nightwatch

Newsletter of the Pomona Valley Amateur Astronomers

Life is like riding a bicycle
- in order to keep your balance, you must keep moving.
Albert Einstein

Volume 36 Number 4 ***nightwatch*** **April 2016**

President's Message

Lots of stuff coming in the next couple of months. Our next star party is Saturday, May 7, at Cow Canyon Saddle on the slopes of Mount Baldy. We usually have a good turnout for the nearby star parties, and I hope you're able to make it to this one.

Speaking of observing from the mountains, our annual Mount Wilson trip is coming up in early June - our rather, our trips, plural. We have the evening of Friday, June 3, booked on the 100-inch Hooker telescope, and the very next evening on the 60-inch telescope. Mars will be almost at opposition so if the seeing is good, we may get exceptional views of the red planet, plus all the other great stuff up there. The price is $330 for the 100-inch and $100 for the 60-inch. If you're interested, please contact Ron Hoekwater to get on the list, and please get your payment in as soon as possible, as we have to get our telescope rental fees to the observatory well in advance.

The end of our organizational and fiscal year is coming up next month, which means two things: elections and dues. By now you should have received a ballot from John and Claire Stover, our hardworking webmasters and newsletter editors. We'll also have some paper ballots available at the May meeting, when the voting will actually take place.

In addition to voting on club officers, we also need to vote on the proposed amendment to the club bylaws to reflect our status as a tax-exempt 501(c)(3) nonprofit public benefit corporation. Please read over the proposed amendment and let me know if you see any ways that it can be improved - there's still plenty of time to incorporate edits before the vote in May.

Please get your dues in to our club treasurer, Gary Thompson, as soon as it's convenient. Dues are still $30 for individuals and $40 for families. That includes membership in our national parent organization, the Astronomical League (https://www.astroleague.org/). You should all be receiving the Astro League newsletter, "The Reflector", 3-4 times a year. If you're not getting yours, please let me know and I'll send a fix up the line.

Our speaker this month is our own Dr. Dave Kary, who teaches astronomy at Citrus College. Dave will speak on gravitational waves, including the recent discoveries from the Laser Interferometer Gravitational-Wave Observatory (LIGO).

Matt Wedel

PVAA Officers and Board

Officers

President ….....	Mathew Wedel	909-767-9851
Vice President ..	Joe Hillberg	909-949-3650
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Karl Rijkse (2016)	909-428-1884
Ron Hoekwater (2017).........................	909-391-1943
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Membership / Publicity....	Gary Thompson ..	909-935-5509
Outreach	Jeff Schroeder	909-758-1840
Programs	Ron Hoekwater	909-391-1943

PVAA General Meeting 2/26/16

In our February meeting we had 3 speakers for the night: Terry Nakazono, MA UCLA with his presentation entitled "Looking for Astronomy in Denmark." David Nakamoto with his presentation of "Crazy over Planets – The Modern Discovery of Planets." – And Dave Kary of Citrus College on Kuiper Belt Objects.

Terry Kakazono presented pictures he took in December last year of the Round Tower and Tycho Brache Planetarium in Denmark. The Round Tower is actually the oldest functioning observatory in the world [1642], while the planetarium opened in 1989. He gave us an entertaining history of Tycho, who became famous, and then fell out of favor with Denmark's rulers. Here are pictures of Tycho Brache, Tycho Crater, and the Round Tower.

David Nakamoto gave us a little history lesson of finding new planets after the original 7. (Mercury, Venus, Mars, Jupiter, Saturn, the Moon & Sun, and eventually, the Earth. It took a while to move the sun out of the planet category & replace it with Earth, as Earth was thought to be the center of the universe, with everything revolving around it. That left us with 6 planets & one moon of Earth.

