ABOVE THE FOG
• BULLETIN OF THE SAN FRANCISCO AMATEUR ASTRONOMERS •

Vol. 63, No. 4 – April 2015

GENERAL MEETING
THE PRESIDIO . OBSERVATION POST . BUILDING 211
211 Lincoln Boulevard, San Francisco
7:00 pm Doors Open . 7:30 pm Announcements . 8:00 pm Speaker
Effective February 17, 2015: SFAA's General Meetings occur on the 3rd TUESDAY of each month (except January)

TUESDAY - APRIL 21, 2015

NORBERT WERNER, Ph.D., Stanford University

Kavli Institute for Particle Astrophysics and Cosmology (KIPAC)

THE DARK SIDE OF THE UNIVERSE: DARK MATTER, DARK ENERGY AND SUPERMASSIVE BLACK HOLES

Once monthly, the San Francisco Amateur Astronomers hosts distinguished guest speakers who are leaders in the fields of astronomy, physics, and related disciplines, to present the latest developments from cutting-edge scientific programs.

Dr. Werner's talk will explore the 95% of the Universe that is unseen, "Dark Side of the Universe," and will show how the unseen dark energy, dark matter, and the invisible supermassive black holes sculpt the observed Universe.

About the Speaker:
Dr. Norbert Werner is an astrophysicist at the Kavli Institute for Particle Astrophysics and Cosmology (KIPAC) at Stanford University. He can also often be found at the Japanese Space Agency (ISAS/JAXA) near Tokyo where, next to his everyday research, he is helping to prepare the initial observing program for the upcoming Japanese-US Astro-H satellite. Before coming to sunny California, he obtained his PhD at SRON Netherlands Institute for Space Research, in the rainy but magically beautiful city of Utrecht in the Netherlands. He spent his undergraduate years at the Safarik University in Kosice in his home country Slovakia.

Ages: **Geared for adults; All ages welcome**
Cost: **FREE - Donations encouraged**
Info: **www.sfaa-astronomy.org**

SAN FRANCISCO AMATEUR ASTRONOMERS' NEW HOME

NEW MEETING LOCATION
EFFECTIVE
FEBRUARY 2015

THE PRESIDIO OBSERVATION POST - BUILDING 211
http://www.presidio.gov/venues/Documents/Bldg%200211%20Floor%20Plan.pdf
Driving Directions
http://www.presidio.gov/venues/Pages/observation-post-at-the-presidio-driving-directions.aspx
Public transportation information link
http://www.presidio.gov/transportation/Pages/default.aspx

PRESIDENT'S MESSAGE

SFAA continues to be a very active organization. We have a nice grouping of events throughout the year, and spring towards summer becomes busier and busier.

We again participated in the Big History event last month. The event was a success with our members sharing telescopes. This was our third year joining their event. We also gathered at Ocean Beach again to observe the lunar eclipse early morning April 4th. Weather cooperated and it was a successful astronomical event.

We're also organizing new events for membership. Before our next Astronomy Lecture, we will have telescopes and other observing equipment and accessories for a show and tell we're calling "Observing Basics" I'll have my home-built telescope out along with others, plus

various commercial scopes, binoculars, and accessories. This will be a great opportunity if you're just starting to get involved with observing. Also, a reminder- the club has loaner scopes available.

These are just a few of our events. Be sure to check the calendar to keep current on our events. We're also looking for feedback on how we can improve. Also, if you have ideas for new events or would like to become involved to help with events in the future, just let me know! president@sfaa.astronomy.org

DOUGLAS SMITH
President - 2015
San Francisco Amateur Astronomers

2015 STAR PARTY DATES

Scott Miller

Below is the schedule for 2015 San Francisco City Star Parties staffed by volunteers of the SFAA. Note that the Presidio, our new host for SFAA meetings during the Randall Museum renovation, is a favored Star Party location for 2015. Lands End, a traditional City Star Party location, and the popular Exploratorium museum, are the other Star Party sites.

