The Spectrogram

Newsletter for the Society of Telescopy, Astronomy, and Radio

May 2015

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S*T*A*R
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May Meeting

The next meeting of S*T*A*R will be held Thursday, May 7 at 8 p.m. at Monmouth Museum. The agenda for the meeting will be presentations of astronomy-related equipment. Members can bring scopes and other equipment to show the club, and ask questions about devices in which they have an interest.

Calendar

May 7, 2015 – S*T*A*R meeting

May 8, 2015 – Monmouth University star party

May 15, 2015 – Holmdel Park star party

June 4, 2015 – S*T*A*R meeting

April Meeting Minutes

By Rob Nunn

S*T*A*R met Thursday, April 2, 2015 at Monmouth Museum. The meeting was called to order at 8 p.m. by president Kevin Gallagher. There were 38 people in attendance. Attendees included about 15 people from Monmouth Camera Club, plus three other first time attendees.

After welcoming new attendees, Kevin introduced the night's speaker. Dr. William Gutsch is a professor at Saint Peter's University in Jersey City, New Jersey. He is past chairman of the Hayden Planetarium and past president of the Astronomical Society of the Pacific. The title of his talk was "Stalking and Shooting the Northern Lights."

Dr. Gutsch began his talk with an account of early beliefs about the northern lights, or aurora borealis. The name comes from the Roman Goddess Aurora, who announces the arrival of dawn each day. Some peoples considered the aurora to be spirits of the dead playing ball with the skull of a walrus, or spirits of animals.

He then presented a description of solar activity and its relation to the aurora. The sun exhibits spots that appear dark in visible light, but very bright in x-ray radiation. The spots are regions of strong magnetic fields, and are observed to occur in numbers that form a cycle of about eleven years. The sun has just recently passed a sunspot maximum.

Sunspots are associated with regions of strong solar activity that includes solar flares and Coronal Mass Ejections (CMEs). Flares produce strong electromagnetic radiation, while CMEs generate enormous clouds of charged particles moving at speeds of millions of miles per hour. These events can have a power equivalent to that of millions of hydrogen bombs being exploded in a second.

If a CME travels toward Earth, its particles interact with the earth's magnetic field. The magnetic field deflects many particles, but some follow the magnetic field lines toward the earth's poles. The particles then interact with atoms in the earth's atmosphere at heights from about 50 to 200 miles. The interaction generates light whose color is determined by the type of atom in the interaction. The region of interaction forms a ring around the magnetic pole. As the strength of the cloud of particles increases, the width of the ring increases. For the strongest CME clouds, the ring can be seen from New Jersey.

The shape of the ring is determined by the structure of the CME, which changes slowly over a matter of hours. Earth rotates below that ring structure. Forecasts about the strength of the aurora are made from information collected by the Advanced Corporation Explorer satellite, which orbits between Earth and the sun about one million miles from Earth. Forecasts are available at the website www.swpc.noaa.gov.

Dr. Gutsch then showed photographs he took of the aurora in October of 2014 from Tromso, Norway, which is about 200 miles north of the arctic circle. The images were strikingly beautiful, with vivid green and red colors, and shapes resembling ribbons and curtains. Some more complex shapes hinted at angels. The aurora can provide enough light to read a newspaper, and can cover the entire sky. Shapes can be seen to change over a period of a few seconds. A video shown at many times true speed illustrated the complex motions of the curtains and ribbons.

Dr. Gutsch finished his talk with a discussion of photographic techniques, and an announcement of an arranged tour to Tromso to take place in November. Information about the tour is available from Unique Photo. Go to their web site at www.uniquephoto.com , then the "classes and workshops" tab at the top of the page. Photographic equipment needed includes a camera with low noise at high ISO, a wide-angle lens, and a heavy tripod. Exposures times are about 10 seconds, ISO is a few thousand, and precise focus can be achieved by imaging the Pleiades.

The audience greatly enjoyed the talk by Dr. Gutsch. His description of the aurora process was very informative, he answered many questions, and his images were spectacular.

Following a break, Ken Legal presented events of the month. Comet Lovejoy is still visible at magnitude 6.5. There is a magnitude 5 nova in Sagitarius. Venus is visible in the evening sky, and will be staying up later in coming weeks, eventually setting close to midnight. Sirius B is nearing the point of greatest separation from Sirius, making this a time with the best chance to see Sirius B.

