PRIMEFOCUS

Tri-Valley Stargazers

November 2017

Meeting Info

What:
How to Design, Launch, and Operate Geostationary Satellites

Who:
Dr. Jonathan Noland

When:
November 17, 2017
Doors open at 7:00 p.m.
Meeting at 7:30 p.m.
Lecture at 8:00 p.m.

Where:
Unitarian Universalist
Church in Livermore
1893 N. Vasco Road

Inside

November Meeting

How to Design, Launch, and Operate Geostationary Satellites

Dr. Jonathan Noland, Sandia National Laboratory

Popularized by Arthur C. Clarke, Geostationary (GEO) satellites orbit high above the surface of the Earth (approximately 36,000 km), and have become invaluable to the functioning of our modern, data dependent world. A GEO satellite, like all space-craft, is a complex system-of-systems. Each system is dependent on every other system, and all systems must work together to accomplish a given mission.

In this talk, I will first discuss the major systems that are required in almost all GEO satellites (with a particular emphasis on propulsion). Once a satellite is designed and built, it needs to be launched into space. The second portion of my talk will focus on launch vehicle interfaces, and placing satellites into a desired orbit. Finally, I will discuss the typical on-orbit operation of a GEO satellite.

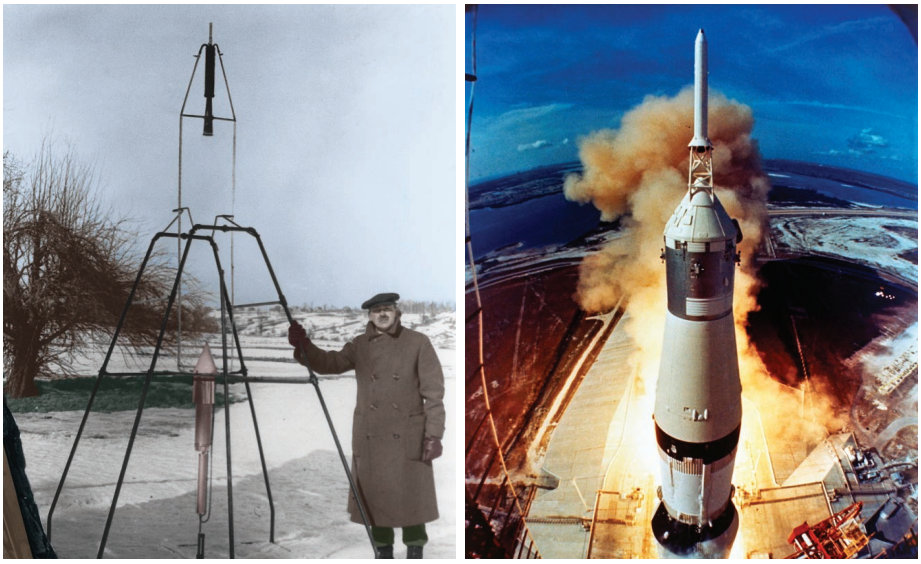


Image Caption: Left-Robert H. Goddard with his first liquid fueled rocket on March 16, 1926. Right: Launch of Apollo 11, Saturn V, July 16, 1969. Image Credits: NASA

Dr. Jonathan Noland has over 10 years of experience within the aerospace industry and government laboratories. He has specialized in the analysis and simulation of advanced propulsion concepts, in the conceptualization and execution of scientific experiments in the area of plasma physics and electrodynamics, and in the design of geostationary satellites. Dr. Noland holds a B.S. in Mechanical Engineering from the University of Alaska, an M.S. in Aerospace Engineering from the University of Michigan, and a Ph.D. in Applied Physics from UC Berkeley. He is currently employed at Sandia National Laboratories in Livermore, CA.

News & Notes

2017/2018 TVS Meeting Dates

Below are the TVS meeting dates for 2017/2018. The lecture meetings are on the third Friday of the month, with the Board meetings on the Monday following the lecture meeting.

