June 2009

Volume 23 Issue 6

The Observer

East Valley Astronomy Club

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From the Desk of the President
by David Douglass

What a marvelous and amazing time we live in. Especially so if you have an interest in astronomy. There are new discoveries being reported every month. Discovery is in the air.

We have many new members looking for information on how to look into the skies and look at the wonders that are there. We have members who have new equipment that want to learn better how to use it, all in an effort to discover for themselves what they have been hearing and reading about.

NASA has just completed a fantastic journey into space, to repair the Hubble telescope. And accordingly to all early tests that have been announced, it seems they did a marvelous job. Professional astronomers, and amateurs alike, are most anxious to see what the Hubble can do. Hubble has already provided us with so much. What wonders will be discovered with the new equipment now on board? We can all barely wait to see the new images that will be forthcoming. NASA and ESA are estimating another 7-10 years of discovery for the world's most popular telescope.

Did you know that the replacement for the Hubble is being constructed? The successor to the Hubble is the (James) Webb Space Telescope, scheduled to launch in 2013. A common reference to the Hubble is that the telescope is the size of a school bus. Well, the Webb Space Telescope is the size of a tennis court! Can you imagine? There are some very nice multimedia presentations of the Webb "opening up" during deployment on the projects website. Well worth watching. You can see it at http://webbtelescope.org/webb_telescope/. Such a simple feat. What could go wrong during that exercise?

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The Backyard Astronomer
Bootes - Double Star Wonderland *by Bill Dellinges*

Rising high in the east these spring evenings is a constellation loaded with interesting double stars. Bootes (Bo-oh-teez), one of the original 48 Greek constellations, represents the Bear Driver, Bear Guardian or Herdsman. As is the case with many, if not all constellations, there are several interpretations for this star grouping. A common accepted version is that of a Herdsman guarding his flock from the nearby bears Ursa Major and Ursa Minor or chasing the bears around the Pole Star. Most people have difficulty seeing this group of stars as a herdsman. The constellation appears to look more like an ice cream cone or kite.

In his left hand he holds a lead to his two hunting dogs, Asterion and Chara - the constellation Canes Venatici created relatively recently by Johannes Hevelius in 1687. It is interesting to note that the early spring night sky is going to the dogs with a total of four canines panting down at us from the firmament: the Canes Venatici pair and Canis Major and Canis Minor low in the west.

Bootes' brightest star is Arcturus. It is an orange giant of spectral class K2 III with an apparent magnitude of -0.06, which makes it the brightest star north of the celestial equator. Arcturus' diameter is 25 times that of our Sun. If placed at the Sun's distance, it would cover 12 degrees of sky (24 full moon diameters). That would be quite a sight (before your eyeballs exploded).

As far as deep sky objects go, Bootes doesn't have much to offer. While Bootes shows 18 galaxies plot-

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Upcoming Events:

Public Star Party – June 12

Local Star Party – June 13

Monthly General Meeting – June 19

Deep Sky Star Party – June 20

Check out all of the upcoming club events in the Calendars on page 8

The Backyard Astronomer

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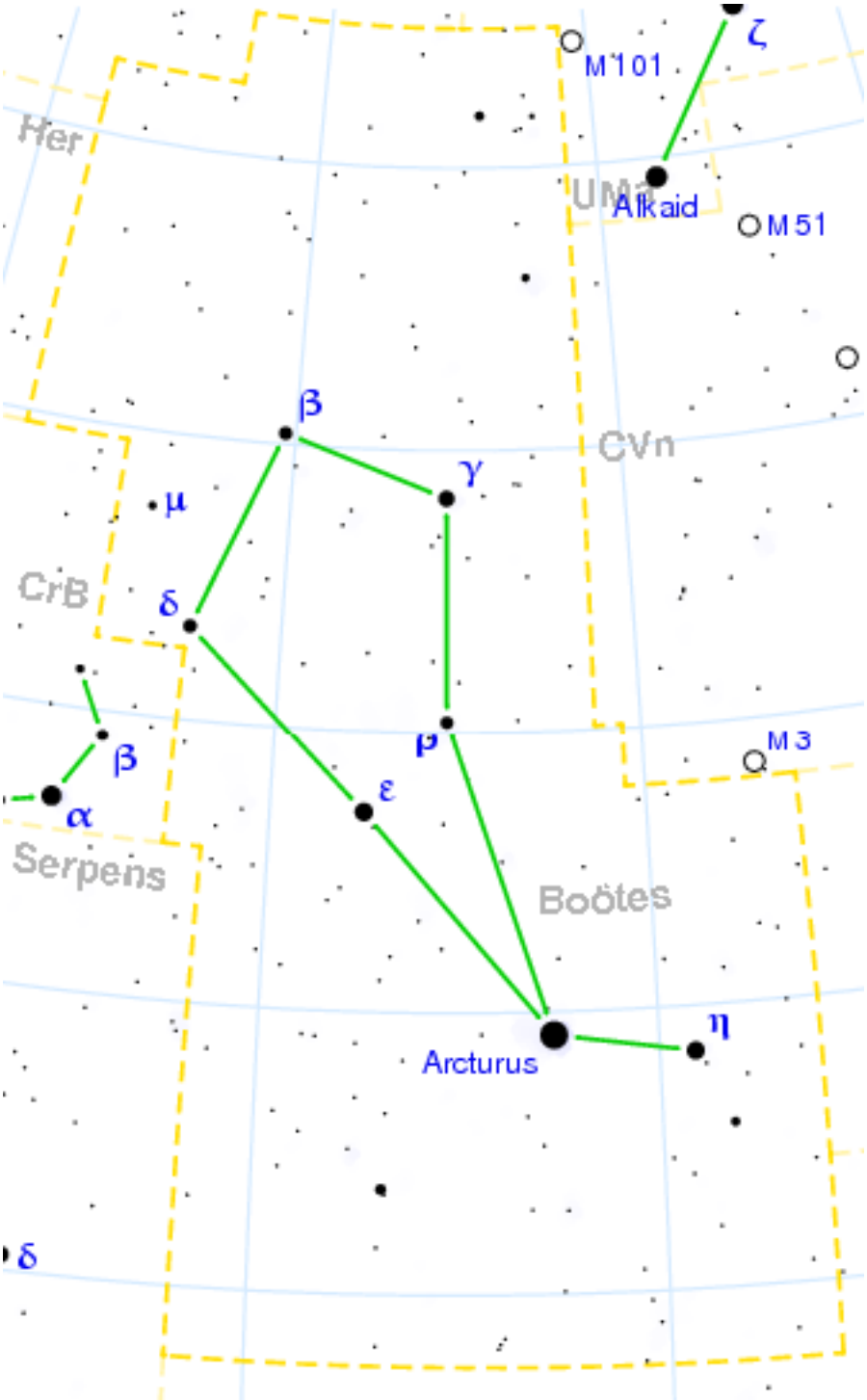
ted in Sky Atlas 2000, the brightest, NGC 5248, is only magnitude 10.3 and its one globular star cluster, NGC 5466, is magnitude 9.2. Both these objects appeared extremely dim in an 11" telescope.

