Saguaro Astronomy Club

SACnews

Volume 34 Issue 2 February 2010

SAC Officers

President: Dick Harshaw
480-275-2764
president@saguaroastro.org

Vice President: Tom Polakis
480-967-1658
tpolakis@cox.net

Treasurer: David Fredericksen
602-460-7310
david.fredericksen@gcmail.maricopa.edu

Secretary: A. J. Crayon
602-938-3277
Acrayon@cox.net

Properties: Lynn Blackburn
602-451-4739
lynnrb11@yahoo.com

Public Events:
Jack Jones
623-322-1559
publicevents@saguaroastro.org

Astro-Imaging Sub Group:
Al Stiewing
623-875-3969
amst@cox.net

SACNEWS Editor:
Rick Tejera, 623-572-0713
saguaroastro@cox.net

Inside This Issue

TOP TWENTY THINGS AN ASTRONOMER SHOULD SEE
#20: The International Space Station
By Helen Mahoney

The International Space Station (ISS) is actually a bonus item. The ISS isn't a natural astronomical object, but it is a space object, and it is really cool to see it. You don't need to go anywhere, because it is bright enough to be seen even in light polluted skies. You also don't need a telescope or even binoculars, as it is clearly visible with the naked eye.

Now that it has had several arrays of solar panels added to it, it is very bright, often the brightest object in the night sky (apart from the moon). On a good pass, it can be as bright as *minus* 2! (The brightest, or First Magnitude stars are *plus* one).

The ISS orbits the earth with an orbit time of about 90 minutes. The earth turns below its orbit, so we are periodically in position to see it. We are able to see it best when the sky is darkened after sunset, but the ISS is still in sunlight, sailing over the earth at an altitude of about 200 miles (340 km). It is possible to see it in daylight, but very difficult, and you can't see it later on in the night when it is in the earth's shadow.

There are several good websites that can give you the information to help you see it. I usually use www.heavens-above.com. You don't have to know your latitude and longitude to use this web site, just plug in the nearest large city to your observing site, and it will let you know when a pass will be visible, and where in the sky to look for it. You can also use the Satellite Flybys link from Spaceweather.com.

Some people have managed to track the ISS with telescopes, and see its shape clearly. There have been some phenomenal photos taken of the ISS, including some

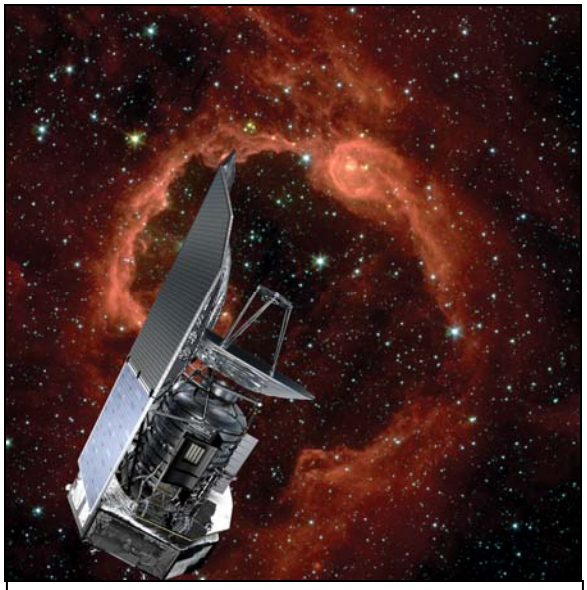
(Continued on page 3)

NASA Space Place

Flipping the Lights on Cosmic Darkness

Exploring the universe is a bit like groping around a dark room. Aside from the occasional pinprick of starlight, most objects lurk in pitch darkness. But with the recent launch of the largest-ever infrared space telescope, it's like someone walked into the room and flipped on the lights.

Suddenly, those dark spaces between stars don't appear quite so empty. Reflected in the Herschel Space Observatory's 3.5-meter primary mirror, astronomers can now see colder, darker celestial objects than ever before—from the faint outer arms of distant galaxies to the stealthy "dark asteroids" of our own solar system.



The Herschel Space Observatory has 3.5-meter primary mirror, allowing astronomers to see colder, darker celestial objects than ever before.

Many celestial objects are too cold to emit visible light, but they do shine at much longer infrared wavelengths. And Herschel can observe much longer infrared wavelengths than any space telescope before (up to 672 microns). Herschel also has 16 times the collecting area, and hence 16 times better resolution, than previous infrared space telescopes. That lets it resolve details with unprecedented clarity. Together, these abilities open a new window onto the universe.