After the telescope came along, William Herschel used his big alt-azimuth mounted telescope to find Uranus. The official date for the discovery is 3/13/1781. Herschel originally thought it was a comet. Later Johann Daniel Titus and Johann Elert Bode came up with the Titius-Bode law. (Sometimes just called Bode's law.) If Earth was 1 AU, then using Mercury & Venus as .4 and .7 AU, then there should be planets at 1.6 (Mars), 2.8 (Asteroid Belt), 5.2 (Jupiter), etc. using the formula:

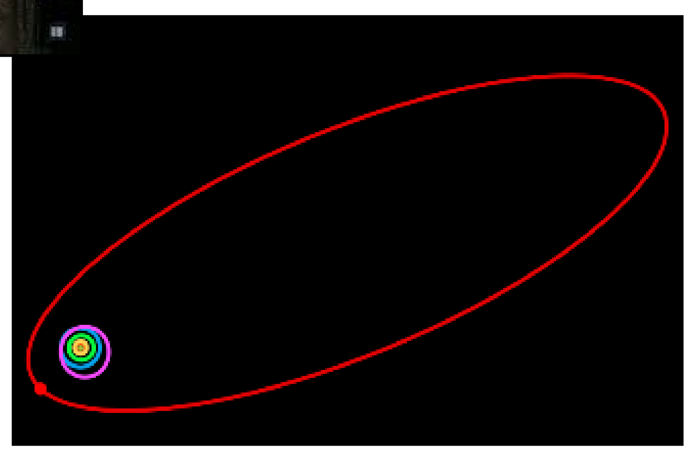
(4+0)/10, (4+3)/10, (4+6)/10, (4+12)/10, (4+24)/10, (4+48)/10,……

A year after Herschel discovered Uranus, Bode finds previous sightings of Uranus that went unnoticed. In 1821 it was decided that Uranus did not fit its orbit, and that there must be another planet out there. In 1843 Adams presents his calculations, and Urbain Le Verrier predicted where the new planet was. He told Johann Galle where to look, and Galle observed Neptune on 9/23/1846, within a degree of Le Verrier's prediction. Neptune is approximately 30 AUs from the sun. 1 AU = Earth's distance from the sun.

Pluto was discovered by Clyde Tombaugh by examining 14 x 17 inch glass plates that would "flip" from one of two images of the same piece of sky, and looked for movement. He searched over 90 MILLION star images looking for what became known as Pluto. Clyde died in 1997 at the age of 90. In 1992 the New Horizons spacecraft project started. The project director met with Clyde. The spacecraft carried a small portion of Clyde's ashes with it to Pluto and now beyond.

Now with the Kepler and other spacecraft and better ground equipment, Exo planets – planet circling other stars, are being discovered at an ever-increasing rate.

Dave Kary talked about the difficulty of imaging Kuiper belt objects. Sedna is the most famous of the trans-Neptunian object, other than Pluto. Its aphelion is estimated to be 937 AU, or 31 times Neptune's distance from the Sun. The picture shows Pluto's orbit in purple, and Sedna's in red.

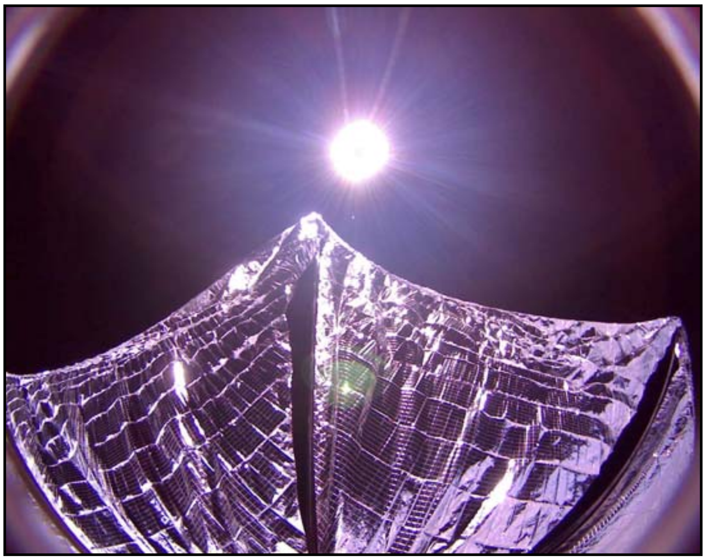


PVAA General Meeting 3/25/16

For PVAA's March general meeting our speaker was Geovanni Somoza from the Planetary Society. He works at Mt Wilson, Griffith Observatory, and is with the Los Angeles Astronomical Society. He talked about the Planetary Society's previous Light Sails and the upcoming Light Sail 2.

