Saguaro Astronomy Club

SACnews

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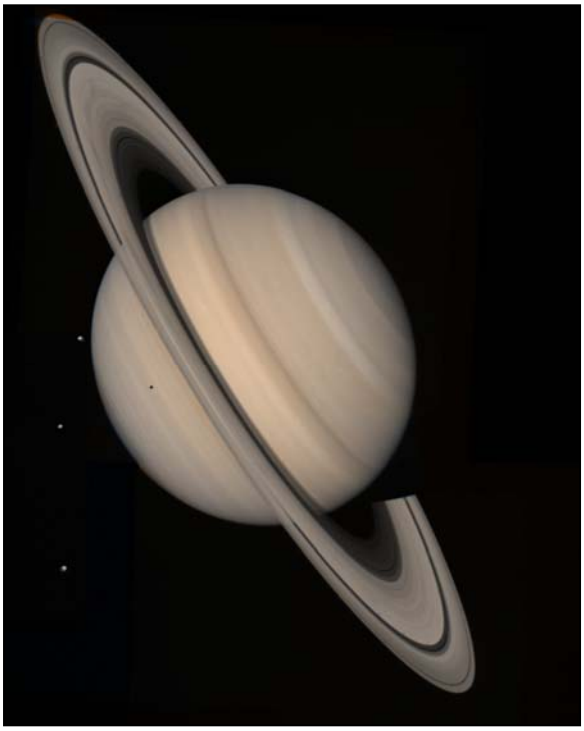
TOP TWENTY THINGS AN ASTRONOMER SHOULD SEE
#19 Saturn's Rings
By Helen Mahoney

Seeing Saturn through a telescope for the first time is what made many an individual get excited about astronomy. It happened to my husband, Doug Millar. He went to an OCA outreach hosted by former OCA president John Sanford. One look at the beautiful rings of Saturn, and Doug was hooked. He bought a telescope and joined OCA—where we met.



I put seeing Saturn's rings at number 19 because it is a relatively easy thing to do. Saturn is so bright that it can be seen even from the city. With a small telescope or large binoculars (such as 20 x 80's), you can tell that Saturn is not just a point source, or even a ball. It has a distinctly elongated shape. Galileo described it as having "ears", and drew pictures of the handle-like projections. When I saw Saturn through a small telescope, it looked to me like an electrical outlet.

Of course, the bigger the telescope, the better the view. The best view I ever had of Saturn was through the Mount Wilson 60 inch telescope. As a wedding present, Doug paid for us to join OCA's trip to the 60 inch. Twenty of us had the whole night on the scope, and our favorite object was Saturn. We actually climbed up onto and straddled the telescope to look through the eyepiece. Saturn was as big as my fist.

With a large telescope, you can appreciate the bands on the planet, see the Cassini division and possibly the Encke gap, and sometimes see the planet's shadow on the rings. The rings give Saturn a three dimensional appearance that is more obvious than any of the other planets.

If you view Saturn year after year, you will be able to appreciate the fact that the rings tilt back and forth, from their most open angle to edge-on. Galileo was the first person to see and document the disappearance of the rings when the ring plane was edge-on from the earth. This happens about every 15 years, the most recent of which was in September of 2009. Saturn was too close to the sun this time to see it well when it was directly edge-on, but the previous time this occurred, in August of 1995, I got the opportunity to see it from Anza. It was so weird to see Saturn that

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NASA Space Place

Deadly Planets

By Patrick L. Barry and Dr. Tony Phillips

About 900 light years from here is a rocky planet not much bigger than Earth. It goes around its star once every hundred days, a trifle fast, but not too different from a standard Earth-year. At least two and possibly three other planets circle the same star, forming a complete solar system.

Interested? Don't be. Going there would be the last thing you ever do.

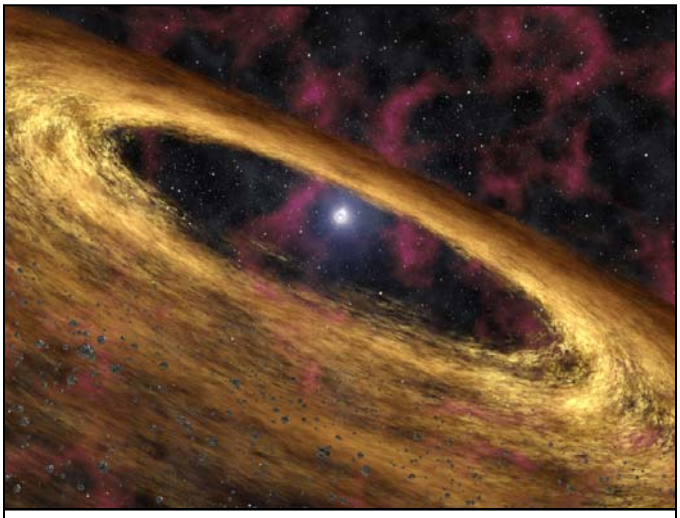
The star is a pulsar, PSR 1257+12, the seething-hot core of a supernova that exploded millions of years ago. Its planets are bathed not in gentle, life-giving sunshine but instead a blistering torrent of X-rays and high-energy particles.

"It would be like trying to live next to Chernobyl," says Charles Beichman, a scientist at JPL and director of the Michelson Science Center at Caltech.

Our own Sun emits small amounts of pulsar-like X-rays and high energy particles, but the amount of such radiation coming from a pulsar is "orders of magnitude more," he says. Even for a planet orbiting as far out as the Earth, this radiation could blow away the planet's atmosphere, and even vaporize sand right off the planet's surface.

Astronomer Alex Wolszczan discovered planets around PSR 1257+12 in the 1990s using Puerto Rico's giant Arecibo radio telescope. At first, no one believed worlds could form around pulsars—it was too bizarre. Supernovas were supposed to destroy planets, not create them. Where did these worlds come from?

NASA's Spitzer Space Telescope may have found the solution. In 2005, a group of astronomers led by Deepto Chakrabarty of MIT pointed the infrared telescope toward pulsar 4U 0142+61. Data revealed a disk of gas and dust surrounding the central star, probably wreckage from the supernova. It was just the sort of disk that could coalesce to form planets!



