Southwest Florida Astronomical Society
SWFAS

The Eyepiece
August 2015

Contents:

A MESSAGE FROM THE PRESIDENT

Hope your scopes haven't floated away with all the rain we have been getting. They don't call this our rainy season for nothing. Hopefully we will have good weather for the Star Party on the 15th. Please check the emails I send or the CRP park website to see if the northside (bikes/horses) is open. If closed, we will be at Seahawk Park.

The program this month is about the current missions to Pluto, Ceres and the Rosetta Comet mission. We have had a lot of great images and information over the last month or two.

This month we have the Perseid meteor shower peaking the 11th to the 14th. Our star party on the 15th will be just after the peak, but we may still have a few.

Sept 19th is International Observe the Moon Night/Astronomy Day. We are planning to have an event at the Nature Center, but may also have an event at another site.

Brian

In the Sky this Month

Moon: August – Full, July 31st; Last Quarter, Aug 6th; New, 14th; 1st Qtr, 22nd; Full, 29th.

The Planets: We lose Venus and Jupiter from the evening sky this month. Saturn continues to shine for optimum viewing. The Perseids put on a show mid-month.

Venus is lost to the evening sky early in the month, but returns in the morning sky starting August 22.
Jupiter is visible in the evening sky only for a few days beyond Venus' departure.
Saturn, the only easily observed planet this month, will be visible until midnight all month. It will shine at magnitude 0.4 – 0.5. It's positioned for outstanding telescopic views. Its ring tilt is near a maximum of 24°. It is located 5° west of the double star β Scorpii.
To the east is another double star, ν Scorpii, which in optimum seeing conditions and high power reveals a Double-Double.

The Perseid Meteor Shower peaks August 12-13. The waning crescent moon promises to make this viewing better than most. The Perseids is a long-lasting shower so if it's cloudy, the preceding and following nights are worth a try, as well.

International Space Station: The ISS is visible in the evening July 29th, 30th & 31st; August 2nd, then for an extended period from 18th – 24th.
See this link for specific times: http://www.heavens-above.com/

Future Events

Star Party and Event Schedule

Date	Event	Location	Time	Info/Contact
August 6th	Monthly Meeting – Program: Pluto, Ceres and a Comet	Calusa Nature Center & Planetarium	7:30 pm	Brian Risley
August 15th	Star Party		Dusk	Bruce Dissette
Sept. 12th	Star Party		Dusk	Bruce Dissette
Sept. 19th	International Observe the Moon Night/Astronomy Day	TBD		Brian Risley
October 10th	Star Party		Dusk	Bruce Dissette
October 18th	Ding Darling Days	Sanibel	10am – 4 pm	Brian Risley
November 14th	Star Party		Dusk	Bruce Dissette
December 12th	Star Party		Dusk	Bruce Dissette

Minutes of the Southwest Florida Astronomical Society – July 2, 2015

The regular monthly meeting of the Southwest Florida Astronomical Society was called to order at 7:38 pm by vice president Bruce Dissette in the Calusa Nature Center Planetarium. There were 22 people present including 1 visitor.

Brian Shultis made a motion, seconded by Ed Sidor, to approve the purchase of a solar filter for the 8 inch Celestar. The motion carried. The club is seeking voluntary contributions for eyepieces.

Ed Sidor made a motion, seconded by Tony Heiner, to accept the minutes as published in the newsletter. The motion carried.

Treasurer Tony Heiner reported a June balance of $2720.45. It was moved and seconded to accept the treasurers report. The motion carried.

It was moved and seconded to approve the yearly payment of approximately $250 to the planetarium. The motion carried.

Becky Brooks and Carol Morin have club events up on the Facebook page. We were reminded to like the page and invite friends to like it to increase awareness of the club.

Ron Madl reminded us that the planetarium has an account for donations. He suggested that we actively solicit donations to the planetarium from groups that we help. Ron moved that we suggest to groups that we assist that they make a donation to the planetarium, and that we provide a brochure "Friends of the Planetarium" explaining what the donations are for, and to increase the credibility of our request. Carol Morin seconded the motion. The motion carried.

Ron Madl also brought up the suggestion from the June meeting about donating telescopes to the Lee County Library system. A motion was made and seconded to table the idea until equipment coordinator Brian Risley is present. The motion to table was passed.

The business meeting was adjourned at approximately 8:15.

Heather Preston presented a brief program "Journey to the Centre of the Milky Way" followed by a National Geographic video from Carol Morin "Inside the Milky Way" on the history, shape and structure of the Galaxy, star formation and ending processes, and the possibility of life.

Submitted by Don Palmer, secretary

Fireflies, Green Stars, and Chromatic Duos

By: Bob King

July nights bring the green flicker of fireflies and a question — are there any green stars we can see in our telescopes? The answer may surprise you.