"The sky looks much more crowded when you look in infrared wavelengths," says George Helou, director of the NASA Herschel Science Center at Caltech. "We can't observe the infrared universe from the ground because our atmosphere blocks infrared light, and emits infrared itself. Once you get above the atmosphere, all of this goes away and suddenly you can look without obstruction."

Herschel launched in May from the Guiana Space Centre in French Guiana aboard a European Space Agency Ariane 5 rocket. Since then, it has expanded the number of distant galaxies observed at far infrared wavelengths from a few hundred to more than 28,000. And with the instrument testing and system check-out phases finally completed, the discoveries are only now beginning.

Beyond simply imaging these dark objects, Herschel can identify the presence of chemicals such as carbon monoxide and water based on their spectral fingerprints. "We will be able to decipher the chemistry of what's going on during the beginnings of star formation, in the discs of dust and gas that form planets, and in the lingering aftermath of stellar explosions," Helou says.

And those are just the expected things. Who knows what *unexpected* discoveries may come from "flipping on the lights?" Helou says "we can't wait to find out."

Herschel is a European Space Agency mission, with science instruments provided by a consortium of European-led institutes and with important participation by NASA. See the ESA Herschel site at sci.esa.int/science-e/www/area/index.cfm?fareaid=16. Also, see the NASA sites at herschel.jpl.nasa.gov, www.herschel.caltech.edu, and www.nasa.gov/mission_pages/herschel. Kids can learn about infrared light by browsing through the Infrared Photo Album at The Space Place, spaceplace.nasa.gov/en/kids/sirtf1/sirtf_action.shtml.

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

(Continued from page 1)

taken with solar filters so that the ISS is silhouetted against the disk of the sun. Some of these can be seen in the archives of Astronomy Picture of the Day (APOD) or Spaceweather.com.

It's fun to see the ISS appear in the sky and sail overhead. I drag people outside to see it, and everyone enjoys it. Most of them are amazed that you can see the ISS, and that there are astronauts and cosmonauts aboard it. (They are also amazed that I knew where to find it.) I often send a text message to my friends and family shortly before a good pass to alert them. Afterwards, I get texts back from several of them with "Wow", "That was great", and other delighted comments.

Probably the best sighting was one night in 2008 when the Space Shuttle had just undocked from the ISS, and the Jules Verne supply ship was also in the vicinity. Traveling along approximately the same path in the sky came the Jules Verne, followed by the Shuttle, and then the very bright ISS. That was quite a treat for everyone who saw it!

The web sites can also inform you when you can see Iridium flares and the Hubble Space Telescope passing over. The Iridium flares occur when one of the Iridium communication satellites is in a position such that the sun glints off of its solar panels at just the right angle to make them flare in brightness tremendously. Kind of what happens when the sun reflects off a car window into your eyes. The brightest one I've seen was minus 7! The Hubble Space Telescope is not nearly as bright as the ISS, or even the space shuttle, so it is only easily seen in a dark sky. I did see it once in Anza Borrego.

I hope you investigate the web sites, and take the opportunity to go outside and see a real space station with your own eyes.

This article was first run in the February 2010 issue of "The Sirius Astronomer", the official Newsletter of the Orange County Astronomers (www.ocastronomers.org) and is use here with permission of the both OCA and the Author.

This article was first run in the February 2010 issue of "The Sirius Astronomer", the official Newsletter of the Orange County Astronomers (www.ocastronomers.org) and is used here with permission of the both OCA and the Author.

Such-A-Deal

"For sale-Vintage 1956 Coast Treckerscope 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."

Call For Observations–Fornax

By A.J. Crayon

As indicated a second southerly constellation was requested and Fornax seemed to be a good choice mainly because of the *Fornax Galaxy Cluster*. I have only been to this area a few times and have been taken aback with the numerous galaxies that are available in a one degree field. It seems from SAC members' observations they were too.

For starters it was suggested to center on RA 03 37.0 Dec –35° 19' which put 8 galaxies in a one degree field of view. We will follow this field in NGC order, starting from the west side of the field and work our way to the east side.