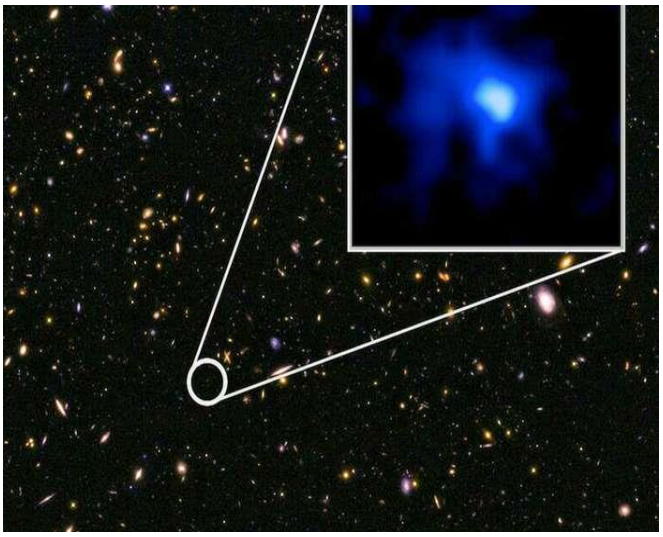
Kevin then conducted the announcement and business portion of the meeting. April 17/18 is an observing session at Dorbrook. April 25 is a star party at Holmdel Park. We then discussed possible new meeting locations. Monmouth University has offered a free room, and may construct an observatory on the roof of the science building. Russ Drum will arrange a time for several members to visit the proposed location. Holmdel Park might offer us use of its activity center. Andy Zangle, Russ Drum, and George Zanetakos offered to investigate meeting site possibilities. Steve Seigel suggested changing the meeting night to one other than Thursday because other groups meet on Thursday. Jay Respler suggested that the club rate speakers as advanced, intermediate, or beginning so that we are less likely to disappoint new attendees. Kevin noted that the club has been offered a donation of an eight-inch Celestron scope. George Zanetakos reported that the observing site at Colliers Mills is available. Kevin reminded the club that Gordon plans to have the new 25-inch scope at the April 25 star

party. Dave Britz, Mike Kozik, and Steve Siegel are investigating scopes that might be purchased when the 25-inch scope is sold. Mike and George Zanetakos will look at possible scopes at NEAF. Jay Respler announced that another club that he belongs to is having a picnic on May 16, and invited STAR members. Dave Britz received a request for a speaker at a retirement community, and believes such a community might be a source of new members. Finally, Kevin announced that he is willing to host a picnic at his house.

The meeting concluded about 10:30 p.m.

Astronomers unveil the farthest galaxy

May 5, 2015



The galaxy EGS-zs8-1 sets a new distance record. It was discovered in images from the Hubble Space Telescope's CANDELS survey. Credit: NASA, ESA, P. Oesch and I. Momcheva (Yale University), and the 3D-HST and HUDF09/XDF teams

(Phys.org) An international team of astronomers led by Yale University and the University of California-Santa Cruz have pushed back the cosmic frontier of galaxy exploration to a time when the universe was only 5% of its present age.

The team discovered an exceptionally luminous galaxy more than 13 billion years in the past and determined its exact distance from Earth using the powerful MOSFIRE instrument on the W.M. Keck Observatory's 10-meter telescope, in Hawaii. It is the most distant galaxy currently measured.

The galaxy, EGS-zs8-1, was originally identified based on its particular colors in images from NASA's Hubble and Spitzer space telescopes. It is one of the brightest and most massive objects in the early universe. Age and distance are vitally connected in any discussion of the universe. The light we see from our Sun takes just eight minutes to reach us, while the light from distant galaxies we see via today's advanced telescopes travels for billions of years before it reaches us—so we're seeing what those galaxies looked like billions of years ago.

"It has already built more than 15% of the mass of our own Milky Way today," said Pascal Oesch, a Yale astronomer and lead author of a study published online May 5 in *Astrophysical Journal Letters*. "But it had only 670 million years to do so. The universe was still very young then." The new distance measurement also enabled the astronomers to determine that EGS-zs8-1 is still forming stars rapidly, about 80 times faster than our galaxy.

Only a handful of galaxies currently have accurate distances measured in this very early universe. "Every confirmation adds another piece to the puzzle of how the first generations of galaxies formed in the early universe," said Pieter van Dokkum, the Sol Goldman Family Professor of Astronomy and chair of Yale's Department of Astronomy, who is second author of the study. "Only the largest telescopes are powerful enough to reach to these large distances."

The MOSFIRE instrument allows astronomers to efficiently study several galaxies at the same time. Measuring galaxies at extreme distances and characterizing their properties will be a major goal of astronomy over the next decade, the researchers said.