Fireflies flash green light as they zig, streak, and squiggle in this time exposure taken several summers ago. Jupiter glares at upper left. *Bob King*

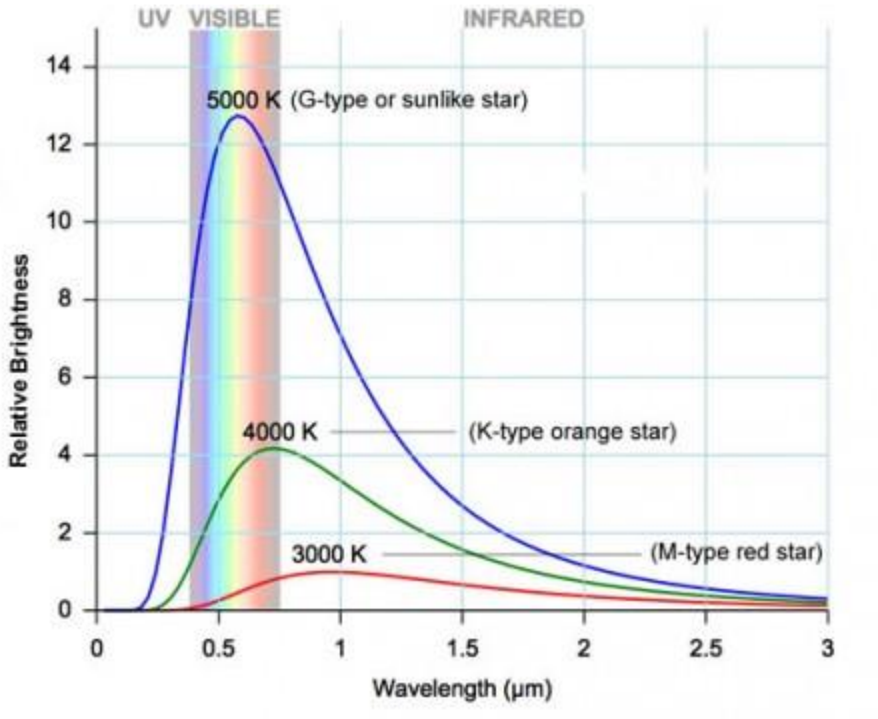
Like many kids growing up in the Midwest, I collected **fireflies** on warm June and July nights. We'd cup the slow-flying beetles in our hands and transfer them to a jar with holes poked in the lids for air. All the while they tried to escape by crawling back up our hands and arms. Later, I'd set the jar by the bedside and fall asleep to their silent flashes.

I still love fireflies, though I don't catch them anymore. More often they catch me. By surprise. When out observing, I've mistaken them for meteors, Iridium satellites, and once, a supernova. That happened when one crawled into the bottom of my focuser and let off a blast of light while I was in middle of making a variable star estimate. Ka-boom!

Stars come in many colors — mostly appearing in pale hues to our eyes — but you won't find a green one in this time exposure of star trails above three of the four auxiliary telescopes of the Very Large Telescope Interferometer (VLTI) at the European Space Observatory's Paranal Observatory in Chile. *ESO / Babak Tafreshi*

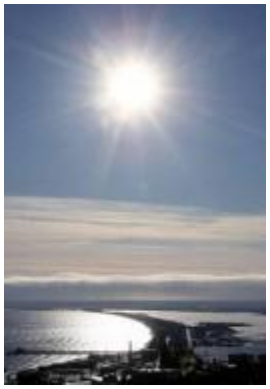
The color of light emitted by the **luciferin molecule** responsible for the firefly's beacon can vary from green to yellow to red. In my neighborhood, most flash green, a color never exhibited by the stars overhead. It's true. We've all seen white, pale blue, yellow, orange, and red stars, but you'll search in vain for true green.

Here's the problem. Stars emit light across the visible spectrum with hotter stars radiating more light at shorter, bluer wavelengths and cooler stars at longer, redder wavelengths. Ruddy Antares in Scorpius has a surface temperature of 3600° Kelvin (6000° F) with a peak emission in the near-infrared end of the spectrum. The Sun is hotter at 5700° K (9800° F) with a blue-green peak. Yet Antares is certainly not "infrared colored" nor is the Sun blue-green.



The x-axis shows depicts the wavelength or star color, the y-axis relative brightness. Curves show light emitted by several classes of stars. The peak of each curve is the color or wavelength at which a star emits most of its light.
Wikipedia, with additions by the author

Even though a star's peak emission may lie anywhere in the spectrum, it also pours out *lots* of light at other wavelengths. Blended together, this makes most stars, including the Sun, appear white or, at the very least, weakly color-saturated. Green stars are absent for the same reason. Any star hot enough to emit a significant amount of green light will also radiate blue, red, and all the rest, effectively masking the green. Flooded with every color of the spectrum, we see white. Kermit had it right all along: "It isn't easy being green."



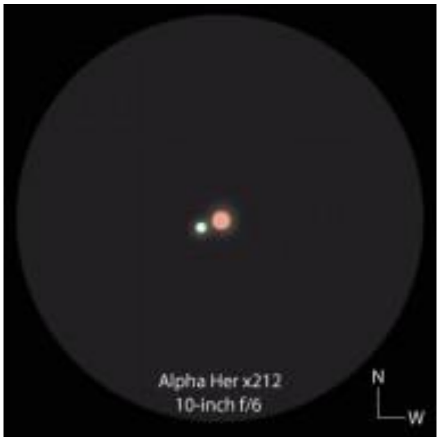
The Sun may peak in the blue-green part of the spectrum, but because it pours out light of every color the net effect is snowy white. *Bob King*

So are the twinkles of fireflies as close as we'll come to seeing green on a July night? Not if you take advantage of *color contrast* in double stars.