Lecture Meeting	**Board Meeting**	Prime Focus **Deadline**
Nov. 17	Nov. 20	
Dec. 15	Dec. 18	Nov. 24
Jan. 19	Jan. 22	Dec 29
Feb. 16	Feb. 19	Jan. 26
Mar. 16	Mar. 19	Feb. 23
Apr. 20	Apr. 23	Mar. 30
May 18	May 21	Apr. 27
Jun. 15	Jun. 18	May 25
Jul. 20	Jul. 23	Jun. 29
Aug. 17	Aug. 20	Jul. 27
Sep. 21	Sep. 24	Aug. 31
Oct. 19	Oct. 22	Sep. 28
Nov. 16	Nov. 19	Oct. 26
Dec. 21	Dec. 17	Nov. 30

TVS Elections in November

TVS will hold its annual election at the November 17 meeting. Rich Combs will present the slate of candidates, and election is by acclimation. The present nominations are:

• President: Rich Combs

• Vice President: Eric Dueltgen

• Treasurer: Roland Albers

• Secretary: Ron Kane

Additional nominations can be voiced at the meeting.

Money Matters

As of the last Treasurer's Report on 10/23/17, our club's checking account balance is $14,601.91.

RASC 2018 Handbooks and Calendars

For those who pre-ordered a RASC Handbook and/or Calendar, Roland will have them available for pick-up at the November 17 club meeting. Due to the volume discount, the Handbooks are only $18.50 each, and the calendars are only $12.50 each. You can pay for your RASC materials in one of several ways:

1) [PREFERRED] If you haven't already renewed your club membership for next year, you can pay for your RASC materials ahead of time while renewing. Go the club's membership page (http://www.trivalleystargazers.org/membership.shtml), fill out your contact information, and then proceed to the club's payment page (http://www.trivalleystargazers.org/pay.shtml). On the payment page, use the "Other" field to enter your RASC payment and the "Explanation" field to note what you purchased (for example, "1 RASC handbook").

2) If you've already renewed your membership, you can still pay for your materials ahead of time by going directly to the payment page and paying for your RASC materials as described above.

3) You can wait until the club meeting and pay for your RASC materials when you pick them up by using either a credit card, a check made out to "Tri-Valley Stargazers", or cash (exact amount, please!)

Time to Renew Club Membership for 2018

TVS membership is open to anyone with an interest in astronomy. Amateurs and professionals are equally welcome; skilled amateurs comprise the majority of the membership. You do not have to own a telescope in order to be a member.

Those renewing their club membership are encouraged to do so by using the online application before the end of December. The term of membership is one calendar year - January through December. The regular club membership remains a bargain at $30. Student membership (High School or College) is only $5! Alternatively, Patron Membership, which grants use of the club's 17.5" reflector at H2O, is available at the annual rate of $100.00.

You can join TVS or renew your membership online at:

http://www.trivalleystargazers.org/membership.shtml After filling out the application form you are connected to the PayPal payment form. You do not need to have a PayPal account to pay online, since PayPal will accept credit cards. Everyone is encouraged to use the online application. Alternatively, you can mail in the Membership Application on the last page of this newsletter along with a check to the Tri-Valley Stargazers, P.O. Box 2476, Livermore, CA 94551-2476. Note that TVS will not share your information with anyone. We only use the e-mail address to notify you when the newsletter becomes available.

All members agree to hold the Tri-Valley Stargazers, and any cooperating organizations or landowners, harmless from all claims of liability for any injury or loss sustained at a TVS function.

Outreach Star Party: Help Needed

Wednesday 11/29/17, Outreach party at Altamont Creek School in Livermore, setup 5:30

Wednesday 12/06/17, Outreach party at Sunset School in Livermore, setup 5:30

Please contact Eric Dueltgen for more information.

Header Image: Artist's concept of the Geostationary Operational Environmental Satellite-R Series (GOES-R) satellite in geostationary orbit around the Earth. Credit: NOAA. See: https://www.nasa.gov/topics/earth/features/goesr-exis.html

Calendar of Events

November 13, 7:30pm

What: Black Holes: An Up Close and Personal Look
Who: Feryal Ozel, University of Arizona
Where: California Academy of Science, 55 Music Concourse Dr., Golden Gate Park, San Francisco, CA
Cost: Advanced ticketing required. Academy members $12, Seniors $12, General $15. Reserve a space online or call 1-877-227-1831.

The Event Horizon Telescope is an experiment that is being performed on a large and ever-increasing array of radio telescopes that span the Earth, from Hawaii to Chile and from the South Pole to Arizona. In April of this year, the EHT collaboration has performed its first set of observations with this full array of telescopes in order to take the first ever picture of a black hole. This unprecedented spatial resolution and the novel methods of this experiment will allow us to get up close and personal with the black hole at the center of our Galaxy, Sagittarius A*, and the black hole at the center of the nearby galaxy M87. The ultimate goal is to test Einstein's theory of General Relativity by looking for its most bizarre prediction: a shadow that is a direct evidence for the event horizon of a black hole.