But when it comes to double stars, Bootes shines. Below are four of the best the Herdsman has to offer. The star's SAO number (Smithsonian Astrophysical Observatory) is included to facilitate Celestron GOTO telescope owners (depressing the "Star" button brings up the SAO list).

Bootes' most notable double has to be its second brightest star, ***Izar*** (Epsilon Bootis, SAO 83500) .This is a challenging double due to the disparity in brightness of the two components. The primary and secondary are magnitudes 2.6 and 4.7 with a separation of 2.9" (arc seconds). Though not terribly tight, this is a classic situation where the glare of the primary works against you. Recently I was able to split the pair with an 11" SCT at 165x but was more pleased with the view at 233x with an LPR filter held to the eyepiece to reduce the primary's glare. F.G. Struve, the noted double star observer, called this star Pulcherrima, Latin for "most beautiful."

Triple star ***Mu Bootis*** (SAO 64686) is also a most beautiful sight. Even an 8x50 finder will split the AB pair. They are magnitude 4.3 and 6.5 separated by a generous 108.9" (1.8'). But here's where it gets interesting – the B component has a magnitude 7.5 companion 2.3" away. The 11" could barely crack it at 165x . At 200x it was much more pleasing (and convincing!). To see all three stars resolved, especially the delicate BC pair, is a fascinating sight.

Pi Bootis (SAO 101138) is a classic looking double star. The primary is magnitude 4.8, the secondary 5.8. The separation is 5.5", just enough to make resolving it interesting. My notes show it split at 83x in a C-8 with the comment "I like this guy! Two white stars. B just a little dimmer than A. Nice pair, just the right magnitude difference and separation to give it that classic double star appearance."



Kappa Bootis (SAO 29045). You'll need to go way up into the attic of Bootes for this one. Kappa can be found about five degrees northeast of Alkaid, the end star in the handle of the Big Dipper. This is a two for the price of one deal. Though not a difficult double, Kappa is unique in that another double, Iota Bootis, can be seen in the same 0.8 degree field. If you've found the quadruple star Epsilon Lyrae frustrating to resolve, try this easy foursome. Just note that the two pairs are not related and Kappa is an optical double (chance alignment). Still, both show Struve and ADS designations, so if they're good enough for Struve and Aitken, they're good enough for me. Even a 70mm Ranger at 26x splits each pair. A C-8 at 83x with a 0.8 degree field can still accommodate both pairs in the same field. Kappa is composed of 4.5 and 6.6 magnitude stars separated by 13.5". Nearby Iota is dimmer but wider than Kappa with its 4.8 and 8.4 magnitude stars and 38.8" separation.

This brief selection of doubles will introduce you to Bootes' double star wonderland. You just might catch binary fever and want to explore the many other doubles in the Herdsman's flock!

Alternatives to Black Holes, Part Two

by Henry De Jonge IV

In the last segment we discussed some interesting alternatives to black holes, (BHs) such as gravastars and dark energy stars. In this last installment we will look briefly at a couple of other strange alternatives as well as wormholes which are a logical extension of black holes.

Van der Waals stars

A van der Waals (VDW) dark energy, (quintessence) description of space-time, offers a solution to the puzzle of dark energy, without the presence of "exotic" fluids. Here a VDW "gas" actually treats dark matter and dark energy as a single fluid, (how strange is this?). BHs with this relativistic stellar configuration consisting of an inhomogeneous compact sphere, are called van der Waals quintessence stars. In a cosmological sense, the van der Waals fluid is considered homogeneous, while BH forming density fluctuations may arise through gravitational instabilities, (as we have seen before with gravastars) in the cosmological background. Two specific classes of solutions to Einstein's equations, namely, gravastars and traversable wormholes (wormholes that cross to another part of space-time and are not pinched off) are also found with this description.

A wormhole is usually defined as a "shortcut" in space-time and are predicted and studied under general relativity. A traversable wormhole solution may also constructed from VDW theory. These VDW quintessence wormholes have interesting consequences, such as the production of closed timelike curves and the consequent violation of causality, (you could go back and eliminate your family history for example).