Double stars where the brighter primary star is vividly orange or red will cause its fainter companion to assume the complementary color. Red stars "push" their fainter companions towards green, while yellow stars make us see the secondary as blue. This is all the more interesting when you realize that most of these companions are far too dim to excite the eye's cone cells responsible for color vision. Seeing can be a very subjective thing.

Looking over older double star observations, you'll sometimes come across descriptions of "apple green" or "emerald green". There's even a single star, Libra's **Zubeneschmali** (Beta Librae), that some observers claim looks green, though to my eye, it appears white.

Just as we find artificial flavors better than no flavor at all, let's embrace the greens of double stars, even if they're nothing but ocular artifice. Below you'll find a few to peruse the next clear night. The "color pushing" just described is most easily seen with a brief look. Stare a while and the hues might just disappear. Be sure to check out the links, too. Some point you to beautiful digital sketches of double stars by **Jeremy Perez**. Good luck!



Alpha Herculis is one of a few doubles where the fainter companion star looks green. *Bob King*

* **Izar** (Epsilon Boötis) — Mags. 2.7, 5.1, separation 2.9″. Orange primary with a secondary some observers see as pale green.
* **Rasalgethi** (Alpha Herculis) — Mags. 3.1 and 5.4, sep. 4.9″. Lovely red-orange primary. This one works for me — I see green ... briefly!
* **95 Herculis** — Mags. 4.8 and 5.2, sep. 6″. A real gem. Maybe because the magnitudes are so similar, this one presents an obvious color contrast for many, my eye included. A 19th-century amateur astronomer described them as "apple-green and cherry red."

* **Graffias** (Beta Scorpii) — Mags. 2.9 and 5.1, sep. 13.6″. One of the prettiest doubles of summer. I see two white stars, but some observers report the secondary as being slightly greenish.
* **Antares** (Alpha Scorpii) — Mags.1.0 and 5.4, sep. 2.5″. Probably the most famous example of color contrast. A tough challenge requiring excellent seeing, but if you can crack it, the companion looks distinctly green nestled next to its brilliant, orange-red primary.
* **Zeta Lyrae** — Mags. 4.3 and 5.9, sep. 44″. Ruddy primary and watery green secondary.
* **Gamma Delphini** — Mags. 4.4 and 5.0, sep. 9.1″. Awesome double! I see two yellowish stars but others see one yellow and one pale emerald.

Astronomers Spot Unusual Five-Star System

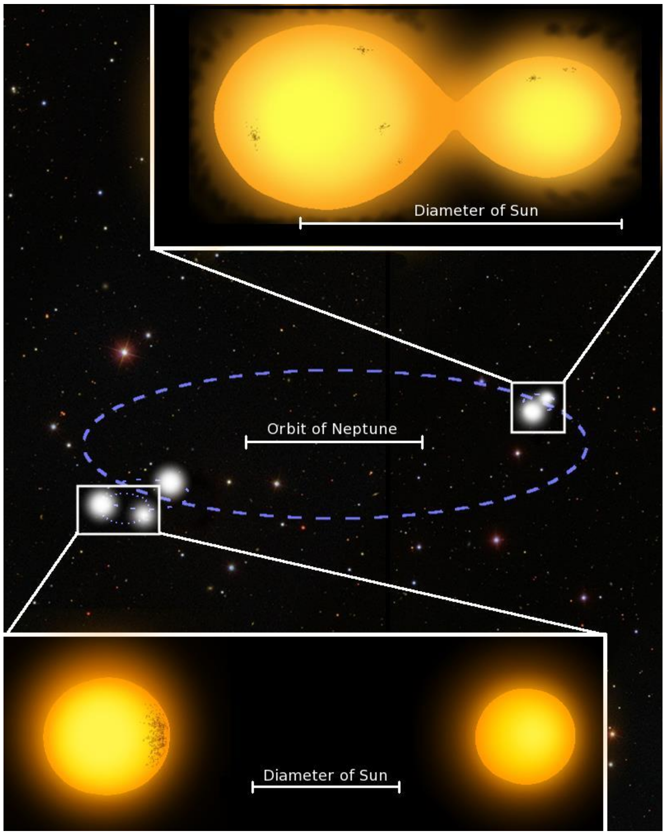
By: Anne McGovern

Two binary systems and a fifth stellar wheel make for a rare, and so far unique, set of stars.

Multiple systems — when two or more stars orbit a center of gravity between them — are not unusual. In fact, almost all bright, massive stars have companions, as do about half of Sun-like stars. Some famous examples include Sirius, the brightest star in the Northern sky and its faint white dwarf companion, and the triple Alpha Centauri system that includes the closest star to Earth, Proxima Centauri.

But systems containing more than three stars are rare. So Marcus Lohr (The Open University, UK) and colleagues were understandably excited in 2013 when they discovered a quadruple star system (1SWASP J093010.78+533859.5) in Ursa Major. It contains two eclipsing binaries, where both systems are angled edge-on to Earth so that during every orbit, one star passes in front of, and is eclipsed by, its partner.

It was a rare find, but this year the team upped the ante when they discovered a fifth star hiding in the mix. The five-star system is around 9 to 10 billion years old.



