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Rick Tejera at April 5th PAS Meeting

By Terri, Event Coordinator and Rick Tejera

We would like to invite all PAS Members to join us at the April 5th meeting. Bring a snack to share. Bring your friends & family. This meeting will have a guest speaker on a topic that all the beginners in astronomy should attend. Even those of us who are experienced, will enjoy Rick's presentation & the ideas he has to share. The meeting will be in the Library at PVCC. Water will be provided by President Bruce. Meet as early as 7pm. The meeting will open promptly at 7:30pm.

Navigating the Night Sky: How to Use a Star Atlas

Rick was Born and raised on Lon Gyl-land, Noo Yawk. He moved to Arizona in 1995. He always had a fascination for things that fly. Earned a private pilot's li-

cense back in what seems like another life (1982). Graduated from Dowling College in 1987 with a bachelors degree in Aeronautics & management. He has worked 22 years in the transportation & logistics industry. Rick enjoys a wide range of hobbies, including radio control airplanes, Model railroading, geocaching, astronomy and most recently ham radio (Call K7TEJ).

He got started in Astronomy in 1990 when his wife gave him a department store refractor for Christmas. Took it out on the balcony & soon discovered Saturn. From that point, he was hooked!

He joined the Saguaro Astronomy Club in Feb. 1996. He earned the SAC Messier & 110 Best of the NGC awards & is currently 77 objects from the Herschel

400. He has participated in 12 Messier Marathons & observed over 100 object at least 7 times. In 2009, He completed a perfect Marathon of observing all 110 objects in one evening. He has been married to his wife Susan for 28 years, and is currently enjoying watching his 16 year old daughter Lindsay blossom into a talented young lady, both on the theater stage & in life (even if she does think astronomy is geeky).

Rick's presentation for the Apr 5th PAS Meeting is titled: Navigating the Night Sky: How to Use a Star Atlas. Rick will talk about the basics of celestial motion, types of atlases, how to translate the dots on the atlas to the stars in the sky & cover the basics of star-hopping. He'll also talk about the pros & cons of computer planetarium programs & how they fit into the overall picture.***

PAS Meeting Review of March 1st

By Terri, Event Coordinator

Wow! What an awesome turnout & a fantastic speaker we had for the March 1st PAS meeting. It was held on the PVCC Main Campus in the Q Building in 120A and 120B. We had a turnout of 55 people.

Dr. Hartmann did a presentation about the Moon with some historical & scientific data, plus his own humor & a lot of fun photos. It was very enjoyable & informative. His presentation was very interesting.

I wish to thank everyone who brought snacks to share. Ed Wurst provided the snacks. President Bruce provided the bottled water (4 cases were brought to be sure everyone would get 1 bottle). Sam Insana brought the popcorn - yummy. Tim Jones provided candy at the last Meeting of the Minds, for which I brought it to this event

and it was totally gone by the end of the meeting.

The evening started with very few announcements and we turned it over to Dr. Hartmann who did a presentation for about 1 hr & 15 minutes. He then opened it to Q & A for which we eagerly asked questions, and got answers for another 20 minutes. Mike Marron asked the most questions. At the end of his presentation, I did a few announcements about the snacks, thanking Dr. Hartmann, the Portal Star Party Mar 11 - 17 at Dave's place, the book signing Dr. Hartmann was doing, and the raffle. Many thanks to Dr. Hartmann who donated a book to the raffle for which Albert Tucker won. Jenny won the main raffle.

Many thanks goes to Dr. William Hart-

mann for a fine presentation. I'd also like to thank Jenny for finding a this fine room to have this larger presentation in and for the PVCC Astronomy club for donating half of the honorarium we gave to Dr. Hartmann. I'm setting up another date with Dr. Hartmann in which he is going to share his artwork with us. I can't wait! ***



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Upcoming April PAS Events

By Terri, Event Coordinator, Events@pasaz.org
 Upcoming events list:
<http://www.pasaz.org/forums/downloads.php?do=file&id=49>

April 1: FREE Telescope Workshop at Bookman's 19th Ave & Northern, 3:30pm to 5:30pm in Musical Instrument section of the store. RSVP is required. Please provide type of scope & number in your party, when you RSVP.

<http://www.pasaz.org/forums/calendar.php?do=getinfo&day=2012-4-1&c=1>

Apr 3: School Star Party (Private) 7pm to 9pm.
<http://www.pasaz.org/forums/calendar.php?do=getinfo&e=799&day=2012-4-3>

Apr 5: PAS Meeting in the Library of PVCC Main Campus. Bring a Friend. Meet at 7pm, Meeting begins 7:30 with a few brief announcements & then Guest Speaker takes the floor. Meeting concludes & Library closes 9:30pm. Bring a snack to share. Water provided by our President.

<http://www.pasaz.org/forums/calendar.php?do=getinfo&e=643&day=2012-4-5&c=1>

Apr 7: DBG Private Star Party Back up date for Mar 31.

Apr 10: CTCA Private Star Party in Goodyear, PAStimes Star Tours Members Only.

<http://www.pasaz.org/forums/calendar.php?do=getinfo&e=770&day=2012-4-10&c=2>

Apr 12: FREE Telescope Workshop & Star Party at PVCC Main Campus in G-147 & in Overflow Parking lot, from 7pm to 10pm. PAS Members may use the 6" Dobs provided by PVCC for the Star Party. I do

suggest PAS members bring their own eye-pieces for better views. RSVP with Terri is required for the Telescope Workshop. When you RSVP, please include what type of scope you need assistance with & how many are in your party.

<http://www.pasaz.org/forums/calendar.php?do=getinfo&e=685&day=2012-4-12&c=1>

Apr 13: School Star Party near Metro Center Mall (Private) 7pm to 9pm.
<http://www.pasaz.org/forums/calendar.php?do=getinfo&e=802&day=2012-4-13&c=2>

Apr 19: Meeting of the Minds (Business meeting of PAS), open to everyone. No Children please. 7pm to 10pm in G-147 Main Campus. This Special meeting is for the NSN Awards Ceremony. The Pins are in! It's a party, so bring a snack! Drinks provided by President Bruce.

<http://www.pasaz.org/forums/calendar.php?do=getinfo&e=804&day=2012-4-19&c=1>

Apr 20: DBG Private Star Party 7pm to 9pm

Apr 23: Solar Viewing at a School (Private) 1:30pm to 3:30pm. RSVP with Terri to assist.
<http://www.pasaz.org/forums/calendar.php?do=getinfo&e=795&day=2012-4-23&c=2>

Apr 24: Back up date for Apr 10 CTCA
<http://www.pasaz.org/forums/calendar.php?do=getinfo&e=771&day=2012-4-24&c=2>

Apr 26: Indoor / Outdoor Astro Event 7:30 to 9:30pm. Indoors: Hands on activities, handouts & demos. Outdoors: Star Party. Everyone welcome. RSVP is with Terri to attend this event. PVCC Main Campus G-147.