Friday	April 24	Presidio Parade Grounds, 7:00 PM

Thursday	May 28	The Exploratorium, 8:00 PM
Saturday	June 27	Presidio Parade Grounds, 8:00 PM
Friday	July 24	Lands End, 8:00 PM
Tuesday	August 25	Presidio Parade Grounds, 7:30 PM
Thursday	September 24	The Exploratorium, 6:30 PM
Thursday	October 22	Presidio Parade Grounds, 6:00 PM
Saturday	November 21	Lands End, 5:30 PM
Saturday	December 19	Presidio Parade Grounds, 5:30 PM

"We are invited to again take part in the Dominican University "Big History" program in San Rafael. SFAA members are welcome to bring telescopes and join an evening of pizza and stargazing with students, faculty and administration of Dominican. The event takes place on Monday evening March 23rd from 6;00 pm to 9:30 pm at the campus in San Rafael. If you can bring your telescope and take part, please contact Paul Salazar at salazar.paul@gmail.com."

SAN FRANCISCO AMATEUR ASTRONOMERS

Upcoming Lectures

TUESDAY, MAY 19 - 7:30 P.M.

MICHAEL BOLTE, UC Santa Cruz
BUILDING THE TMT: THE WORLD'S MOST ADVANCED GROUND-BASED TELESCOPE

Join Michael Bolte, professor of astronomy and astrophysics at UC Santa Cruz and member of the TMT International Observatory Board, for a presentation on ***Building the TMT: The Worlds Most Advanced Ground-Based Telescope.*** The Thirty-Meter Telescope (TMT) is a next-generation giant telescope. As the name suggests it will have a primary mirror that is 30 meters in diameter and composed of 492 hexagonal shaped segments. The primary mirror has very high-performance sensors and actuators that are used in a real-time control system to continuously keep the primary mirror in proper optical figure. The TMT will routinely operate with an adaptive optics system that will correct for the blurring of the atmosphere. There is a suite of very sophisticated instruments being designed and built along with the telescope.

Dr. Bolte will discuss the development of the telescope and project, the capabilities of the telescope and the highlights of the science case for the TMT. "With the TMT, we believe we will be able to obtain images and spectra of objects throughout the observable Universe," explains Bolte. "The science case includes everything from high-resolution studies of solar system objects, to the discovery of planets orbiting other stars, and from the co-development of supermassive blackholes and galaxies, to the first stars formed in the Universe some 12.5 billion years ago."

SAN FRANCISCO AMATEUR ASTRONOMERS
March 23, 2015
Dominican College, San Rafael
“Through the Lens of Big History” Outreach Event

Big History is a universal and trans-disciplinary narrative that examines the timeline of our universe on the largest possible scale. It is “a modern, scientific creation story…based on the best findings of modern science…a history that includes all human societies, and places their histories within the larger histories of the earth and the Universe as a whole” (Christian, Brown, Benjamin 2014). Big History begins with the Big Bang, follows the creation of stars and planets and the emergence of life on Earth, and extends to human beings and societies that have existed up to the present. It is a multidisciplinary study, employing astronomy, anthropology, biology, ecology, geology, literature, economics, political science, and sociology, among other fields, in its approach to understanding our collective past and possible futures. While Big History is taught at universities around the world, Dominican University of California pioneered the use of this content, along with its own "Through the Lens of Big History" courses, for a first-year course sequence.

Here are some photos of our outreach event at Dominican University of California in San Rafael on Monday 23 March. All Freshman at Dominican are required to take a academic year-long class titled "Big History" which is described on the Dominican website as follows:

Photo at left shows SFAA Board Member

Paul Salazar addressing the approximately 60 students in attendance on size and scale of the universe and his favorite subject, solar eclipses. SFAA Speaker Chair, Linda Mahan is on the right listening and taking a few pictures. Note the fellow in the foreground, sitting on a wooden stool. He is playing gentle melodies on an acoustic guitar (he was quite good) while Paul talks, enhancing the mood for the students and astronomers.

Photo at right shows Paul demonstrating the role our Moon plays in a solar eclipse. As you can see from how everyone was dressed, it was a fairly cool evening even though the cloud cover was working its' way over the sky to unfortunately limit the viewing for the students.