Artist's concept of a pulsar and surrounding disk of rubble called a "fallback" disk, out of which new planets could form.

As deadly as pulsar planets are, they might also be hauntingly beautiful. The vaporized matter rising from the planets' surfaces could be ionized by the incoming radiation, creating colorful auroras across the sky. And though the pulsar would only appear as a tiny dot in the sky (the pulsar itself is only 20-40 km across), it would be enshrouded in a hazy glow of light emitted by radiation particles as they curve in the pulsar's strong magnetic field.

Wasted beauty? Maybe. Beichman points out the positive: "It's an awful place to try and form planets, but if you can do it there, you can do it anywhere."

Find more news and images from Spitzer at http://www.spitzer.caltech.edu/ . In addition, The Space Place Web site features several games related to Spitzer and infrared astronomy, as well as a storybook about a girl who creamed of finding another Earth. Go to http://tiny.cc/lucy208.

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

Crook Trail Sky
By Chuck Conner

Far beyond the darkened dust and thru the lighted sky

The Milky Way reveals to us a star that's born to die,

Red giants, White dwarfs, a comets glittering tail

These live and die in Vela each driven by her sail.

Traveling at the speed of light, history meets our eyes

While generations came and left, this light has just arrived

Andromeda takes her time in all her terrible charm

Someday she will live with us, our spirals arm in arm

She glories in the night, she rules the endless sky

Look straight ahead then look again through the corner of your eye

And you will see both near and far, what made you who you are

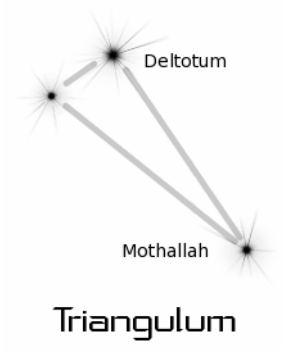
Born of fire, breath of life, gravity's own child

Expanding sun calls us home and shines through space and time

Until one day, somewhere in space, our history meets an eye

Call For Observations–Triangulum

By A.J. Crayon



After having done Fornax and Sculptor, putting **Triangulum** I the mix is a welcome change. Although M 33 is the show piece of the constellation, it was passed over for a number of not so bright galaxies. No doubt we will be back some time in the future.

The introduction discussed elliptical galaxies and requested SAC observers to estimate the ellipticy, the number to describe the elongation. Where an E0 galaxy was perfectly round and an E7 very elongated. We won't go into why E7 is the largest elongation found in the universe. After the estimate it was OK to go check some catalog to see how close everyone came.

So much for the introduction. Let's get to the observations.

We began with **NGC 672** located near the Pisces border a barred galaxy, but what does coarse sprial mean?
8" F6 Newtonian, 60X; Charlie Whiting: I could not see this galaxy with direct vision. But it is fairly distinctive with averted vision. It is very elongated. Probably 6' by 1', aligned approximately northeast. It was uniformly bright over its extent.
8" SCT; 104X; Dick Harshaw: Faint, with an NE-SW axis. It may be a little mottled at medium power. Slightly stronger nucleus.
16" F4.5 Dobsonian 261x; Dave Hofland: At **114x** ~ 30' NW of Cr 21 a rather bright and conspicuous very elongated wispy diffuse haze, at **261x** with av ~5'x2' aligned ~ ENE-WSW with an elongated bright nucleus and a wide very diffuse and wispy textured halo. AV also reveals the faint glow of nearby galaxy IC 1727 ~5' SW.

In the same 30' field is the 11.5 galaxy IC 1727 which is also elongated at about 90° and distorted by **NGC 672.**
8" F6 Newtonian, 60X and 150X; Charlie Whiting: I looked hard to detect this galaxy. But I cannot say for certain that I saw it. It is very faint. There was only one fleeting glimpse that my eye registered that something was there.
8" SCT; 104X; Dick Harshaw: not seen.

Next was the open cluster **Cr 21**, a grouping of 15 or 20 stars. Do you think it rather surprising with an open cluster in this constellation?
8" F6 Newtonian, 38X; Charlie Whiting: this group of stars is very visible. It is actually located about 10' south of the Skymap position. It was a nice object in the 20mm eyepiece (**60X**). It looked to me like a dot-to-dot picture of the StarWars robot, R2D2. I count 13 or 14 stars within a circular area about 6' in diameter. Brent Archinal's book, "Star Clusters" gave me the heads-up on the correct location. There's one 8th mag star and several 10th mag stars. Brent's book also states that Brian Skiff determined that this collection of stars is not a true cluster, but rather an asterism.
8" SCT; 104X; Dick Harshaw: It has an outline like a genie's magic lamp! There is a bright star in the SE end. Brian Skiff says this might be an asterism.
16" F4.5 Dobsonian 55x; Dave Hofland: ~7' diam collection of about a dozen stars, the brightest of which form a wide irregular "C" shaped asterism with the open end facing ~E. " Star Clusters" by Archinal and Hynes, indicates that this is more likely an asterism and not a physical cluster. An 8th mag star is the brightest and is on the S side, the remainer of stars are ~10+ mag. NGC 672 is conspicuous ~ 30' NW.

Next galaxy was **NGC 750,** an elliptical and paired with NGC 751. No one seemed to detect its companion of 14th mag. No wonder.
8" F6 Newtonian, 60X; Charlie Whiting: the galaxy can be seen as a tiny gray smudge. At **150X** the extra power doesn't help much except that in moments of better seeing there appeared to be a tiny bright spot on it. Going back to **60X** I cannot see the bright spot. This galaxy is very small. The part I am seeing is about 1' or less. It is either round or very slightly oblong. I assumed that what I was looking at was NGC 750 rather than NGC 751, only because 750 is slightly brighter. The two galaxies occupy virtually the same position. There was no way that I could have made out two galaxies.
8" SCT; 104X; Dick Harshaw: Very bright nucleus. halo. An 8.5 mag star is 3 min ESE.
16" F4.5 Dobsonian 261x; Dave Hofland: At **55x** small spot of faint glow ~15' NE of NGC 736, ~20' W of a

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7th mag double star, **261x** a diffuse irregular-oval ~2' diam diffuse glow extended ~N-S gradually brighter middle with two very closely arranged cores aligned N-S. The chart indicates the N to be NGC 750 and the S to be NGC 751.

