FIRST LIGHT

Journal of the South Bay Astronomical Society – December 2017
on line at http://sbastro.net/
On Facebook at facebook.com/SBAstroSociety
On Yahoo Groups at: https://groups.yahoo.com/neo/groups/SBASTRO/info

Monthly General Meeting: Friday December 1st 7:30 PM

"TBD"

TBD

The November 3 Meeting

President Ken Rossi rang the meeting to order at 7:37, and welcomed Jim Hill as a newcomer. He also thanked the various members who have worked to keep the SBAS running all these years, but noted that we do not have a full roster of candidates for the upcoming election, and our club may have to scale back its operations if we don't have enough active members to keep it functioning. In particular, we may have to abandon the practice of having monthly meetings, a mission that we have faithfully kept going since the SBAS was founded.

This would be a shame, as we have been able to attract high-quality speakers from NASA and from local colleges and universities, giving us the opportunity to hear about modern astronomy firsthand from important members of the astronomical community. We have been fortunate in ways that most amateur astronomers can only dream of, and it may all go away if we don't get a few members volunteering to join the Executive. No final decisions have been made, and members in good standing are urged to communicate with President Rossi and present themselves as candidates at our December meeting.

After a ten-minute social break, President Rossi introduced David Nakamoto of the Griffith Observatory, who spoke on "The Curious Case of BL Lacertae". The light variability of this object was discovered in 1929 at the Sonneberg Observatory in Germany, and was given its variable-star designation because at the time nobody thought it could be anything else. Its brightness varied irregularly between magnitudes 14 and 17, and was largely ignored for the next few decades because little information could be deduced from the light curves of irregular variable stars.

This changed with the advent of radio astronomy, when it was discovered that BL Lacertae emitted radio waves. This is highly unusual for any star, but the radio waves were also found to occur across the radio spectrum, they were polarized, and they rotated their orientation over a time scale of mere hours. When BL Lacertae's visible spectrum was examined, it was found to have no absorption lines or emission lines. This made the object remarkable, but with no lines to study, nothing about the object's composition or velocity could be determined.

Measurements of its colors (technically, its value of U-B and B-V) placed it between the quasars and the N galaxies (galaxies that each have a small, bright, blue nucleus). This suggested that the object might not be a star at all. The 200-inch Palomar telescope was used by the astronomers Oke and Gunn to take the spectrum of the very faint nebulosity around BL Lacertae, with the light of BL Lacertae itself blocked from view, and they detected the spectrum of an elliptical galaxy 800 million light-years away.

It is now understood that the BL Lacertae objects, for which BL Lacertae itself is the prototype, are quasars with jets

pointing toward the observer, rather than tilted or hidden by the surrounding galaxy as occurs in quasars themselves. Both quasars and BL Lacertae objects are distant galaxies that have massive black holes at their centers, and in the early Universe these black holes swallowed lots of matter, creating bright jets that are heated by friction and can't create spectral lines as gas does in stellar atmospheres. The ionized gas creates electric currents that create magnetic fields, and these magnetic fields polarize the light. As the jets emitting the gas change, the polarization changes as well.

David Nakamoto ended his lecture by answering many questions from the audience of 20. This brought the meeting to a close at 9:28.

- Dr. Steven Morris

This article is provided by NASA Space Place.

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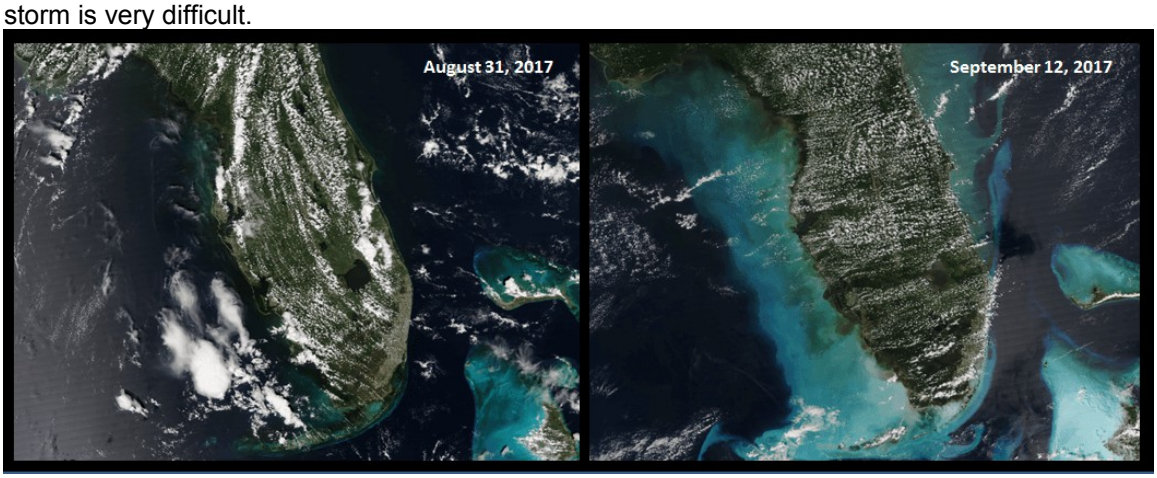
Studying Storms from the Sky