<http://www.pasaz.org/forums/calendar.php?do=getinfo&e=694&day=2012-4-26&c=1>

Apr 27: School Star Party 7:30pm to 9:30pm (Private) RSVP with Terri to attend.

<http://www.pasaz.org/forums/calendar.php?do=getinfo&e=702&day=2012-4-27&c=2>

Apr 28: ASTRONOMY DAY at Mike's home in Carefree. Public Event. RSVP with Mike to attend 480-488-3031. Potluck at 5pm. BYO snacks & drinks for after the potluck. Everyone welcome!

<http://www.pasaz.org/forums/calendar.php?do=getinfo&e=712&day=2012-4-28&c=1>

May 1: School Career Day Event 8am to 3pm in Surprise (Private).
<http://www.pasaz.org/forums/calendar.php?do=getinfo&e=765&day=2012-5-1&c=2>
 RSVP with Terri to attend. Solar viewing & Venus.

May 2: School star party during dusk 6pm to 7:30pm viewing Sun, Moon, Venus. RSVP with Terri To attend.
<http://www.pasaz.org/forums/calendar.php?do=getinfo&e=797&day=2012-5-2&c=2>

May 3: PAS Meeting at PVCC Main Campus in G-147. Bring a Friend. Meet at 7pm, Meeting begins 7:30 with a few brief announcements & then Guest Speaker takes the floor. Meeting concludes & Library closes 9:30pm. Bring a snack to share. Water provided by our President. This is our year end Pizza Party! RSVP's for pizza are mandatory. Email or call in RSVP, 2 slices per head.
<http://www.pasaz.org/forums/calendar.php?do=getinfo&e=643&day=2012-5-3&c=1>

Astronomical Calendar 2012 Moon page

Jerry gave me a call the other day. He received, in the mail, 11 updated Moon pages for the Astronomical Calendar 2012. If you ordered one of these awesome calen-

By Terri, on behalf of Jerry Belcher
 dars from Jerry, please plan to pick up your updated Moon page, which is page 37, at the April 5th PAS Meeting. Jerry has put your name on your page, for those who

purchased a calendar from him, or in Bruce's case, won the calendar during the White Dwarf Gift Exchange at the PAS Social. See you at the meeting. ***

Norterra Canyon School Star Party Feb 24

By Terri, Event Coordinator

We arrived early, set up, ate pizza, and there was an annoying breeze blowing my handouts around. It was a lovely night for a star party at a school. In attendance from PAS was Eric Steinberg, Tim Jones, Bob Christ, William & Terri Finch, Don Boyd, Albert Tucker, Sam & Frank Insana, & Mike Marron. Our Contact was Kim Lanese who supplied the much needed pizza & water. Many thanks to the Telescope Team and Dewell Howell. Dewell set up this star party with Kim. Dewell showed up, without his scope, but assisted with handouts. Thank you all!

As the evening went on, the breeze died down, and we realized this was an awesome place for a star party. One of the darker school sites we have done yet. Everything about the evening was awesome! I did Q & A with the kids. I think I stole most of them away from Mike this time! We were surrounded by people the whole night. Many thanks to Kim and her school crew for making this a successful, fun event for everyone! We would like to do this event again, sometime. We estimated that attendance of the school kids & parents was about 200 people.

A nice surprise was had by William &

I during the evening. An old friend, Justin Cain, a past President of PAS brought his family to the star party! We haven't seen him in a very long time. Justin was president about the time I took over as Editor of the PAStimes Newsletter. That's many years ago. It was very good to see him again.

Many objects were shown by the Telescope Team: William & I started out on Jupiter, but then when it became dark, stayed on Orion Nebula the rest of the night & did Q & A.

Frank used his small refractor to show the moon to many kids. He also showed the Pleiades open star cluster. Sam used his 8 inch Newtonian reflector to show close ups of 3 craters on the moon, showing mountain peaks and small craters inside the 3 larger craters. Sam also showed Jupiter, and the Orion nebula, and Mars.

Eric writes: Showed Jupiter to about 30 people. Showed M42 to possibly 100 people at 203X, concentrating on the Trapezium. Many very positive comments made the long lines worth it. Later showed M37 to maybe 20 people and finally M51 (Whirlpool) to a few. Because of the light pollution, M51 was just a fuzzy smudge. Staff was extremely helpful, pizza was bet-

ter than average (though not New York quality) and most parents and children were pretty well behaved.

Bob writes: Supporting the Norterra Canyon School event was a pleasure, although setting-up on the basketball court was a double-edged sword: convenient to do, yet hard on the back and legs by the end of the event. Ah, the joys of advancing years. The attendees were very engaged, including the school's Principal who peregrinated from scope to scope and back again. The sky was cooperative that night and I showed the "usual suspects" such as Jupiter, the Double Cluster, M42 (with and without filtering), the Pleiades (in the finder), the Winter Hexagon (visually), M31, and other objects. The parents of the younger attendees were amazed at the ability to see across intergalactic space at other galaxies through the telescope, and of course the time it takes the light from galaxies to reach us is quite a topic of discussion. One small group thought Capella was the North Star so a quick tutorial led them to Polaris. It seemed there was a second wave of attendees so I revisited some of the objects I had displayed earlier. It was a great event. ***

Many Thanks to Laura Lincoln, NASA

By Terri, Event Coordinator

In a recent envelope from NASA, via Laura Lincoln, PAS received a nice space folder and a few other things. I wrote to Laura, via email, and requested a few more of those folders as well as some extra prizes for the kids when I do Q & A at a school star party. I wish to thank Laura for all the goodies she sent to me in two very heavy boxes. The boxes contained: The folders I

requested, Space Place New Millennium Card Decks, Galex post cards NASA Space Place bookmarks, GALEX -Galaxy Evolution Explorer stickers (if any PAS Member wants one for their telescope, let me know and I will bring to next meeting), Feel the Pride cards, Jupiter lithographs (I requested these, as we are out of them), Space Place temporary tattoos, & a variety of CD's. This

is awesome & most of these items will be used as prizes for the kids at school for Q & A. The Folders have a purpose on Apr 19th, find out more by attending the Apr 19 Meeting of the Minds. Thank you Laura! And thanks to NASA for creating all these awesome things I can use as prizes! ***

Scope for Sale: Classic C11 OTA

. This has been in storage for nearly 10 years but worked great back in the day. Should still be fine. It has been tested on the sky and achieved resolution limit for an 11" aperture on double stars. There are some minor scuffs and scratches. Asking \$700 pick up in Tucson only (photos below)

C11 fork and base that was purchased separately from the OTA and while

the drive works it has never carried the OTA. No photos available at this time. Asking \$400 pick up in Tucson only.