NGC 777, an E1/E2 elliptical, along with its much fainter buddy NGC 778, 7' to the south of southeast.
8" F6 Newtonian, 60X; Charlie Whiting: I detected this galaxy fairly easily using averted vision. It is positioned due north of a group of fairly bright stars forming a quadrilateral. At **150X** the galaxy is on the fringe of being visible with direct vision. It is round, about 1' in diameter, and only slightly brighter in the middle. For NGC 778: At **150X** I could only catch this tiny and very dim galaxy in good moments using averted vision. I think that I detected that it is oblong but I could not hold it steady long enough to be sure.
11" SCT; 115X; Dick Harshaw: An oval lozenge with a tiny, star-like nucleus.
16" F4.5 Dobsonian 261x; Dave Hofland: At **55x** round small spot of glow ~5' N of a pair of ~9th mag stars (sep ~7' PA ~100) at **261x** ~2.5' diam round glow, pretty bright, gradually brighter middle without distinct core. NGC 778 shares the south edge of the field as a very faint av only 1' long thin glow ~3' SW of the E star of the 9th mag pair.

NGC 784 is a nice, very elongated barred spiral, yet with it being nearly edge-on the bar was not detectable.
8" F6 Newtonian, 120X; Charlie Whiting: I had to work this galaxy with several eyepieces in order to get a good mental picture of it. The low power eyepiece showed the galaxy a little more intensely, but did not show its surroundings at all. In the high power eyepieces the galaxy all but disappeared due to the illumination being thinned out. The wide angle 10 mm eyepiece (**120X**) did the best job. I saw the five-star figure of a Roman numeral "X" to the northwest of the galaxy. There were four 13th and 14th mag stars that coralled the galaxy within their triangular configuration. The galaxy itself was so ghostly that, even with averted vision and looking carefully, it was as though I was imagining that I saw it. But with enough staring I am sure that I saw it. It is very elongated, about 4:1. Elipticity estimate: 6.
16" F4.5 Dobsonian 114x; Dave Hofland: At **55x** ~5' long pretty bright streak of glow, at **114x** very elongated ~5'x1' ~N-S oriented streak of glow , gradually brighter middle, without distinct core.

It appears that, sometimes, there is confusion between **NGC 1060** and NGC 1062. The SAC database lists the second as a single star with a magnitude of 14.9. The galaxy, listed as magnitude of 14.0 is less than 1' in both major and minor axes. Not sure where the 12th mag came in the preliminary write-up. Guide 8.0 lists iy as magnitude 13.0. There are 5 other galaxies in the same 15' field, all fainter than the object of our interest and a mag 7.3 star.
8" F6 Newtonian, 60X; Charlie Whiting: there are two 11th mag stars 6' to the southeast of the galaxy that helped to locate it. The galaxy is at the apex of an isosceles triangle formed with these stars. At this low magnification the galaxy is barely detectable. It is a small and very faint smudge. At **160X** and using averted vision, it seemed to grow and shrink between 30" and 80". The ghostly smudge is elongated and aligned to the northeast. Most of the time it was 3 times longer than wide. At moments it was seen as much brighter in the middle. Elipticity estimate: 3. I nudged the scope to the position of NGC 1066 (mag 13.1 ajc) and NGC 1067 (mag 13.7), but was not able to detect either galaxy.
11" SCT; 98X; Dick Harshaw: Soft, oblong glow in a very rich field. The nucleus is stellar and it looks like there may be a 13th mag or 14th mag star 40" SE of the nucleus.
16" F4.5 Dobsonian 261x; Dave Hofland: At **55x** a small spot of glow ~8' E of 7th mag star, another small spot of glow (NGC 1066) is visible ~5' W of that star, at **261x** ~1.5' diam wide oval extended ~E-W gradually brighter middle without distinct core.

Call for Observations

Time for another pass through Camelopardalis – the camel. It has a nice sprinkling of many deep sky objects, and we will tour several of them starting with **Tombaugh 5**, which was discovered by Clyde Tombaugh. We all know he discovered Pluto by has many star clusters with his name. This one is found at R.A. 03h 47.7' Dec +59° 05' and is almost 20' in size with many stars. How many did you count or estimate? Next is about 3° northeast of Tombaugh 5, the 12th magnitude planetary nebula **NGC1501**. Is it round or elongated to your eye? Then 1.5° north is the open cluster **NGC1502** that has 2 doubles - Struve 484 and Struve 485. This cluster has about 45 stars. Now a departure for our normal selection brings us to an asterism called **Kemble's Cascade**. It is a chain of 19 stars about 4° degrees starting from NGC1502. A good binocular of finder object. Now

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President's Corner
Where Have The Dark Skies Gone?
By Dick Harshaw

The 2010 All-Arizona Messier Marathon is now history and was apparently a great success from all I have heard. (I did not attend as I was at the Antennas site that weekend. I have done two Messier Marathons in my lifetime—both while living under the crummy skies of Missouri—and do not find them to be my cup of tea.) While Tom Polakis was doing a Herschel Marathon (388 of the Herschel 400—wow!!!), I was collecting 250 million year old light streaming in from Sextans and Hydra. (Rumor has it that Tom will attempt a Herschel II marathon next year with a 102mm refractor.)

And that, to me, is one of the great things about this club—whether you prefer mass events like the Messier Marathon, quieter events like a weekend with seven friends at a remote desert site, or something in between like the Grand Canyon Star Party—this club has a lot to offer just about any taste. On top of that, many of us also pursue fun activities together outside the club, whether it be Ham radio (Jimmy, Rick, Andrew, others), geocaching and benchmarking (Rick, myself, Andrew, others), or eating out (all of us).

By the time you read this, we should have found a replacement for our treasurer who has had some health issues of late and requested to be excused from his term of duty. I agree that good health is Job One, so although I hate to lose David in this role, it is also important that he stay healthy so he can be a part of us for a long, long time! I look forward to the new treasurer (or, as the Brits like to say, minister of the exchequer) and his or her service to our club. We are in very good financial health right now and should continue to be in good shape for at least two years to come.