In photo below, Mr. Acoustic Guitar didn't seem to mind the cool evening as his music kept him in a pleasant space. Later he joined the students in looking through our telescopes and enjoyed views of the Moon, Venus and Jupiter, and at the end of the evening, the Orion Nebula. For most it was the first time they had looked through a telescope at an astronomical object and many "Wow's" were heard during the evening. Students, Dominican staff, astronomers and Mr. Acoustic Guitar very much enjoyed the experience, which has become an annual event with the SFAA and Dominican University.

Following are photos of Paul Salazar speaking to the students and Anil Chopra delighting student observers with his Dobsonian telescope, and Mt Tam as his backdrop.

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We took the opportunity to invite the students to come to our monthly star parties and lectures.

This recent evening at Dominican University is a great example of SFAA educational outreach at its best, with participants learning and experiencing aspects of astronomy perhaps for the first time. The payback for SFAA participants interacting with students, of various age groups, or the general public, is immensely satisfying and downright fun. The SFAA makes itself available for outreach events such this and others where we are approached by a school or group or as several years ago, the Marin Public Library system. If you would be interested in being part of the cadre of SFAA Members available for outreach opportunities throughout the year, please contact any of the Officers or Board Members and you will be added to our list for this marvelous opportunity to share your knowledge of astronomy.

★★★★★

BAY AREA ASTRONOMY EVENTS

Kenneth Lum

http://tech.groups.yahoo.com/group/bayastro/?v=1&t=directory&ch=web&pub=groups&sec=dir&slk=94

BAY AREA REGULARLY SCHEDULED EVENTS

EVERY FRIDAY NIGHT
7:00 PM – 10:00 PM
excluding major holidays

The Telescope Makers' Workshop

CHABOT SPACE AND SCIENCE CENTER
10000 Skyline Boulevard
Oakland, CA 94619-2450

THE TELESCOPE MAKERS' WORKSHOP is held every Friday night from 7pm - 10pm, excluding major holidays (e.g. Christmas Day and New Year's Day) that fall on Fridays. The Workshop is always closed on Memorial Day Weekend. Attendance every Friday night is not mandatory, and members work at their own pace. The Workshop meets at Chabot Space & Science Center, 10000 Skyline Blvd., Oakland.

Chabot's TMW is one of only a handful of regularly scheduled telescope making workshops in the U.S., and probably the world; it meets every Friday evening throughout the year, except Memorial Day weekend. It has been in operation since December of 1930, founded by Franklin B. Wright, and is currently run by Eastbay Astronomical Society member Rich Ozer, with help from other EAS members, Dave Barosso, Barry Leska, and others. The price of admission is FREE. All you have to do is show up, buy a mirror blank and a "tool" (typically around $100 - $200 depending on the size of the mirror) and start "pushin' glass!" We supply you with instruction, the various grits you'll need to first grind, and then polish and figure your mirror, and all the testing equipment needed. With a small bit of luck, you could wind up with a telescope that costs 1/3 or 1/4 the cost of a store-bought telescope, that is yet optically superior! Itdoes take time - depending on how much time you put in on it, and other factors, it could take a few months or several months. But, it's a fun project, great for kids, and at the end you get a great telescope!

For more information call or email Richard Ozer at rozer@pacbell.net or phone (510) 406-1914.

EVERY FRIDAY & SATURDAY EVENING, weather permitting **7:30 PM – 10:30 PM** **CHABOT SPACE AND SCIENCE CENTER** **10000 Skyline Boulevard** **Oakland CA 94619-2450** **(510) 336-7300**	**EXPLORE THE NIGHT SKIES AT THE CHABOT OBSERVATORIES** For more information: http://www.chabotspace.org/ **Free Telescope Viewing** Regular hours are every Friday & Saturday evening, weather permitting: 7:30pm - 10:30pm Come for spectacular night sky viewing the best kept secret in the Bay Area and see the magnificence of our telescopes in action! **Daytime Telescope Viewing** On Saturday and Sunday afternoons come view the sun, moon, or Venus through Chabot's telescopes. Free with General Admission. (weather permitting) 12pm - 5pm: Observatories Open

