

ABOVE THE FOG

• BULLETIN OF THE SAN FRANCISCO AMATEUR ASTRONOMERS •

Vol. 58, No. 7 – July 2010

Wednesday, July 21, 2010 – General Meeting

Randall Museum . 199 Museum Way . San Francisco

7:00 pm Doors Open

7:30 pm Announcements

8:00 pm Speaker

SFAA's General Meetings take place on the 3rd Wednesday of each month (except January)

Extrasolar Planets & NASA's Kepler Mission **A Presentation by Dr. Jack J. Lissauer** **NASA's Ames Research Center**

Join Jack Lissauer from NASA's Ames Research Center for a presentation on *Extrasolar Planets & NASA's Kepler Mission* to learn more about the vast array of planets that orbit stars outside our solar system. NASA's Kepler spacecraft, launched in March of 2009, will extend the search for distant planets from unearthly massive gaseous orbs to objects akin to our Earth. Lissauer will present an overview of our current knowledge of exoplanets, early results from Kepler, and a preview of what is expected.

Dr. Jack J. Lissauer is a Space Scientist in the Planetary Systems Branch at NASA's Ames Research Center and a Consulting Professor at Stanford University.

IMPORTANT DATES

SFAA GENERAL MEETINGS & LECTURES

Randall Museum, 199 Museum Way (Near 14th Street and Roosevelt)

Third Wednesday of each month: 7:00 p.m. Doors open. 7:30 p.m. Announcements. 8:00 p.m. Speaker

SFAA BOARD MEETINGS IMMEDIATELY PRECEDE GENERAL MEETINGS AND BEGIN AT 6:00 P.M.

July 21
August 18
September 15

October 20
November 17
December 15

CITY STAR PARTIES *Land's End (Point Lobos)*

Map and directions: <http://www.sfaa-astronomy.org/clubarchive/directions-pointlobos.php>

August 21/7:30
September 18/7:30
October 16/6:30

November 13/5:00
December 11/5:00

TELESCOPE CLINIC ONE HOUR BEFORE SUNSET

NOTE: While City Star Parties WILL ALWAYS be held on Saturdays, some will be close to the last quarter phase of the moon; others will be close to first quarter. This is so we can work around dates for Mt. Tam public star parties as well as our Mt. Tam members-only events.

2010 MT TAM SPECIAL USE PERMIT STAR PARTIES - MEMBERS ONLY

GATEKEEPERS NEEDED

Special Use Permit observing nights on Mount Tamalpais are private and open only to SFAA members. Please arrive by sunset. A permit is required for each car. We must vacate the mountain by 2:00 a.m. except on specially approved nights (such as Messier Marathon).

August 7
September 4
October 2

November 6
December 4

MT TAM PUBLIC STAR PARTIES – TO BE ANNOUNCED

Public nights on Mount Tamalpais start with a lecture in the Mountain Theatre, followed by public viewing in the Rock Springs parking lot. SFAA members may view privately after crowd departs from approx. 11 pm-2 am.

AUGUST 14 - 8:30pm THE MANY MYSTERIES OF ANTIMATTER

Dr. Helen Quinn, SLAC-Stanford University

SEPTEMBER 11 - 8: 30pm THE GLOBE AT NIGHT: HOW AND WHY TO PRESERVE THE NIGHT SKY

Kenneth Frank, Astronomical Society of the Pacific-Dark Sky Network

OCTOBER 9 - 8:00pm TERRAFORMING THE SECOND HOME FOR HUMANITY

Jim Brown, The Mars Society

For more information: <http://www.sfaa-astronomy.org/starparties/>

2010 San Francisco Amateur Astronomers Lecture Series

Free & Open to the Public
sfaa-astronomy.org

Randall Museum
199 Museum Way
San Francisco
Randall Museum Theater
randallmuseum.org
7:30 p.m.

July 21st

Jack Lissauer, NASA Ames

Dr Lissauer will discuss the Kepler Mission, launched March 2009 to search for habitable planets, and the most recent discoveries.

August 18th

Bryan Mendez, UC Berkeley

We will learn about the latest discoveries from NASA's WISE (Wide Field Infrared Survey Explorer) mission.

September 15th

Chris McKay, NASA Ames

"Hot and Cold Extreme Environments". This talk centers on astrobiologist Chris McKay's travels and his research to learn about possible life in our Solar System.

October 20th To be announced.

November 17th

Lynn Cominsky, NASA Fermi & Sonoma State Astrophysics Dept.