This diagram depicts the quintuple star system to scale, using Neptune's orbit around the Sun for reference. (The binary orbits are not included since they are too small to show on this image.) The box at the top shows what a contact binary might look like. These two stars orbit close enough to touch and share their mass. The box at the bottom shows a detached binary. The orbital periods are 6 hours and 31 hours, respectively. Lohr and colleagues think the fifth star is located to the right of the separated binary, though this is not confirmed. *Marcus Lohr*

Commenting in a press release, Lohr related the discovery to what for now remains science fiction: "This is a truly exotic star system . . . Any inhabitants [of this system's exoplanets] would have a sky that would put the makers of Star Wars to shame — there could sometimes be no fewer than five Suns of different brightnesses lighting up the landscape. Days would have dramatically varying light levels as the different stars were eclipsed. They would though miss out on night for a large part of their 'year', only experiencing darkness (and a night sky) when the stars were on the same side of their world."

(Star Wars isn't the only one to take on multiple stars: Isaac Asimov wrote a pretty bleak tale on how alien people living under six suns might react to rare total darkness in his short story, "Nightfall.")

The two binaries' similar inclination angles hint that the quintuplets formed when a single protostellar disk fell into pieces. The authors don't speculate further, but write, "This bright, close, and highly unusual star system would doubtless repay further investigation."

Reference:

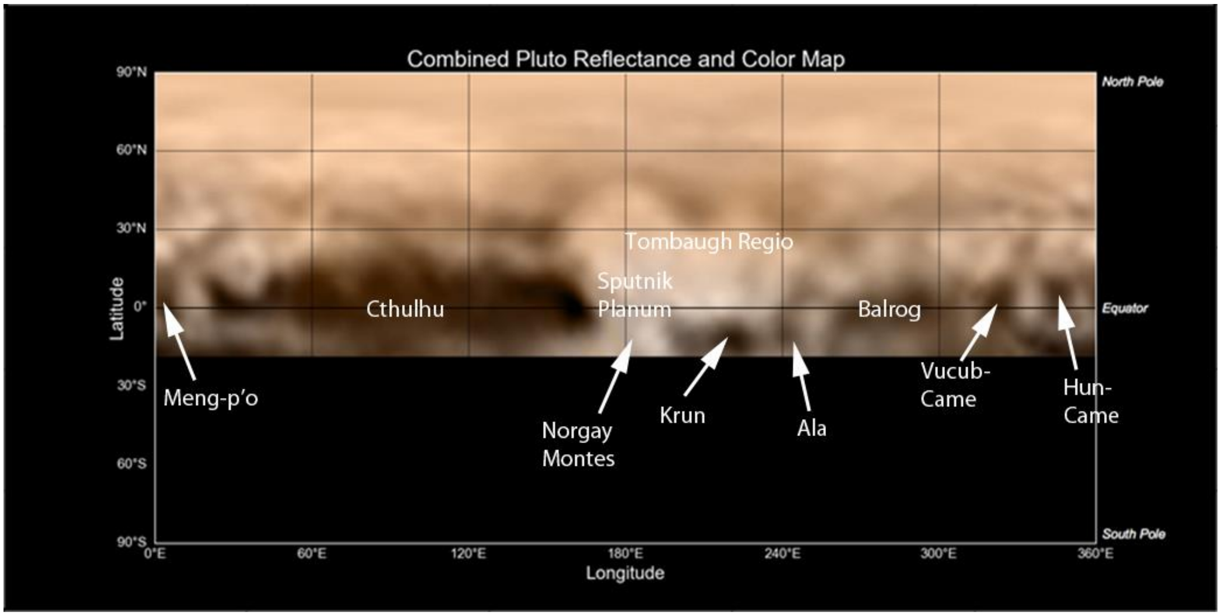
Marcus Lohr et al. "The doubly eclipsing quintuple low-mass star system 1SWASP J093010.78+533859.5." *Astronomy & Astrophysics,* April 28th, 2015.

(Unofficially) Naming Pluto

By: Anne McGovern

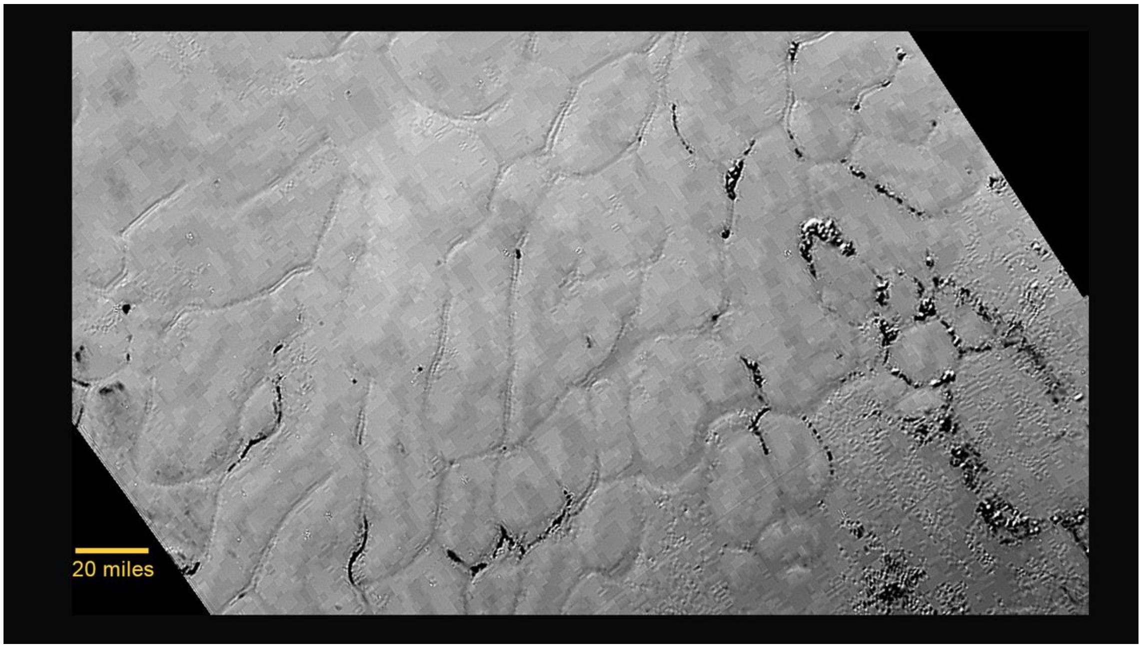
Amidst all the excitement of seeing Pluto's unique features for the first time, NASA researchers have been using unofficial names to talk science until official terms come down the pipeline.