We will, of course, be introducing a proposed amendment to our constitution to cover a case when an officer resigns or is somehow incapacitated (surprisingly, there are currently no provisions for such a case now). When that is voted into force, I can then resign and walk off into the sunset, telescope under my arm…

By the way, this IS the April Newsletter. Ahem. (*Ed. Note: The joke's on you Dick, this is the March issue!)*

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way—it looked like a smaller Jupiter with fewer bands. Very interesting!

Astronomy Picture of the Day (APOD) has pictures in its archives of Saturn's rings in their various configurations. May 24, 1997 shows a Hubble Space Telescope photo from August 6, 1995 when Saturn's rings were edge-on. To see them the most wide open, look at APOD from April 5, 2003. They also have a very nice animation on April 6, 2007. You can access these pictures at http://antwrp.gsfc.nasa.gov/apod/ap970524.html, http://antwrp.gsfc.nasa.gov/apod/ap030405.html, and http://antwrp.gsfc.nasa.gov/apod/ap070406.html or go to APOD and look through the archives for these dates.

Another memorable Saturn experience was the night that Saturn and its rings occulted a bright star. We were at Anza watching through our scope when the leading edge of the rings overtook the star. It was amazing to see the actual motion of Saturn against the background star. Then, as it drifted over the star, the star would blink out, and then blink back in when a gap in the ring passed in front of it. All over the site, you could hear echoes of people shouting "It's out...It's back!" for each ring and gap. The display repeated with the rings on the other side of the planet.

If you haven't had a good view of Saturn's rings yet, find someone with a telescope, or show up at an outreach. It may start a lifetime hobby, and perhaps, also a lifetime friendship.

April 2010

SUN	MON	TUE	WED	THU	FRI	SAT
				1	2	3 SAC Star Party at Saddle Mountain
4	5	6 ☾	7	8	9	10 DOTM Star Party @ Antennas
11	12	13	14 ●	15	16	17 Thunderbird Starwatch @ Thunderbird Park
18	19	20	21 ☽	22	23	24
25	26	27 ATM Meeting 1930, Paul Lind's House	28 ○	29	30 SAC Meeting, GCU 1930	

Schedule of Events for April 2010

Apr. 3rd	SAC Star Party at Saddle Mountain: Sunset 1854, Ast. Twilight Ends 2019, Moonrise 0014, 3:55 Hours of Dark Time
April 6th	Moon is at Last Quarter at 0235mst.
April 10th	DOTM Star Party at the Antennas, Sunset 1902, Ast. Twilight Ends 2028, Moonrise 0424, 7:56 Hours of Dark Time
April 14th	Moon is New at 0528mst.
April 17th	Thunderbird Starwatch Public Star Party, Thunderbird Park, Glendale, See page 14 for details
April 21st	Moon at First Quarter at 1119mst.
April 27th	ATM/Astro Imagining Subgroup Meeting at Paul Lind's House at 1930
April 28th	Moon is full at 0518mst
April 30th	SAC General meeting at Grand Canyon University at 1930: Speaker: Tom Kaye, Principal Investigator for Spectrashift

Future Planning

June 5th-12th	Grand Canyon Star Party. For South Rim Info goto: http://www.tucsonastronomy.org/gcsp.html. For the North Rim: http://www.saguaroastro.org/content/2010GrandCanyonStarPartyNorthRim.htm

Why our Analemma looks Like a Figure Eight

By Ethan Siegal

Last month, I posed a question to you as to why, when you photograph the Sun at the same exact time every day for a year, you get something that's shaped like a figure 8, like so (see Figure 1):

Figure 1

We got a good number of thoughtful comments, many of which are on the right track, and many of which have some misconceptions. Let's clear them up, and then let's give you the explanation of what gives us *our* figure 8, and why other planets make other shapes.

What does the analemma look like at other places on Earth? You can see, above, that (from the ruins) the above analemma is from the Northern Hemisphere. Well, in the Southern Hemisphere (G'day to my Aussie readers!), it looks like this (See Figure 2):

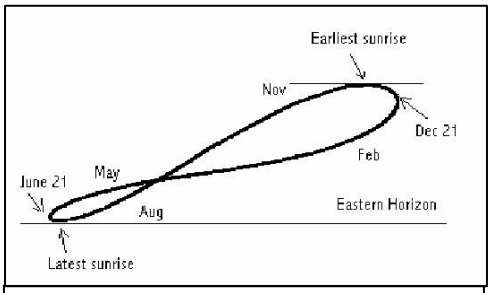

Figure 2

So, at the North Pole, the analemma would be completely upright (an 8 with the small loop at the top), and you'd only be able to see the top half of it. If you headed south, once you drop below the Arctic Circle, you'd be able to see the entire analemma, and it would start to tilt to one side the closer to the horizon you photographed it. By time you got down to the equator, the analemma would be completely horizontal. Then, as you continued to go south, it would continue rotating so that the small loop was beneath the large loop in the sky. Once you crossed the Antarctic Circle, the analemma, now nearly completely inverted, would start to disappear, until only the lower 50% was visible from the South Pole.

So when you do an image search and you find one that looks like Figure 3, you know that it's **photoshopped** or **faked**, because complete, upright analemmas with other stuff on the horizon aren't completely visible from Earth!

The only exception? If you photographed the Sun at exactly noon every day and never did daylight savings time. But in that case, you should get a picture of the *sky*, not of the horizon. (So beware of fakes!)