Back in 1608 Kepler talked about solar sails to Galileo. Seeing comets in the sky, and looking at the comet's tail, he thought that the comet's tail was caused by solar wind. Therefore he believed that a sailboat could use that wind to go to the other planets and stars.

In 2005 the Planetary Society built their first Light Sail called Cosmos1. It was launched from a Russian submarine on a Volna submarine ICBM missile. The rocket did not make it to orbit, and it, and its payload fell into the sea.



In 2008 SpaceX launched the NASA Nanosail-D, that was taken over by the Planetary Society, on its Falcon 1 rocket, that failed to put its payload into orbit. NASA tried again in August 2010 with NanoSail-D2 and successfully delivered it to orbit aboard a Minotaur IV rocket, but not before Japan successfully launched their IKAROS solar sail in May of 2010. IKAROS stands for Interplanetary Kite-craft Accelerated by Radiation Of the Sun. On 12/8/2010 IKAROS passed by Venus at a distance of 50,200 miles. (80,800 km)

In 2015 the Planetary Society's LightSail 1 hitched a ride on an Atlas V rocket that had a military payload. It was successfully deployed and sent back this image:

The LightSail spacecraft had many problems that gave the ground crew fits, but it was dubbed a success, and a huge learning experience. The ground lost communications with it several times, and it was only spotty when they did communicate. Due to the volunteer and shoestring (for a spacecraft) budget associated with this project, there were few ground communication stations, and satellite communications were not used. LightSail 2 will be launched on the Falcon Heavy rocket either late this year or early 2017. All the lessons learned from LightSail 1 will be incorporated into the new craft. The biggest change will be software and its orbit. It will be released at a height of about 650 miles up. They calculated that it had to be higher up and 400 miles to be able to overcome Earth's atmospheric drag. LightSail 2 will have a sail area of 32 square meters, and have torque rods to move the sails.

Gary Thompson

Club Events Calendar

April 22, 2016 General Meeting – Dave Kary, Gravitational Waves

May 7, 2016 Star Party--Cow Canyon Saddle, Mt Baldy
May 12, 2016 Board Meeting
May 20, 2016 General Meeting – Dr Jason Fallicchio – Quasars to Test Quantum Mechanics

June 3, 2016 Mt Wilson Observing 100"
June 4, 2016 Mt Wilson Observing 60"
June 16, 2016 Board Meeting
June 24, 2016 General Meeting

July 30, 2016 Star Party - Grandview
July 14, 2016 Board Meeting
July 22, 2016 General Meeting

Aug 27, 2016 Star Party – Cow Canyon Saddle, Mt Baldy
Aug 11, 2016 Board Meeting
Aug 19, 2016 General Meeting

Sept 3, 2016 Star Party– Cow Canyon Saddle, Mt Baldy
Sept 8, 2016 Board Meeting
Sept 16, 2016 General Meeting – Elijah Quentin – Stars Consumed by Black Holes

Oct 1, 2016 Star Party--Afton Canyon
Oct 6, 2016 Board Meeting
Oct 14, 2016 General Meeting

Oct 29, 2016 Star Party
Nov 10, 2016 Board Meeting
Nov 18, 2016 General Meeting

Dec 3 , 2016 No Star Party
Dec 1, 2016 Board Meeting
Dec 9, 2016 Xmas Party, no General meeting

What's Up? - A Stormy Giant

Jupiter is certainly a giant planet, it's 88,846 miles in diameter. Its striking cloud bands strangely orbit in opposite directions at 30,000 mph. which is 30 times faster than Earth's rotation, a speed that flattens its poles so that it's not spherical. Jupiter's day is only 10 hours long. Its stormy banded atmosphere is made of hydrogen and helium in proportions much like the Sun. Jupiter could be seen, not as a giant planet, but as a small un-ignited sun. It radiates a lot more heat than it receives from sunshine. Remarkable, considering Jupiter's a cold 500 million miles from our Sun.