By Teagan Wall

The United States had a rough hurricane season this year. Scientists collect information before and during hurricanes to understand the storms and help people stay safe. However, collecting information during a violent storm is very difficult.



These images of Florida and the Bahamas were captured by a satellite called Suomi-NPP. The image on the left was taken before Hurricane Irma and the image on the right was taken after the hurricane. The light color along the coast is dirt, sand and garbage brought up by the storm. Image credit: NASA/NOAA

Hurricanes are constantly changing. This means that we need a lot of really precise data about the storm. It's pretty hard to learn about hurricanes while inside the storm, and instruments on the ground can be broken by high winds and flooding. One solution is to study hurricanes from above. NASA and NOAA can use satellites to keep an eye on storms that are difficult to study on the ground.

In Puerto Rico, Hurricane Maria was so strong that it knocked out radar before it even hit land. Radar can be used to predict a storm's path and intensity—and without radar, it is difficult to tell how intense a storm will be. Luckily, scientists were able to use information from a weather satellite called GOES-16, short for Geostationary Operational Environmental Satellite – 16.

The "G" in GOES-16 stands for geostationary. This means that the satellite is always above the same place on the Earth, so during Hurricane Maria, it never lost sight of the storm. GOES-16's job as a weather satellite hasn't officially started yet, but it was collecting information and was able to help.

From 22,000 miles above Earth, GOES-16 watched Hurricane Maria, and kept scientists on the ground up to date. Knowing where a storm is—and what it's doing—can help keep people safe, and get help to the people that need it.

Hurricanes can also have a huge impact on the environment—even after they're gone. To learn about how Hurricane Irma affected the Florida coast, scientists used images from an environmental satellite called Suomi National Polar-orbiting Partnership, or Suomi-NPP. One of the instruments on this satellite, called VIIRS (Visible Infrared Imaging Radiometer Suite), took pictures of Florida before and after the Hurricane.

Hurricane Irma was so big and powerful, that it moved massive amounts of dirt, water and pollution. The information captured by VIIRS can tell scientists how and where these particles are moving in the water. This can help with recovery efforts, and help us design better ways to prepare for hurricanes in the future.

using satellites like GOES-16 and Suomi-NPP to observe severe storms, researchers and experts stay up to date in a safe and fast way. The more we know about hurricanes, the more effectively we can protect people and the environment from them in the future.

To learn more about hurricanes, check out NASA Space Place: https://spaceplace.nasa.gov/hurricanes/

SBAS Executive Board

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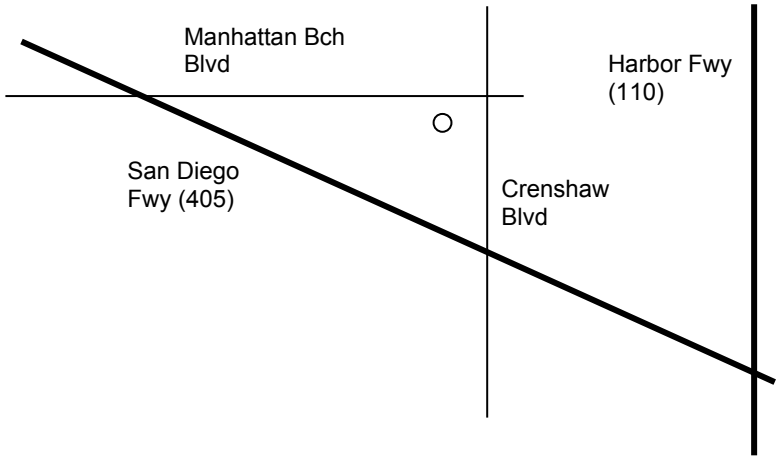
Monthly General Meetings

We normally meet on the first Friday of each month at 7:30 p.m. in the Planetarium at El Camino College (16007 Crenshaw Bl. In Torrance). If the first Friday is on or close to a holiday, we usually defer the meeting until the second Friday of the month. The Planetarium is on the south side of Manhattan Beach Blvd., one block west of Crenshaw Blvd. (near the center of the map at left).