On July 8th we showed you a picture of Pluto's odd equator, containing two features that NASA scientists at the time had dubbed "the whale" and "the donut." Here is the same image again, but this time with some more plausible (but still preliminary) names that Mark Showalter (SETI), organizer of the OurPluto campaign to solicit Pluto-feature names from the public, put together for a July 14th science presentation. (Most of these names were captured in a photo taken by Emily Lakdawalla and posted to Twitter.) Instead of "the whale," it's Cthulhu that's lurking at Pluto's equator, with a Balrog and a gaggle of underworld gods and beings as neighbors.



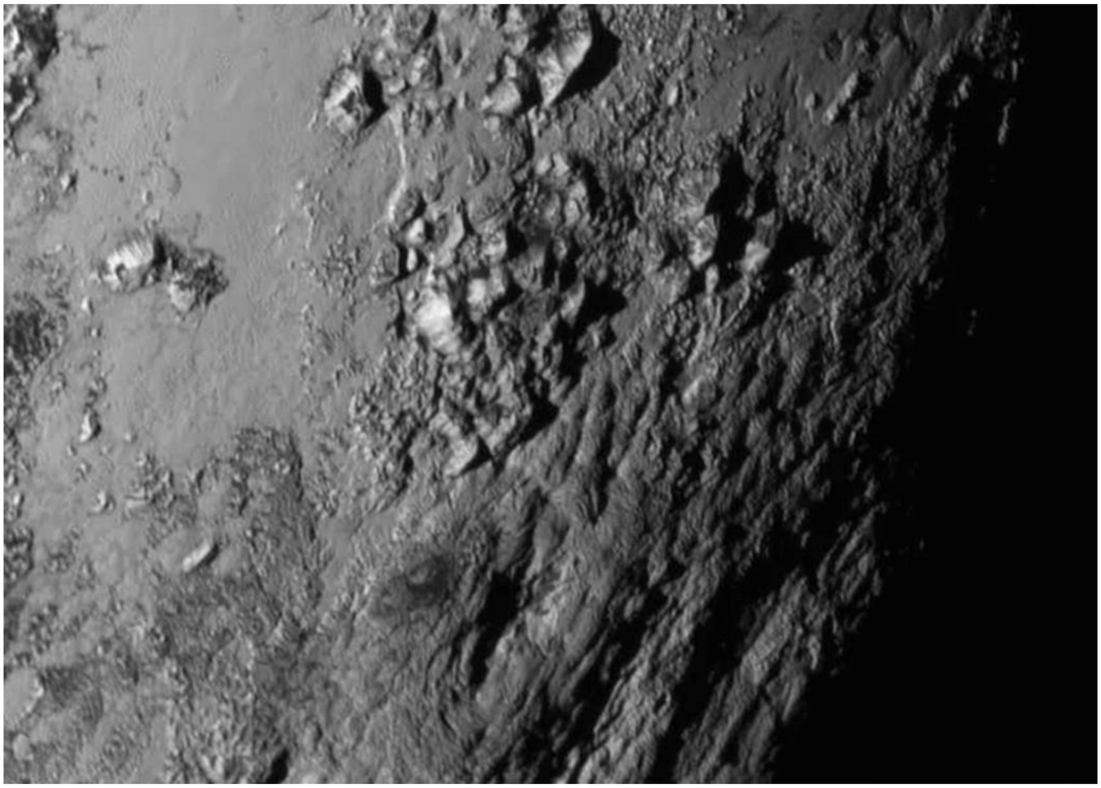
Preliminary names shown on the pre-flyby map of Pluto. (Later image releases will result in sharper maps and more precise feature classifications and names.)
NASA / JHU-APL / SWRI

The center of the image shows Pluto's "heart" and the names that have been informally attached to that region. The photo below reveals a close-up of the Sputnik Planum taken during the flyby.