Its stormy atmosphere doesn't have a clear lower boundary but transitions gradually down into a central core of molten metallic hydrogen. Its the surface cloud bands that are known to observers. In 1979 the Voyager spacecraft transmitted the first detailed images of these bands and the famous Great Red Spot. In 1995 the Galileo spacecraft dropped a probe down into the Jovian clouds. It gathered valuable information before it was crushed by extreme atmospheric pressures. Now we have over 20 year of Hubble Space Telescope views of storms in the Jovian bands.

The darker orange-brown bands called belts are made of descending air that swirls in spot-like cyclones bordered by wild instabilities. Between them the lighter bands are called zones. At a higher elevation they're whitened by cold icy crystals of ammonia.

In 1995, Comet Shoemaker-Levy 9 crashed explosively into Jupiter. Spectroscopic studies were able to detect gases thrown out from below the surface. Still what really goes on below is a deep dark mystery.

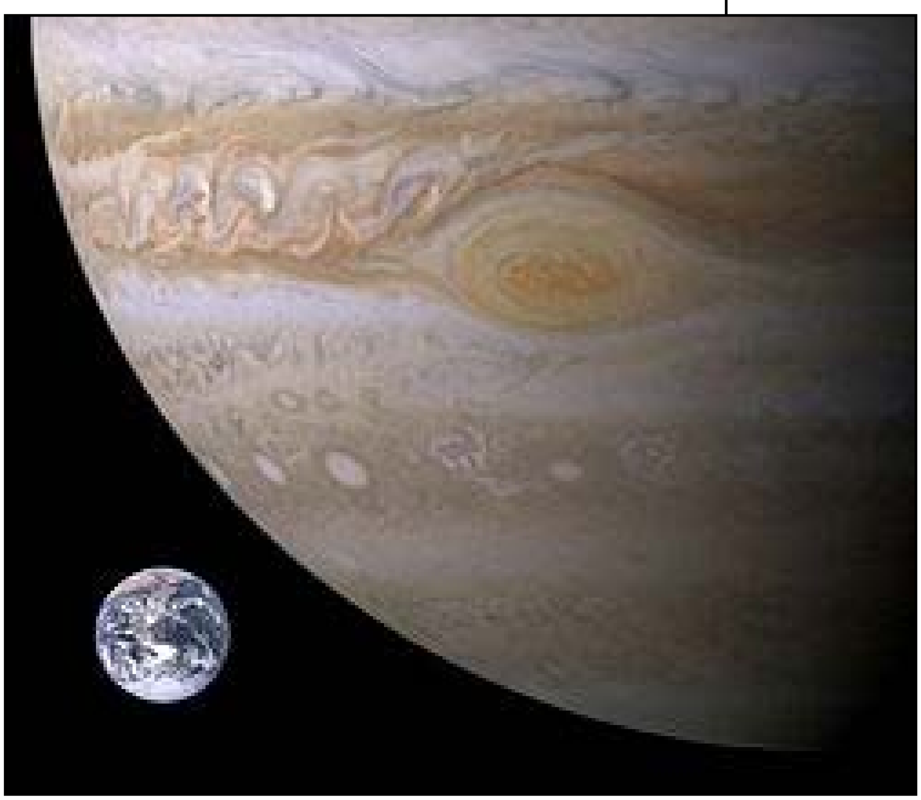
The red-orange belts have powerful storms with lightning strikes hundreds the size of Earth lightning. Methane and hydrogen sulfide, are involved along with small amounts of carbon, nitrogen, sulfur, and oxygen. With all these elements, a flying or floating alien life form could exist at warmer lower levels but it would be truly weird.