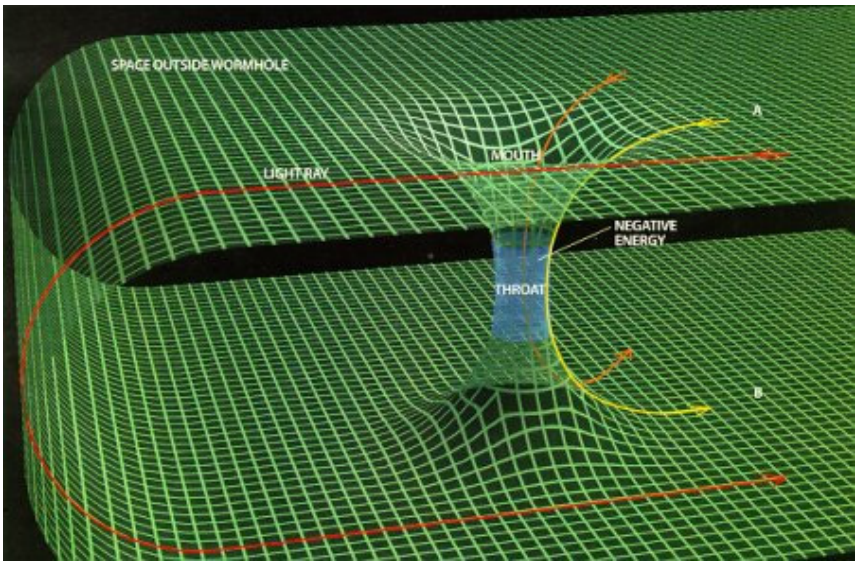


Figure 1: Diagram of a wormhole

These VDW alternatives to BHs seem to use a "gas" instead of a "liquid" to describe the BH. They invoke an exotic kind of energy field that pushes particles away from each other, overpowering gravity and the other fundamental forces called quintessence. Quintessence includes a wide range of possibilities as an explanation for dark energy. It is a dynamic, time-evolving, and spatially dependent form of energy with negative pressure. This gives it the ability to drive the accelerating cosmic expansion we have documented. Essentially quintessence is a repulsive force and thus these VDW dark stars also avoid the singularity problem.

Dilatonic BHs

One of the candidates for a theory of quantum gravity is string theory. One variant theory is the four-dimensional theory of superstrings at low energies and a simple particular case is known as Einstein-Dilatonic-Gauss- Bonnet (EDGB) theory. In EDGB theory, only the space-time-dependent coupling, (or linking) between the dilaton, (a dilaton is a particle with zero spin that arises in the string study of gravity and helps give particles their mass.) and gravity is considered. Einstein-Dilatonic-Gauss-Bonnet theories are alternative theories of gravity, which share many features in common with Einstein's gravity. Dilatonic Black Holes (DBHs) exist in EDGB theories. They have a regular event horizon and the geometry is flat at infinity, (like regular BHs). They are also stable against radial perturbations, (in falling matter) like gravastars. DBHs are very interesting as an alternative to BHs. However they seem to not obey the "no-hair" theorem of General Relativity. The no hair theorem states that the external gravitational and electromagnetic fields of a stationary BH are uniquely determined by only 3 parameters, the mass of the BH, the electric charge of the BH, and the angular momentum, (spin) of the BH. The BH can have no other independent characteristics, (hair).

How could we tell the difference between DBHs and regular BHs? One method would be by testing the no-hair theorem, either by gravitational-wave observations or by observations of highly eccentric orbits around super massive black holes. Depending on the values of mass, dilaton charge, and angular momentum of the DBH, we might see measurable differences in the ISCO, (innermost stable circular orbit) location and orbital frequency, relative to GR black holes. In particular circular orbits whose radius is close to the horizon, (highly eccentric) may be extremely useful, because they are in strong gravitational field regions. Remember that the particles in orbit around a BH can give us information to probe its space-time geometry. Current methods to measure the ISCO include spectral fitting, quasi-periodic oscillations and relativistic iron line measurements. These differences may be detectable in future experiments, (we are talking of a difference of a few percent in the positions of the ISCO for example). In the near future however it seems a possibility that the GRAVITY experiment , designed to make precision measurements of orbits of stars in the neighborhood of the SMBH in the center of our galaxy, might already be able to discriminate between these black hole solutions and GR solutions. The most likely region where these differences will be noticed, (if they exist) are at the later stages in the in spiral, when the particle is about to merge with the BH. Such differences in the ISCO will be useful in these future experiments to help us discriminate between alternative theories of gravity, (such as quantum gravity).

Worm Holes-Phantom Stars

Black holes and traversable wormholes are

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Alternatives to Black Holes, Part Two

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some of the most bizarre examples of objects predicted by GR. They have been studied theoretically for decades. However they are also associated with alternatives to black holes and have some interesting properties associated with them. Usually, black holes and traversable wormholes are considered opposed to each other since a black hole has an event horizon whereas a traversable wormhole does not have it by definition, (since it is supposed to be usable by a future traveler). It is however looked at as if the BH formed the "entrance/exit" to the wormhole.

In regards to dark energy BHs, for example, the enormous pressure in the center may in theory open up a tunnel, and convert the dark energy star into a wormhole, even though it is still not certain these types of changes would be permitted by any theory of quantum gravity. It has also recently been shown that traversable wormholes may in principle, be supported by phantom energy, (another form of dark energy) which apart from being used as an interstellar shortcuts may allow closed time like curves with the accompanying causality violations. In an alternative to BH vein of thought we could also denote these exotic geometries consisting of dark energy stars, (looked at in the first installment) and phantom wormholes as phantom stars. Would they become compact bodies which behave very similarly to black holes but do not have an event horizon? This can also be important concerning the fate of wormholes in the course of the evolution of the Universe as it is thought that such wormholes could "evolve" to form black holes.

Figure 2: Artist drawing of a wormhole

In a recent paper wormholes were added to the list of alternatives to BHs and were deemed as "hybrids" of these quasi-black holes. It was proposed to consider wormholes with the throat, (main opening) very close to the would-be horizon as a good mimicker of a black hole that looks almost indistinguishable from a true black hole. However we have seen that a quasi BH does not usually form a singularity and avoids the infinite density of a BH as in GR.

In general though, static, spherically symmetric, and stationary, traversable wormholes have been ruled out for, (in almost all theories including GR) mainly due to the presence of event horizons, the unstable energy condition at the throat, and due to the imposition of the principle of finiteness, which states that a satisfactory theory should avoid physical quantities becoming infinite. However they may exist in the quantum foam. Thus we may have to wait a very long time to be able to travel in a wormhole safely.