The first **NGC1374** at magnitude 11.1 is a little elongated and has a little brighter middle. Nearby, but not on our list are two fainter galaxies, NGC1373 and NGC1375 with listed magnitudes of 13.3 and 12.4 respectively. No doubt within reach of many telescopes.
8" f6, Dobsonian, 81X; Rick Tejera: The final object in FOV is slightly elongated and bright with suddenly brighter middle. Averted vision brought out what seemed to be an extension to the south, which I suspected is NGC1376 [possibly NGC1375 ajc], although I won't claim it.
10" f5.8 Newtonian, 125x; Rick Rotramel: G - pS, fB, oval, much brighter in the middle.
14.5" f/4.8, Dobsonian, 138X; Paul Lind: pS,pF,lE,mbM.

Next is **NGC1379** a magnitude 10.5 elliptical galaxy that is, basically, 2' round with a gradually pretty much brighter middle.
8" f6, Dobsonian, 81X; Rick Tejera: showed about the same size as 1387 (which appeared more round in this field) but fainter with a slight brightening in the middle.
10" f5.8 Newtonian, 125x; Rick Rotramel: G - S, pF, oval, brighter in the middle.
14.5" f/4.8, Dobsonian, 138X; Paul Lind: (than 1374) F,R,lbM.

Now slew 28' north to **NGC1380** a nice sized, mag 9.9, barred galaxy with a bright middle. There were positive responses in reference to detecting the bar.
8" f6, Dobsonian, 81X; Rick Tejera: Moving west from NGC1382 in FOV, NGC 1308 is the largest in this field. Pretty bright and elongated about 2-1, this one seemed to show a bar. There are two bright stars nearby to help in sorting this one out.
10" f5.8 Newtonian, 125x; Rick Rotramel: G - fL, pB, oval, much brighter in the middle.
14.5" f/4.8, Dobsonian, 138X; Paul Lind: pB,pL, little Elongated, possible hint of on a N-S bar with ends tilting NW and SE, from my sketch.

To get to **NGC1381** slew 19' south. This is a small, magnitude 11.5 galaxy. With this galaxy centered there are five other galaxies in a 35' field. See Paul's observation – nice description!
8" f6, Dobsonian, 81X; Rick Tejera: Moving East through FOV NGC1381 showed as pretty bright and slightly elongated, No other real detail seen, uniformly bright throughout.
10" f5.8 Newtonian, 125x; Rick Rotramel: G - vS, pB, edge-on, much brighter in the middle.
14.5" f/4.8, Dobsonian, 66X; Paul Lind: With this galaxy centered, there were many gaxaxies in the field, including bright objects NGC1380 and NGC1399. Also, starting a little above center in my field, SE, a kite shape oriented E-W is formed by 1387,1379,1381 and 1374. The kite fits in the 138x 13mm Nagler field, which was 37 min. diameter on the sky. Using my abbreviations this galaxy is pS,pF,pE,bM.

NGC1387 carries us, from NGC1381, south of southeast. It is another, fairly small, bright and round spiral.
8" f6, Dobsonian, 81X; Rick Tejera: Moving west in FOV this galaxy seemed to show slightly elongated although it is listed as round, Caused me to double check the charts and this was in fact 1387. Possibly seemed to be elongated as it was near the edge of the FOV. Uniform in brightness throughout.
10" f5.8 Newtonian, 125x; Rick Rotramel: G - S, pB, round, with a very much brighter nucleus.
14.5" f/4.8, Dobsonian, 138X; Paul Lind: pS,pF, nearly R, gbM. Same brt as 1379 & 1374.

Moving to the most southerly galaxy is **NGC1389**, yes it is in Eridanus but well worth the trip. Isn't it?
8" f6, Newtonian, 60X; Charlie Whiting: I was able to detect this galaxy as a faint gray smudge. The galaxy and three 10th and 12th mag stars to its north, northeast and east form a quardrilateral figure. At **160X** the bright center is seen with direct vision. Averted vision is needed to see the halo. The center is non-stellar and a little brighter than the halo. It is oblong, about 1' by 0.5' and aligned northeast. Elipticity estimate: 3.
8" f6, Dobsonian, 81X; Rick Tejera: The final galaxy in FOV, this was the faintest, Seemed almost stellar like until averted vision was applied. Slightly elongated and uniform brightness (what passes for bright) throughout.
10" f5.8 Newtonian, 125x; Rick Rotramel: G - S, pF, oval, brighter in the middle.

Now we are getting to the eastern part of the basic field of view with **NGC1399**. This magnitude 9.6 elliptical is just a tad elongated and pretty bright. How much of this gem can you resolve? The NGC description for the middle is

(Continued on page 5)

(Continued from page 4)

pretty small brighter middle and resolved. It size is 6.6' X 6.1'.