Classic Star Liner German Equatorial Mount that carried the C11 OTA for many years. It has a homemade tangent arm Dec. drive and tracks very well. This thing is massive (see below) so pick up in Tucson only. Asking \$500.

The C11 on the Star Liner mount. Drive corrector not included (it died).

Photos of this telescope at:

<http://www.lpl.arizona.edu/~rhill/instr.html>

Buy the whole assembly for \$1100 pick up in Tucson.

Email: RHILL@LPL.ARIZONA.EDU

CTCA Star Party Feb 28

By Joe Collins

This event occurred on the February back-up date, as we cancelled the St. Valentine's Day primary date due to inclement weather. Don Boyd, Eric & Ora Steinberg and myself (Joe Collins) attended the full event from 5:30pm- 9:30pm. Steve Palmer joined us for dinner and attended as a volunteer for the duration of the event. Chris Johnson, a Goodyear local, joined us for morale support for the last hour.

Don setup for solar sunspot viewing, but had no customers (for the first hour). For the evening program, we viewed all the celestial objects on our handout sheets: Jupiter & Galilean moons, Venus, Mars, numerous binary stars, Core of M31, M42 Orion Nebula, The double Cluster, The Pleiades, The Beehive Cluster and the Moon.

During our dinner break in the Cafe, we personally invited patients and caregivers, unfortunately, several patients expressed they were feeling 'too out of sorts' or tired, and the evening was chilly, conse-

quently, we had the lowest attendance for the year: only six people total for about four hours. Refreshments provided were cookies and ICED bottled waters. The few customers who came up did not stay long or chat with us as is usually the case during warmer nights. The event was advertised properly and I discussed the low attendance with Marisa Benincasa of CTCA informally the following week and just before the start of the 3/13 Event.

Assuming it warms up for future events, we will advertise and spend more time/effort at the beginning of the event with solar viewing and other activities, for example, we would like to have Mike Maron come out with his meteorites. In the future, if we have a chilly night, we will request the hospitality servers to recall the iced waters and exchange them for hot coffee and/or hot chocolate service, if we can catch them before they leave for the night. We found out that on Tuesdays now there

are three groups that meet in the Cafe prior to our evening event. Renee Collins agreed to join the patient/caregiver focus group, so in addition to her participation, she invites this group to attend the SkyTour afterwards. We can also drop off flyers advertising the event with Blas of the new patient welcome dinner group, and with attendees of the "Cookies & Ice Cream" social networking group. We verified the Patient and Event calendars and they have the correct event time information for our next upcoming event 3/13 (The solar and evening start times were off a half hour for 2/28).

All said and done, we had a good but chilly viewing night opportunity for CTCA patients and caregivers, with a amateur astronomer/customer ratio better than 1:1, for the few who could join us. We have plans in place to increase and maintain attendance in the future and we continue to have great support from Marisa of CTCA. ***

CTCA/PAS SkyTour Event March 13, 2012 Report

By Joe Collins

Attendees: PAS members: Frank and Sam Insana, Albert Tucker, Joe & Renee Collins. We had eight customers for solar viewing and nine customers for the evening program for a total of 17 for tonight's event.

Conditions: We experienced near perfect weather and sky clarity for both solar and night viewing. This date was pre-selected to be moonless (3rd quarter moon) during the event for best possible viewing of dark sky objects. The general temperature outdoors on the 5th floor garden terrace was comfortable, being warmer than last event and only becoming chilly at the close of the event. This was the second best night for seeing dark sky objects since PAS has been at CTCA. Tonight was the 15th Anniversary of the "Phoenix Lights", and coincidentally, we saw at least seven Magnesium military flares over the Estrella mountain range between 8:15pm and 9pm.

Equipment: Sam & Frank brought their Coronado PST for solar viewing, spotter scope and 6" reflector w/Solar filter. Albert Tucker had a successful 'first light' of his Meade LDX55 6" APO Refractor. Joe Collins brought his Celestron CGEM 11" SCT, binoculars & iPad.

Objects Viewed: Solar Viewing: Sun-

spots, flares, filaments. We could see the residual activity of sunspot region 1429, the source of a coronal mass ejection the previous night and much flare and auroral activity reported in the news the previous week. Our event handout section on the Sun was expanded with a little more information on the Sun's lifecycle and sunspot cycles. Several patients remarked how informative it was to me.

Evening SkyTour: What was striking at the beginning of the evening was the proximity of Venus & Jupiter in the western sky and Mars in the eastern sky. During the course of the evening we viewed all the objects listed and explained in our event handout: Jupiter & its Galilean moons, Venus, Mars, Cor-Caroli, iota-Cancri, Polaris, Sirius, Rigel and several other binary/multiple stars, the core of M31 Andromeda galaxy, the Great Nebula in Orion (M42, my personal favorite), the Pleiades (M45), the Praesepe/Beehive (M44) and the Double Cluster in Perseus open clusters (some looked better as binocular objects, so I suggest for the next event someone bring a wide field lower magnification eyepiece 30-35mm) or binoviewers for our customers to be able to better appreciate these last three objects through our telescopes). Mars

has been at close proximity to Earth for the past week or so due to its retrograde motion. We could all see the yellowish-red color of the hematite rust surface, but it was difficult to make out any polar regions with our telescopes. The satellite Io was closest to Jupiter this time; we could see banding on Jupiter, but the GRS (Great Red Spot) was not facing us this time. The flares of the Orion Nebula were a fantastic sight tonight...speaking of flares....

A little after eight o'clock we had some unexpected excitement- we could see multiple (7-9) bright yellow objects just above the rim of the Estrella mountains. We were able to confirm via Frank's spotter scope that they had smoke trails, so we identified them as aerial MTV flares (possibly MJU-6 Magnesium/Teflon/Viton); obviously (due to their location) part of a military exercise over the Barry Goldwater test range. It was odd that there were no news reports about this, but we were on the 5th floor- probably you couldn't see these at ground level because at that vantage point they would be behind the Estrellas. I stayed until 11:30pm to look at Saturn and Saturnian moons and share that view with one of the CTCA guards who was going to be on break after doing his rounds.

Continued on pg 5

ASU West Mar 15

By Terri Finch, Event Coordinator

This was a huge, with extremely clear skies star party! Many, many thanks to the Telescope Team for this event: Don Boyd, Bruce Wurst, Eric Steinberg, Tim Jones, Mike Marron, Terri & William Finch, & Albert Tucker. Paul Schmidtke also provided a scope for this event.

We estimate we had a minimum of 450 people there. The skies were absolutely, totally clear. The temperatures were wonderful, becoming a little chilly near the end of the event. The new location, East side of Campus, just East of the most East building, up on top of a hill, was a great new location. Everyone agreed that it was wonderful and we would do it again in that location.