Conclusions

We have seen that GR predicts BHs with properties that can be tested, and many of these predictions already have been detected, thus BHs would seem to be a satisfactory conclusion. However some alternatives to BHs theoretically exist that also offer solutions with testable predictions. The future data may hold the key. Since we have yet to completely demonstrate proof of BHs and have a great rift between GR and quantum theory as now defined, I thought it interesting to look at alternatives to conventional BHs involving different paradigms of gravity and/or quantum gravity. As has been said before, the Universe is stranger than we can imagine!

New EVAC Members in May

Daniel Oppenheim - Chandler

Rob Smalley - Chandler

Robert Hurst - Phoenix

Andrej Mitrovic - Phoenix

Peter Wesson - Phoenix

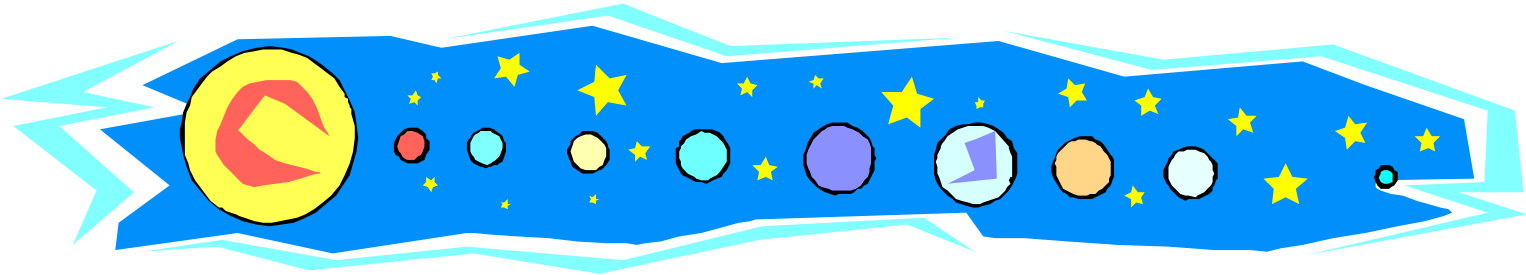
June Guest Speaker: Ted Dunham

Ted Dunham, Ph.D., Cornell University, 1978

Answering an Age-Old Question: Extra-Solar and Beyond

Few would argue that the discovery of life on other planets is an exciting possibility. For Ted Dunham, it is just one of his current scientific missions. A participant in NASA's upcoming Kepler mission - a space-borne telescope designed to hunt for Earth-sized planets in our galaxy - Ted will provide input on the optics, detectors and electronics of the telescope. He is also building the main test instrument for NASA's revolutionary airborne observatory, the Stratospheric Observatory for Infrared Astronomy (SOFIA). The SOFIA telescope is attached to the top of a Boeing 747 that observes occultations - when one celestial body conceals or obscures another. In addition, Ted will assist in the building of NGLT's complex and unique camera system.

Ted Dunham is the Principal Investigator for development of HIPO, a specialized occultation instrument for SOFIA. HIPO will see its first use on SOFIA as a critical component in the test program of the completed facility. Subsequently it will be used to observe occultations of stars by solar system objects, transits of extrasolar planets, and stellar oscillations. Dunham is also a co-investigator on the Kepler mission, a NASA Discovery mission designed to detect earth-size planets orbiting sunlike stars in their habitable zones. His responsibilities for Kepler center on focal plane development, optics, and the system test program. By coincidence, the Kepler detector array is approximately the same size as the one in the DCT prime focus camera.



◐ First Quarter Moon on May 30 at 20:22

● Full Moon on June 7 at 11:12

◑ Last Quarter Moon on June 15 at 15:14

○ New Moon on June 22 at 12:35

◐ First Quarter Moon on June 29 at 04:29

Classified Ads

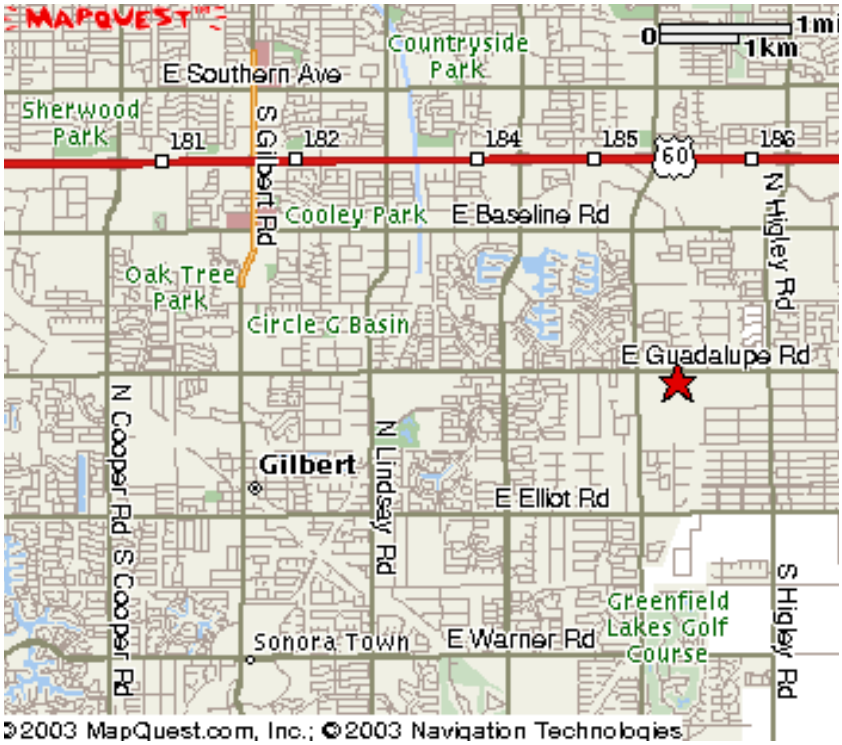
Orion 8" F10 SCT & SkyView Pro Equatorial Mount

Standards include: XLT coatings, 24mm Plossl and manual for mount.
Extras include: Pro GoTo Upgrade Kit, v 3.20, firmware upgraded, cable and documentation manual for GoTo upgrade kit, polar axis finder and 12v battery. List price $1999.00

This equipment is 18 months old. Used sparingly because 14.5" Dob gets preference. Reason for sale is to finance an upgrade.