Sunset – 5:11 PM **(TWICE MONTHLY)** **Inclement weather (clouds, excessive wind and showers) will cause the event to be canceled without notice.** **SAN MATEO COUNTY ASTRONOMICAL SOCIETY STAR PARTY**	**STAR PARTIES AT CRESTVIEW PARK, SAN CARLOS** Come out and bring the kids for a mind expanding look at the universe The City of San Carlos Parks and Recreation Department and the San Mateo County Astronomical Society has open Star Parties twice a month. These events are held in Crestview Park, San Carlos California. Note that inclement weather (clouds, excessive wind and showers) will cause the event to be canceled without notice. For more information call Bob Black, **(650)592-2166**, or send an email to SMCAS@live.com or call Ed Pieret at **(650)862-9602.** **Reasons to Attend** If you have kids interested in space or planets bring them here for a real life view of planets, nebula, star clusters and galaxies. If you are thinking of buying a telescope or want help using a telescope you own, come here to talk with experienced users. If you think you might have an interest in astronomy come and talk to experienced amateur astronomers. Cautions Dress warmly and wear a hat. Visitors should park on the street and walk into the park so your headlights don't affect the observer's dark adaptation. Only park in the parking lot if you are arriving before dark and plan to stay until the end of the event. You shouldn't need lights but if you feel you do, only bring a small flashlight with the lens covered using red cellophane or red balloon. Please respect the telescopes and ask permission from the owner if you wish to touch. Parents, please watch your children. The park is residential, and adjacent to homes and backyards, please keep noise to a minimum. Schedule Time Astronomers arrive to set up at around sunset. Observing starts at about one hour after sunset and continues for two to three hours.
EVERY CLEAR SATURDAY MORNING OBSERVATORY **10:00 AM – 12:00 PM** **FOOTHILL COMMUNITY COLLEGE** **12345 Moody Road** **Los Altos Hills** **Cost: Free**	Solar observing with a Hydrogen alpha solar telescope every clear Saturday morning. This allows spectacular views of solar prominences and unusual surface features on the Sun not otherwise visible with regular white light telescopes. Admission is free. Foothill Observatory is located on the campus of Foothill College in Los Altos Hills, CA. Take Highway 280 to the El Monte Rd. exit. The observatory is next to parking lot 4. Parking at the college requires visitor parking permits that are available from the machines in the parking lots for $ 3.00.

EVERY CLEAR FRIDAY EVENING **9:00 PM – 11:00 PM** **FOOTHILL COMMUNITY COLLEGE OBSERVATORY** **12345 Moody Road** **Los Altos Hills** **Cost: Free**	Foothill Observatory is open for public viewing every clear Friday evening from 9:00 p.m. until 11:00 p.m. Visitors can view the wonders of the universe through the observatory's computer-controlled 16- inch Schmidt-Cassegrain telescope. Views of objects in our solar system may include craters and mountains on the moon, the moons and cloud-bands of Jupiter, the rings of Saturn, etc. Deep space objects including star clusters, nebulae, and distant galaxies also provide dramatic demonstrations of the vastness of the cosmos. The choice of targets for Any evening's viewing depends on the season and what objects are currently in the sky. The public viewing programs at Foothill are free of charge and are open to guests of all ages. Please note that the observatory is closed when the weather is cloudy. Also note that visitor parking permits are available from the machines in the parking lots for $3.00. Come to Foothill Observatory and join us in the exploration of our Universe! Foothill Observatory is located on the campus of Foothill College in Los Altos Hills, CA. Take Highway 280 to the El Monte Rd exit. The observatory is next to parking lot 4. Parking at the college requires visitor parking permits that are available from the machines in the parking lots for $3.00.

Monday, 04/06/15 07:30 PM

California Academy of Sciences
55 Music Concourse Dr.
San Francisco, CA 94118

Celebrating 25 Years of the Hubble Space Telescope

In this presentation, Scowen will discuss the legacy of the Hubble Space Telescope with respect to what it has taught us about the formation of stars and planets in our Galactic neighborhood. The resolution of Hubble has allowed us to see things moving over the 20-25 years of its mission lifetime. We'll discuss topics ranging from both the Eagle and Trifid nebulae to protostellar systems with protoplanetary disks. Add to that the meteoritic element that reveals a smoking gun that the Sun formed in an environment like the Eagle Nebula.