See www.calacademy.org/events/benjamin-dean-astronomy-lectures for lecture and reservation information.

November 21, 7:30-10:00pm

What: Hyperstar Imaging
Who: Joe Lin, SJJA Member
Where: Houge Park, 3972 Twilight Dr, San Jose, CA, We will be in the 1st building, closest to the parking lot and tennis courts.
Cost: Free

In his words: " I would like to share my experiences imaging with Hyperstar on an SCT, a way to image at f/2.1, an blazing 23 times faster than the native focal ratio. I'll cover some of the challenges of making such a setup work and the best way to take advantage of such a setup. I"ll also talk about Hyperstar imaging from light polluted areas.

I'm a bay area local inspired by my dad who took me out to see the 1991 partial eclipse, Comet Hale-Bopp, and the Mars opposition in 2003. I have been an active amateur astronomer for over a decade and have aggressively pursued astrophotography in the past year. During that time I experimented with the gamut of possibilities from a wide field lens on a light Skytracker to high focal lengths on a heavy mount. I'm happy to share experiences and help other budding astrophotographers with improving their skills."

For more information see: https://www.meetup.com/SJ-Astronomy/events/242667855/

November 29, 7:00pm

What: Kepler, K2, and Beyond: The Era of Exoplanets Has Arrived!
Who: Jeff Coughlin, K2/Kepler Science Office Director, SETI Institute / NASA Ames; Geert Barentsen, K2/Kepler Guest Observer Office Director, BAER Institute / NASA Ames
Where: SRI International Conference Center, Menlo Park, CA
Cost: Free

NASA's Kepler space telescope was launched in 2009 and measured the brightness of 200,000 stars at unprecedented precision for over four years, with the prime mission goal of detecting Earth-sized exoplanets. Now after another four, Ke-

continued on page 4

Calendar of Events (continued)

pler's final planet catalog is complete --- over 4,000 planet candidates have been found, with 50 of them possibly rocky and capable of having liquid water. For the first time in human history, we can calculate how common planets the same size and temperature as Earth are, a key component to SETI's goal of figuring out how common life may be in the universe.

The K2 mission began three years ago, and uses the Kepler spacecraft to stare at many different parts of the sky for 80 days at a time. A broad portion of the Astronomical community chooses what targets to observe, resulting in a wide variety of science, including supernovae, galaxies, stars, and of course exoplanets. K2 has found over 300 confirmed exoplanets and an additional 500 candidates. Some of these are likely to be habitable, and many of them are prime targets to be observed by future missions, such as the James Webb space telescope. We'll discuss what we may learn about these worlds over the next few decades, and what future missions are being planned to find planets to which our descendants may one day travel.

For more information see: http://www.seti.org/talks, e-mail info@seti.org, or phone 650-961-6633.

December 1, 6:00-10:00pm

What: $5 First Fridays

Who: You

Where: Chabot Space and Science Center, 10000 Skyline Blvd., Oakland, CA 94619

Cost: $5

At $5 First Fridays you can join a Night Hike through the redwoods or enjoy various laser and planetarium shows. Admission also includes hands-on activities and live demonstrations throughout the center, as well as any special events that are going on that evening. It's fun for the whole family! Featured Moive: Frozen

See http://www.chabotspace.org/events.htm for more information, or call (510) 336-7373.

Journal Club By Ken Sperber

NGC253: Chemistry in a Starburst Galaxy

I'm betting that most TVS members have seen NGC253 through a telescope, and or imaged it (e.g., http://www.trivalleystargazers.org/gert/CCD_Galery/ngc0253_st10xme.html). At a distance of only 11 million light years, it is large (27' x'7), bright (8.0mag), and the dominant member of the Sculptor Group of galaxies. At the eyepiece it presents a mottled struc-