This captivating photo of the vast, craterless plain that lies in the center-left of Pluto's heart has been informally named the Sputnik Planum. The heart itself has also been unofficially named Tombaugh Regio, to honor Pluto's discoverer, Clyde Tombaugh.
NASA / JHU-APL / SWRI

Here is a close-up of the Norgay Montes region:



NASA-JHUAPL-SwRI

These preliminary names come from the list compiled during the OurPluto naming campaign, but so far the International Astronomical Union (IAU) has not approved them (or any others).

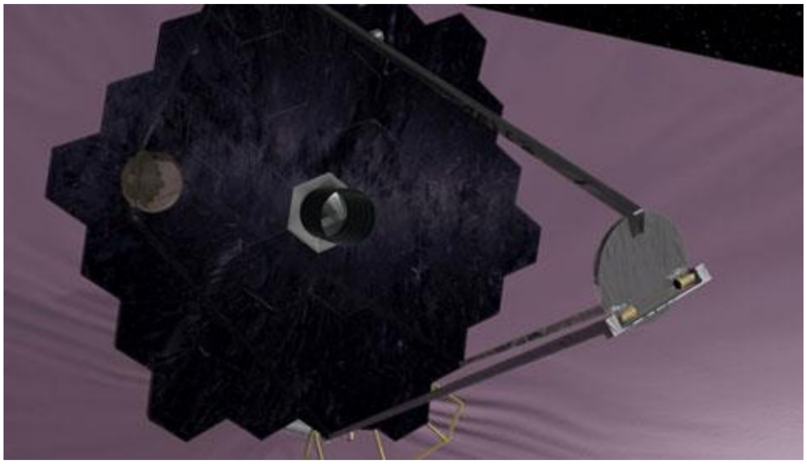
The IAU is very precise about how they name planetary features. Similar to how biological beings are divided into kingdoms, classes, and species, so too are solar system features (along with stars and galaxies) grouped and classified, then named according to an overarching theme. For example, craters 60 km or greater on Mars are named after deceased scientists and explorers, as well as writers who wrote about the Martian planet. Smaller Martian craters are named after cities with populations less than 100,000. Here's the full list of the IAU's themes and conventions.

As such, until those studying Pluto can understand and classify Pluto's features, the IAU will have to wait to properly group and approve names. However, according to Rita Schulz, chair of the IAU's Working Group on Planetary System Nomenclature, the first name likely to come down the Pluto-naming pipeline will be the Tombaugh Regio — and it seems fitting to name Pluto's heart after the world's discoverer.

High Definition Space Telescope — Hubble's Successor?

By: David Dickinson

A proposal released earlier this month calls for a giant orbiting space telescope that could revolutionize astronomy — that is, if we can afford it.



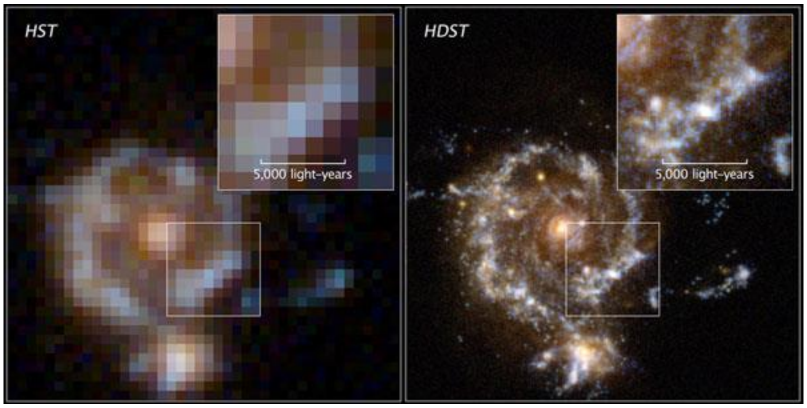
An artist's conception of the HDST in orbit. *NASA/GSFC*

A consortium of 40 international affiliates and U.S. institutions known as the Association of Universities for Research in Astronomy (AURA) recently unveiled a proposal to orbit a large, segmented-mirror telescope more than five times the diameter of the Hubble Space Telescope. Dubbed the High Definition Space Telescope (HDST), this instrument would peer deeper in space and time than ever before and enable astronomers to directly image nearby Earth-like exoplanets.

The HDST proposal calls for a segmented mirror 39 feet (12 meters) in aperture, which would be placed at the L2 Lagrange point, a stable region where the gravitational influences from the Sun and Earth balance out. The Sun-Earth L2 point is located 932,000 miles (1.5 million kilometers) anti-sunward from the Earth. HDST's diameter would almost double the effective diameter of the James Webb Space Telescope, set to launch in 2018 for the same L2 orbit.

Though the JWST has often been touted as the "successor to Hubble," it's primarily an infrared workhorse. The HDST would — like Hubble — work at ultraviolet and near-infrared wavelengths, as well as visible light.

What HDST Can Do



A comparison of the resolution of HST versus HDST.
Association of Universities for Research in Astronomy (AURA)

"There is no area of astronomy and astrophysics that HDST will not impact," says Mario Livio (Space Telescope Science Institute). "Arguably, the most fascinating topic would be the ability to image dozens of extrasolar Earth-like planets in the habitable zones of their parent stars, and to characterize their atmospheres. This will enable us either to detect extrasolar life, if such life is common, or at least place meaningful constraints on how rare extrasolar life is."