Speaker: Paul Scowen, Arizona State University

Contact:
Website: http://www.calacademy.org/events/benjamin-dean-astronomy-lectures/celebrating-25-years-of-the-hubble-space-telescope

Cost: $12 General, $8 Members

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Tuesday, April 07 2015 - 12:00 pm, PDT

SETI Institute Colloquium Series
189 Bernardo Ave

Mountain View, CA 94043

Stardust: analyses of cometary and interstellar dust in the laboratory

Andrew Westphal
UC Berkeley

Stardust was the first spacecraft ever to bring back to Earth extraterrestrial materials from beyond the Moon. It was two missions in one spacecraft. Stardust returned the first samples from a known primitive solar system body, the Jupiter-family comet Wild 2. Stardust also carried a separate collector that was exposed the interstellar dust stream for 200 days before the encounter with the comet. These tiny rocks — a trillion would fit into a teaspoon — were identified in the returned collector by a small army of more than 30,000 citizen scientists, through a project called Stardust@home. Dr. Westphal will present results of laboratory analyses of samples from both collectors, including laboratory analyses of seven particles that are likely the first individual rocks from the local interstellar medium ever identified.

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Tuesday, 04/07/15 04:15 PM

Hewlett Teaching Center
Stanford University
Room 201
Stanford, CA 94305

Searching for Dark-Matter Axions
Prof. Leslie Rosenberg from the University of Washington will give the Applied Physics/Physics colloquium.

Cost: Free

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Wednesday, 04/08/15 - 07:00 PM - 08:30 PM

Silicon Valley Astronomy Lecture Series
Foothill College
Smithwick Theater
Los Altos Hills, CA 94022

Encountering the First Dwarf Planet

NASA's Dawn mission has now arrived in orbit around Ceres-the largest asteroid in the asteroid belt and also the first dwarf planet to be discovered. Ceres is among the last uncharted worlds in the solar system, and one of the largest "left-overs" from the formation of our solar system. We are about to have amazing photos and data from this intriguing world (just as Dawn got from its previous target, the second-largest asteroid, Vesta). Dawn is also the first spacecraft to orbit two different bodies in the solar system, thanks to its use of ion propulsion, a technology that until recently was mostly the domain of science fiction.

Speaker: Marc Rayman, NASA

Cost: Free ($3 parking)

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Thursday, 04/09/15 - 06:00 PM - 10:00 PM

California Academy of Sciences
55 Music Concourse Dr.
San Francisco, CA 94118

Yuri's NightLife

Go straight up spacey this week as NightLife celebrates cosmo-pioneer Yuri Gagarin, the first human in space.

Groove to an out-of-this-world live DJ set by Space Cowboys, a sonically-inspired SF collective and Burning Man favorite.

Take a (rare) sip of Ground Control, a limited-edition beer by Ninkasi brewed with yeast that has actually traveled to space!

Chat with astro-aficionados from the NASA Kepler Mission, UC Berkeley Space Sciences Lab, the Academy's own Morrison Planetarium, and more.

Stargaze from the Living Roof (weather permitting) with telescopes and sky-watching tips from UC Berkeley.

Plus, ask all your burning cosmos questions at an "Ask a Astronomer" table.

Wanna get away? Experience virtual reality by peeping through Google Cardboard in a virtual exoplanet simulation.

In the planetarium, learn about the latest cutting-edge advances in space travel during a special presentation of The Future of Space Flight, followed by Back to the Moon for Good, a thrilling account of our race to reach the Moon.

In African Hall, watch a special screening of the short film Wanderers, a stunning vision of humanity's expansion into the Solar System based on scientific ideas of what our future in space might one day look like.

Plus, create your very own exoplanet model with the crafters from Green Art Workshop. Ready for blast-off?