Terri: I showed Jupiter, Mars, & Orion Nebula. I handed out about 75 copies of the NSN March Sky Chart / Who R We Page to those who looked through my scope. The crowd was pleasant & fun to talk with.

Paul writes: I showed only bright objects: Venus, Jupiter, Mars, Sirius (someone asked), and the Orion Nebula. There never was time for anything else! Thanks for coordinating the "crew!"

Eric writes: We arrived before sunset and set up our scopes in a very dusty field on the east side of campus. Skies were vivid blue with no clouds and near-perfect transparency. A few guests began to arrive at 6:30 for the 7 PM start, and by that time a small crowd was present. I began shortly after sunset by showing Venus, clearly visible in its slightly "gibbous" phase, to about 20 people. As it got darker I switched to Jupiter at 389X. I showed Jupiter to about 50 people, but as it dropped toward the horizon, seeing became so poor that good detail was no longer visible. I then moved to the Orion Nebula and showed that to probably 70 or 80 folks. Even with the

skyglow, M42 shows extremely well in the 16" scope and reactions of the viewers were often dramatic. Hearing them and watching their faces makes all the work worth it. As the crowd thinned, I moved to M37, showing it to around 15 people, and finally (at the request of one very enthusiastic guest) looked at a washed-out M3 with a few stragglers and club members. Overall it was a very successful night with a large and thankfully mostly very polite crowd. There's a lot of dust to clean off today, but the location on campus was good in that there were no glaring lights nearby, so even with the heavy (Bortle Level 8) skyglow, decent viewing was possible.

Tim wrote: I showed Jupiter, Venus, M42, M45, Mars, Double Cluster, Hyades. Discussed and showed Orion, Cassiopeia, Taurus, Andromeda, and several stars with the laser pointer.***

For Sale: Eyepiece & Filter Set

Brand new in-the-box, unused Meade Series 4000 Eyepiece and Filter Set. \$518 worth of separate items. Meade sells the kit for \$249. Your price \$199. Call Eric @203-223-0132

Designed and manufactured to exacting standards, Meade Series 4000 Super

Plössl eyepieces deliver wide 52° apparent fields of view (44° for the SP40mm) with all of the resolution, edge-of-field sharpness and color correction demanded in the most advanced visual applications. All eyepieces are multi-coated and include soft rubber eyeguards. Each Series 4000 Set Includes: • 6.4mm Super Plössl, • 12.4mm Super

Plössl, • 32mm Super Plössl, • 2x Barlow Lens (#126), • 9.7mm Super Plössl, • 15mm Super Plössl, • 40mm Super Plössl, • Aluminum Hard Carry Case, • Color Filter Set #1 (yellow/red/green/blue), • Moon Filter. See photo of this item at this link: <http://www.pasaz.org/forums/downloads.php?do=file&id=176> ***

Don't Worry, Armed Space Walkers, Pistols Will Fire There

from Valley 101 by Clay Thompson, The Arizona Republic (reprinted by permission of the author)

Today's question: *Does a gun need oxygen to fire? If I fired a pistol in the vacuum of outer space, would it go off?* Got some time on our hands, do we? Not much to do except sit around wondering about shooting something in outer space? Maybe you should think about taking up some sort of hobby. Anyway, lock and load because, yes, you can fire a conventional weapon in space. The ammunition in conventional

guns consists of a bullet (the part that actually gets shot out) set in a shell casing that contains the charge -- gunpowder or cordite, which contain its own oxidizer. When the hammer hits the cartridge's firing pin or, in the case of rimfire ammo, the rim sets off the charge and -- boom -- there goes the bullet. It's the same thing with solid-fuel rockets. In fact, you would probably get more distance from a bullet in outer space.

That's because there's no atmosphere to cause friction that would slow down a bullet. The only problem might be if you got really far away from the sun where it would be very, very cold. The whole process would freeze up. One thing I read said the Russians once took an automatic aircraft cannon to their Salyut space station to see what would happen. Apparently, it worked just fine.***

CTCA/PAS SkyTour Event March 13, 2012 Report

From pg 4

Quotes: From Sam & Frank Insana (insanas@aol.com) : Frank says the temperature was fantastic. He showed the solar flares, Orion Nebula, the Pleiades, and some mysterious Phoenix lights. His scope showed the bright orange lights to the Southwest had smoke coming out of them,

showing they were flares, probably over the Goldwater military training range. Sam showed sunspots, Venus, Jupiter, Mars, and the gamma Andromeda double stars. With no moon and little wind it was a good night for observing.

Thanks: To Marisa Benincasa of CT-

CA for advertising, printing out (and stapling) our handouts and for meal tickets. To the hospitality staff for providing refreshments for this Event. To PAS members for working and volunteering your time to make this event a success and enjoyable for CTCA patients and caregivers! ***

Arizona Sky

By Leah Sapir



The planets are certainly putting on a good show for us this month.

Mercury, unfortunately, has disappeared into the sunset, after a very good showing in late February and early March. This month Mercury is a morning star, very low in the east just before dawn. But, keep watching, because for a while in mid-June, Mercury will again be easily visible in the west after sunset.

Neptune and Uranus are also morning stars, rising around 3:30 and 5 am, respectively. On the other hand, Mars is high in the east after sunset, and Saturn rises soon after. Mars will be visible for most of the night, and Saturn is at opposition and will be up till dawn.

But the two show-stealers this month are still Venus and Jupiter, shining brightly together in the west each evening. Of course, the close appearance of these “twins” is an optical illusion; they are currently just in the same line of sight. Right now Venus is about 70 million miles from us, while Jupiter clocks in at about 530 million miles. If we would set out in a spacecraft going around 35,000 mph, it would take about three months to reach the current position of Venus, and almost two years to reach that of Jupiter. (Of course the planets are moving targets and wouldn't be in the same position at that time. When sending a space probe, we need to aim at where the planet is going to be, not where it is now. But this is just for comparison of their current distances.)

Jupiter will be fading into the sunset towards the end of the month, but Venus will be a very visible evening star till the end of May.

Through a telescope this month, we can easily see details on Mars, Jupiter and Saturn. Saturn's rings and its largest moon, Titan, are visible even in a small telescope, as are Jupiter's main bands and its four Galilean moons. Mars is a little tougher, because it isn't as close this time as it has been in some of its recent oppositions, but a

good (larger) telescope can bring out some of the dark-colored surface features, and the Martian polar cap.

But Venus is covered with

opaque clouds, and the only detail we see is its phases. As Venus orbits the Sun just inside our orbit, we can see it varying from gibbous to crescent. When it first came into view as an evening star last November, it was an almost-full gibbous. Now it is moving into the quarter-phase, and after mid-May it will be a crescent – before it disappears into the sunset, to reappear in June as a morning star. The phases are visible in a small telescope, and the crescent phase can sometimes be seen in binoculars.