8" f6, Newtonian, 38X; Charlie Whiting: the galaxy can be easily seen with direct vision. It has a bright middle and a faint halo can also be seen. At **160X** I saw the bright middle easily. It is almost so glaring that the rest of the galaxy can be seen only with averted vision or intermittently with direct vision. It is fairly large, maybe 5' in its widest part. It was seen as mostly round. I knew that it was supposed to be a little oblong but I could not see that. The halo is much fainter than the middle. The middle was seen as nearly stellar. There's a neat group of four 10th to 12th mag stars due east of the galaxy. One of the brighter stars seems to have a faint companion. There are two 13th mag stars on the very edge of the halo in the due south position. Elipticity estimate: 2.

8" SCT, 65x; Dick Harshaw: It is a small fuzzy patch between 8.1 mag SAO 194428 (13 min SE) and 7.1 mag 194426 (15 min N). It is a Fornax Galaxy Cluster member, and dominant elliptical of the system. It has a staggering 5,000 globular clusters (a figure comparable to M87, the dominant elliptical in the Virgo Cluster)! It also has a low-lumisity radio jet.

8" f6, Dobsonian, 81X; Rick Tejera: The second of four galaxies in FOV, this one was the largest in this filed of view. Again very bright and large, which affected the surface brightness. This one is listed as mag 9.6 vs. 10 for NGC1404, but it seemed to be not as bright. It also seemed to be slightly brighter in the middle.

10" f5.8 Newtonian, 125x; Rick Rotramel: G - pS, fB, slightly oval, brighter in the middle.

14.5" f/4.8, Dobsonian, 138X; Paul Lind: L,B,R, gbM?, No detail seen.

Finally, just to the southeast is **NGC1404**, another elliptical that is a little fainter than the prior one, but has a slightly higher surface brightness. It is 10th mag with a pretty small much brighter middle.

8" f6, Newtonian, 38X; Charlie Whiting: this galaxy is in the same field of view as NGC 1399. It sits about 10' to the southeast of NGC 1399. It also has a bright middle that can be easily seen with direct vision. There is an 8th mag star parked 3' to the southeast of the galaxy. At **160X** it has a bright middle that is somewhat extended and not stellar. About 1/2 of its halo can be seen with direct vision. The other 1/2 can be seen using averted vision.The galaxy is round, about 3' in diameter. There is a very faint star on the southeast edge of its halo. Elipticity estimate: 1.

8" f6, Dobsonian, 81X; Rick Tejera: was the brightest of the grouping Near the eastern edge. It was seen as round and brighter in the middle.

10" f5.8 Newtonian, 125x; Rick Rotramel: G - S, fB, round, brighter in the middle.

Call for Observations

OK, after having done a couple of southerly constellations, it is time to get back to a northern one, and that one is **Triangulum**. So, for January 2010, we will leave the show piece for another time and will start with a selection of 5 galaxies and one open cluster. Beginning in the southwester part, near the Pisces border will be the elongated barred spiral **NGC 672**, which is listed as a coarse spiral. What does that mean to you? In the same 30' field is the fainter IC 1727 which is also elongated at about 90°. From this galaxy pair move about 40' to the southeast to the sole open cluster **Cr 21** containing about 15 or 20 stars with the brightest being about 8th mag. Beware the coordinates may be a little off, about 15', so you may have to pan around a little to find this, rather poor, grouping of stars. Now, moving much more to the north is the elliptical galaxy **NGC 750**. This galaxy is paired with NGC 750, they could, easily, be in contact with one another. Swing south, into the triangular part, is another elliptical, **NGC 777** along with its much fainter buddy NGC 778. Moving more to the south, almost near where we started, is the 12th mag barred spiral **NGC 784**. Quite elongated, don't you think? Moving to the very eastern part is the last of the selections, **NGC 1060**, which is said to be in the same position as NGC 1062 – watch that when you use your digital setting circles. At nearly 12th mag it should be rather faint but you should be able to detect the slightly brighter middle. While making this observation look for other field stars and galaxies. For the elliptical galaxies in this list estimate the ellipticy, that is assign the number that best describes its elongation. The number ranges from 0 for round to 7 for very elongated. No fair peeking before you observe but you should check afterwards to see how close you came with your estimates.

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 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?