21+ only

Website: http://www.calacademy.org/nightlife/yuris-nightlife

Cost: $12 General, $10 Members

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Friday, 04/10/15 7:30 PM

Peninsula Astronomical Society
Foothill College
Room 5015
Los Altos Hills, CA 94022

A Hard Rain's A-Gonna Fall
The explosion of a small asteroid near Chelyabinsk in 2013, and numerous near-misses since then serve as reminders that we live in a cosmic shooting gallery. We'll look at the threats posed by Near Earth Objects (NEOs), the strategies for mitigating these hazards, and the key roles that amateur astronomers can play in helping to save the Earth.

Speaker: Brian Day, NASA Ames

Cost: Free ($3 parking)

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Saturday, 04/11/15 - 05:00 PM - 10:00 PM

Physics and Astrophysics Building
452 Lomita Mall
Stanford University
Stanford, CA 94305

Open House: Kavli Institute for Particle Astrophysics and Cosmology

Program:

- The Hive -- Movie -- Dark Universe, narrated by Neil deGrasse Tyson (First-come-first-served)
- Talks (6:00 - 8:30, 20 minutes each) (First-come-first-served)
- Extrasolar planets
- The Beating Hearts of Galaxies
- Weighing Galaxies
- Solar Telescopes (Day)
- Star Viewing (Evening)
- Lensing Booth - Gravitationally lens your own face and print it out!
- Galaxy Zoo
- Cosmic Puzzle
- Spectroscopy Demonstration
- Inflatable Dome Planetarium -- No infants or toddlers. Tickets are required and are avaialbe at the event first-come-first.
- Fermi Table
- Cratering Activity -- Suitable for young children
- Treasure/Scavenger Hunt

Register at: https://www.eventbrite.com/e/2015-kipac-public-open-house-tickets-15719982892

Cost: Free

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Saturday, 04/11/15 7:30 PM

East Bay Astronomical Society
Chabot Space & Science Center, 10000 Skyline Blvd
Dellums Bldg
Oakland, CA 94619

Simulating Compact Astronomical Objects
Speaker: Mikhail "Mike" Balyaev

Cost: Free

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Tuesday, April 14 2015 - 12:00 pm, PDT

SETI Institute Colloquium Series
189 Bernardo Ave
Mountain View, CA 94043

Viewing Solar System Orbital Architecture through an Extrasolar Lens
Konstantin Batygin, Caltech

The statistics of extrasolar planetary systems indicate that the default mode of planetary formation generates planets with orbital periods shorter than 100 days, and masses substantially exceeding that of the Earth. When viewed in this context, the Solar System, which contains no planets interior to Mercury's 88-day orbit, is unusual. Extra-solar planetary detection surveys also suggest that planets with masses and periods broadly similar to Jupiter's are somewhat uncommon, with occurrence fraction of less than ~ 10%. In this talk, Dr. Batygin will present

calculations which show that a popular formation scenario for Jupiter and Saturn, in which Jupiter migrates inward from a > 5AU to a $\sim$ 1.5

AU and then reverses direction, can explain the low overall mass of the Solar System's terrestrial planets, as well as the absence of planets with a < 0.4 AU. Jupiter's inward migration entrained s > 10 − 100 km planetesimals into low- order mean-motion resonances, shepherding of

order 10 Earth masses of this material into the a $\sim$ 1 AU region while exciting substantial orbital eccentricity (e $\sim$ 0.2 − 0.4). He will argue that

under these conditions, a collisional cascade will ensue, generating a planetesimal disk that would have flushed any preexisting short-period super-Earth-like planets into the Sun. In this scenario, the Solar System's terrestrial planets formed from gas-starved mass-depleted debris that remained after the primary period of dynamical evolution.

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Monday, 04/20/15
08:00 PM - 09:00 PM

Hewlett Teaching Center
Room 200
Stanford University
Stanford, CA 94305

Entangled Photons: Einstein's Spooky Action in Quantum Communication and Teleportation
Prof. Anton Zeilinger of the University of Vienna and the Austrian Academy of Sciences will give the annual Robert Hofstadter Memorial Lecture.