Composed of 54 mirror segments, HDST would also be outfitted with a starlight-blocking coronagraph, enabling it to directly image exoplanets around stars up to 100 light-years away. Such a device could be built into the structure of the telescope, or, even better, could consist of a free-flying occulting disk thousands of kilometers away. The HDST would also be capable of resolving structures 330 light-years across in the universe when it was just 3 billion years old (that is, out to a redshift of 2.)

The proposed megascope would provide images up to 24 times sharper than those from Hubble. "HDST will have an important impact on solar system studies," says Marc Postman (Space Telescope Science Institute). "We could monitor outer planets and satellites on long timescales. The images of Pluto that HDST would get would be similar in detail to those released by New Horizons when it was about three weeks out from closest approach. HDST would be able to detect features the size of the island of Manhattan on Jupiter. It would also be able to search for more distant and very faint Kuiper belt objects out beyond Pluto."

From Concept to Reality

One of the gold-coated primary mirror segments for the James Webb Space Telescope in the lab. *Drew Noel / NASA*

But getting HDST to space won't be easy. Take JWST: that project was plagued with cost overruns for years, culminating in the threat of cancellation in 2011. Although it's on track for a 2018 launch, JWST's budget is now nearly $9 billion, after an initial budget proposal of $1.6 billion. There's no official budget allocated to the HDST as of yet, and it's still early in the game to make an official cost estimate, but unofficial estimates put it in the ballpark of $10 billion. The lessons learned from JWST, such as development, design, and getting the observatory from the drawing board to orbit, will prove crucial to HDST.

HDST does have some advantages in the cost department. It can operate at much warmer temperatures than JWST will, and it does not require extensive cryogenic testing on Earth. Construction of the HDST can also utilize low-cost optical materials and simpler component design.

The project envisions the telescope to be folded up for launch aboard a NASA Space Launch System (SLS) rocket sometime in the 2030s. NASA plans to test its SLS rocket in November 2018. Like JWST, HDST would be out of range for repairs once deployed, and it would have to unfold and operate successfully on its own. It remains to be seen how this will work out for JWST and HDST alike, since Hubble required immediate repair following its launch in 1990. The crew of space shuttle *Atlantis* serviced Hubble one last time in 2009, so failure of any key component of Hubble now means the loss of a crucial instrument with visible-light capabilities, an asset that may not be replaced for years to come.

The Hubble Space Telescope overcame budget and engineering problems to usher in a new era of astronomy. Perhaps the promise of the High Definition Space Telescope will do the same in the decades to come.

On The Brightness Of Venus

By Ethan Siegel

Throughout the past few months, Venus and Jupiter have been consistently the brightest two objects visible in the night sky (besides the moon) appearing in the west shortly after sunset. Jupiter is the largest and most massive planet in the solar system, yet Venus is the planet that comes closest to our world. On June 30th, Venus and Jupiter made their closest approach to one another as seen from Earth—a conjunction—coming within just 0.4° of one another, making this the closest conjunction of these two worlds in over 2,000 years.

And yet throughout all this time, and especially notable near its closest approach, Venus far outshines Jupiter by 2.7 astronomical magnitudes, or a factor of 12 in apparent brightness. You might initially think that Venus's proximity to Earth would explain this, as a cursory check would seem to show. On June 30th Venus was 0.5 astronomical units (AU) away from Earth, while Jupiter was six AU away. This appears to be exactly the factor of 12 that you need.

Only this doesn't explain things at all! Brightness falls off as the inverse square of the distance, meaning that if all things were equal, Venus ought to seem not 12 but 144 times brighter than Jupiter. There are three factors in play that set things back on the right path: size, albedo, and illumination. Jupiter is 11.6 times the diameter of Venus, meaning that despite the great difference in distance, the two worlds spanned almost exactly the same angular diameter in the sky on the date of the conjunction. Moreover, while Venus is covered in thick, sulfuric acid clouds, Jupiter is a reflective, cloudy world, too. All told, Venus possesses only a somewhat greater visual geometric albedo (or amount of reflected visible light) than Jupiter: 67 percent and 52 percent, respectively. Finally, while Venus and Jupiter both reflect sunlight toward Earth, Jupiter is always in the full (or almost full) phase, while Venus (on June 30th) appeared as a thick crescent.

All told, it's a combination of these four factors—distance, size, albedo, and the phase-determined illuminated area—that determine how bright a planet appears to us, and all four need to be taken into account to explain our observations.

Don't fret if you missed the Venus-Jupiter conjunction; three more big, bright, close ones are coming up later this year in the eastern pre-dawn sky: Mars-Jupiter on October

17, Venus-Jupiter on October 26, and Venus-Mars on November 3.

Keep watching the skies, and enjoy the spectacular dance of the planets!