The most fascinating features visible on the windy surface are the great spot-like vortices that grow and shrink. The Great Red Spot is the largest and oldest stormy vortex in the solar system. This Jovian feature was first observed by astronomers Robert Hooke and Gian Domenico Cassini. Descriptions were published by the Royal Society in 1665. In 1700 a painting by Donato Creti showed the heavens with Jupiter having a large red spot. It was based on information from Italian astronomer Eustachio Manfredi. This was the first depiction of the Great Red Spot. So the GRS existed as early as the 17thcentury, although it wasn't seriously measured until the 1870's. We now know that its maximum length averages about 25,000 miles. That's three times the Earth's diameter. But early observers merely used the GRS to determine Jupiter's speed of rotation.

Better telescopes encouraged a study of the GRS itself as the largest storm in the solar system. It has been around for hundreds of years, is it a never ending storm or will it eventually die out?

Observations indicate that the Great Red Spot was larger about 1890. Since 1900 it has been gradually getting smaller. Confusion exists because the GRS often blends in with the windy lighter ring that surrounds it. Its redness also varies. But after all, it's a huge hurricane

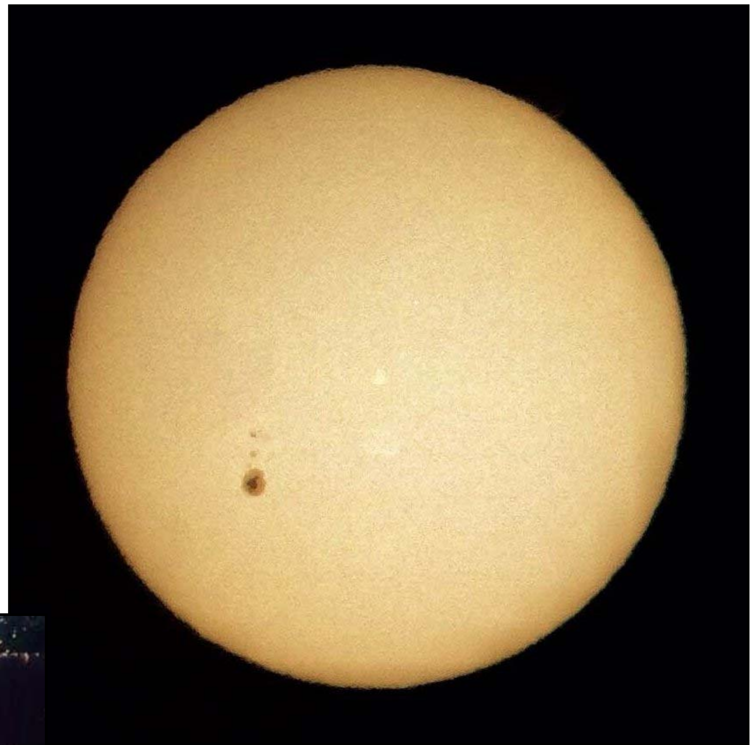
All of the belts feature strings of smaller storms which appear, fade and then often revive through the years. Named by color, there are white ovals, brown ovals, even ochre ovals. Smaller storms are called spots or curly festoons, even though most are Earth sized or larger. In 2010 a Red Spot Jr. half the size of the Great Red Spot appeared near it only to fade into white in a few years. Infrared studies can show how some (like GRS) are cooler and higher in the atmosphere than others. But it's unknown what rising volcanic type forces begin the formation of these spots.



Nor is it known how Jupiter's powerful magnetic field influences the bands or their stormy spots. Jupiter has the largest, strongest magnetic field in the solar system, some 20,000 times stronger than Earth's magnetosphere. It's powerful radiation has damaged space probes. It creates a giant disk of ionized gas plasma that reaches out as far as its inner most moons This magnetic storm would make it impossible for a manned spacecraft to go anywhere near Jupiter without suffering fried electrical circuits and fatal doses of hard radiation that would kill its crew. Truly a dangerously stormy giant.