Sale price $1600.00

If you are interested in seeing this telescope contact AJ Crayon at 602-938-3277 or e-mail at acrayon@cox.net



Upcoming Meetings

June 19

July 17

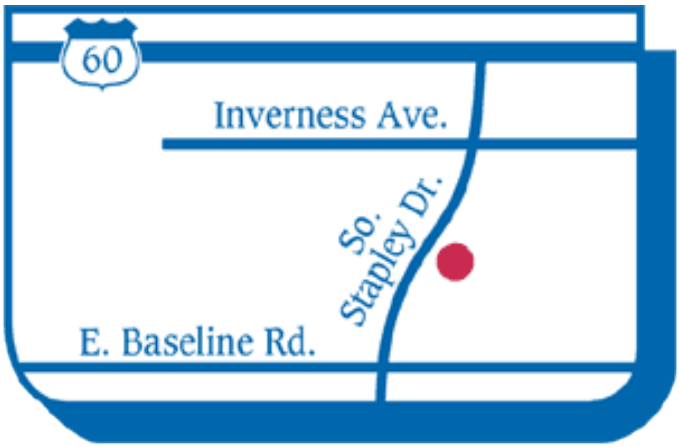
August 21

September 18

October 23

November 21

December 19

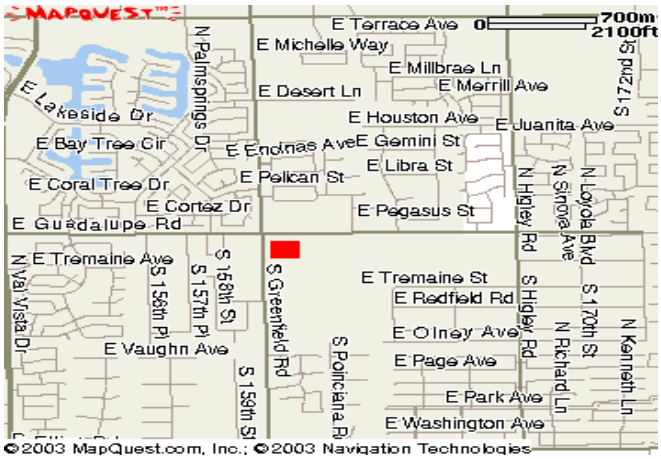


The monthly general meeting is your chance to find out what other club members are up to, learn about upcoming club events and listen to presentations by professional and well-known amateur astronomers.

Our meetings are held on the third Friday of each month at the Southeast Regional Library in Gilbert. The library is located at 775 N. Greenfield Road; on the southeast corner of Greenfield and Guadalupe Roads.

Meetings begin at 7:30 pm.

Visitors are always welcome!



Southeast Regional Library
775 N. Greenfield Road
Gilbert, Az. 85234

All are welcome to attend the pre-meeting dinner at 5:30 pm. We meet at Old Country Buffet, located at 1855 S. Stapley Drive in Mesa. The restaurant is in the plaza on the northeast corner of Stapley and Baseline Roads, just south of US60.

Old Country Buffet
1855 S. Stapley Drive
Mesa, Az. 85204

Likewise, all are invited to meet for coffee and more astro talk after the meeting at Denny's on Cooper (Stapley), between Baseline and Guadalupe Roads.

Denny's
1368 N. Cooper
Gilbert, Az. 85233

June 2009

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
	1	2	3	4	5	6
7	8	9	10	11	**12**	**13**
14	15	16	17	18	**19**	**20**
21	22	23	24	25	26	27
28	29	30				

June 12 - Public Star Party at Riparian Preserve in Gilbert

June 13 - Local Star Party at Boyce Thompson Arboretum

June 13 - Grand Canyon Star Party

June 19 - General Meeting at Southeast Regional Library in Gilbert

June 20 - Deep Sky Star Party at Vekol Road

July 2009

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
			1	2	3	4
5	6	7	8	9	**10**	11
12	13	14	15	16	**17**	**18**
19	20	21	22	23	**24**	**25**
26	27	28	29	30	31	

July 10 - Public Star Party at Riparian Preserve in Gilbert

July 17 - General Meeting at SE Regional Library in Gilbert

July 18 - Local Star Party at Boyce Thompson Arboretum

July 24 - Chandler Environmental Center Star Party

July 25 - Deep Sky Star Party at Vekol

East Valley Astronomy Club -- 2009 Membership Form

Please complete this form and return it to the club Treasurer at the next meeting or mail it to EVAC, PO Box 2202, Mesa, Az, 85214-2202. Please include a check or money order made payable to EVAC for the appropriate amount.

IMPORTANT: All memberships expire on December 31 of each year.

Select one of the following:

☐ New Member ☐ Renewal ☐ Change of Address

New Member Dues (dues are prorated, select according to the month you are joining the club):

☐ **$30.00 Individual** January through March

☐ **$35.00 Family** January through March

☐ **$15.00 Individual** July through September

☐ **$17.50 Family** July through September

☐ **$22.50 Individual** April through June

☐ **$26.25 Family** April through June

☐ **$37.50 Individual** October through December

☐ **$43.75 Family** October through December

Includes dues for the following year

Renewal (current members only):

☐ **$30.00 Individual** ☐ **$35.00 Family**

Magazine Subscriptions (include renewal notices):

☐ **$34.00** Astronomy ☐ **$33.00** Sky & Telescope

Name Badges:

☐ **$10.00** Each (including postage) Quantity: _____

Name to imprint: _____

Total amount enclosed: _____

Please make check or money order payable to EVAC

☐ Payment was remitted separately using PayPal ☐ Payment was remitted separately using my financial institution's online bill payment feature

Name: _____ Phone: _____

Address: _____ Email: _____

☐ Publish email address on website

City, State, Zip: _____ URL: _____

How would you like to receive your monthly newsletter? (choose one option):

☐ Electronic delivery (PDF) *Included with membership* ☐ US Mail **Please add $10 to the total payment**

Areas of Interest (check all that apply):

☐ General Observing ☐ Cosmology

☐ Lunar Observing ☐ Telescope Making

☐ Planetary Observing ☐ Astrophotography

☐ Deep Sky Observing ☐ Other

Please describe your astronomy equipment:

Would you be interested in attending a beginner's workshop? ☐ Yes ☐ No

How did you discover East Valley Astronomy Club? _____

PO Box 2202
Mesa, AZ 85214-2202
www.eastvalleyastronomy.org

All members are required to have a liability release form (waiver) on file. Please complete one and forward to the Treasurer with your membership application or renewal.