Dr. Cominsky has been analyzing data on high energy physics and neutron star binaries from X-ray satellites for over 25 years. She will share the most recent discoveries.

Dec. 15th

John Dillon, past president of San Francisco Amateur Astronomers

John will continue with another of his insightful talks on the history of science, especially as it relates to astronomical knowledge

2010 GENERAL MEETING SNACKS SIGN-UP LIST

San Francisco Amateur Astronomers list for volunteers to bring snacks before the lectures at the Randall Museum. Plan to arrive to set up by 7:00pm.

Plan to bring "munchie" snacks and soft drinks.

The Randall supplies a coffee pot to make hot water, instant coffee & tea bags, and paper supplies.

You may be reimbursed, or donate your items to SFAA, with thanks.

| Date | Name | E-mail | phone # |
|------|------|--------|---------|
|------|------|--------|---------|

August 18 _____

September 15 _____

October 20 _____

November 17 _____

December 15 _____






You will be contacted to confirm the month you've volunteered to bring snacks.

Thank you.




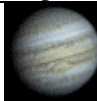
July 2010 Almanac for San Francisco (Pacific Daylight Time)




(Source: US Naval Observatory)

Sun and Moon Data:

| Date | Astronomical Twilight Begins | Sunrise | Sunset | Astronomical Twilight Ends | Moon | Moonrise | Moonset |
|--------|------------------------------|---------|---------|----------------------------|--|----------------------|----------------------|
| 3 Jul | 3:59 am | 5:53 am | 8:35 pm | 10:29 pm |  | 11:55 pm prev day | 12:44 pm |
| 10 Jul | 4:05 am | 5:57 am | 8:33 pm | 10:25 pm |  | 4:35 am | 7:51 pm |
| 17 Jul | 4:12 am | 6:02 am | 8:30 pm | 10:19 pm |  | 1:02 pm | 00:01 am next day |
| 24 Jul | 4:20 am | 6:07 am | 8:25 pm | 10:11 pm |  | 7:40 pm | 4:46 am |
| 31 Jul | 4:29 am | 6:13 am | 8:19 pm | 10:02 pm |  | 10:49 pm | 11:33 am |

Planetary Data:

| | Mercury | | Venus | | Mars | | Jupiter | |
|--------|---|---------|---|----------|--|----------|---|----------|
| |  | |  | |  | |  | |
| | Gem (1-7) / Can (8-18) / Leo (19-31) | | Leo | | Leo (1-18) / Virgo (19-31) | | Pisces | |
| Date | Rise | Set | Rise | Set | Rise | Set | Rise | Set |
| 3 Jul | 6:17 am | 9:08 pm | 9:11 am | 10:57 pm | 11:03 am | 11:50 pm | 0:34 am | 12:38 pm |
| 10 Jul | 6:59 am | 9:30 pm | 9:24 am | 10:50 pm | 10:55 am | 11:32 pm | 0:08 am | 12:12 pm |
| 17 Jul | 7:36 am | 9:39 pm | 9:36 am | 10:41 pm | 10:48 am | 11:14 pm | 11:37 pm | 11:45 am |
| 24 Jul | 8:06 am | 9:39 pm | 9:47 am | 10:31 pm | 10:41 am | 10:57 pm | 11:10 pm | 11:18 am |
| 31 Jul | 8:27 am | 9:31 pm | 9:57 am | 10:19 pm | 10:35 am | 10:39 pm | 10:42 pm | 10:50 am |

| | Saturn | | Uranus | | Neptune | |
|--------|---|----------|---|----------|---|---------|
| |  | |  | |  | |
| | Virgo | | Pisces | | Aquarius | |
| Date | Rise | Set | Rise | Set | Rise | Set |
| 3 Jul | 12:11 pm | 0:35 pm | 0:27 am | 12:28 pm | 11:01 pm | 9:50 am |
| 10 Jul | 11:46 am | 0:08 am | 11:55 pm | 12:00 pm | 10:33 pm | 9:22 am |
| 17 Jul | 11:21 am | 11:38 pm | 11:28 pm | 11:32 am | 10:05 pm | 8:54 am |
| 24 Jul | 10:56 am | 11:12 pm | 11:00 pm | 11:04 am | 9:37 pm | 8:25 am |
| 31 Jul | 10:31 am | 10:46 pm | 10:32 pm | 10:36 am | 9:09 pm | 7:57 am |

July Phenomena:





5 Jul, 5:00 pm: Uranus stationary
 6 Jul, 4:00 am: Earth at aphelion
 10 Jul, 4:00 am: Venus 1.0° N of Regulus
 11 Jul, 2:51 pm: Total solar eclipse, South Pacific
 12 Jul, 3:00 pm: Mercury 3.9° N of Moon
 18 Jul, 1:00 am: Spica 3.1° N of Moon

21 Jul, 1:00 pm: Antares 1.8° S of Moon
 23 Jul, 8:00 pm: Jupiter stationary
 27 Jul, 2:00 pm: Mercury 0.3° S of Regulus
 27 Jul, 8:00 pm: Neptune 4.2° S of Moon
 28-29 Jul: Delta Aquarids meteor shower
 31 Jul, 1:00 am: Mars 1.8° S of Saturn





August 2010 Almanac for San Francisco (Pacific Daylight Time)




(Source: US Naval Observatory)

Sun and Moon Data:

| Date | Astronomical Twilight Begins | Sunrise | Sunset | Astronomical Twilight Ends | Moon | Moonrise | Moonset |
|--------|------------------------------|---------|---------|----------------------------|--|----------|----------|
| 7 Aug | 4:38 am | 6:19 am | 8:12 pm | 9:52 pm |  | 3:21 am | 6:27 pm |
| 14 Aug | 4:47 am | 6:25 am | 8:04 pm | 9:41 pm |  | 11:58 am | 10:36 pm |
| 21 Aug | 4:55 am | 6:31 am | 7:54 pm | 9:29 pm |  | 6:16 pm | 3:40 am |
| 28 Aug | 5:03 am | 6:37 am | 7:44 pm | 9:17 pm |  | 9:21 pm | 10:24 am |

Planetary Data:

| | Mercury | | Venus | | Mars | | Jupiter | |
|--------|---|---------|---|----------|--|----------|---|----------|
| |  | |  | |  | |  | |
| | Leo (1-4, 7-30) / Sex (5-6, 31) | | Virgo | | Virgo | | Pisces | |
| Date | Rise | Set | Rise | Set | Rise | Set | Rise | Set |
| 7 Aug | 8:38 am | 9:16 pm | 10:06 am | 10:07 pm | 10:28 am | 10:22 pm | 10:14 pm | 10:21 am |
| 14 Aug | 8:37 am | 8:55 pm | 10:14 am | 9:53 pm | 10:22 am | 10:04 pm | 9:46 pm | 9:52 am |
| 21 Aug | 8:19 am | 8:26 pm | 10:21 am | 9:39 pm | 10:17 am | 9:48 pm | 9:17 pm | 9:21 am |
| 28 Aug | 7:38 am | 7:49 pm | 10:26 am | 9:24 pm | 10:11 am | 9:31 pm | 8:48 pm | 8:50 am |

| | Saturn | | Uranus | | Neptune | |
|--------|---|----------|---|----------|---|---------|
| |  | |  | |  | |
| | Virgo | | Pisces | | Aquarius | |
| Date | Rise | Set | Rise | Set | Rise | Set |
| 7 Aug | 10:07 am | 10:20 pm | 10:04 pm | 10:08 am | 8:41 pm | 7:28 am |
| 14 Aug | 9:43 am | 9:54 pm | 9:36 pm | 9:40 am | 8:13 pm | 7:00 am |
| 21 Aug | 9:19 am | 9:28 pm | 9:08 pm | 9:11 am | 7:45 pm | 6:31 am |
| 28 Aug | 8:55 am | 9:02 pm | 8:40 pm | 8:42 am | 7:17 pm | 6:03 am |

August Phenomena:

8 Aug, 10:00 am: Venus 2.7° S of Saturn
 10 Aug, 3:00 pm: Regulus 4.3° N of Moon
 11 Aug, 4:00 pm: Mercury 2.1° N of Moon
 12-13 Aug: Perseids meteor shower
 13 Aug, 2:00 am: Venus 4.1° N of Moon
 13 Aug, 6:00 am: Mars 5.4° N of Moon
 14 Aug, 7:00 am: Spica 3.0° N of Moon

17 Aug, 4:00 pm: Antares 1.9° S of Moon
 19 Aug, 1:00 pm: Pluto 5.6° N of Moon
 19 Aug, 7:00 pm: Mercury stationary
 20 Aug, 3:00 am: Neptune at opposition
 20 Aug, 2:00 pm: Venus 2.0° S of Mars
 26 Aug, 7:00 pm: Uranus 5.8° S of Moon
 31 Aug, 11:00 pm: Venus 1.0° S of Spica

What's Up July Podcast: Dark Nebulae

For those of you escaping the urban jungle, pack a pair of binoculars and surf the glorious Milky Way and all the dark nebulae in the vicinity. That's what Mojo and I did a couple of weekends ago - dusk to dawn skywatching and it was truly awe-inspiring!