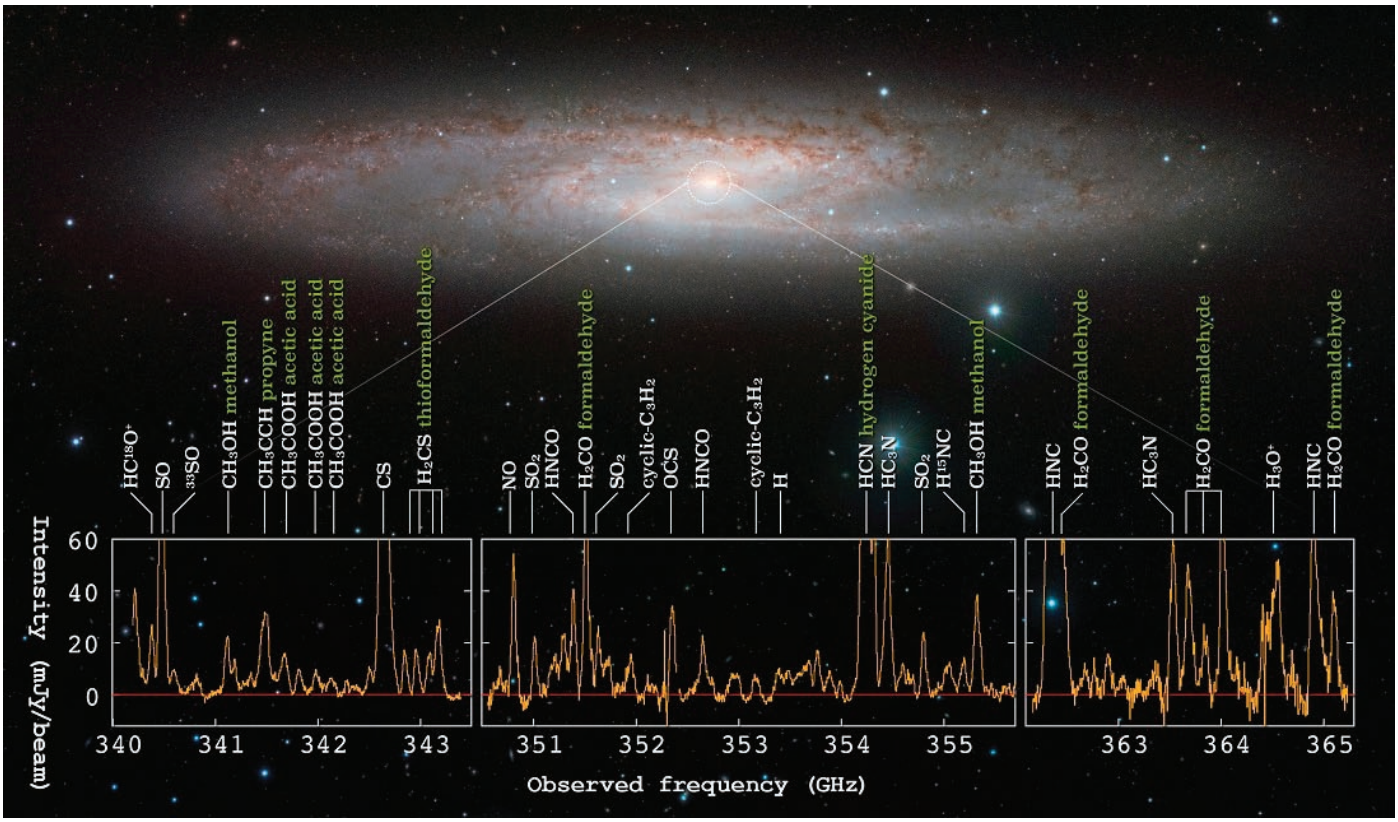


Image Caption: The starburst galaxy NGC 253 and the radio spectra obtained with ALMA. ALMA detected radio signals from 19 different molecules at the center of this galaxy. Credit: ESO/J. Emerson/VISTA, ALMA (ESO/NAOJ/NRAO), Ando et al. Acknowledgment: Cambridge Astronomical Survey Unit