President's Corner

Where Have The Dark Skies Gone?

By Dick Harshaw

Global warming, global schmarming! I want to know who has stolen our pristine, dark skies this year.

I have never seen such a spate of cloudy weather, especially around new moons, as we have been experiencing the last six months or so. Meteora has struck with a vengeance this year, as if she were releasing hundreds of years of pent-up frustration. Do you think she'd fall for a Trojan Horse? Should we build a 50 foot tall 10 foot objective Dob at Antennas out of cardboard and Saran wrap and burn it as an offering to her anger? I don't know. It might be worth a shot.

On a more serious side now— I am looking forward to our annual open-for-the-public Spring Star Party at Thunderbird Park, even though the City of Glendale has, because of budget cuts, become more difficult to work with. The good news is we can still use the park this year, but we'll have to change the access point (67th Avenue only). Hey, it could have been worse—they could have told us the park was no longer available. Mark your calendar for April 17.

Several club members have lately been helping out at small star parties at local schools. I know that Jennifer Polakis recently was involved with such an event at Shaw Butte Elementary (as of this writing, that is still four days off and the forecast looks iffy), and I am working with 6 other SACers (Jeff Hopkins, Jimmy Ray, Chris Hanrahan, Chico Romero, Rick Tejera and Joe LTG Goss) to do a star party at Peoria Elementary, hopefully this Saturday (Feb. 27)—but again, the forecast is iffy, so we may have to put it off to March. If you have never served at a school star party, you should try it sometime. (Don't bring your best eyepieces! Little ones like to touch everything, and that includes finely ground oculars!) But they ooh and ahhh and their parents gush with gratitude. It doesn't pay much as a gig, but the payoff is not in money anyway. If you can put a value on smiles and giggles and heartfelt "Thanks" from mom and dad, you'd be a rich person indeed!

Speaking of Jennifer, she is working on a field trip to the Large Binocular Telescope for this year. As soon as she has confirmed dates, she'll be letting us know. This was the number one venue voted on by the club last winter and I think it will be a dynamite trip!

In June (during the dark of the moon), we'll be doing our annual Five Mile Meadow star fest. The site is phenomenal for darkness and fairly steady seeing and you'll want to be sure to bring your ancient photon vacuum cleaners with you. (I will be at the Grand Canyon North Rim Star Party that week so will miss the 5MM event. But I'll be there in spirit!) Mark your calendar for June 11-12.

And, of course, we have our monthly Druidic Escapades at various dark sites when the moon graciously agrees to hide her face for a few nights.

So we are off to a busy and fulfilling season of electromagnetic radiation collection. Let's all hope that the weather soon returns to our normal desert sky conditions and Meteora decides to go bug the dickens out of some other area, like the Midwest (sorry for my old stomping ground astronomers…. Not!).

March 2010

SUN	MON	TUE	WED	THU	FRI	SAT
	1	2	3	4	5	6 SAC Star Party at Saddle Mountain
7 ☾	8	9	10	11	12	13 All Arizona Messier Marathon, AZ City
14	15 ●	16	17	18	19	20 Vernal Equinox at 1032
21	22	23 ☽ ATM Meeting 1930, Paul Lind's House	24	25	26 SAC Meeting, GCU 1930	27
28	29 ○	30	31			

Schedule of Events for March 2010

Mar. 6th	SAC Star Party at Saddle Mountain: Sunset 1833, Ast. Twilight Ends 1955, Moonrise 0131, 6:58 Hours of Dark Time
Mar. 7th	Moon is at Last Quarter at 0840mst.
Mar. 13th	All Arizona Messier Marathon at Farnsworth Ranch, Arizona City: Sunset 1833, Ast. Twilight Ends 1955, Ast. Twilight Begins 0517, Moonrise 0548, Sunrise 0638
Mar. 15th	Moon is New at 1400mst.
Mar. 20th	Vernal Equinox at 1032mst.
Mar. 23rd	Moon at First Quarter at 0359mst.
Mar. 23rd	ATM/Astro Imagining Subgroup Meeting at Paul Lind's House at 1930
Mar. 26th	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

A Question of Why: The Analemma

By Ethan Siegal

Figure 1

I'm trying something new here: I'm going to give you a little bit of information and a teaser, and we'll see -- in the comments section -- whether any of you can figure it out.

Imagine that you went outside, each and every day at the same time, and mapped the position of the Sun. What would you see? (Image Credit: Michael Stecker.)