The sky looked exactly like the images in this month's What's Up podcast. In fact, nearly all the astrophotos in July's podcast were taken June 12-13 by Mojo from our getaway astronomy location halfway between Indio and Blythe, just off the I-10.

Here's the new Solar System Exploration News and Events webpage, and from here you can get to the podcast and some blogs :-)
<http://solarsystem.nasa.gov/news/index.cfm>

And take a stroll through all the new SSE web content too, we've spent the better part of a year working on this new look!
<http://solarsystem.nasa.gov/index.cfm>

Here's the JPL Youtube video page, too. <http://is.gd/c3r1i>

-- Jane Houston Jones
Monrovia, CA

What's Up July 2010? Dark Nebulae! <http://solarsystem.nasa.gov/news/index.cfm>

What's Up Podcast on YouTube: <http://is.gd/c3r1i>

Twitter: <http://twitter.com/jhjones> <http://twitter.com/CassiniSaturn> <http://twitter.com/otastro> Blog:
<http://jane.whiteoaks.com/>

MT TAMALPAIS STATE PARK
MT. TAMALPAIS INTERPRETIVE ASSOCIATION
2010 ASTRONOMY PROGRAMS
our 22nd season on the Mountain

AUGUST 14 8:30pm

THE MANY MYSTERIES OF ANTIMATTER

How and when the imbalance of matter over antimatter developed is one of the great mysteries to unravel to understand the underlying properties of the universe. Dr. Helen Quinn, SLAC-Stanford University

As always the program is FREE and open to the general public. Weather permitting it will be followed by telescope viewing in the Rock Springs parking lot with the San Francisco Amateur Astronomers. Dress appropriately (June was cold!) and bring a flashlight. Please car pool if possible. If the weather is questionable you can check the hotline 415-455-5370 after 3:00pm which is updated IF there is a change.

Some of you "old timers" may remember Steve Moore, who helped with our programs a few years back. He writes that he is now with the National Park Service at Great Basin National Park this summer as an Interpretive Park Ranger. Great Basin is in the far eastern side of Nevada, and is rated as one of the top National Parks for dark skies. The park is hosting its first annual Astronomy Festival on August 6 - 8. It will essentially be a weekend star party, with guest speakers and activities. More information is obtainable from the Park's website. Should any of you go to this event say hi to Steve, and we will welcome a report at our Aug 14 program.

SEPTEMBER 11 8: 30pm

THE GLOBE AT NIGHT: HOW AND WHY TO PRESERVE THE NIGHT SKY

Saving our Dark Skies is a Global Problem. Find out how light pollution is measured and what you can do to understand and help preserve this natural resource locally. Kenneth Frank, Astronomical Society of the Pacific-Dark Sky Network

OCTOBER 9 8:00pm

TERRAFORMING THE SECOND HOME FOR HUMANITY

The ultimate development of a planet as a second home for Earth life is terraforming. Why is Mars the most productive next place to settle and how can it be terraformed. Jim Brown, The Mars Society



pan shot courtesy of Mojo

SFAA Yosemite Star Party at Glacier Point Friday, August 20 & Saturday, August 21, 2010

NEW! Check out last year's [photos](#), thanks to Dave Frey and Dean Gustafson

For those of you unfamiliar with this event, we are given free, reserved admission to Yosemite National Park and shared camping space at Bridalveil Group Campground. The campsite is 8.5 miles away from Glacier Point. In exchange, we give two public star parties at Glacier Point, on Friday and Saturday night. We have the public (about 200 - 300 people) from twilight for a few hours, and then the rest of the night (and all day) to ourselves; this is a mighty good deal, considering how some folks come 12,000 miles to see these rocks. The National Park Service limits astronomy clubs to a maximum of 30 SFAA campers. Please do not ask if your friends can come ... unless they are SFAA members.

Want to [join](#) the SFAA? This is our biggest membership magnet; come join the SFAA! You are expected to have at least one public telescope for every two people. Sign up with [Dave Frey](#) our fearless president. Please title the e-mail Yosemite Sign-Up, let him know what telescope you're bringing and if you're solo or not. We currently have zero members on the wait list. Please let Dave know right away, so that we have an accurate count, and you don't miss out on this very special event! Here is who is on the [sign-up roster](#) as of Saturday, May 22nd. In case you have questions, thanks to [Jim Van Nuland](#) of the SJAA here's a [link](#) San Jose club members have.