Member Astrophoto

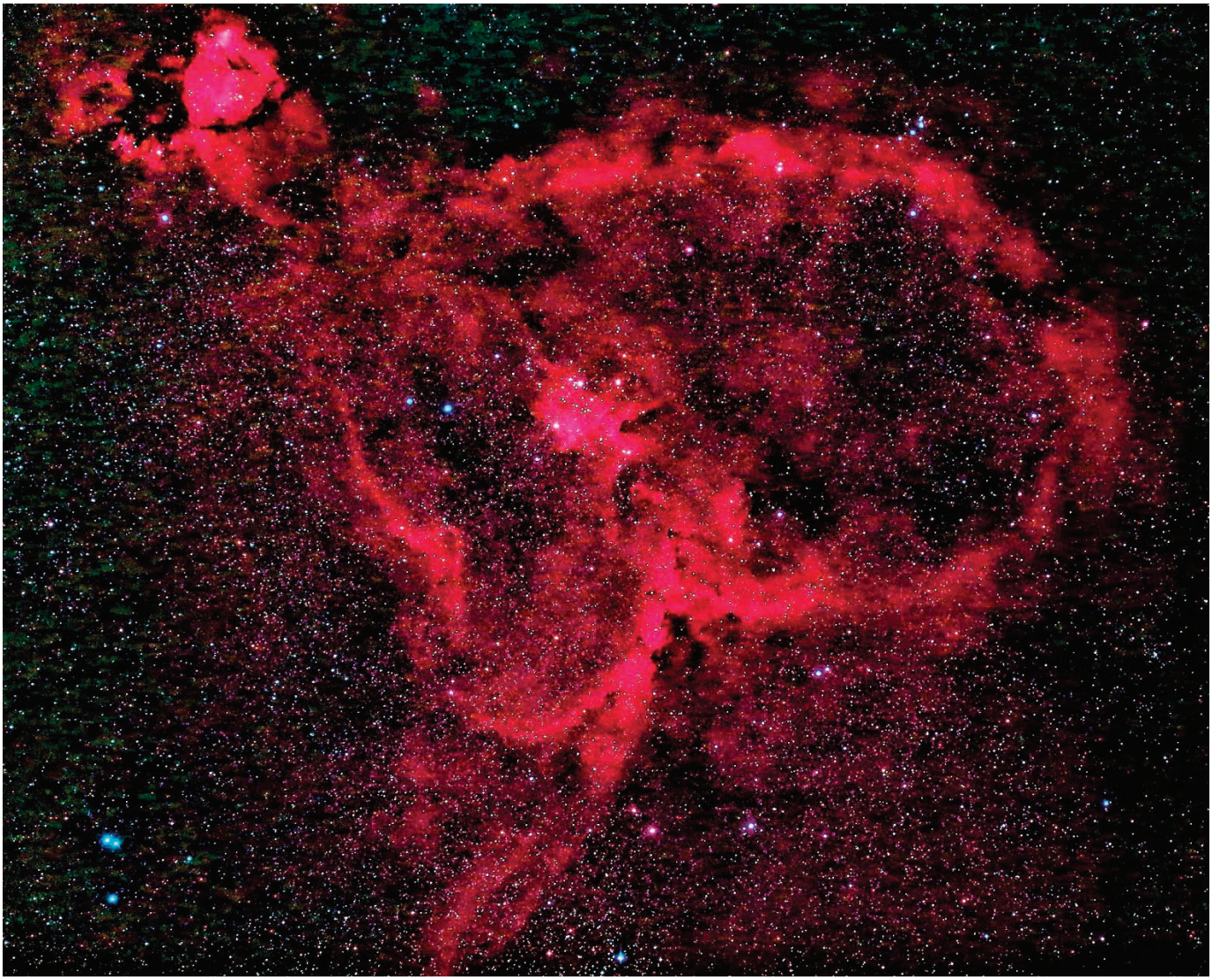


Image Caption: Santa Ana wind gusts of 20 - 25 mph drove most of the astronomers off the hill at Anza on Saturday night, October 28. It's too far for me to drive back once I'm there. Besides www.weather.gov is usually pretty accurate when it comes to cloud cover, wind, and temperature. Dead calm at 1:30 am. The attached image of IC1805, the Heart Nebula, is a 3 minute exposure at ISO 5,000 with my modified Canon 6D full frame DSLR and Televue 5" f/5.2 APO with a Hutech V4 filter. I'm picking up some electronic noise at this ISO so next time out I'll slow it down to ISO 4,000. I was once told that you won't know your limits until you exceed them. Image/Caption Credit: Alan B. Gorski

ture, as the galaxy contains lots of dust and gas that obscures visible light. The excessive dust and gas allows for a formation rate of a few stellar masses/year in the central region. As such, NGC253 is a prototypical "Starburst" Galaxy.