Liability Release Form

In consideration of attending any publicized Star Party hosted by the East Valley Astronomy Club (hereinafter referred to as "EVAC") I hereby affirm that I and my family agree to hold EVAC harmless from any claims, liabilities, losses, demands, causes of action, suits and expenses (including attorney fees), which may directly or indirectly be connected to EVAC and/or my presence on the premises of any EVAC Star Party and related areas.

I further agree to indemnify any party indicated above should such party suffer any claims, liabilities, losses, demands, causes of action, suits and expenses (including attorney fees), caused directly or indirectly by my negligent or intentional acts, or failure to act, or if such acts or failures to act are directly or indirectly caused by any person in my family or associates while participating in an EVAC Star Party.

My signature upon this form also indicates agreement and acceptance on behalf of all minor children (under 18 years of age) under my care in attendance.

EVAC only recognizes those who are members or invitees and who also have a signed Liability Release Form on file as participants at an EVAC Star Party.

Please print name here ***Date***

Please sign name here

PO Box 2202
Mesa, AZ 85214-2202
www.eastvalleyastronomy.org

NASA's Space Place

Scoring More Energy From Less Sunlight

For spacecraft, power is everything. Without electrical power, satellites and robotic probes might as well be chunks of cold rock tumbling through space. Hundreds to millions of miles from the nearest power outlet, these spacecraft must somehow eke enough power from ambient sunlight to stay alive.

That's no problem for large satellites that can carry immense solar panels and heavy batteries. But in recent years, NASA has been developing technologies for much smaller microsatellites, which are lighter and far less expensive to launch. Often less than 10 feet across, these small spacecraft have little room to spare for solar panels or batteries, yet must still somehow power their onboard computers, scientific instruments, and navigation and communication systems.

Space Technology 5 was a mission that proved, among other technologies, new concepts of power generation and storage for spacecraft.

"We tested high efficiency solar cells on ST-5 that produce almost 60 percent more power than typical solar cells. We also tested batteries that hold three times the energy of standard spacecraft batteries of the same size," says Christopher Stevens, manager of NASA's New Millennium Program. This program flight tests cutting-edge spacecraft technologies so that they can be used safely on mission-critical satellites and probes.

"This more efficient power supply allows you to build a science-grade spacecraft on a miniature scale," Stevens says.

Solar cells typically used on satellites can convert only about 18 percent of the available energy in sunlight into electrical current. ST-5 tested experimental cells that capture up to 29 percent of this solar energy. These new solar cells, developed in collaboration with the Air Force Research Laboratory in Ohio, performed flawlessly on ST-5, and they've already been swooped up and used on NASA's svelte MESSENGER probe, which will make a flyby of Mercury later this year.

Helen Johnson, a spacecraft technician at NASA's Goddard Space Flight Center, works on one of the three tiny Space Technology 5 spacecraft in preparation for its technology validation mission.

Like modern laptop batteries, the high-capacity batteries on ST-5 use lithium-ion technology. As a string of exploding laptop batteries in recent years shows, fire safety can be an issue with this battery type.

"The challenge was to take these batteries and put in a power management circuit that protects against internal overcharge," Stevens explains. So NASA contracted with ABSL Power Solutions to develop spacecraft batteries with design control circuits to prevent power spikes that can lead to fires. "It worked like a charm."

Now that ST-5 has demonstrated the safety of this battery design, it is flying on NASA's THEMIS mission (for Time History of Events and Macroscale Interactions during Substorms) and is slated to fly aboard the Lunar Reconnaissance Orbiter and the Solar Dynamics Observatory, both of which are scheduled to launch later this year.

Thanks to ST-5, a little sunlight can go a really long way.

Find out about other advanced technologies validated in space and now being used on new missions of exploration at nmp.nasa.gov/TECHNOLOGY/scorecard. Kids can calculate out how old they would be before having to replace lithium-ion batteries in a handheld game at spaceplace.nasa.gov/en/kids/st5_bats.shtml.

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

If It's Clear...

by Fulton Wright, Jr.
Prescott Astronomy Club

JUNE 2009

Shamelessly stolen information from Sky & Telescope magazine, Astronomy magazine, and anywhere else I can find info. When gauging distances, remember that the Moon is 1/2 a degree or 30 arc-minutes in diameter. All times are Mountain Standard Time.

On Thursday, June 4, at 2:58 AM, Io occults Europa. The partial coverage lasts about 5 minutes. Even with a small (3 inch) telescope, you can watch Jupiter's two moons appear to merge, then separate.

On Saturday, June 6, at 7:13 PM, the full Moon rises with Antaries behind it. The Moon moves out of the way and Antaries appears at 7:53 PM. Because it is full Moon and only 13 minutes after sunset, you can see this event best through a medium (6 inch) or larger telescope.

On the evening of Monday, June 8, you can watch some events with Jupiter's moons. Here is the schedule:

11:55 PM Jupiter rises with Ganymede's shadow on it.
1:06 AM (June 9) Io's shadow falls on Jupiter (2 shadows)
2:19 AM Io moves in front of Jupiter
3:17 AM Ganymede's shadow leaves (1 shadow)
3:21 AM Io's shadow leaves (no shadows)
4:36 AM Io moves from in front of Jupiter
4:44 AM Ganymede moves in front of Jupiter
5:20 AM the Sun rises

On Monday, June 15, at 8:45 PM, you will have your 8th of 10 chances to see Titan's shadow on Saturn. Saturn sets at 12:23 AM with the shadow still on it.