Bear Alert- Please remember we are guests at Yosemite and among those who live there are [bears](#). Last weekend one of our intrepid Sidewalk Astronomers and SFAA members (Dean Gustafson) spent time with the Santa Cruz Club at Glacier Point. Dean wants us to know that a bear with a yellow tag of # 47 helped himself to a bag of food behind the back of an SCAS member at Glacier Point while observing! Please keep all food (including gum, toothpaste, canned food, you-name-it) in the metal bear boxes and not in your car, tent or now unfortunately, while observing.

Observing site at Glacier Point- The observing area is mostly open, with incredible views from about NNW to the east, around to due south. The horizon from south around to the west is partly blocked by tall trees. Still, there is a lot of open sky, and typically, the seeing and transparency are excellent. It has warm temperatures of 70 to 90 during the day, and cool to chilly 40's at night, due to the elevation of 7200 feet.

Star Party- One of the rangers does a sunset talk, and then delivers the crowd to us. Following that, a member of the club will give an evening talk, (want to volunteer?) The public will have white flashlights, and we need to be tolerant of that. We will have 3 club members with red brake light tape to politely cover the offending flashlights. Expect many questions from the public. Here is an [object list](#) with corresponding finder charts and some brief information.

The Reward- By around 9:30 or so, we will have the place to ourselves, and can stay until dawn if you so choose. Scopes must be removed when we quit, then set up again on Saturday. Some of us may set up sun scopes during the afternoon, show Half Dome festooned with rock climbers, and invite people to come again after sunset.

Gastronomic Astronomic- Early Saturday eve is the traditional potluck meal and is always [tons of fun](#). Please provide enough for ~ say 4 or 5 people. Salads, main courses, pu pu's and desserts are all welcome. Who will have the best astronomical theme of incredible edibles this year? Remember the Brown Dwarfs? Prizes will be awarded! Please remember this repast takes time. It's better to start our own gastronomic party early so there's no need to rush for set up Saturday evening on Glacier Point. Sunset Friday will be at 8:25 pm.

Check the [National Weather Service](#) for up-to-date weather info on Yosemite Park current weather and conditions. Here is a live cam of Half Dome from [Ahwahnee Meadow](#) and [NPS Air Quality Cam & data](#).

For newbies and oldsters alike please review the [directions and guidelines](#). See you at the campsite,

Ken & Dave
Copyright © 2010

October 8-9, 2010 Annual SFAA NIGHT - Fremont Peak Observatory



Photo courtesy of ART ROSCH
Some previous years photos:
[05](#) [06](#) [07](#) [08](#) [09](#)

Each year for the past few years the FPOA has graciously granted us use of their 30-inch telescope for a Friday. In exchange, we do a public program the following day and night as a thank you. We have reserved the Observatory Friday, October 8th evening for an exclusive private gathering of members from the SFAA.

Wanna come? It's open to all current dues paying [members](#) of SFAA. Please [email](#) all the following information: your license plate #, type and color of your car, if you are Friday Only in attendance and if you're bringing a scope the type and size like you do for Yosemite.

[Here's](#) who has signed up.

The Fremont Peak Observatory features a fine [30-inch f/4.8 Newtonian telescope](#) built by Kevin Medlock of the [Eastbay Astronomical Society](#). The telescope is mounted on an English cross-axis equatorial system. There are also 6 powered observing pads outside the observatory, where visiting astronomers (like SFAAer [Richard Crisp](#)) can set up to observe in Fremont Peak's dark skies.

From [March through October](#), Fremont Peak Observatory conducts programs for the public at least three Saturday evenings a month, excluding the Saturday closest to full moon.

[Fremont Peak State Park](#) is about 100 miles south of San Francisco, and eleven miles south east of the town of San Juan Bautista. The park features camping facilities which are available either by [reservation](#) or first come first served basis. Please be sure and pay the day or or if camping the overnight fee in the green box by the public phone. At the bottom of the hill in San Juan Bautista is the [San Juan Inn](#) for those who would like more civilized overnight amenities.

Doug Brown, President of FPOA, noted that Fremont Peak has long been popular as a nearby dark sky observing and astrophotography site with a excellent southern horizons, and is even mentioned as a stopping place on page 50 of the May-June 2005 issue of AAA's Via Magazine! If you're interested, contact [Doug](#).