A key to understanding starburst galaxies is to investigate the stages of stellar evolution across a diverse selection of molecular clouds. To observe individual molecular clouds one needs high spatial resolution. Also, high spectral resolution is needed to resolve the spectral lines of individual molecules, and be able to do so at wavelengths that are not attenuated by the Earth's atmosphere. Enter ALMA, the Atacama Large Millimeter/submillimeter Array, located in Chile, used by Ando et al. (2017, The Astrophysical Journal, doi: 10.3847/1538-4357/aa8fd4) to resolve individual molecular clouds in NGC253, using interferometry with up to 36 ALMA radio telescopes at baseline separations of up to 784 meters. In this configuration they were able to resolve 8 individual clouds of about 30 light years diameter each in the central 650 light years of the galaxy. As seen in the figure on page 4, they were able to identify 19 different molecules, ranging from Nitric Oxide (NO), Hydrogen Cyanide (HCN), Methanol (CH_3OH), to Acetic Acid (CH3COOH). This is the first time such

continued on page 6

What's Up By Ken Sperber (adapted from S&T and The Year in Space)

All times are Pacific Standard Time

November

10	Fri	Last-Quarter Moon (12:36pm)
11	Sat	Jupiter 2 degrees below Venus, barely above the east-southeast horizon (Dawn)
11	Sat	Regulus about 3 degrees to the lower-left of the Moon (Morning)
16	Thu	The Moon hangs 17 degrees below Mars. Jupiter and Venus are 6 and 9 degrees below the Moon (Dawn)
17	Fri	One day from New, the Moon forms a triangle with Jupiter and Venus low in the east-southeast (Dawn)
18	Sat	New Moon (3:42am)
20	Mon	The crescent Moon and Saturn pair in the southwest. Search for Mercury, 7 degrees below, with binoculars (Sunset)
25	Sat	Algol at minimum brightness for 2 hours centered on 12:49am
26	Sun	First-Quarter Moon (9:03am)
27	Mon	Algol at minimum brightness for 2 hours centered on 9:38pm
28-	Tue-	Use binoculars to find Saturn and Mercury, located 3 degrees apart, in the southwest. They close in on each other over the next 9 days

December

3	Sun	Full Moon (7:47am)
9	Sat	Last-Quarter Moon (11:51pm)
13-14	Wed	Geminids peak on this night. The peak is forecast to occur at 10:30pm-look for Earth-grazing meteors. The Zenith Hourly rate is about 120.
13	Wed	Waning crescent Moon about 5 degrees above Mars, low in the east-southeast (Dawn)
14	Thu	Thin crescent Moon about 9 degrees below Mars, low in the east-southeast (Dawn)
17	Sun	New Moon (10:30pm)
17	Sun	Algol at minimum brightness for 2 hours centered on 11:22pm
20	Wed	Jupiter rising in the southeast less than 1 degree away from Alpha Librae (Dawn)
20	Wed	Algol at minimum brightness for 2 hours centered on 8:11pm

Journal Club (continued)

a "molecular forest" has been found outside of the Milky Way. Interestingly, despite separations of only about 30 light years between clouds, they exhibited very different compositions. The colder clouds, at about 25K, exhibited fewer kinds of molecules, while one of the clouds, with hot molecular gas at about 90K, exhibited the most diverse composition. The diversity is not just sensitive to temperature, but also to the intensity of ultraviolet light. For example, Isocyanic Acid (HNCO) was not detected in one of the clumps that had a large number (~600) of O-type stars. While some other clumps also have large numbers of O-type stars, such photosensitive compounds are found, suggesting that some shield mechanism protects these species, and/or these latter clouds are "dense molecular regions in the early evolutionary phase of star formation, just after such molecules are produced."

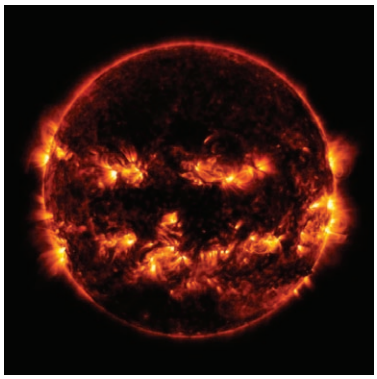
So, the next time you observe NGC253, I hope you will think about the ongoing stellar evolution and complex chemistry that is occurring before your eyes!

For more information see: https://alma-telescope.jp/en/news/press/ngc253-201711

Spooky in Space: NASA Images for Halloween

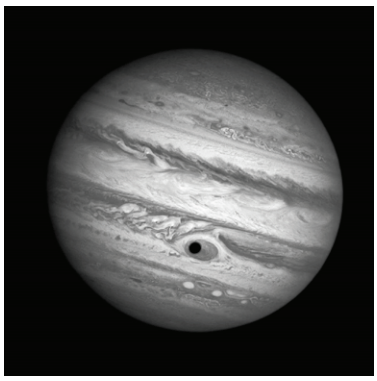
By Linda Hermans-Killiam

Have you ever seen a cloud that looks sort of like a rabbit? Or maybe a rock formation that looks a bit like an elephant? Although you know that a cloud isn't really a giant rabbit in the sky, it's still fun to look for patterns in images from nature. Can you spot some familiar spooky sites in the space images below?