Cost: Free

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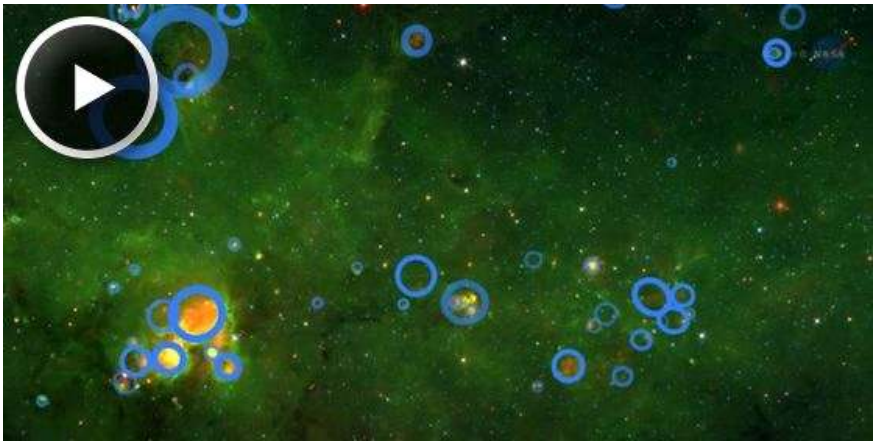
NASA SCIENCE NEWS

Citizen Scientists Discover Yellow "Space Balls"

April 9, 2015: Citizen scientists scanning images from NASA's Spitzer Space Telescope, an orbiting infra-red observatory, recently stumbled upon a new class of curiosities that had gone largely unrecognized before: yellow balls.

"The volunteers started chatting about the yellow balls they kept seeing in the images of our galaxy, and this brought the features to our attention," said Grace Wolf-Chase of the Adler Planetarium in Chicago.



A new ScienceCast video examines "yellow balls" and their role in star formation. Play it

The Milky Way Project is one of many "citizen scientist" projects making up the Zooniverse website, which relies on crowdsourcing to help

process scientific data. For years, volunteers have been scanning Spitzer's images of star-forming regions—places where clouds of gas and dust are collapsing to form clusters of young stars. Professional astronomers don't fully understand the process of star formation; much of the underlying physics remains a mystery. Citizen scientists have been helping by looking for clues.

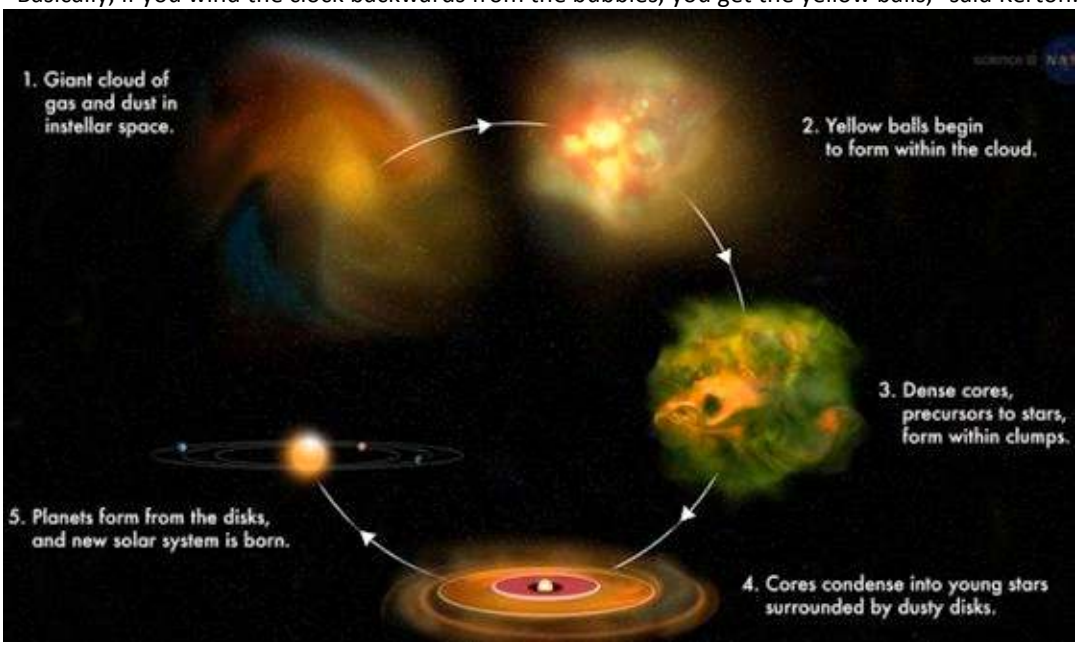
Before the yellow balls popped up, volunteers had already noticed green bubbles with red centers, populating a landscape of swirling gas and dust. These bubbles are the result of massive newborn stars blowing out cavities in their surroundings. When the volunteers started reporting that they were finding objects in the shape of yellow balls, the Spitzer researchers took note.