Venus is largest as a crescent because then it is closest to us. It is brightest when it is 28% full, as this stage provides the best balance between close-distance and illuminated area.

And this year, Venus will provide a rare treat for us: a transit across the Sun's disk, on the evening of June 5. Since the plane of Venus's orbit is slightly inclined to the Earth's plane of orbit, Venus doesn't usually pass directly in front of or behind the Sun at the closest and furthest points of its orbit: in its “new” and “full” phases, it actually passes a bit above or below the Sun. But even so, Venus is too close to the Sun to observe successfully at those times.

However, twice in approximately 120 years, Venus crosses the Earth's orbit at the right time to be seen directly in front of the Sun – this is a transit of Venus. The two transits in each 120-year cycle are 8 years apart. In the current cycle, a Venus transit occurred on June 8, 2004, and we will now witness the second one. The previous pair of transits were in 1874 and 1882, and the next pair will be in 2117 and 2125.

Hidden behind its cloud cover, Venus has long been a mystery. Since it appears alternately either before dawn or after sunset, in ancient times it was considered to be two objects: the “morning star” and the “evening star”. However, the Babylonians realized by around 1600 BCE that the two objects were really one. The Greeks also reached that conclusion, but it took them 1000 years longer – till the 6th century BCE.

When Galileo first aimed his telescope at the sky, he observed for the first time the phases of Venus. This was one of the key pieces of evidence in proving the Copernican theory, since we wouldn't be able to see all of the phases if Venus orbited the Earth rather than the Sun.

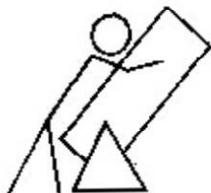
The next important information came from a transit of Venus. In our time, a Venus transit is just a rare but interesting occurrence. But in the 18th and 19th centuries, it was also an opportunity to settle an important scientific matter: the size of the solar system. Kepler's laws enabled astronomers to calculate the distances of the planets relative to Earth, expressing the distance of each planet in “astronomical units”, where 1 AU was the Earth's distance from the Sun. But what was the size of the astronomical unit? How could it be measured without travelling to the Sun and back?

In 1663, the Scottish mathematician James Gregory realized that if a transit of Venus was observed, and if its length was exactly timed at various locations around the world, then the solar parallax and the size of the astronomical unit could be calculated. Edmund Halley tried to make such a measurement in a transit of Mercury in 1676, but his measurement was not sufficiently accurate, and he didn't have other measurements to compare to. He realized that a Venus transit could be measured more accurately, and recommended that the next Venus transit would be widely observed and measured. And in fact, in 1761 and 1769, astronomers travelled to locations around the world to observe and measure the Venus transit.

The Russian astronomer Mikhail Lomonosov, observing the transit in 1761 from the Petersburg Observatory, noticed an additional detail: a slight halo around Venus as it began and ended the transit. He realized that this must be the refraction of the Sun's rays through an atmosphere – the first time that an atmosphere had been observed on a planet other than our own!

In the first half of the 20th century, astronomers used spectroscopy and radio astronomy to try to learn what was hidden behind Venus's cloud cover. The results, surprisingly, implied that the atmosphere of Venus was composed mostly of carbon dioxide, and that its surface temperature was higher than the boiling point of water.

Space probes in the second half of the 20th century confirmed these details and more. In 1964, Mariner 2 flew by Venus – the first spacecraft to visit another planet – and confirmed that the surface temperature



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was over 400 degrees Fahrenheit. (Today we know that it is actually around 900 F.)

In the meantime, the Soviet Union sent several space probes in a series named Venera. Venera 3 crash-landed in 1965 and was not able to send back any data. Venera 4 parachuted into the Venusian atmosphere in 1967 and measured its temperature and composition, confirming that over 90% of the atmosphere was composed of carbon dioxide. However, the probe was destroyed by heat and pressure before it reached (and crash-landed on) the surface.

At about the same time as Venera 4's arrival, Mariner 5 orbited Venus and made measurements of the composition, pressure and density of the atmosphere. Russian and American scientists compared their data to further our knowledge of Venus.

In 1969, Venera 5 and 6 were reinforced to withstand the pressure, but they too were crushed before reaching the surface, and later crash-landed. Venera 7 was further reinforced and pre-cooled, and managed to land on the planet's night side in 1970 – the first controlled landing on another planet. It measured the surface temperature and pressure at its landing site for about 20 minutes. Venera 8 found the same conditions on the daytime side when it landed in 1972. Venera 9 and 10 in 1975 sent back the first pictures of the surface of Venus.

In 1978, Pioneer Venus 1 observed Venus from orbit, and Pioneer Venus 2 released four probes that further explored the atmosphere of Venus.

The Magellan spacecraft orbited Venus from 1990 to 1994, and mapped the surface using radar. Although earlier measurements had been made by Earth-based radar observations in the 1970's and by various American and Russian space probes, most of our knowledge of Venus's surface features is from Magellan. Information about Venus has also been obtained from infrared and ultraviolet observations.

Venus is often considered to be Earth's "twin", since the two planets are about the same size, and orbit relatively close to the Sun. Venus is slightly smaller than Earth (95% of Earth's diameter and 80% of Earth's mass) and is about 2/3 of Earth's distance from the Sun. Like Earth, Venus has an iron core covered by a rocky mantle. The two planets have a similar density and chemical composition, and both have an atmosphere.

But here the similarity stops! Earth's atmosphere is mostly nitrogen (78%) and oxygen (21%), while the atmosphere of Venus is 96% carbon dioxide and 3% nitrogen. Although Earth has a similar amount of carbon dioxide, only a trace of this is found in Earth's atmosphere. Most of the carbon dioxide on Earth is in a combined form in rocks: for example, limestone is calcium carbonate.

Atmospheric pressure at the surface of Venus is about 90 times that of the Earth. About ¾ of Earth's surface is covered by water, but any water on Venus has long since evaporated due to the extreme heat.

The thick clouds that hide Venus from our view are not water clouds, but sulfuric acid. Sulfur dioxide from volcanoes on Venus combines with the small amount of water vapor in the atmosphere to form sulfuric acid in a concentration of 80%, stronger than a car battery.

The clouds are about 30 miles above the surface, and a few miles thick. They reflect over 60% of the sunlight that hits them – the reason for Venus's bright appearance. Sometimes vague markings can be seen on the cloud tops. The clouds rotate rapidly from east to west, making a complete rotation once every 3-4 days, due to high-speed winds (about 300 mph) in the upper atmosphere.