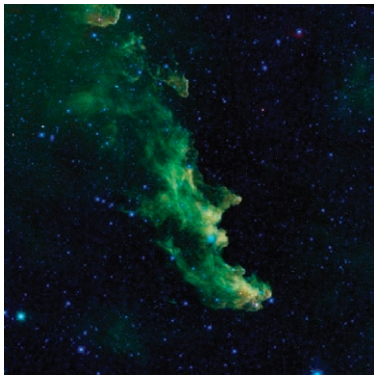
Credit: NASA/GSFC/SDO

This might look like the grinning face of a jack-o'-lantern, but it's actually a picture of our Sun! In this image, taken by NASA's Solar Dynamics Observatory, the glowing eyes, nose and mouth are some of the Sun's active regions. These regions give off lots of light and energy. This causes them to appear brighter against the rest of the Sun. Active regions are constantly changing locations on the Sun. On the day this image was captured, they just happened to look like a face!



Credit: NASA/ESA/A. Simon (Goddard Space Flight Center)

This is a Hubble Space Telescope image of Jupiter. Do you notice something that looks like a big eye peeking back at you? That's actually the shadow of Jupiter's moon Ganymede as it passed in front of the planet's Great Red Spot. Jupiter's Great Red Spot is a gigantic, oval shaped storm that is larger than Earth and is shrinking. It has been on Jupiter for several hundred years, and its winds can swirl up to 400 miles per hour!



Credit: NASA/JPL-Caltech

Can you see the profile of a witch in this image? This image, from NASA's Wide-Field Infrared Survey Explorer, shows the Witch Head nebula. The nebula is made up of clouds of dust heated by starlight. These dust clouds are where new stars are born. Here, the dust clouds happen to be in the shape of an open mouth, long nose and pointy chin.

Credit: NASA/JPL-Caltech/Univ. of Wisc.

The Black Widow Nebula looks like a giant spider in space. It is a huge cloud of gas and dust containing massive young stars. Radiation and winds from these stars push the dust and gas around, creating a spider-like shape. This image is from NASA's Spitzer Space Telescope.

To learn some fun planet facts and make a planet mask, check out NASA Space Place: https://spaceplace.nasa.gov/planet-masks

Tri-Valley Stargazers
P. O. Box 2476
Livermore, CA 94551
www.trivalleystargazers.org

Tri-Valley Stargazers Membership Application

(or apply for membership online: *www.trivalleystargazers.org/membership.shtml)*

Contact information:

Name: _____ Phone: _____

Street Address: _____

City, State, Zip: _____

Email Address: _____

Status (select one): _____ New member _____ Renewing or returning member

Membership category (select one): Membership term is for one calendar year, January through December.

_____ Student member ($5). Must be a full-time high-school or college student.

_____ Regular member ($30).

_____ Patron member ($100). Patron membership grants use of the club's 17.5" reflector at H2O. You must be a member in good standing for at least one year, hold a key to H2O, and receive board approval.

Hidden Hill Observatory Access (optional):

_____ One-time key deposit ($20). This is a refundable deposit for a key to H2O. New key holders must first hear an orientation lecture and sign a usage agreement form before using the observing site.

_____ Annual access fee ($10). You must also be a key holder to access the site.

Magazine Subscriptions (optional): Discounted subscriptions are available only to new subscribers. All subsequent renewals are handled directly with the magazine publishers.

_____ One-year subscription to Sky & Telescope magazine ($32.95).

_____ One-year subscription to Astronomy magazine ($34).

Donation (optional):

_____ Tax-deductible contribution to Tri-Valley Stargazers

Total enclosed: $ _____

Member agrees to hold Tri-Valley Stargazers, and any cooperating organizations or landowners, harmless from all claims of liability for any injury or loss sustained at a TVS function. TVS will not share information with anyone other than other club members and the Astronomical League without your express permission.

Mail this completed form along with a check to: Tri-Valley Stargazers, P.O. Box 2476, Livermore, CA 94551.