Doing this -- taking a snapshot of the Sun at the same exact time from the same exact place on different days -- gives you what's called an analemma. Now, on Earth, the top of the analemma happens during the Summer Solstice, the lowest point of the analemma happens during the Winter Solstice, and the "crossing" takes place twice a year: once on around April 15th and once (coming soon) about August 31st. Here's an image I found (Figure 2) that illustrates what happens throughout the year to the Sun's position:

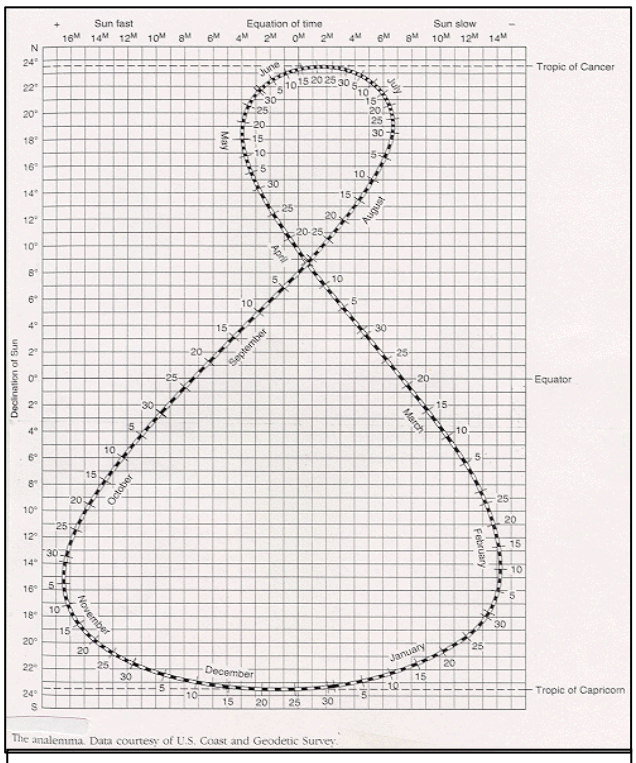


Figure 2

The figure-8 shape that we see happens on *some* of the other planets, but not on most of them. For example, if we did the same thing on Mars, taking a picture of the Sun at the same exact time every day for a year, we would get a *teardrop* shape instead of a figure-8. (Figure 3)

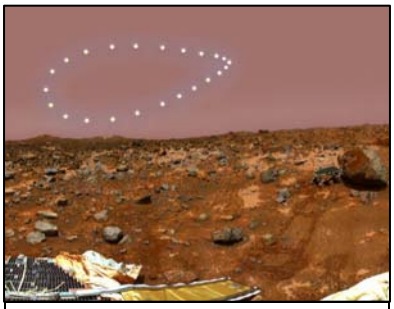


Figure 3

In fact, if you made a list of what these shapes look like on all the terrestrial planets, here's what you'd find:

1. Mercury: a single point (because a day on Mercury takes exactly two years!)
2. Venus: an ellipse
3. Earth: figure 8
4. Mars: teardrop
5. Jupiter: ellipse
6. Saturn: teardrop with a teeny-tiny loop at the end
7. Uranus: figure 8
8. Neptune: figure 8
9. Pluto: a very large figure 8

So of all the planets close to the Sun, *only Earth sees a figure-8*. My question for you is this: **why does the Sun trace a figure-8 shaped analemma?** If you want to go a little beyond that, I'll ask you what the significance of April 15th and August 31st are, too.

Any thoughts?

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

Monthly Trivia Question

This Month's Question: What connection do the following stars have with Project Apollo?

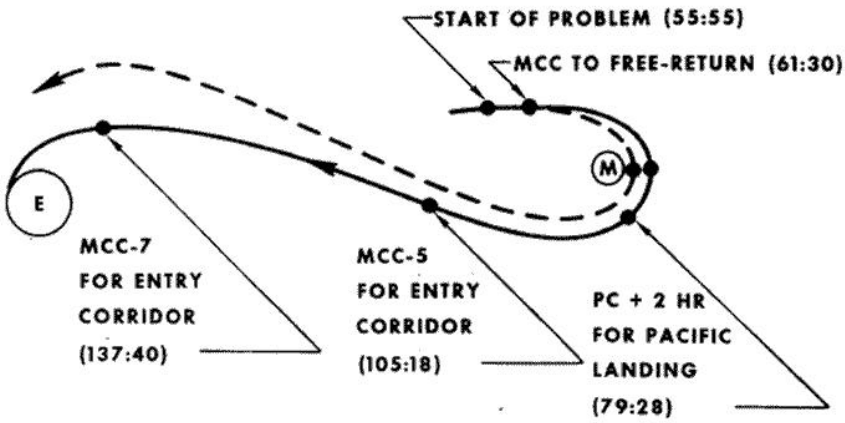
γ Velorum
ι Ursa Majoris
ε Cas

Last Month's Answer: What was a Hybrid Lunar trajectory?