Sometimes the clouds produce raindrops of sulfuric acid, but this evaporates before it reaches the surface. The Magellan probe also detected a very reflective substance, like snow, on the highest mountaintops. But since Venus is too hot for snow, it has been theorized that this substance might be lead sulfide, or elemental tellurium. Several probes have detected lightning and thunder in the atmosphere, but since Venus doesn't have rainstorms as Earth does, this could not be the source of the lightning. Perhaps it is caused by the blowing of volcanic ash by the wind, or from cosmic radiation.

The surface temperature of Venus is about 890 F. Venus receives twice as much sunlight as Earth does (because it is closer to the Sun); but only about 1% of the sunlight can get through the thick clouds. Light reaching the surface is orange, and resembles an overcast day on Earth.

The sunlight is absorbed by surface rocks, and is then radiated back at infrared wavelengths. Since infrared light cannot

pass through the carbon dioxide in the atmosphere, the heat builds up, producing a runaway greenhouse effect. Venus is as hot at the poles as at the equator, and night and day are equally hot.

The axis of Venus is almost vertical, only 3 degrees from the plane of its orbit, so there are no seasons. The seasons on Earth are a result of the Earth's 23-degree tilt, that causes the Sun to shine more directly on the northern hemisphere from March to September, and on the southern hemisphere from September to March.

Venus orbits the Sun with a year of 225 Earth-days; and it turns on its axis once every 243 Earth-days – making a sidereal day on Venus longer than its year. And if that's not strange enough, the planet rotates with retrograde motion (east to west). i.e., it turns clockwise if viewed from above ("north" of) the ecliptic, while all the other planets rotate in a counter-clockwise or west-to-east direction.

Due to the retrograde motion, a solar day on Venus (the amount of time from sunrise to sunrise, or sunset to sunset) is much shorter than the sidereal day (the amount of time required for a point on the planet to return to the same direction relative to the stars). In general, a sidereal day differs from a solar day, due to the motion of a planet in its orbit. On Earth, for example, a sidereal day is 4 minutes shorter than a solar day. But on Venus, due to the retrograde motion, this situation is reversed: the solar day is about half the length of a sidereal day. For an observer on Venus, the Sun would rise in the west and set in the east, and a day (e.g. from sunrise to sunrise) would be 117 Earth days long. A year on Venus (one orbit around the Sun) is therefore about 1.9 Venusian solar days.

The surface rocks of Venus are similar in composition to volcanic basalt. The winds near the surface are slow (a few miles per hour) but because of the high density of the atmosphere, the surface winds have enough force to move dust and small stones.

The surface of Venus, as imaged by Magellan and other space probes, is relatively flat. Around

80% of the surface of Venus is a gently-rolling lava plain, with a few depressions (called "planitia"), and a few wrinkle ridges. The remaining 20% forms two continents, which reach an altitude a few miles higher than the plains. As Venus is the

PVCC Telescope workshop Mar 22

By Terri, Event Coordinator

It was an awesome, clear night for a star party. The turnout was great. I counted 35 in attendance of Jenny's students & the public. Here's the attendance & those who were not counted as part of the 35: Don Boyd brought his 6" scope. Tim Jones brought his 90mm. Frank Insana worked with the 16" Light Bridge & was the main attraction for most of the night. Kevin Adams, PVCC student helped with a PVCC 6" scope. Jenny Weitz, of PVCC, also worked a 6" school scope. Mike Marron did his meteorites with the help of Ofelia Waters. Jarod Fizz, PVCC student, brought an old C90, orange, from another location for which he asked for help with.

This event was supposed to start with a

Teleconference, however, because Daylight Savings Time changed a couple weeks prior, it threw off the start time, from 7pm to 6pm. So, we missed the conference. Some people were disappointed but they went outside and enjoyed the star party.

Attending folk for the Telescope Workshop were Neil Pedersen with his ETX 125. Rand brought his Ventura 114mm and showed a few of us how to juggle. Lindsey brought the Orion XT8 SkyQuest. Joe Semancik had an ETX 90 that Tim assisted him with. Our newest, soon to be members Mandy & Rachael showed up with their scope. William and I assisted them in aligning the main scope and finders scope. Discovered how to do it

and showed them so they can enjoy the use of their scope.

Weather wise was perfect. Didn't get that chilly at all. I believe it said the temperature, upon leaving that night was 78 degrees. It was comfortable, it was absolutely clear, and Tim said it was very dry, so the seeing was awesome! Objects that were shown were Orion Nebula, Venus, Jupiter, Mars, that I recall hearing about.

This event was a great success. Many thanks goes to the Telescope Teachers: Tim, Don, Frank, & William. Many thanks goes to Jenny who stayed late to allow us to do this event. The event closed up about 9pm, but there was much discussion going on in G-147 after 10pm. ***

New Meeting Location

By Terri, Event Coordinator

At the PVCC Telescope Workshop on Mar 22, Jenny Weitz, PVCC Astronomy Teacher, William Finch, Don Boyd and I went to the LS building to seek out a new meeting location. Here's what's happening with the Library. They want to close at 9pm, instead of 9:30. That means 2 things: 1) we search for a different location on the campus to hold our main meetings, when not in G-147, or 2) we adjust our schedule so that we gather at 6:30pm, and open the meeting at 7pm, to end and out of the Library by 9pm. Some of us have great difficulty getting to the Library by 7pm for set up. So, to get there by 6:30 might be more of a chal-

lenge. At the next Meeting of the Minds, Apr 19, we will be discussing this situation. Do we want to move our meeting time earlier? Or, just move our meeting location to a classroom in the LS building. The classroom we saw seats 50 people comfortably, with a long table to put your things on, including your snacks and drinks. Plus, in a classroom we aren't limited to how loud we may get. These are things to consider when deciding if we want to change our location, or adjust the time of our meeting. Think about it and come to the April 19th Meeting of the Minds to discuss it. See you there!

Messier Marathon at Mike's Mar 24

By Eric Steinberg

Saturday March 24th dawned with a solid grey cloud deck, not a good sign for the night's activities. Toward evening it began to break up a bit and might have permitted a modest number of objects to be seen. Nevertheless, six club members gathered for a potluck dinner at Mike's at 4:00 pm. Besides Mike, in attendance were Sam and Frank, Kevin, Eric and Ora and a friend of Mike's named Judy. Kevin brought the only scope - a 2.5" Celestron "kids" scope. We took a few peeks with it but couldn't see much - more fun was had with Sam's night vision scope. Otherwise it was just a low key social evening - gastronomic, rather than astronomical. ***

March Issue Photo Captions

By Terri, Event Coordinator & Newsletter Proofer

Due to the program Matt used to create the March 2012 issue of PAStimes, he was, in the short amount of time we had left to get the issue out, having difficulties in adding captions to the photos for that issue. He didn't have a page layout program available, so he used a word program instead, which is why it is difficult to do page layout in a word program. So, below, I have listed the location of the photo, and here are the captions & photo credits.