On Monday, June 15, you can look for deep sky objects before midnight, because the last quarter Moon doesn't rise till 12:37 AM (Tuesday).

On Thursday, June 18, about 10:00 PM, you can find the asteroid 1 Ceres fairly easily. Find Theta Leonis (magnitude 3.3), the hip of Leo the lion. Half a degree to the left (binoculars or non-inverting telescope) is SAO 99521 (magnitude 7.4). Half a degree to the right is 1 Ceres (magnitude 8.6). On June 19, Ceres has moved closer to Theta. On June 20, the three form a somewhat distorted equilateral triangle.

On Friday, June 19, about 3:45 AM, you can see Venus (magnitude -4), Mars (magnitude 1), and the crescent Moon near each other just above the east horizon.

On Saturday, June 20, at 10:46 PM, the Sun is at northern solstice, so we have long days and short nights.

On Monday, June 22, it is new Moon so you can look for faint fuzzies all night.

On Sunday, June 28, the Moon is at first quarter and sets at 11:53 PM.

From the Desk of the President

Continued from page 1

There are many telescopes in space now. Some orbit the earth, and others are on probes that have been sent to distant locations to look at specific objects. But few have caught the imagination of the public at large like the Hubble has. Hopefully, the Webb will pick up the challenge, and continue the tradition.

Recently, we launched another space telescope. The Kepler Mission. Kelper was launched into a heliocentric orbit. I think this means that it orbits around the sun, but follows the earth, lagging behind it. Its mission is slated to run for only three (3) to five (5) years. Seems like a short time. Hubble has been amazing us for 17 years, with another 7-10 to go. The Kepler telescope has completed its early testing, and is now hard at work. Its mission is to search for earth-like planets in a densely populated star field populated between two of the brightest stars in the sky, Vega and Deneb, in the constellation Cygnus (The Swan). You can read about the Kepler Mission, and follow the progress, and discoveries, at their mission website: http://kepler.nasa.gov/

And talk about timing. Our featured speaker for June is Ted Dunham of the Lowell Observatory in Flagstaff. He is also a member of the NASA Kepler Mission Team, and will be speaking to us about the mission. This promises to be one of our most exciting presentations, considering the timing of the mission, and its potential promise. Please plan on joining us on June 19th for the regular monthly membership meeting, and this very timely discussion about the Kepler Mission. I hope to see you there. Until then though, don't forget… Keep Looking Up!