Lee Collins

Getting Ready for Mercury



The planet Mercury will transit the sun on the morning of Monday, May 9. Mercury transits are not as rare as the more famous transits of Venus, but they still only come around once or twice a decade on average. The last Mercury transits before this one were in 2003 and 2006, and the next two after this year will be in 2019 and 2032. From southern California, the transit will already be underway when the sun rises at 5:57 AM, maximum transit (the point when Mercury is the furthest inside the sun's disk as seen from Earth) will be at 7:58, and Mercury will exit the sun's disk between 11:39 and 11:42 AM.

For the transit of Venus in 2012, I used a simple homemade device called a "sun funnel" attached to a small reflecting telescope to project an image of the sun. You can read more about that here:
https://10minuteastronomy.wordpress.com/2012/07/04/observing-report-the-transit-of-venus-in-claremont/.

The sun funnel worked well enough – I also used it for the annular eclipse in 2012 and the partial eclipse in 2014 – but the screen material degraded the resolution somewhat. Mercury is a lot smaller than Venus, and much closer to the sun, and both of those factors make it appear much smaller than Venus during a transit.

I want maximum resolution for observing and photographing the upcoming transit, so I finally sprung for a full-aperture solar film filter for my 80mm telescope. I got it out the other day for a test drive and got some decent photos of the current large sunspot AR2529. I'm pretty happy with the results – now if we can just get clear skies on the morning of May 9. If you're curious, the filter I got is the GoSky Optics full-aperture filter with Baader solar film. There are several sizes available to fit all kinds of telescopes, and the filter attaches securely to your telescope tube or dewshield with three nylon-tipped screws. I got the filter for telescopes 81-113mm in diameter (outside tube or dewshield diameter, not optical diameter!), which is currently a little under $50 on Amazon
http://www.amazon.com/Gosky-Optics-Aperture-Astronomical-Telescope/dp/B013SA3QTU.

Unfortunately, I won't be here in California to share the transit with you. I'll be in Utah chasing dinosaurs from May 4 to May 14, so I'll have to catch the transit from there. I'm driving up and bringing my 80mm scope to take advantage of dark Utah skies in the evenings. If you'll be traveling and want to plan your own transit observation, or just want to investigate how the transit will appear from various points on Earth's surface, this interactive map is excellent:
http://xjubier.free.fr/en/site_pages/transits/xST_GoogleMap3.php?Trt=+20160509&Acc=2.

And if you need safe, inexpensive ways to observe the sun, check out my page on safe solar observing:
https://10minuteastronomy.wordpress.com/safely-observe-the-sun/.

Clear skies!