Page 1 is William K. Hartmann, photo provided by Dr. Hartmann.

Page 3 is "Chet Schuler, the February Guest Speaker." Photo by Matt Kohl.

Page 5 is "Mike Marron, back to us, showing 2 guests Meteorites at Bookmans." Photo by Terri Finch.

Page 6 is "Leah Sapir, Guest Speaker for the night, with help of Jenny Weitz, setting up for the presentation." Photo by Terri Finch.

Page 7 is "Mike Marron, stealing the show - like usual, with a crowd around him, learning about meteorites at the PVCC Telescope Workshop." Photo by Terri Finch

Page 7 bottom is "Fr. William Stoeger of the Vatican Observatory doing a presentation about the Cosmos. Dan Heim is in background to the left." Photo by Terri Finch

Page 8 is "Dr. Anthony F. Aveni, Guest Speaker of the teleconference." Photo provided by Night Sky Network.

Page 10 has 3 photos. Upper left is Chet Schuler. Lower Left is Leah Sapir. and Right is Mike Marron. All 3 photos taken by Terri Finch. ***



The Planet in the Machine

By Diane K. Fisher and Tony Phillips

The story goes that a butterfly flapping its wings in Brazil can, over time, cause a tornado in Kansas. The “butterfly effect” is a common term to evoke the complexity of interdependent variables affecting weather around the globe. It alludes to the notion that small changes in initial conditions can cause wildly varying outcomes.

Now imagine millions of butterflies flapping their wings. And flies and crickets and birds. Now you understand why weather is so complex.

All kidding aside, insects are not in control. The real “butterfly effect” is driven by, for example, global winds and ocean currents, polar ice (melting *and* freezing), clouds and rain, and blowing desert dust. All these things interact with one another in bewilderingly complicated ways.

And then there’s the human race. If a butterfly can cause a tornado, what can humans cause with their boundlessly reckless disturbances of initial conditions?

Understanding how it all fits together is a relatively new field called Earth system science. Earth system scientists work on

building and fine-tuning mathematical models (computer programs) that describe the complex inter-relationships of Earth’s carbon, water, energy, and trace gases as they are exchanged between the terrestrial biosphere and the atmosphere. Ultimately, they hope to understand Earth as an integrated system, and model changes in climate over the next 50-100 years. The better the models, the more accurate and detailed will be the image in the crystal ball.

NASA’s Earth System Science program provides real-world data for these models via a swarm of Earth-observing satellites. The satellites, which go by names like Terra and Aqua, keep an eye on Earth’s land, biosphere, atmosphere, clouds, ice, and oceans. The data they collect are crucial to the modeling efforts.

Some models aim to predict short-term effects—in other words, weather. They may become part of severe weather warning systems and actually save lives. Other models aim to predict long-term effects—or climate. But, long-term predictions are

much more difficult and much less likely to be believed by the general population, since only time can actually prove or disprove their validity. After all, small errors become large errors as the model is left to run into the future. However, as the models are further validated with near- and longer-term data, and as different models converge on a common scenario, they become more and more trustworthy to show us the future while we can still do something about it—we hope.

For a listing and more information on each of NASA’s (and their partners’) Earth data-gathering missions, visit <http://science.nasa.gov/earth-science/missions/>. Kids can get an easy introduction to Earth system science and play Earthy word games at <http://spaceplace.nasa.gov/ecosphere>.

This article was provided by the Jet Propulsion Laboratory, California Institute of Technology, under a contract with the National Aeronautics and Space Administration.



CloudSat is one of the Earth-observing satellites collecting data that will help develop and refine atmospheric circulation models and other types of weather and climate models. CloudSat’s unique radar system reads the vertical structure of clouds, including liquid water and ice content, and how clouds affect the distribution of the Sun’s energy in the atmosphere. See animation of this data simulation at www.nasa.gov/mission_pages/calipso/multimedia/cloud_calip_mm.html.

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From page 7

name of the Roman goddess of love and beauty, the two continents are named after her Greek and Babylonian counterparts: Aphrodite Terra, about the size of Africa or South America, is slightly south of the equator, and Ishtar Terra, about the size of the US or Australia, is located in the northern hemisphere.

Aphrodite Terra is split by many crevices and fractures, while Ishtar Terra is home to several large mountain ranges, of which the main one is Maxwell Montes. Most features on Venus are named after women (either historical or mythological), but Maxwell Montes received its name before the IAU (International Astronomical Union) decided on the rules for naming Venusian features. Since Maxwell Montes was discovered by radar, it was named after James Clerk Maxwell, who discovered the nature of electromagnetic waves in the 19th century and thus made radar possible.

Maxwell Montes contains the highest point on Venus - 7 miles above the level of the lava plains. It is so massive that the crust is not strong enough to support it; it is apparently supported by plumes of molten rock rising from the mantle. Another large mountain is Maat Mons, 5 miles high, in Aphrodite Terra, which has recent lava flows on its sides.

Venus might have had a plate-tectonics phase in the past; some parts of the continents resemble mountains on Earth that were formed by plate tectonics. But there seems no evidence of plate tectonics in the present. Instead, folds and faults seem to have been produced by convective movements within the mantle.

There are also many volcanic features, some of which have imaginative names. There are long channels formed by previous lava flows, and there are fissures and vents from which lava poured out in the past. "Pancake domes" are flattened shield volcanoes, up to 9 miles in diameter but less than a mile high. (By comparison, a terrestrial shield volcano such as Mauna Kea is a few dozen miles wide and 6 miles above its base on the ocean floor.) The "pancake domes" are often found in groups. There are also ring-like features ("coronae") which are up to a few hundred miles across and up to a mile high, and have cracks and ridges around the edge. Perhaps they were formed by a plume of hot molten rock rising from the mantle, creating a dome, and then

collapsing in the center. There are also "arachnoids", which are similar to coronae but have a network of concentric and radial cracks resembling a spider web.

Like other planets and moons, Venus has impact craters, but most of them have been covered over with lava flows, and most show signs of being filled with lava, as if the impact tapped a source of molten lava below the surface.

The largest impact crater is named Mead, and is 175 miles wide. In general, the craters are all very large – from 2 to over 60 miles wide. Probably the smaller meteorites can't get through the atmosphere, and burn up before they reach the surface. In some places, the surface seems to be pulverized – perhaps by a shock wave from a meteorite that exploded before impact.

Venus has a smaller number of craters compared to other planets and moons, and they are all in relatively "new" condition – not eroded like impact craters on Earth, or overlaid with more recent impacts like the older craters on Earth's Moon. This leads to the conclusion that only the craters younger than about 600 million years are still visible, and the rest have been covered over by lava flows.