The new observations establish EGS-zs8-1 at a time when the universe was undergoing an important change: The hydrogen between galaxies was transitioning from a neutral state to an ionized state. "It

appears that the young stars in the early galaxies like EGS-zs8-1 were the main drivers for this transition, called reionization," said Rychard Bouwens of the Leiden Observatory, co-author of the study.

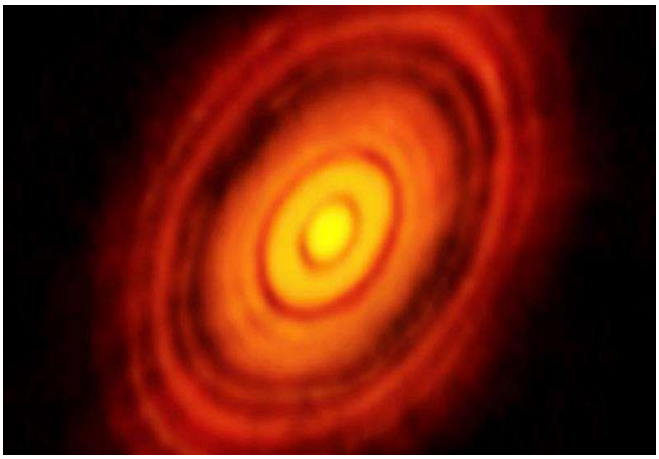
Taken together, the new Keck Observatory, Hubble, and Spitzer observations also pose new questions. They confirm that massive galaxies already existed early in the history of the universe, but they also show that those galaxies had very different physical properties from what is seen around us today. Astronomers now have strong evidence that the peculiar colors of early galaxies—seen in the Spitzer images—originate from a rapid formation of massive, young stars, which interacted with the primordial gas in these galaxies.

The observations underscore the exciting discoveries that are possible when NASA's James Webb Space Telescope is launched in 2018, note the researchers. In addition to pushing the cosmic frontier to even earlier times, the telescope will be able to dissect the galaxy light of EGS-zs8-1 seen with the Spitzer telescope and provide astronomers with more detailed insights into its gas properties.

"Our current observations indicate that it will be very easy to measure accurate distances to these distant galaxies in the future with the James Webb Space Telescope," said co-author Garth Illingworth of the University of California-Santa Cruz. "The result of JWST's upcoming measurements will provide a much more complete picture of the formation of galaxies at the cosmic dawn."

Astrophysicists offer proof that famous image shows forming planets

May 5, 2015 by Don Campbell



This image sparked scientific debate when it was released last year, with researchers arguing over whether newly forming planets were responsible for gaps in the dust and gas swirling around the young star. Credit: Atacama Large Millimeter/submillimeter Array (ALMA)

(Phys.org) A recent and famous image from deep space marks the first time we've seen a forming planetary system, according to a study by University of Toronto astrophysicists.

The team, led by Daniel Tamayo from the Centre for Planetary Science at U of T Scarborough and the Canadian Institute for Theoretical Astrophysics, found that circular gaps in a disk of dust and gas swirling around the young star HL Tau are in fact made by forming planets.

"HL Tau likely represents the first image taken of the initial locations of planets during their formation," says Tamayo. "This could be an enormous step forward in our ability to understand how planets form."

The image of HL Tau, taken in October 2014 by the state-of-the-art Atacama Large Millimeter/submillimeter Array (ALMA) located in Chile's Atacama Desert, sparked a flurry of scientific debate.

While those who observed the original image claimed that planets were most likely responsible for carving the gaps, some remained skeptical. It had been suggested that the gaps, especially the outer three, could not represent forming planets because they are so close together. It was argued that planets massive enough to carve such gaps should be scattered violently by the force of gravity and ejected from the system early on in its development.

But Tamayo's study is the first to suggest the gaps are evidence of planetary formation because the gaps are separated by amounts consistent with what's called a special resonant configuration. In other words, these planets avoid violent collisions with each other by having specific orbital periods where they miss each other, similar to how Pluto has avoided Neptune for billions of years despite the two orbits crossing one another.

Tamayo created two videos to show how HL Tau would appear in both resonant and non-resonant configurations.

The system can be much more stable in a resonant configuration and it's a natural state for planets in the HL Tau system to migrate to says Tamayo.

The HL Tau system is less than a million years old, about 17.9 billion kilometres in radius and resides 450 light years from Earth in the constellation Taurus.