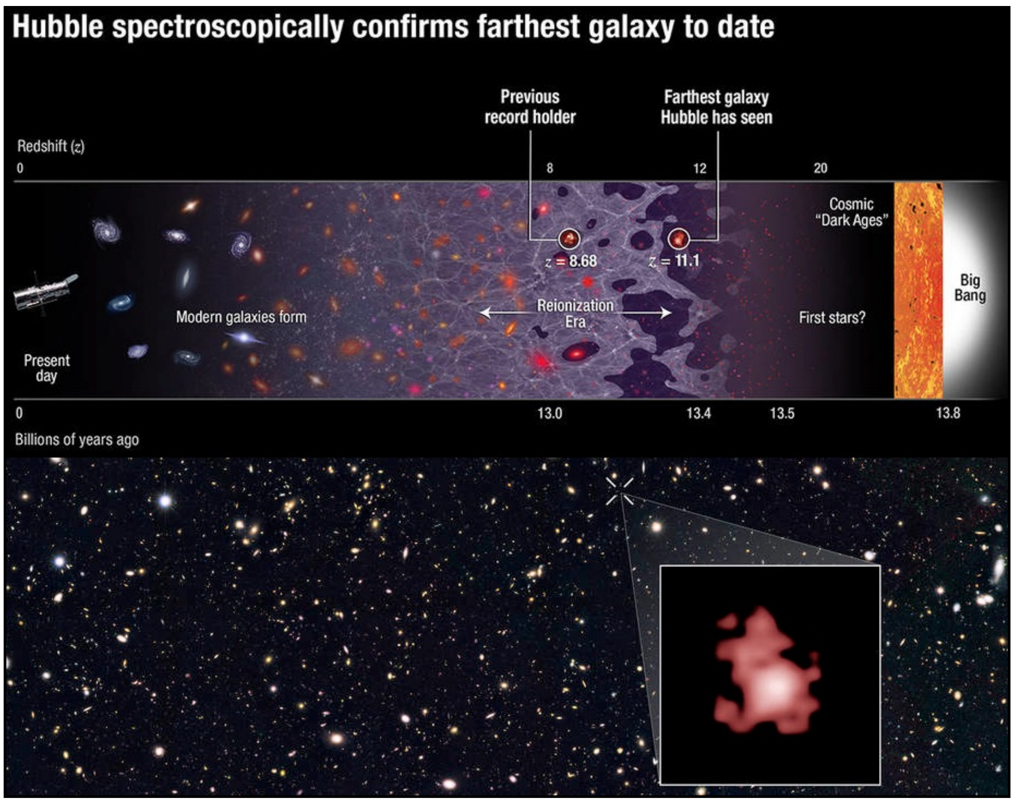
Matt Wedel

Hubble Shatters The Cosmic Record For Most Distant Galaxy

.The farther away you look in the distant universe, the harder it is to see what's out there. This isn't simply because more distant objects appear fainter, although that's true. It isn't because the universe is expanding, and so the light has farther to go before it reaches you, although that's true, too. The reality is that if you built the largest optical telescope you could imagine -- even one that was the size of an entire planet -- you still wouldn't see the new cosmic record-holder that Hubble just discovered: galaxy GN-z11, whose light traveled for 13.4 billion years, or 97% the age of the universe, before finally reaching our eyes.

There were two special coincidences that had to line up for Hubble to find this: one was a remarkable technical achievement, while the other was pure luck. By extending Hubble's vision away from the ultraviolet and optical and into the infrared, past 800 nanometers all the way out to 1.6 microns, Hubble became sensitive to light that was severely stretched and redshifted by the expansion of the universe. The most energetic light that hot, young, newly forming stars produce is the Lyman-α line, which is produced at an ultraviolet wavelength of just 121.567 nanometers. But at high redshifts, that line passed not just into the visible but all the way through to the infrared, and for the newly discovered galaxy, GN-z11, its whopping redshift of 11.1 pushed that line all the way out to 1471 nanometers, more than double the limit of visible light!

Hubble itself did the follow-up spectroscopic observations to confirm the existence of this galaxy, but it also got lucky: the only reason this light was visible is because the region of space between this galaxy and our eyes is mostly ionized, which isn't true of most locations in the universe at this early time! A redshift of 11.1 corresponds to just 400 million years after the Big Bang, and the hot radiation from young stars doesn't ionize the majority of the universe until 550 million years have passed. In most directions, this galaxy would be invisible, as the neutral gas would block this light, the same way the light from the center of our galaxy is blocked by the dust lanes in the galactic plane. To see farther back, to the universe's first true galaxies, it will take the James Webb Space Telescope. Webb's infrared eyes are much less sensitive to the light-extinction caused by neutral gas than instruments like Hubble. Webb may reach back to a redshift of 15 or even 20 or more, and discover the true answer to one of the universe's greatest mysteries: when the first galaxies came into existence!



Ethan Siegel

Images credit: (top); NASA, ESA, P. Oesch (Yale University), G. Brammer (STScI), P. van Dokkum (Yale University), and G. Illingworth (University of California, Santa Cruz) (bottom), of the galaxy GN-z11, the most distant and highest-redshifted galaxy ever discovered and spectroscopically confirmed thus far.

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