Neptune	12-15-15	11:51	23:04
Pluto	12-15-15	08:50	06:58

All Times Arizona Time

December 15 2015

Sunrise: 07:24
Sunset: 17:22



Q3: December 03



New: December 11



Q1: December 18



Full: December 25

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