M51 The Whirlpool Galaxy

Canes Venatici

April, 2009

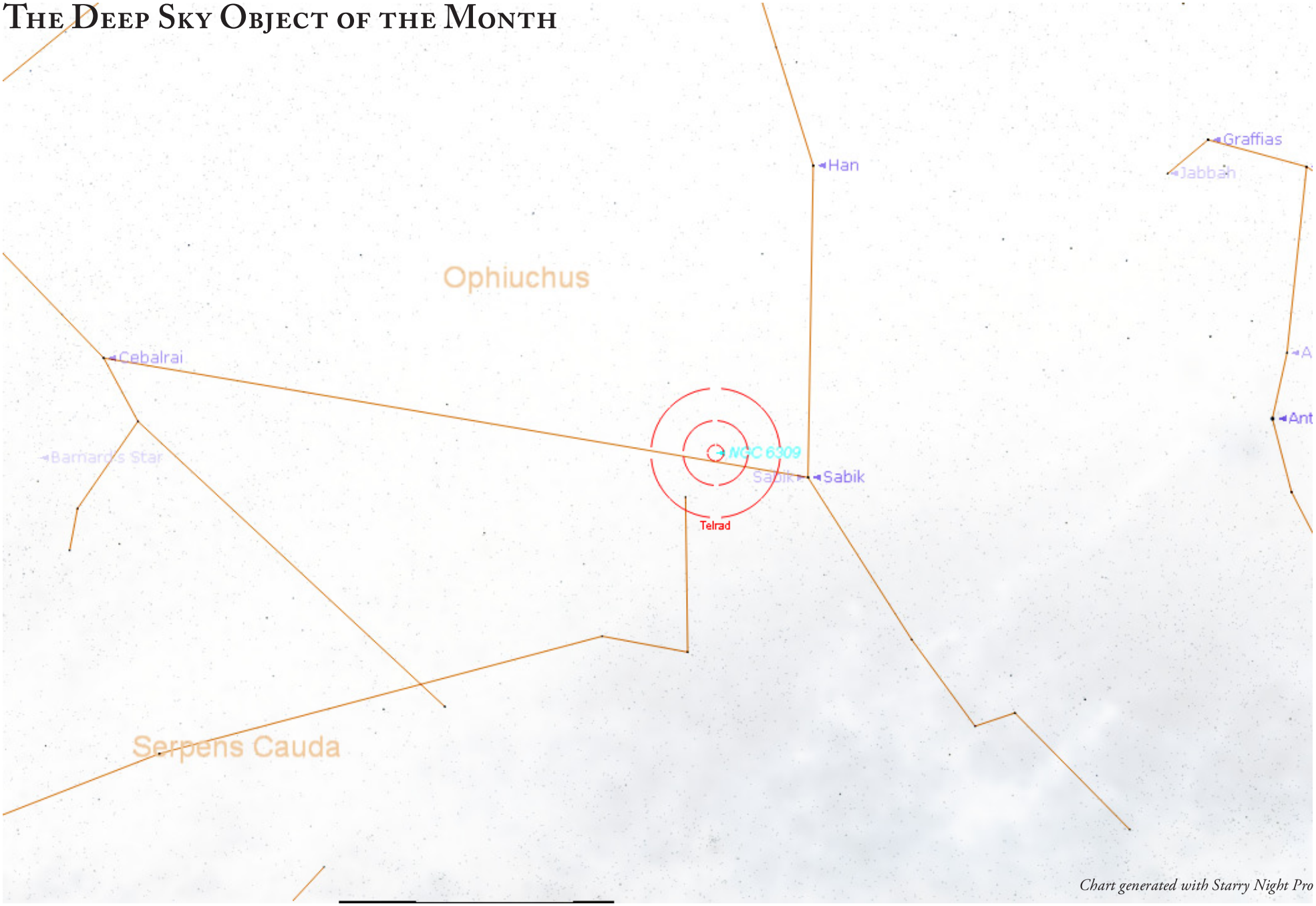
RCOS 12½ inch RC Telescope

SBIG STL11000M Camera

Luminance: 300 minutes

Color: R 100, G 80, B100

Photo courtesy of Jon Christensen



NGC 6309 (Box Nebula) Planetary Nebula in Ophiuchus

RA 17h 14m 04.3s DEC -12° 54' 38" Magnitude: 11.6 Size: 20"

Wake Up & Smell the Coffee -- On the Moon!

by Dana Coulter

Have you ever wondered how you'd make your morning cup of java if you lived on another planet, or perhaps the moon? That steaming beverage would be a must on a cold lunar morning. But with rare sunlight, no coal or wood to burn, and no flowing water for hydro-electrical power, how would you make that cup of coffee, much less cook breakfast, heat your abode, and power the life support equipment and tools you needed to live and work up there? NASA, planning for a future lunar outpost, has been asking those same questions lately.

There's more than one way to generate power on the moon. Fission Surface Power is one of the options NASA is considering. If this method is chosen, an engine invented in the early 1800s by Scottish brothers Robert and James Stirling could help make it work.

The Stirlings were so proud of their creation that they made it their namesake – and with good reason. Over the years the Stirling engine -- the reliable, efficient "little engine that could" -- has earned a sterling reputation here on Earth, and it may one day prove its worth on the moon.

"Inhabitants of a lunar outpost will need a safe and effective way to generate light and heat and electricity," says Mike Houts of NASA's Marshall Space Flight Center. "The tried and true Stirling engine fits the bill. It's not only reliable and efficient, but also versatile and clean."

NASA is partnering with the Department of Energy to develop Fission Surface Power technology to produce heat and feed it into a Stirling engine, which, in turn, would convert heat energy into electricity for use by moon explorers.

It's not certain that this kind of power system will be adopted by NASA, but it does have some very appealing qualities. Houts explains: "A key advantage to this power system is that it wouldn't need sunlight to operate. An FSP system could be used to provide power any time, any place, on the surface of moon or Mars. It could be used at the poles and away from the poles, it could weather a cold lunar night, and it would do well in places like deep craters that are always shaded. Not even a swirling, sunlight obscuring, Martian dust storm could stop it."

NASA's engine would only need to produce 40 kW or less power – just enough for a lunar outpost.

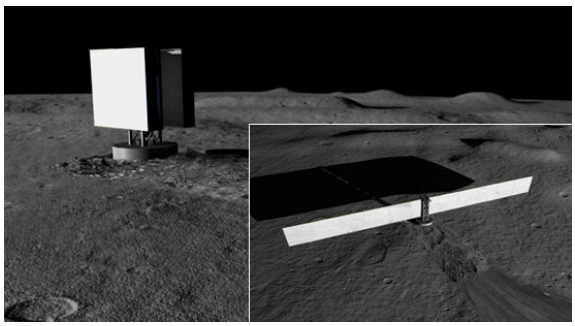
"This power level is high by space standards but extremely low by Earthly standards," says Houts. "It's about 1/20,000th of what a typical Earthly reactor puts out. We'd only need a tiny reactor on the moon – the fueled portion would be only about 10 inches wide by 1½ feet long."

It would provide more power with less mass than other power systems. The whole assembly, radiator on top of Stirling engine on top of reactor, could be stowed in a fraction of the lunar lander.

Before developing the final system, Houts and his team are testing with non-nuclear power for proof of concept.

"We're conducting tests in a thermal vacuum to learn about operating and controlling the system on the moon," says Houts. "We're using resistance heaters to simulate nuclear heat. Electrical resistance produces heat."

After the test system proves the viability of the concept, the team could be directed to build the "real thing," drawing heavily on US and international terrestrial reactor experience.



An artist's concept of a Fission Surface Power System embedded in lunar regolith.

"It would be built from stainless steel and fueled by uranium dioxide. This combination has been used in terrestrial reactors throughout the world, so scientists and engineers are well-versed in its operation."

The unit would not be active at launch, but would be "turned on" once in place on the lunar surface, where it would be surrounded by shielding to prevent any hazard from the radiation emitted.

"It would be very safe," says Houts. "And the beauty of the system is that it would be practically self-regulating."

Here's how it would work: Inside the reactor is a bundle of small tubes filled with uranium. Outside the reactor are control drums -- one side of each drum reflects neutrons and the other side absorbs them, providing a way to control the rate that neutrons escaping the reactor core are reflected back in. To start up the unit, the absorbent side of each control drum is turned out, away from the reactor core, so the reflective material faces in and sends escaping neutrons back in to the core. The resulting increase in available neutrons enables a self-sustaining chain reaction, which produces heat.

A coolant (sodium potassium mixture)* flows through the passage-ways between the tubes, picks up the thermal heat produced by the reacting uranium, and transfers the heat to the Stirling engine. The Stirling engine then does its magic** to generate electricity. Meanwhile the coolant, which has "downloaded" some of its cargo (heat) to the Stirling engine, circulates back through the reactor core, where it picks up heat and is ready to repeat the entire cycle.

The system would use only a miniscule amount of fuel -- 1 kg of uranium every 15 years – and still have enough reactivity to run for decades.

"We give it a life expectancy of 8 years, though, because something else would falter before the fuel would run out."

After shutdown, radiation emitted by the system would decrease rapidly. A replacement system could easily be installed at the same site.

After all, coffee may be in high demand up there!

Editor: Dr. Tony Phillips | Credit: Science@NASA

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Keep Looking Up!

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