So, now that you know what it looks like everywhere on Earth, you're probably thinking that this analemma has something to do with the Earth's axial tilt. In fact, many of you guessed that that plays a role. *You're right!* You see, the Sun always traces out a nice arc through the sky, like this series of pictures taken during winter solstice from the UK(Figure 4)

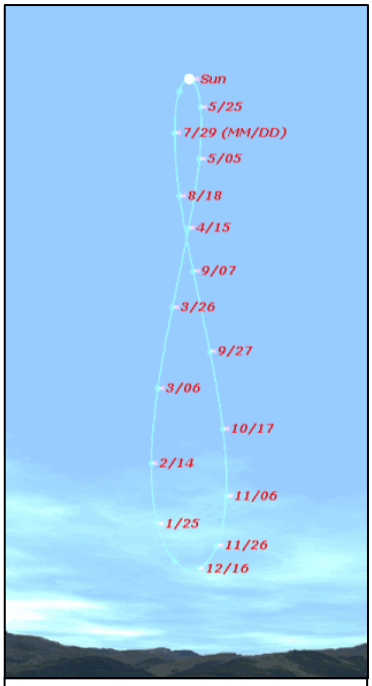

Figure 3

Figure 4

Well, as winter transitions into summer, that arc gets higher and higher in the sky, peaking at its highest point during the summer solstice, and then declining back down to its low point as summer transitions back into the winter. The Earth's axial tilt -- responsible for this phenomenon -- explains why the Sun moves along this direction (drawn in white) of the analemma (Figure 5)

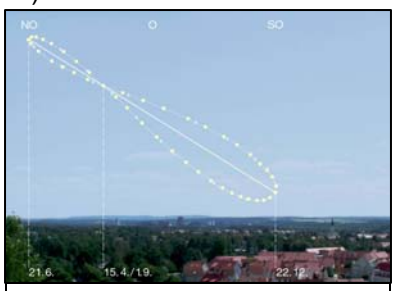

Figure 5

(Continued on page 10)

Monthly Trivia Question

This Month's Question: Little known fact: The American Crew of the Apollo Soyuz Test Project almost died during re-entry. Why?

Last Month's Answer: What connection do the following stars have with Project Apollo?

γ Velorum
ι Ursa Majoris
ε Cas

The three stars mentioned above were part of the Apollo Computer's Guide Stars. Similar in scope to the alignment stars in your go to telescope, these stars along with 42 others, were used to align the spacecraft's navigations system with the current REFSMMAT (See the 12/08 trivia question). So why did I ask about these three stars in particular? Well they were given cryptic nicknames alluding to the astronauts by Apollo One Commander Gus Grissom as a practical joke. After the Apollo One fire, the names were kept by the engineers at NASA as a tribute to the fallen astronauts.

γ Velorium was named Regor, Which is Roger spelled backwards in honor of Pilot Roger Chaffee.

ι UMa, which alluded to Senior Pilot Ed White was named Dnoces. One would have to know that Ed White was named for his grandfather and thus carried a generational suffix to his name, Ed White II. Dnoces is Second, spelled backward.

ε Cas was named Navi for Commander Gus Grissom. The connection? Grissom's middle name was Ivan, again spelled backwards, Navi.

The Apollo Guidance star catalogue included 45 stars in total along with the earth, Sun, & Moon. There was also an empty space in which data about a planet could be inserted if need be. The stars were selected to ensure that at least two could be sighted at any point during the mission. Not all were bright as some of the sparser area of the sky needed to have a guide star. In these area, they were selected to be easy to identify (Goto users, sound familiar?). The stars would be initially sighted through the spacecraft's telescope (Actually a one power finder, Neil Armstrong once quipped that NASA was probably the only outfit the could be sold a one power telescope!). This gave a wide filed view which help Identify the correct star. This star was then sighted through the sextant and the information fed to the computer. A second sighting was made and the computer could determine the spacecrafts position.

If this sounds familiar, it should. The alignment process in your Goto telescope is a direct descendant of this procedure (See the trivia question from 11/08)

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for a couple of galaxies. First is **UGC 3580**, almost 12th magnitude, elongated and it should have a small brighter middle. Do you see it? Finally **NGC2715**, a barred galaxy, that is 11th magnitude, elongated with a well defined outline. After viewing this galaxy what does well defined outline mean to you?

Ursa Major again!? Why? There's so much to do and so little time. Galaxies are here, let's enjoy them to the utmost by including some Herschel 400 and SAC Best of the NGC. So we begin with **NGC3675** located about ½ degree northeast of 56 Ursa Majoris, in the southerly part of the constellation. It is elongated, bright and large. See what other detail is there for your viewing enjoyment. Moving to the bowl find **NGC3690**, a double system in collision with a near-by friend. It is bright, small, elongated and has a brighter middle. Moving just below the bowl is a recent personal favorite - **NGC3718**, an elongated barred spiral with central dust lane. It is difficult to see the bar but, in my 14" Dob, its brighter middle was bifurcated owing to the dust lane. In the field to east of northeast is companion NGC3729. What makes this a favorite is the fuzzy spot about 7' to the south. It is the compact galaxy group Hickson 56 that I observed in February this year. How many galaxies in this group can you see? Going in a southerly direction from the bowl find **NGC3726** a bright, large spiral that is reported to have a well defined spiral pattern. How much of this pattern can you detect? It has some faint field stars. Staying in and around the bowl bottom is next NGC3729 a peculiar barred spiral. It isn't so bright or large but is in same field with NGC3718. What is so peculiar about this one? Finally find NGC3813, down in the southerly part again. This spiral isn't so large or bright. Any other distinguishing features you care to discuss?

(Continued from page 8)

So on a planet like Mercury, where the axial tilt is less than *one degree*, the Sun's position in the sky doesn't change from day-to-day, and so an analemma on Mercury is just a single point! But something else must be going on; Mars, which has almost the same axial tilt as Earth, has an analemma that looks like Figure 6.

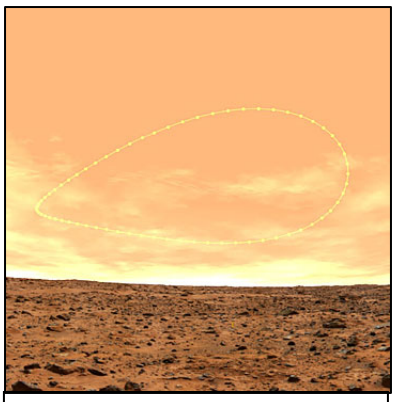


Figure 6

So something must be going on that allows for variations in shape. Some planets see ellipses, some see teardrops, and some see figure 8s. Some see points, too, but they're not as interesting. (There's a list here.)