Dr. Doris Sloan, an FPOA member wrote an article in Bay Nature Magazine about Fremont Peak. Coincidentally the [April-June 08 article](#) is embellished with our own Michael Kran's photos as well!

For SFAA members wanting to enjoy this gorgeous telescope on their own, practically whenever they choose (with a few exceptions) and you're interested in joining FPOA Those interested in joining FPOA can learn about the benefits of membership and [download an application form](#).

Also, if you'd like to participate in a great social activity with the FPOA folks, they are having their Star B Q in conjunction with the [AANC](#) on Saturday July 17th. However, please do let [Doug Brown](#) know if you're interested in coming.. The Fremont Peak Star B Q is always fun and sure to please.

For more information about Fremont Peak Observatory, including excellent directions to Fremont Peak State Park and the Observatory, visit their web site at <http://www.fpoa.net>

Looking forward to seeing you again this year,

Ken

Science @ NASA - DOWN THE LUNAR RABBIT-HOLE

July 12, 2010: A whole new world came to life for Alice when she followed the White Rabbit down the hole. There was a grinning cat, a Hookah-smoking caterpillar, a Mad Hatter, and much more. It makes you wonder... what's waiting down the rabbit-hole *on the Moon*?

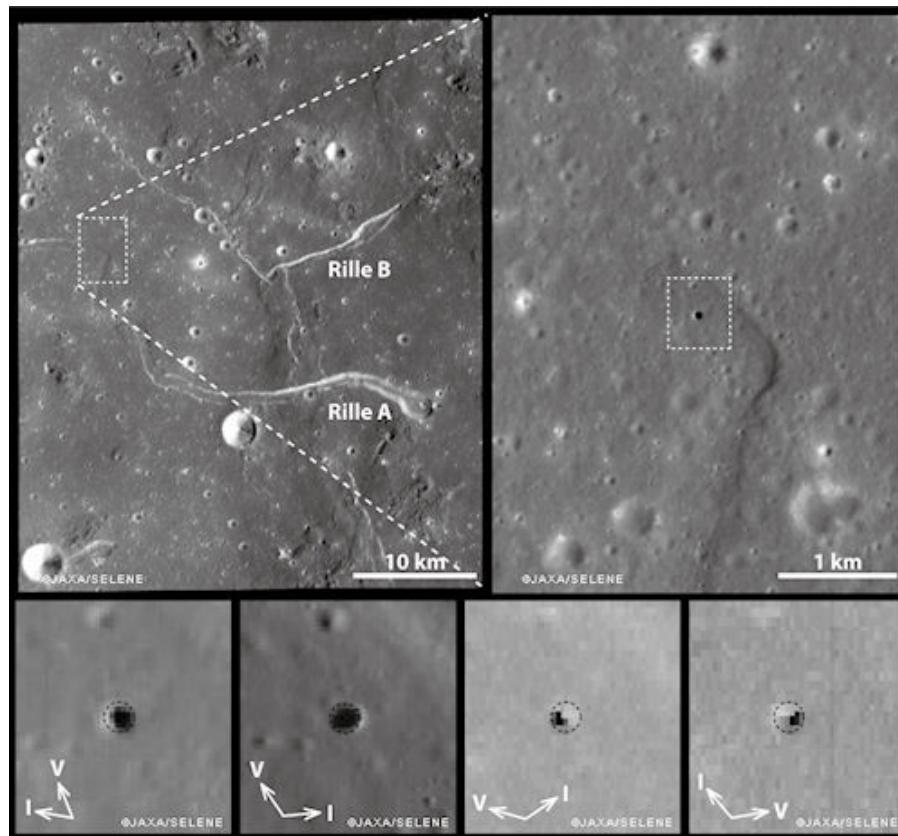
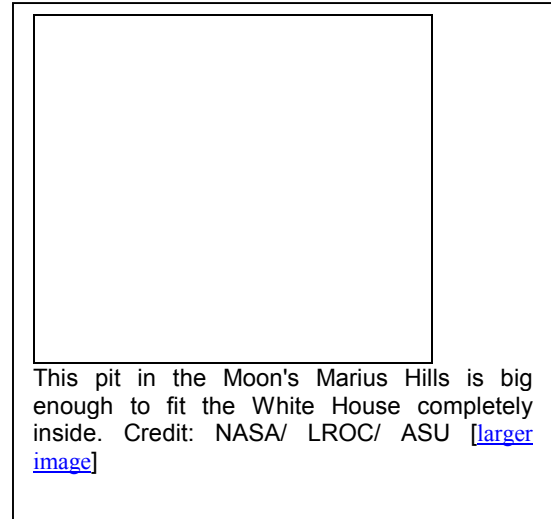
NASA's Lunar Reconnaissance Orbiter (LRO) is beaming back images of caverns hundreds of feet deep -- beckoning scientists to follow.