The rounded features captured by the telescope, of course, are not actually yellow, red, or green—they just appear that way in the infrared, color-assigned images that the telescope sends to Earth. The false colors provide a way to humans to talk about infrared wavelengths of light their eyes cannot actually see.

"With prompting by the volunteers, we analyzed the yellow balls and figured out that they are a new way to detect the early stages of massive star formation," said Charles Kerton of Iowa State University, Ames. "The simple question of 'Hmm, what's that?' led us to this discovery."

A thorough analysis by the team led to the conclusion that the yellow balls precede the green bubbles, representing a phase of star formation that takes place before the bubbles form.

"Basically, if you wind the clock backwards from the bubbles, you get the yellow balls," said Kerton.



An artist's concept shows how "yellow balls" fit into the process of star formation.

Researchers think the green bubble rims are made largely of organic molecules called polycyclic aromatic hydrocarbons (PAHs). PAHs are abundant in the dense molecular clouds where stars coalesce. Blasts of radiation and winds from newborn stars push these PAHs into a spherical shells that look like green bubbles in Spitzer's images. The red cores of the green bubbles are made of warm dust that has not yet been pushed away from the windy stars.
How do the yellow balls fit in?

"The yellow balls are a missing link," says Wolf-Chase. They represent a transition "between very young embryonic stars buried in dense, dusty clouds and slightly older, newborn stars blowing the bubbles."

Essentially, the yellow balls mark places where the PAHs (green) and the dust (red) have not yet separated. The superposition of green and

red makes yellow.

So far, the volunteers have identified more than 900 of these compact, yellow features. The multitude gives researchers plenty of chances to test their hypotheses and learn more about the way stars form.

Meanwhile, citizen scientists continue to scan Spitzer's images for new finds. Green bubbles. Red cores. Yellow balls. What's next? You could be the one who makes the next big discovery. To get involved, go to zooniverse.org and click on "The Milky Way Project."

Credits:
Author: Rachel Molina | Production editor: Dr. Tony Phillips | Credit: Science@NASA

San Francisco Amateur Astronomers
Application for New or Renewing Membership

1. Memberships, with dues payment, are for one year running from standard renewal dates of 1 July to 30 June and 1 January to 31 December.

2. Submitting appropriate dues in April, May, June, July, August, September, membership will run to 30 June of the next year.

3. Submitting appropriate dues in October, November, December, membership will run to 31 December of the next year; submitting appropriate dues in January, February or March, membership will run to 31 December of the same year.

4. Renewals are maintained at the original membership date unless the renewal is made later than the original cutoff date (e.g. September or March as described in 3). In such cases the membership date is shifted to the next renewal date 30 June or 31 December.

5. New or renewal memberships sent in via USPS mail will have membership start date based on postmark date.

This application is for:

□ New

□ Renewing

Name:_____

Address:_____

_____

Email:_____

Home Telephone (optional):_____

Cell Phone (optional):_____

Membership Type: □ Individual $25.00 / □ Family $30.00 / □ Student $10.00 / □ Supporting $75.00

□ Please mail to me a Mt. Tamalpais Parking Permit

To complete the membership process:
A. Print and fill out this form
B. Make check or money order payable to San Francisco Amateur Astronomers

C. Mail this form and payment to:

Treasurer, SFAA
PO Box 15097
San Francisco, CA 94115

New members will be entered onto the SFAA roster on the Night Sky Network (NSN) and will receive a verifying email from the NSN with username and password for the NSN. Renewing members will have their information updated but will not receive an email from the NSN. Both new and renewing members will receive a verifying email from the SFAA Treasurer upon completion of the membership process.