The first flight to the moon were made using what was called a free return trajectory, Which if nothing was done would swing the spacecraft around the far side of the moon and bring it back directly to earth (within the capability of the reaction control system (RCS) to made minor corrections). By it's nature the free return trajectory had to be aligned nearly to the plane of the lunar orbit, thus limiting the lunar orbit to an narrow equatorial band. This put landing sites past about 10 degrees of lunar latitude beyond reach. This was acceptable during the early flights as the primary goal was just getting there. After Apollo 11, science took a more pressing role in mission planning and thus the need to get to more remote sites became a priority.

In order to do so, the trajectory had to aligned well away from the lunar plane so the spacecraft's lunar orbit would pass over the landing site. The dilemma was that to do so meant giving up the safety of the free return. If the SPS engine did not fire behind the moon to put the craft in lunar orbit, the ship would miss the earth on it outward bound journey. Thus the Hybrid trajectory, which was a compromise between efficiency and safety. In this trajectory the spacecraft would be placed into a free retrun trajectory at TLI (Trans Lunar Injection). Once the LM had been extracted from the S-IVB, the SPS engine would fire, altering the trajectory to a non free return. At first this seems counter intutitive, Why bother with the free return portion if you're going to throw it out later on? Well here's the trick: The burn to change the trajectory woould prove the SPS engine was functioning as planned. If the SPS didn't fire, no big, as the craft would still be on it's original free return. But Rick, what if Something happened after the insertion to a non free return? And the SPS engine fails? Then what?. Well the answer lies in the the fact that after LM extraction, there was a second engine available. The LM decent engine could be brought into play to bring about a free return trajectory. This was a planned for maneuver called a PC+2 Burn. The PC stands for Pericynthion (closest approach to the moon) + 2 hours. The crew had regular updates sent to have the parameters for this burn in the computer. The wisdom of this approach was borne out on Apollo 13, which was the first flight to use the hybrid trajectory. When the oxygen tank exploded, the flight was on a non free return trajectory. The crew used the LM engine to retrun to a free return trajectory. The PC+2 burn after passing around the moon was used to target the landing into the Pacific Ocean. (This burn was NOT depicted in the movie "Apollo 13". It was made before they completely powered down the LM, as it's accuracy was vital and to do it without the computer would not have worked. The burn they make in the movie (using the sun as a reference, was to shorten the transit time back to earth to ensure they have enough power & water before reaching home)

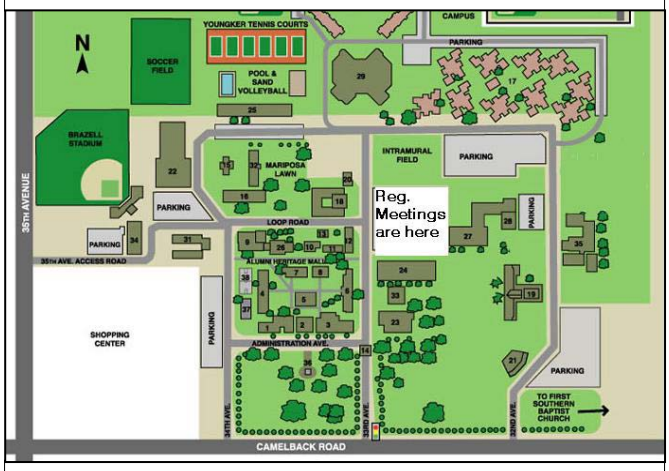
The Hybrid trajectory was also used on Apollo 14. Apollo 16's landing site at Descartes was close enough to the equator that the free return trajectory was suitable. Apollo's 15 & 17's landing sites were not within the capability of even a hybrid trajectory and was launched directly onto a non free return trajectory. By this time there was enough confidence in the SPS & LM decent engines that the risk was deemed acceptable.