If the Earth's orbit were a *perfect circle*, and the Earth always moved at the same speed around the Sun, our analemma would simply be a line**, and the Sun would simply move along that line, reaching one end on the Summer Solstice and the other end on the Winter Solstice. But, no planet's orbit is a perfect circle.

Remember, if you can, Kepler's second law for planetary motion (Figure 7).

A line joining a planet and the sun sweeps out equal areas during equal intervals of time.
In other words, when a planet (with an elliptical orbit) is *closest* to the Sun (perihelion), it moves fastest. When a planet is farthest from the Sun (aphelion), it moves more slowly.

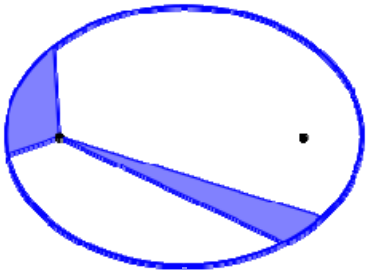


Figure 7

What this means is that the Earth moves different amounts through the sky as it rotates, which is important. You see, the amount of time it takes the Earth to rotate once is **not** 24 hours. It actually takes 23 hours, 56 minutes, and 4 seconds. Why are our days 24 hours, then? Because, *on average*, the Earth revolving around the Sun adds an extra 3 minutes and 56 seconds to each day. But during some days (like in March), it appears that the Sun is moving more slowly, so that 24 hours later -- what we *record* as a day -- the Sun has shifted its position in the sky.
This difference between the Mean Solar Time, which is our 24 hour day, and the Apparent Solar Time, which is how long it takes for the Sun to return to its same position in the sky, governs this "side-to-side" motion in the analemma. The math is given by the equation of time. But, intuitively, how does this work?

It turns out that aphelion and perihelion are close to the solstices on Earth. During these times, a day is actually very close to 24 hours. When the Earth moves from aphelion toward perihelion (when we're experiencing the autumnal equinox in the Northern hemisphere), the Sun appears to move quickly, and so it reaches its apex in the sky at times slightly *earlier* than during the solstices. Conversely, when the Earth moves from perihelion to aphelion (during the months of February and March, for example), the Sun appears to move more slowly, and so reaches its apex at slightly *later* times than normal. (Figure 8)

Figure 8

We call these two situations a "fast Sun" and a "slow Sun". If the y-axis of the analemma was due to the Earth's axial tilt, then the x-axis comes from the Sun appearing fast or slow.

So why is Earth a figure 8 and Mars a teardrop? Because Mars' perihelion and aphelion line up close to Mars' equinoxes, rather than the solstices like it does on Earth. Know what this means? As the Earth's equinoxes precess (which they do over a time period of 26,000 years), the shape of our analemma **will change**. So enjoy the figure 8 now, while we have it!

Update: An astute commentator has pointed out that the Earth's axial tilt also contributes to the Sun's apparent motion in not just the up-down direction, but also in the "side-to-side" motion. I've managed to find an animated image that shows:

1. The effect of eccentricity (what I talked about above),
2. The effect of axial tilt (something that most planets

(Continued on page 11)

(Continued from page 10)

have),

3. The combined effects of both of these (which gives us our equation of time), and

4. The overall path of the analemma, which aligns neatly with the equation of time. (Figure 9)

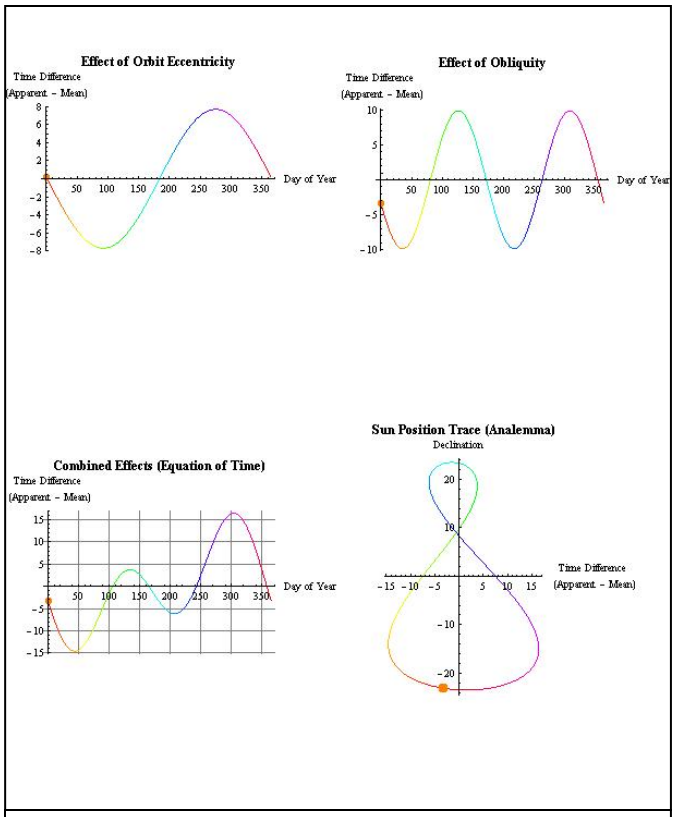


Figure 9

So, if one of these (like eccentricity) always dominates the other (as is the case on Mars), we get a teardrop. If one of them (like eccentricity) is significant and the other is practically zero (as is the case on Jupiter, with a 3 degree tilt only), you get something much closer to an ellipse. And if both are important enough that sometimes eccentricity dominates and sometimes axial tilt dominates (as is the case for Earth, with a tiny eccentricity, and Uranus, with a huge 88 degree axial tilt), you get a figure 8!

** -- Also, note that what I wrote up top about the analemma simply moving up and down in a straight line is *also* incorrect. The Earth's axial tilt (also called obliquity) would still be present, and would still contribute to the side-to-side motion of the Sun in the sky, even if the orbit were a perfect circle.

So you see, this deceptively simple question is actually incredibly complex, *and* I make mistakes sometimes!