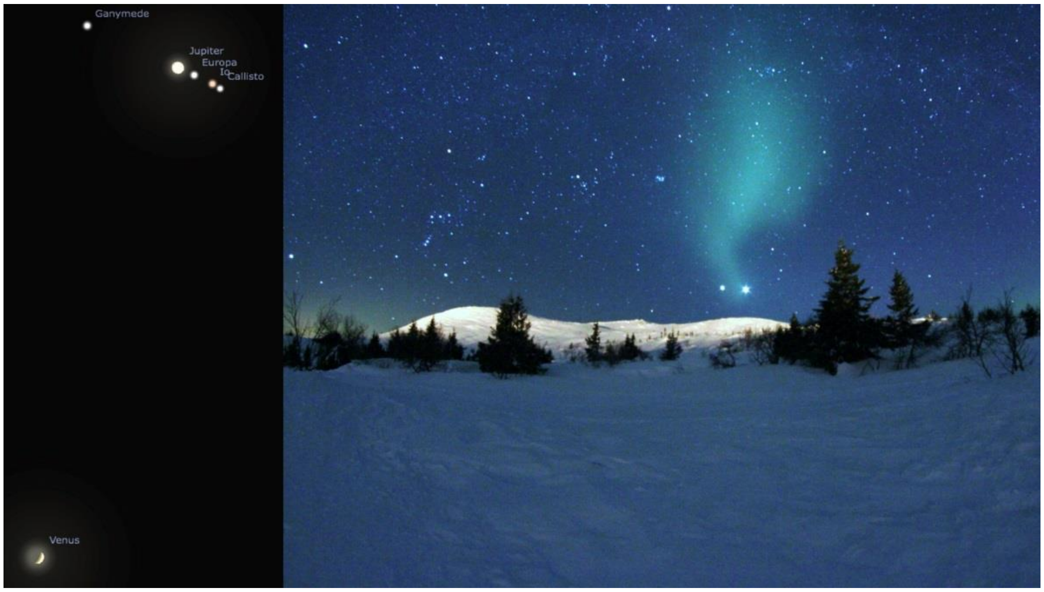


Image credit: E. Siegel, using the free software Stellarium (L); Wikimedia Commons user TimothyBoocock, under a c.c.-share alike 3.0 license (R). The June 30th conjunction (L) saw Venus and Jupiter pass within 0.4° of one another, yet Venus always appears much brighter (R), as it did in this image from an earlier conjunction.

Systems Engineer for Environmental Satellite

Sarah Sherman is a systems engineer for the Soil Moisture Active Passive (SMAP) mission. She helped develop and launch a spacecraft that orbits Earth and looks at how much water is in the soil.

http://climatekids.nasa.gov/career-satellites

There are lots of green careers. You can help others make good choices that don't hurt the environment. You can build things that help the environment.

You can also learn how the environment works. Then we can know how to protect it. One way we learn about Earth is with satellites. Some of them go around Earth and observe it. That means they take pictures or measure things to learn more about how things work.

Sarah at her desk.

A conversation with . . .

Sarah Sherman

Climate Kids: Sarah, what do you do?

Sarah: I do systems engineering for something called SMAP. That means I worked on the planning, development, testing and launch. Now I am on the operations team, where we send instructions to SMAP.

CK: What is SMAP?

Sarah: SMAP stands for Soil Moisture Active Passive. It is a spacecraft that orbits Earth. That means it is a machine that goes around Earth. It looks at how much water is in the soil. It will help us understand a lot more about the water and energy cycles on Earth.

CK: What does SMAP look like?

Sarah: It has a refrigerator-sized body with solar panels. It also has a big antenna that helps it find out how much water is in the top layer of soil.

CK: What's the big deal with water in the soil?

Sarah: We know very little about how much water is in the soil in different parts of the world. It's important to understand where all the water is. If we know this, we can learn more about weather, droughts, and floods. We can also learn more about the plants that grow there.

CK: How many people do you work with?

Sarah: There are hundreds of people involved in the SMAP mission. I work with lots of people every day. Some days I might write a sequence (a string of commands to the spacecraft) on my own, and then meet with a group of four engineers to review it. They provide suggestions based on their experience, and I use their feedback. Other days, I might be doing testing with just one other person.

CK: Why do you need to meet with so many people to do one thing?

Sarah: The spacecraft is so complex that no single person will know everything, which is why we rely on teamwork so much. We also have lots of people double-checking our work. A mistake can result in loss of science data. It could even damage the spacecraft. Sending just one command requires a minimum of two people.

CK: What do you do most days?

Sarah: We have a morning meeting at 8:30 AM, where different teams report on their status. Then we plan for the day. After that, I either sit in the flight director or systems chair to support daily operations. That includes preparing messages to send to the spacecraft, planning future activities, and solving any problems we see.
Sometimes the project scientist comes in to tell us some early science results. That's really rewarding!

CK: What is your favorite part of your job?

Sarah: My favorite part right now is the variety of tasks. I get to interact with every part of the spacecraft. One week, I worked with the guidance, navigation and control team. Another week, I told the spacecraft how to move to change its orbit, which is what we call a maneuver. I also work with the communications system to build the background sequence, which is our way of telling the spacecraft when and how to send data back down to Earth's ground stations. There is never a day exactly like the last.

CK: How did you get interested in space?

Sarah: I've wanted to work at NASA since I was a teenager. My interest in engineering came from playing with LEGO, fort building, and tinkering with tools in my basement as a kid. Also, I could fly a plane before I could drive a car!

CK: How can I become an engineer?

Sarah: Ask lots of questions. Take things apart. Learn to lead and take initiative. Think of creative solutions to problems. Get comfortable with math and science fundamentals now, because you'll keep building on them as you advance further in your education.

Club Officers & Positions:

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Vice President:
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Treasurer:
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Program Coordinator:
Vacant

Librarian:
Maria Berni
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