The planetarium is the only round, domed building on campus. There is on-street parking, and we can often use campus parking: check inside to see if you need a FREE parking permit for your car.

We enjoy the planetarium facilities through the courtesy of the El Camino College Administration, and have several faculty members of the Astronomy Department as members of our Club. Our meetings always include an informal opening, when new attendees are invited to introduce themselves and let us know about their interests in astronomy. Members share their latest news and observations at this time. The rest of the evening is devoted to guest speakers, who range from amateur astronomers to professional astronomers to representatives from local aerospace companies to college professors. We are fortunate to have all these talented people in our area, willing to come and talk to us.

Monthly Planning Meeting

Committee members (and anyone else with an interest in Society activities) meet each month, usually on the Monday following the general meeting. Meetings are sometimes rescheduled due to travel and other circumstances. Exact date and time of each month's meeting will be announced in the monthly meeting. The December planning meeting will be held at the home of TBD..

SBAS Dues

Month Join/Due	Member (Family) Email Only	Student	Expires
January	$40.00	$25.00	Dec
February	$36.67	$22.92	Dec
March	$33.33	$18.75	Dec
April	$30.00	$20.83	Dec
May	$26.67	$18.75	Dec
June	$23.33	$16.67	Dec
July	$20.00	$14.58	Dec
August	$16.67	$12.50	Dec
September	$13.33	$10.42	Dec
October	$10.00	$8.33	Dec
November	$6.67	$6.25	Dec
December	$3.33	$4.17	Dec

Note to Current U.S. Mail Members: The SBAS Board has decided that it is no longer cost effective to publish and mail out hard copies of the FirstLight. Since this decision was made after some 2016 renewals for U.S. Mail memberships were received, we will either refund the difference or extend your full 2015 membership though March of 2016.

To simplify the dues, we suggest that all membership expire in December. Dues are $40.00/year ($25.00/year for students) and expire on December 31, of the current year. The FirstLight is now only available via Email notification and on our web site. New members use Month Join, and current members select your expiring Month to calculate the amount. Members that expire in October or December may wish to write one check and include next year's membership. Make checks payable to the South Bay Astronomical Society. Dues may be paid at the general meeting or mailed to:

South Bay Astronomical Society
Attn: Greg Benecke
P.O. Box 1937
Redondo Beach, CA 90278

SBAS Membership Benefits

Contact Greg Benecke for magazine subscriptions at club rates: "Sky & Telescope" $32.95 and "Astronomy" $34.00/1 year or $60.00/2 years!
Note: S&T subscribers at the club rate renew their subscriptions by mailing their renewal notice and check or calling the 800# on the renewal notice.
Only new subscribers or subscribers converting their subscription to the club rate need to contact Arnie or send a check to the PO Box. Astronomy subscriptions and renewals still go through Arnie or via the PO Box.

Astronomy Technology Today has become a digital only magazine. They have stated that current print subscribers will continue to be able to access digital issues without any cost. New subscribers should check their website for ordering details and subscription costs (www.astronomytechnologytoday.com).

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This year, there is an additional option for club member to order or renew. If you prefer, you can complete your individual transaction online with a credit card. Please follow the instructions below:

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2) When prompted for the promotion code, type in your club's unique offer code "RCLUB165" and click the "Get Offer" button.
3) Select the order term (1 year, 2 years, or 3 years).
4) Enter your name, address and credit card information. Please note: you do not need to enter the promotion code a second time on this order page. That entry field can be disregarded.
5) Click on the "Submit" button. You will receive a confirmation page immediately. Please print this page for your records.

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Astronomical League Observing Clubs

All SBAS members in good standing are also members of the Astronomical League and are eligible to participate in the League's Observing Clubs. The Astronomical League provides many different observing programs (clubs). These programs are designed to provide a direction for your observations and to provide a goal. The programs have certificates and pins to recognize the observers' accomplishments and for demonstrating their observing skills with a variety of instruments and objects. For more information, go to:
http://www.astroleague.org/observing.html.