"This content distributed by the AAVSO Writer's Bureau"

Such-A-Deal

"For sale-Vintage 1956 Coast Trecker-scope 10" F/7 on hand-made German equatorial mount. Original fiberglass tube, mount, slow-motion control cable, finder scope and pedestal. New, low profile JMI focuser, tube rotation system and wheeled dolly for easy transport. Drive needs work. Tube and rotation system 80% complete refurbish. Worth several thousand dollars. Price: $1000. Must sell. Lost another job."

Bits & Pisces, Minutes of the January 29th Board Meeting

Recorded by Dick Harshaw

The first board meeting of 2010 was called to order by President Richard Harshaw in room 107 of Fleming Hall at the Grand Canyon University on Friday, January 26, at 6:15 pm. Those present were Tom and Jennifer Polakis, Rick Tejera, Dave Fredericksen, Steve Dodder and Jack Jones. A. J. Crayon and Paul Dickson arrived later.

The Treasurer reported the checking account balance to be $4,139.86 and about $50 in the Petty Cash fund. In addition, a number of people had just turned in membership renewals.

Rick Tejera reported on the Messier Marathon. It is set for March 13, 2010. Rick reported that everything was well under control with the T-shirt vendor selected (design not finalized yet, but Tom Polakis had a great idea). The shirts will cost $120 for a one-time setup fee and about $7.50 per shirt for screening. This makes our costs for 2010 about what they were for 2009, so the shirts will be sold for the same price. Jack Jones will take care of the Johnny-on-the-Spot rentals. The East Valley Astronomy Club will again have a refreshment table set up.

Steve Dodder reported that the Grand Canyon Star Party (North Rim) has a full complement of workers now and all is ready to go (June 5-12, 2010). He still has not heard from the Kaibab Lodge manager, so we don't yet know whether or not we will have astronomers doing a star party for the lodge or not.

The Five-Mile Meadow star party is scheduled for June 11-12, 2010. We will need to have someone spearhead the event (checking with the rangers, renting a Johnny-on-the-Spot). The President will check with Steve Coe about helping with this, as Steve has done it in the past and done well with it.

The President brought up a request from Optics Planet to link to our web site (without click fees). The board suggested that the President check out the company first and if it looks legitimate and reputable, to agree to a link provided they link back to us. We will also pursue the same mutual-linking concept with other vendors in Arizona. We would probabl put a link to a "Vendors Area" on our home page and place a disclaimer on the Vendors Area page that we simply link to these vendors and in no way vouch for or endorse them.

Jack Jones reported that the city of Glendale has cut the budget so much that they cannot host the Thunderbird Park start party this year. It was suggested to Jack that we try to find an alternate site— ASU West, a library, a school, etc. Jack will look into it. (*Ed. Note: The City 7 Club have come to terms and have scheduled the event for April 17th, 2010. There are some changes to access the site, see the announcement on page xx)*

The field trip the club voted on in 2009 (the Large Binocular Telescope) needs a spearhead. The President will ask Gene Lucas if Gene would like to help (at least to guide the person who would do the heavy lifting)*.

The President brought up the idea of forming a permanent *ad hoc* SAC History Committee to be appointed by the President. Tom Polakis has so far done work on this for us and is willing to continue it. The President suggested he should feel free to recruit a volunteer or two to help him.

The meeting was adjourned at 6:50 pm.

Respectfully submitted,

Richard Harshaw, President

* At the meeting, Gene found a volunteer (Jennifer Polakis) to help coordinate the event.

Bits & Pisces, Minutes of the January 29th General Meeting

Recorded by Paul Dickson

The meeting started at 1930. The officers were introduced and there was one visitor (Mark). The treasurer's report was given.

Steve Dodder reported on the Novice Group, the 50/50 raffle, and the Grand Canyon Star Party north rim event. The latter in June 5th – 12th. A schedule for the GCSP for the next 7 years has been created.

Tom Polakis did a show and tell and reported on his latest effort gather info on SAC's history.

Paul Lind gave a show and tell contrasting two recent star parties at the Antennae site, 10/17/2009 and 1/16/2010, with latter having images of the camp fire built while waiting to see if the clouds cleared.

A.J. Crayon presented an award for the Messier observing list to Steve Scowen. He also covered the upcoming Messier Marathon that will be March 13.

Steve Coe reported on the pending update to the SAC Deep-Sky Database. He was looking for any other corrections. The new version will be 8.1. SAC has other databases and observing lists on it's website. Steve was also selling his 10-in f/4 telescope so he would have more room.

After a 23 minute break, Klaus Brasch gave the talk "An Astronomical Odyssey to Chile" on his trip to northeastern Chile to see the observatories and do some observing from the high/dry altitudes.

The meeting ended at 2128. There were 43 people in attendance (the room had 48 seats).

Such-A-Deal

For Sale

$400, 10 inch f/4.8 Newtoninan optical tube assembly from Sky Watcher, 2 inch focuser, 8X50 finder, dew shield, Losmandy mounting plate, Orion padded bag. This is an almost brand new scope. It provides very good images. I just don't have room in my RV for three telescopes. I will take a reasonable offer. Please note that what is for sale is just the scope, not the mount.

Contact Steve Coe at: stevecoe@cloudynights.com

For Sale

10" Orion Premium DSE. I believe these were made by Discovery telescopes for Orion. I bought new around 2001 for $1000. Perfect condition and mirror passes star test. f/5.6.....fl..1422mm. comes with telrad and 1.25 26mm eyepiece. $550....Call Doug Allen 623-856-5027

Proposed Amendment to the Constitution & Bylaws

On Saturday March 6th, 2010, President Dick Harshaw posted the following note to the SAC-Board Email List:

> Folks,
>
> I talked tonight with David Fredericksen, our current treasurer. He has been undergoing some health issues as he is successfully losing weight and does not feel focused enough right now to do the job of Treasurer. I told David that his health was more important than any club position, and encouraged him to back off for now. I told him we would elect a replacement for him at the next meeting.
>
> I don't see anything in the constitution about a case like this. Does anyone have any idea on how to proceed? We need to nominate and ratify by vote his replacement by the next meeting, or things could get pretty far behind financially.
>
> I welcome your input, and know you will join with me in wishing David the best of luck in his weight loss program and rapid improvement in his health.
>
> Richard Harshaw
> Cave Creek, Arizona

With this in mind the following has been proposed as an amendment to the Constitution & Bylaws to cover this eventuality. The proposal is presented here for your consideration. The required signatures of endorsement will be gathered at the March 26th General meeting, followed by discussion & Comments. A vote will be then be taken Comments are welcome either to the SAC Board Email List (sac-board@freelists.org) or at the meeting prior to the vote. Comments made via email will be presented at the meeting for those who do not have access to the SAC Board list.