"They could be entrances to a geologic wonderland," says Mark Robinson of Arizona State University, principal investigator for the LRO camera. "We believe the giant holes are skylights that formed when the ceilings of underground lava tubes collapsed."

Japan's Kaguya spacecraft first photographed the enormous caverns last year. Now the powerful Lunar Reconnaissance Orbiter Camera (LROC, the same camera that photographed Apollo landers and astronauts' tracks in the moon dust) is giving us enticing high-resolution images of the caverns' entrances and their surroundings.

Back in the 1960s, before humans set foot on the Moon, researchers proposed the existence of a network of tunnels, relics of molten lava rivers, beneath the lunar surface. They based their theory on early orbital photographs that revealed hundreds of long, narrow channels called rilles winding across the vast lunar plains, or maria. Scientists believed these rilles to be surface evidence of below-ground tunnels through which lava flowed billions of years ago.

"It's exciting that we've now confirmed this idea," says Robinson. "The Kaguya and LROC photos prove that these caverns are skylights to lava tubes, so we know such tunnels can exist intact at least in small segments after several billion years."

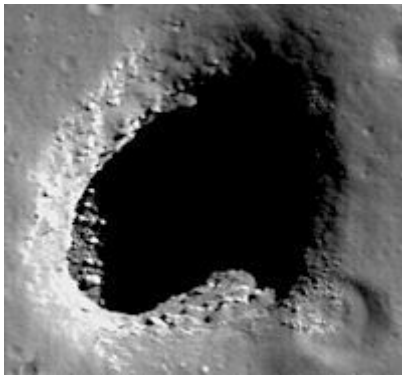


These Kaguya images show the Marius Hills pit in the context of a meandering system of volcanic rilles. Because the pit is in the middle of a rille, it likely represents a collapse in the roof of a lava tube. Credit: JAXA/SELENE [\[more\]](#)

Lava tubes are formed when the upper layer of lava flowing from a volcano starts to cool while the lava underneath continues to flow in tubular channels. The hardened lava above insulates the molten lava below, allowing it to retain its liquid warmth and continue flowing. Lava tubes are found on Earth and can vary from a simple tube to a complex labyrinth that extends for miles.

If the tunnels leading off the skylights have stood the test of time and are still open, they could someday provide human visitors protection from incoming meteoroids and other perils.

"The tunnels offer a perfect radiation shield and a very benign thermal environment," says Robinson. "Once you get down to 2 meters under the surface of the Moon, the temperature remains fairly constant, probably around -30 to -40 degrees C."



This cavern in Mare Ingenii is almost twice the size of the one in the Marius Hills. Credit: NASA/ Goddard/ ASU [\[more\]](#)

That may sound cold, but it would be welcome news to explorers seeking to escape the temperature extremes of the lunar surface. At the Moon's equator, mid-day temperatures soar to 100 deg C and plunge to a frigid -150 deg C at night.

Paul Spudis of the Lunar and Planetary Institute agrees that lunar lava tubes and chambers hold potential advantages to future explorers but says, "Hold off on booking your next vacation at the Lunar Carlsbad Hilton. Many tunnels may have filled up with their own solidified lava."

However, like Alice's White Queen, who "believed as many as six impossible things before breakfast," Spudis is keeping an open mind.

"We just can't tell, with our remote instruments, what the skylights lead to. To find out for sure, we'd need to go to the Moon and do some spelunking. I've had my share of surprises in caving. Several years ago I was helping map a lava flow in Hawaii. We had a nice set of vents, sort of like these skylights. It turned out that there was a whole new cave system that was not evident from aerial photos."

As for something similar under the lunar skylights?

"Who knows?" says Spudis. "The Moon continually surprises me."

This could be a white rabbit worth following.

Author: [Dauna Coulter](#) | Editor: [Dr. Tony Phillips](#) | Credit: Science@NASA

More Information

[Lunar Reconnaissance Orbiter Camera](#) -- instrument home page

[Lunar Reconnaissance Orbiter](#) -- mission home page

Notes: In a 1957 short story called "The Menace from Earth," Robert Heinlein describes a subterranean colony, "Luna City," on the moon. In one of Luna City's huge underground caves, "The Bat's Cave," people strap on wings and fly!