The reason for this is not yet clear; maybe Venus has a thin crust, or periods of volcanic activity. Or, since Venus does not have plate tectonics to release heat accumulating in the mantle, it is possible that when the mantle reaches a certain temperature, the molten rock bursts forth through weakened areas of crust and resurfaces the whole planet, covering previous impact craters.

Venus might still be volcanically active. Some evidence of this is provided by variations of the amount of sulfur dioxide in the atmosphere over the past 15 years, which could be due to release from volcanoes. Also, some of the larger mountains seem to be too heavy for the crust to support. They might be recently formed, or they might be supported by hot molten rock rising from below.

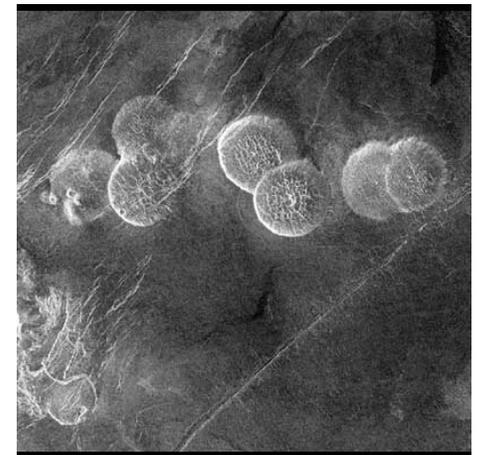
Venus has a magnetic field, but it is much weaker than that of the Earth. The magnetic field of Venus could be the result of an interaction between the ionosphere and the solar wind, rather than by an internal dynamo in the core, as on Earth.

Currently, exploration of Venus continues with the European Space Agency's "Venus Express", which has been orbiting

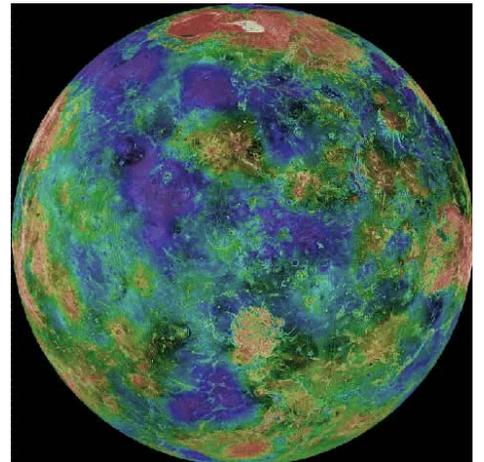
the planet since 2006 and sending back data about the Venusian atmosphere and climate. Space probes planned for the future are NASA's "Venus In-Situ Explorer" and ESA's "Venus Entry Probe", both scheduled for launching in 2013, for learning more about the surface of Venus, our mysterious next-door neighbor.



A complete cycle of Venus phases, including Venus transit. Image credit: Stasis Kalyvas - VT-2004 programme, European Southern Observatory, and Wikipedia



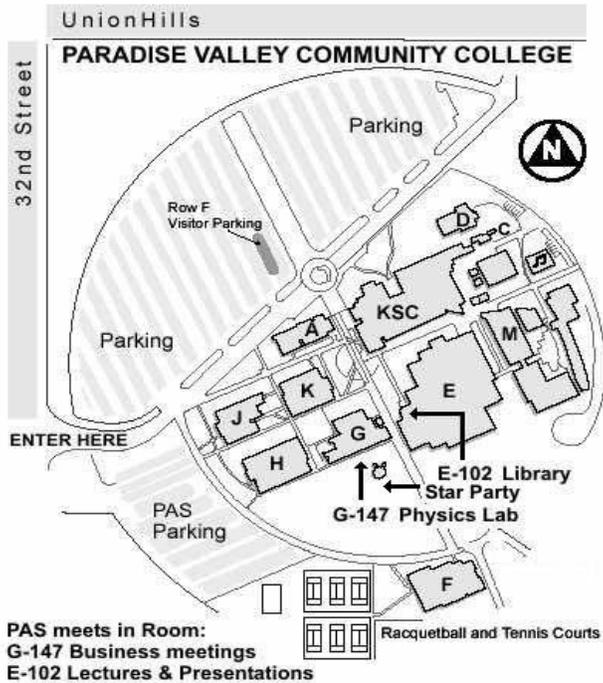
Pancake domes. Image credit: NASA



Topographic map of Venus in false-color indicating altitude. Image credit: NASA

Map of PVCC Main Location

18401 N. 32nd Street | Phoenix, AZ 85032



Map of PVCC Black Mountain

34250 N. 60th Street | Scottsdale, AZ 85266



See page 2 for more information

April

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
1 Telescope Workshop at Bookmans	2	3 School Star Party (Private)	4	5 PAS Meeting, PVCC Library	6	7 Back up date for DBG of 3/31
8 Easter Sunday	9	10 CTCA Private Star Party	11	12 Telescope Workshop & Star Party at PVCC	13 School Star Party (Private)	14
15	16	17	18	19 MOM Awards Ceremony PVCC G-147	20 DBG Private Star Party	21
22	23 School Star Party (Private)	24 Back up date for Apr 10 CTCA	25	26 Astro event PVCC G-147 + Star Party	27 School Star Party (Private)	28 Public Star Party for Astronomy Day in Carefree
29	30					

Telescope For Sale

The scope is a Meade ETX 90mm with computer hand pad and tripod. The owner (a lady) is asking \$350, retails for \$600. Contact Dave Hellman to view scope and purchase it.
david.hellmann@pvmil.maricopa.edu. ***

Don Boyd
 PAsTimes Editor
 701 W. Del Rio St.
 Chandler AZ 85225

To:

2012 PAS GUEST SPEAKER LINE-UP

By Terri, Event Coordinator Events@pasaz.org

Do you have an idea for a Guest Speaker? Email me the details.

May 3 in G-147: Pizza Party: Rogier Windhorst "New Cosmos with the new Hubble, & James Webb Space Telescope"

Sep 6: location TBA: Members Night - Sign up with Terri to do a mini presentation.

Oct 4: location TBA: Dan Heim "Atmospheric Optics" ***

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What's Up For April

By Rod Sutter, PAS Past President

Name	Date	Rise	Set
Mercury	04-15-12	04:51	16:42
Venus	04-15-12	08:05	22:33
Mars	04-15-12	14:37	03:45
Jupiter	04-15-12	07:01	20:27
Saturn	04-15-12	18:44	06:09
Uranus	04-15-12	06:06	17:19
Neptune	04-15-12	03:31	14:36
Pluto	04-15-12	00:55	10:35

All Times Arizona Time

April 15 2012

Sunrise: 05:55

Sunset: 18:45



Q1: March 30



Full: April 6



Q3: April 13



New: April 21