Article V, Section B, Paragraph 5

1) Should a board position become vacant prior to the expiration of the term of the office holder, the President shall announce such to the membership by the best means available. The President shall also ensure that a notice of the vacancy is published in the next issue of the newsletter, and call for nominations to fill the vacancy. Nominations for the vacant position shall be taken immediately and shall be concluded at the next scheduled General meeting. A vote of the general membership shall be taken immediately following the close of nominations.
    a) The term of service for the elected successor shall be the remainder of the term of the preceding holder of the vacant office.
    b) Should the elected successor opt to run for the vacated position outright at the next regularly scheduled election he/she shall be eligible to do so.
    c) He/She may run for re-election the following term if the total term of service does not exceed 30 months (2 ½ Years).
2) In the time between the vacancy opening and the election of a successor, the President shall delegate, to a qualified member (one who meets the requirement of Article V, Section B, paragraph 1), the duties of the vacant position as he deems necessary.
    a) In the event the vacant position is the Treasurer, the board shall approve the member delegated by the President to handle the position until a successor is elected.

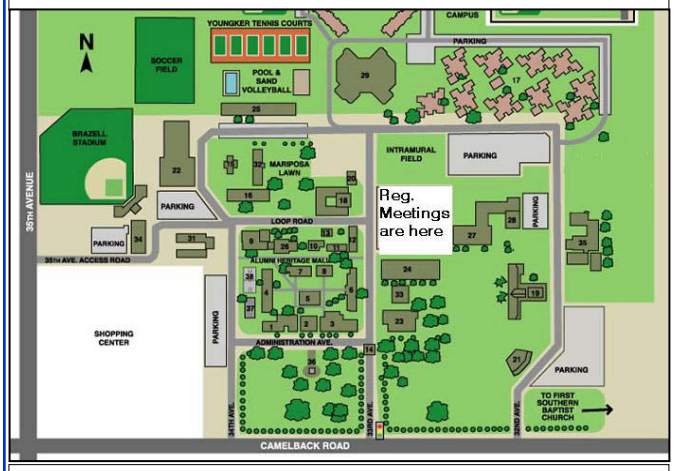
————————-End of Proposal————————

The Current Article V, Section B, Paragraph 5 shall be re-numbered to Article V Section B, paragraph 6

(Ed. Note.) I know we all wish Dave the best of health and support his efforts to restore his health. If you've been a member of the club for any length of time, you know David is one of our most active members & supporters. He has served on the board several times (most often when no one else steps up), and can always be counted on to share his knowledge with anyone who asks. His sense of humor is exceeded only by his generosity.

SAC Member Services

General Meetings



7:30 p.m. at Grand Canyon University, Fleming Building, Room 105: 1 mile west of I-17 on Camelback Rd., North on 33rd Ave., Second building on the right.

Thunderbird Starwatch

Date: Saturday, April 17th, 2010
Location: Thunderbird Park, Glendale
(1.7 Miles north of Loop 101 on 67th Ave.)
Time: Sunset (6:30 p.m.)

Take the Loop 101 to 67th Ave. Head north on 67th Ave. (You should pass the Safeway Supermarket) for 1.7 miles (about 0.7 miles past Deer Valley Rd) to the park entrance on the right (at Patrick Ln.). There is a road leading from the north end of the parking lot, to the observing field. There will be signs posted along the route in the park.

Dark of the Moon Star Parties-2010

Date	Sunset	Moonset	Eve. Twi.	Morn. Twi./Sun Rise	Location
February 13th	1817	-	1941	TW: 0556	Antennas
March 13h (Messier Marathon)	1833	-	1955	MR: 0548	Arizona City
April 10th	1902	-	2028	MR: 0424	Antennas
May 15th	1924	2134	2102	TW: 0347	Cherry II
July 10th	1943	-	2127	TW: 0341	Cherry II
August 14th	1829	2200	2049	TW: 0417	Cherry II
September 11th	1841	2036	2006	TW: 0444	Cherry II
October 9th	1808	1920	1930	TW: 0513	Antennas
November 6th	1738	1756	1902	TW:: 0534	Antennas
December 4th	1726	-	1854	TW: 0556	Antennas

SAGUARO ASTRONOMY CLUB

March 2010

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Email: newsletter@saguaroastro.org

Videmus Stellae

www.saguaroastro.org

SAC Schedule of Events 2010

SAC Meetings

January 29, 2010	July 23rd, 2010
February 26, 2010	August 20th, 2010
March 26th, 2010	September 24th, 2010
April 30th, 2010	October 22nd, 2010
May 28th, 2010	November 19th, 2010
June 25th, 2010	2010 Holiday Party, TBA

Future Planning

April 17th, 2010	Thunderbird Starwatch
June 5th-12th, 2010	Grand Canyon Star Party
June 11th-12th, 2010	5 Mile Meadow Star Party

SAC Star Parties

Date	Sunset	Astronomical Twilight Ends	Moonrise	Site
Jan. 9th, 2010	1742	1910	0351	S
Feb. 6th, 2010	1809	1933	0244	S
Mar. 6th, 2010	1833	1955	0131	S
Apr. 3rd, 2010	1854	2019	0014	S
May 8th, 2010	1919	2054	0245	C
Jun. 5th, 2010	1939	2123	0140	C
Jul, 3rd, 2010	1945	2130	2340	C
Aug 7th, 2010	1924	2059	0357	C
Sep. 4th, 2010	1850	2017	0246	C
Oct. 2nd, 2010	1811	1934	0138	C
Oct. 30th, 2010	1742	1906	0040	S
Nov. 27th, 2010	1725	1852	2339	S

S= Saddle Mountain; C= Cherry Road; A=Antennas