Some researchers have propose using ground penetrating radar to find out whether the lunar lava tunnels are still open. This kind of radar sends radio waves into the ground to determine the structure beneath the surface. When it's used on Earth, the reflected signal depends on the moisture content of the ground. According to Spudis, it would be difficult to interpret the data from ground penetrating radar used on the Moon. Lunar soil has little moisture, so there would be no clear signature returns. He says a robotic rover could be designed to traverse the steep slopes and rough rocky surfaces and venture into the cavern depths. Going underground, however, it would lose radio communications, so it would have to be attached to a fiber optic cable tied to a lunar base on the surface.

2010 Club Officers & Contacts

| | | |
|--|-------------------|----------------------------------|
| <i>President</i> | DAVE FREY | davef@SFAA-Astronomy.org |
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| | | |
| <i>Webmaster</i> | Joe Amato | wbmstr@sfaa-astronomy.org |

Club Telescopes

The SFAA owns eight very fine, easy to use, loaner telescopes well-suited for deep sky, planets, and star parties. All scopes are available to any SFAA member. The loaner custodians for the majority of our fleet are Pete & Sarah Goldie. Please contact them at telescopes@sfaa-astronomy.org for details if you are interested in borrowing a scope or if you have items you can donate for the loaner program (eyepieces, star maps/books, red flashlights, collimator, etc.). Please contact the appropriate member indicated below if you are interested in borrowing one of the telescopes.

- 1) 6" f/10.3 Dobsonian/Ken Frank ken@sfaa-astronomy.org
- 2) 8" f/7 Dobsonian/Pete Goldie
- 3) 8.5" f/6 Dobsonian/Pete Goldie
- 4) 10" f/8 Dobsonian/Pete Goldie
- 5) 114mm f/4 Newtonian StarBlast/Pete Goldie
- 6) 8" f/10 Celestron SCT/Annette Gabrielli/ annette@sfaa-astronomy.org
- 7) 8" f/10 Meade SCT/Stefanie Ulrey/treasurer@sfaa-astronomy.org
- 8) 9.5" f/5.6 Celestron Newtonian/Ken Frank/ ken@sfaa-astronomy.org

Club Astronomy Videos

The SFAA owns a series of astronomy videotapes featuring Alex Filippenko, a world-renowned professor of astronomy at UC Berkeley. The videotapes provide an introduction to astronomy and cover topics such as the Solar System, the lifecycles of stars, the nature of galaxies, and the birth of the Universe. The SFAA loans the tapes free to all members. If you are interested in viewing these tapes, you may check them out at any of the SFAA General Meetings. These tapes were kindly donated to the SFAA by Bert Katzung. For information on the course tapes themselves:

<http://www.teach12.com/tc/assets/coursedescriptions/180.asp>

Membership Dues

Membership is billed for each upcoming year on June 30. Members may receive no more than one bulletin after the expiration of membership.

SFAA Website and Online Services

The SFAA web site at sfaa-astronomy.org is provided to our members and the general public for the sharing of club information and services. The web site contains links for club [star parties](#), [events](#), [newsletters](#), [lectures](#) and [meetings](#). If you wish to interact with other people who are interested in astronomy, the SFAA web site offers public and members only [bulletin board forums](#). If you wish to remain up-to-date on club activities, then we encourage you to subscribe to one or both of our public [mailing lists](#), which will allow you to receive our newsletter and/or club announcements via email. Other useful and interesting information and services are available on the site such as [observing location reviews](#), member [astronomy photos](#), and [members only telescope loans](#). Information about SFAA's membership, organization and by-laws are available at the club's online public document [archive](#). If you need to contact a representative of the SFAA, then please visit our [contacts](#) page to help in finding the right person to answer your questions.

Above the Fog is the official bulletin of the San Francisco Amateur Astronomers. It is the forum in which club members may share their experiences, ideas, and observations. We encourage you to participate by submitting your articles, announcements, letters, photos and drawings. We would also like to hear from our new members. Tell us about yourself – what you have done in the past and what other clubs you have joined. **The deadline for the next issue is the 25th day of the month.** Send your articles to Editor@sfaa-astronomy.org

San Francisco Amateur Astronomers
PO B 15097
San Francisco CA 94115

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Sharing the Wonders of the Universe

Has your membership expired? Your mailing label includes the month and year through which your membership is paid. If it is past, your membership has expired and this may be your last issue.