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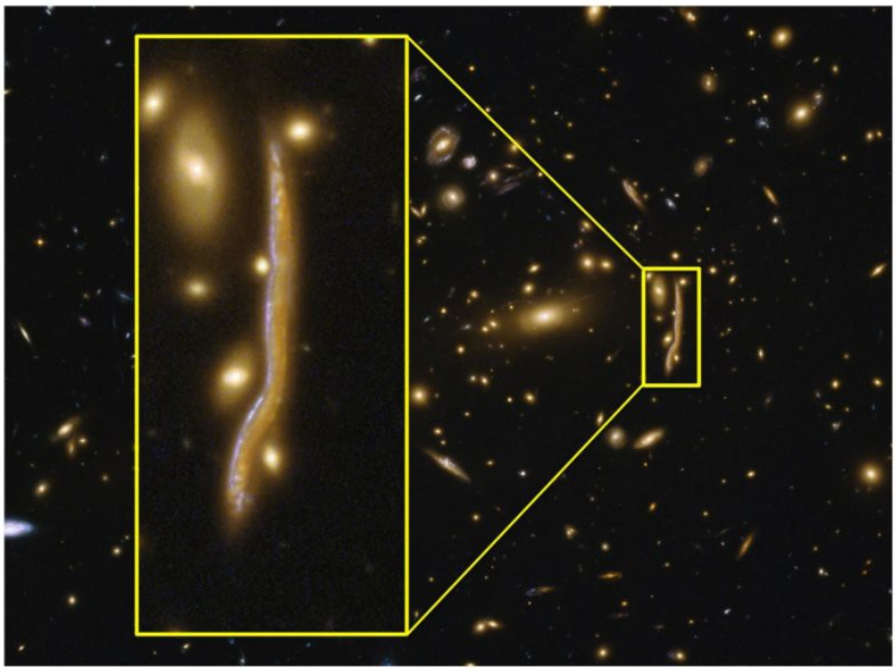
Useful and Interesting Astronomy Websites

Website	Description
http://www.calsky.com/	A useful site for planning an evening's star gazing if you don't have your own planetarium software.
https://www.aavso.org/	Information for observers with an interest in tracking variable stars.
http://www.cleardarksky.com/csk/prov/California_clocks.html	Good site to check to know what the weather will be like where you might be planning on going.
http://ssd.jpl.nasa.gov/horizons.cgi	Great site to use when you want to find a new comet or asteroid that isn't already in your planetarium software's list. See the Ephemeris Generator file on the SBAS Yahoo group site for instructions.
http://heavens-above.com	Check this site to find out what satellites may be visible in your sky.
http://www.lunar-occultations.com/iota/iotandx.htm	Website for the International Occultation Timing Association. Good place to find information on asteroid occultations of background stars.
http://pictures.ed-morana.com/ISSTransits/predictions/	Find out when the ISS will transit in front of the Sun or Moon as seen from your location.
http://www.aerith.net/comet/weekly/current.html	Weekly information on bright comets. Good place to learn where there are bright comets to be seen. Refer to the Horizons website above to generate ephemerides.
http://sohowww.nascom.nasa.gov/	See the sun in ways you might never have imagined! You can even create your own movies of the sun in different the different frequencies imaged by the SOHO spacecraft.

Anatomy of a cosmic snake reveals structure of distant galaxies

Science Daily – November 13, 2017 - We have a fair understanding of the fundamental mechanisms that regulate star formation in galaxies, from the interstellar matter to the diffuse clouds distributed in space, whose gravitational contraction leads to the birth of stars within large stellar clusters. But observations of distant galaxies have questioned this picture, the size and mass of these distant stellar nurseries largely exceeding that of their local counterparts. An international team of astrophysicists led by the Universities of Geneva (UNIGE), Switzerland, for the observations and Zurich (UZH) for the simulations has tackled this inconsistency, which seems to question our knowledge of star formation when we study the early Universe, far away in time and space. They have found the first answers thanks to the observation of the Cosmic Snake. Their study is published in the journal *Nature Astronomy*.



The Cosmic Snake is the image of a distant galaxy, deflected by a strong gravitational lens.