A Diagram of the flight path of Apollo 13 Demonstrates the concept of the Hybrid trajectory

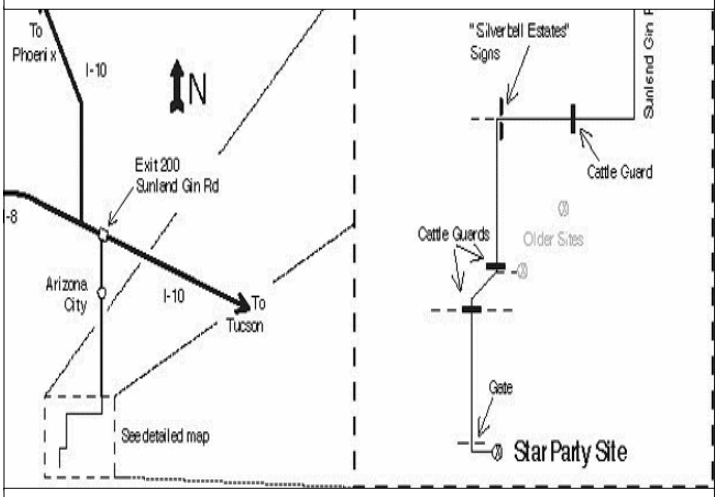
SAC Member Services

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.

All Arizona Messier Marathon



Take 1-1 0 to exit 200 (Sunland Gin Road). From here it is about 29 miles to the site. Turn right (south) after exiting the freeway. After about 15 miles, the pavement ends and about one mile further, the road turns sharply to the west. After another f our miles, the main road will turn south just after the "Silverbell Estates" signs. Three miles past the signs, the road will veer of f to the west, and five miles further, the road will pass through a gate. Turn left immediately after the gate and continue f or another 2/3 of a mile, driving over a fence. The site is to the right.

GPS Coordinates: N32 27.600, W 111 43.800, Elev 1801'

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

SAC Membership Services

Membership– Memberships are for the calendar year and are pro-rated for new members as follows: Jan– Mar: 100%; Apr– Jun: 75%; Jul-Sep: 50%; Oct-Dec; 25%.

- ☐ $32.00 Individual Membership
- ☐ $48.00 Family Membership
- ☐ $14.00 Newsletter Only
- ☐ $10.50 Nametag for members, Pinned Clasp
- ☐ $12.50 Nametag for members, Magnetic Clasp (will be mailed to address below)

Magazine Subscription Services

The following magazines are available at a discount to club members. Check the magazines you wish to subscribe to or renew, and pay the club treasurer. Please allow 3-4 months for the order to be processed.

- ☐ Sky & Telescope $33.00/yr
- ☐ Astronomy $34.00/yr
- ☐ Astronomy $60.00 for 2 Years

Please Print

Make Check Payable to : SAC

Name:_____

Address:_____

City:_____ St:_____ Zip:_____

Phone:_____

E-Mail:_____

Bring completed form to a meeting or mail it with your remittance to:

SAC Treasurer
c/o David Fredericksen
6222 W Desert Hills Dr.
Glendale, AZ 85304

☐ **Check here if this is an update of information already on file.**

SAC on the Internet

SAC has several E-mail mailing lists. To subscribe, send an email to the email address and put Subscribe in the subject box.

SAC-Announce@freelists.org: SAC-Announce is a mailing list for just club announcements, Typically 3-5 messages per month.

SAC-Forum@freelists.org: SAC-Forum is a general discussion mailing list. Topics should be related to Astronomy or SAC

SAC-Board@freelists.org: SAC-Board is a mailing list for discussions of club business. If you'd like to see how the club is run (or not run), or have a question about the club, this is the list to read. Typically month to month matters are discussed.

AZ-Observing@freelists.org: AZ-Observing while not a Sac list , is well attended by SAC members. This is the list to with observing places around Arizona. Find out where people are going and what they saw.

Printed Newsletter

SAC can save a lot of money if you download the PDF version of the newsletter. PDF files are readable by both PC's and Macs. When the newsletter is published, a message will be sent to the address indicated above with the URL of the newsletter. Check the box below if you don't have access to the internet or if your prefer a printed copy.

☐ **Please send me a hard Copy of the newsletter**

SAGUARO ASTRONOMY CLUB

February 2010

5643 W. Pontiac Dr
Glendale, AZ 85308-9117

Phone: 623-572-0713
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

March 13th, 2010	2010 All Arizona Messier Marathon
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