Since young systems like HL Tau are shrouded by a thick cloud of gas and dust, they can't be observed using visible light. ALMA resolves that issue by using a series—or an array—of telescopes located 15 kilometres apart that use much longer wavelengths. The result is unprecedented access to high resolution images that Tamayo says will continue to revolutionize the study of planetary formation.

"We've discovered thousands of planets around other stars and a big surprise is that many of the orbits are much more elliptical than those found in our solar system" said Tamayo.

This and future ALMA discoveries may be the key to connecting these discovered planets to their original birth locations.

While the HL Tau system remains stable in its relatively young age, Tamayo says over billions of years it will act as a "ticking time bomb." Eventually the planets will scatter, ejecting some and leaving the remaining bodies on elliptical orbits like the ones found around older stars.

Our solar system does not seem to have undergone such a dramatic scattering event, notes Tamayo. Future observations could also go a long way in determining whether our solar system is typical or an oddity ideally suited for life.

"If further observations show these to be the typical starting conditions around other stars, it would reveal our solar system to be a remarkably special place," says Tamayo.

Are you a S*T*A*R Member?

S*T*A*R meets the first Thursday of each month, except July and August, at 8:00 p.m. at Monmouth Museum on the campus of Brookdale Community College in Lincroft, NJ. Meetings usually include a presentation of about one hour by a guest speaker, a break for refreshments and socializing, a description of interesting objects to view, and a discussion of club business.

Memberships:
( )Individual...$35
( ) Family...$45
( ) Student…$15

Name_____

Address_____

City_____State___Zip_____

Phone_____

Email_____
Make checks payable to: STAR Astronomy Society, Inc. and mail to P.O. Box 863, Red Bank, NJ 07701

The club owns 8" f/8, and 13" f/4.5 Dobsonian telescopes which are available for use by members. To borrow a telescope, please contact the Vice President.

The officers of S*T*A*R are:
President Kevin Gallagher
Vice President Rob Nunn
Secretary Michelle Paci
Treasurer Arturo Cisneros
Member at Large Dave Britz

S*T*A*R members can join the Astronomical League (AL) for a small fee. Members receive the AL publication Reflector.

In the Eyepiece

Here is a list of objects for this month. This is reproduced from www.skyhound.com with the kind permission of its creator and author of SkyTools Greg Crinklaw.

Object(s)	Class	Con	RA	Dec	Mag
Izar	Multiple Star	Bootes	14h44m59.2s	+27°04'27"	2.4
Xi Boo	Multiple Star	Bootes	14h51m23.4s	+19°06'02"	4.5
44 Boo	Multiple Star	Bootes	15h03m47.4s	+47°39'15"	4.8
M 3	Globular Cluster	Canes Venatici	13h42m11.8s	+28°22'24"	6.3
NGC 5466	Globular Cluster	Bootes	14h05m27.7s	+28°31'49"	9.2
39 Boo	Multiple Star	Bootes	14h49m41.3s	+48°43'15"	5.7
M 53	Globular Cluster	Coma Berenices	13h12m56.2s	+18°09'56"	7.7
Pi 1 Boo	Multiple Star	Bootes	14h40m43.6s	+16°25'06"	4.5
Whirlpool (M51)	Galaxy	Canes Venatici	13h29m52.4s	+47°11'41"	8.9
The Pinwheel (M101)	Galaxy	Ursa Major	14h03m12.5s	+54°20'53"	8.3
NGC 5474 & Co.	Galaxies near M101	Ursa Major	14h05m01.4s	+53°39'45"	11.3
NGC 5529	Galaxy	Bootes	14h15m34.2s	+36°13'35"	12.7
IC 5217	Planetary nebula	Lacerta	22h23m55.7s	+50°58'00"	12.6
NGC 5774 & 5775	Galaxy Pair	Virgo	14h53m42.6s	+03°34'55"	12.8
NGC 5371	Galaxy	Canes Venatici	13h55m39.8s	+40°27'43"	11.5
Hickson 68	Galaxy Group	Canes Venatici	13h53m40.9s	+40°19'41"	10.5
NGC 5634	Globular Cluster	Virgo	14h29m38.1s	-05°58'42"	9.5
NGC 5053	Globular Cluster	Coma Berenices	13h16m28.2s	+17°41'44"	9.0
Arp 84	Interacting Galaxies	Canes Venatici	13h58m38.0s	+37°25'28"	12.1
IC 972	Planetary Nebula	Virgo	14h04m26.0s	-17°13'41"	14.9
UGC 7321	Superthin Galaxy	Com	12h17m34.1s	+22°32'26"	14.1

Coordinates are epoch 2000.0