Credit: ESA/Hubble, NASA, A.Cava

The study of star formation relies on the coordinated work of several international teams that perform observations on different scales. The Hubble Space Telescope, when pointed toward high-redshift galaxies, studies in detail very distant objects when the Universe was much younger than its present age, far away from us both in time and space.

These observations have triggered an unexpected debate amongst astronomers: in the distant past, was star formation governed by different laws or physical conditions? This is what data from the Hubble Space Telescope was apparently suggesting when observations of distant galaxies revealed the presence of giant star forming regions, clumps of gas and stars attaining sizes as large as 3000 light-years, a thousand times larger than those observed in the nearby Universe. And these giant clumps, intriguingly, appeared to be ubiquitous in high-redshift galaxies.

The need for a gravitational telescope

The distance that separates us from these objects prevents their detailed observation, but the astronomers have overcome this difficulty exploiting gravitational lensing, a powerful "instrument" that is offered by the Universe itself, and the laws that govern it. The telescope is pointed in direction of an extremely massive object able to deviate with its gravitational field the path of the light coming from a more distant galaxy located behind it. The light is deflected by the massive object, creating thus multiple and amplified images of the galaxy. In our case, the astronomers have pointed Hubble at a huge gravitational lens, which generates several stretched, warped and almost overlapping images of the galaxy, featuring a true Cosmic Snake in the sky. "The amplified image is more precise, luminous, and allows us to observe details up to 100 times smaller," explains Antonio Cava, lead author of the study and Research and Teaching fellow in the Department of Astronomy at the UNIGE.

The fact that the image of the source galaxy is repeated five times at different spatial resolutions allows, for the first time, to perform a direct comparison and to establish the intrinsic structure -- and size -- of the observed giant clumps. Far from concluding that different laws hold in the young and distant Universe, the international team of astronomers led by UNIGE, and including researchers from the CNRS, the Universities of Zurich and Lyon, and the Universidad Complutense de Madrid, have discovered that the giants clumps are in reality not so large and massive

as suggested by previous Hubble observations, but that they are intrinsically smaller or composed by multiple and unresolved small components, something that was not possible to directly prove so far. The researchers are thus supporting the simulations developed by Valentina Tamburello from the Institute of Computational Science at UZH. Co-author of the study, she stresses that "thanks to the incredibly high resolution of the cosmic snake, we were able to compare our calculations with the UNIGE observations and confirm their match. This was an incredible luck for us."

This is an important step towards the understanding of the fundamental mechanisms driving star formation in distant galaxies, even if it does not completely explain some of the observed differences with respect to local galaxies. "We have reduced the differences between what we observe in the nearby Universe and in distant galaxies from a factor 1000 to a factor 10," stresses Daniel Schaerer, professor at the Geneva Observatory. He also points out the compelling convergence of ground-breaking observations and sophisticated state-of-the-art simulations, such as those developed by the UZH collaborators, which suggest that the remaining differences can be explained by the turbulent nature of the distant galaxies.

Dark matter and dark energy: Do they really exist?

Science Daily – November 22, 2017 - For close on a century, researchers have hypothesized that the universe contains more matter than can be directly observed, known as "dark matter." They have also posited the existence of a "dark energy" that is more powerful than gravitational attraction. These two hypotheses, it has been argued, account for the movement of stars in galaxies and for the accelerating expansion of the universe respectively. But -- according to a researcher at the University of Geneva (UNIGE), Switzerland -- these concepts may be no longer valid: the phenomena they are supposed to describe can be demonstrated without them. This research, which is published in *The Astrophysical Journal*, exploits a new theoretical model based on the scale invariance of the empty space, potentially solving two of astronomy's greatest mysteries.

In 1933, the Swiss astronomer Fritz Zwicky made a discovery that left the world speechless: there was, claimed Zwicky, substantially more matter in the universe than we can actually see. Astronomers called this unknown matter "dark matter," a concept that was to take on yet more importance in the 1970s, when the US astronomer Vera Rubin called on this enigmatic matter to explain the movements and speed of the stars. Scientists have subsequently devoted considerable resources to identifying dark matter -- in space, on the ground and even at CERN -- but without success. In 1998 there was a second thunderclap: a team of Australian and US astrophysicists discovered the acceleration of the expansion of the universe, earning them the Nobel Prize for physics in 2011. However, in spite of the enormous resources that have been implemented, no theory or observation has been able to define this black energy that is allegedly stronger than Newton's gravitational attraction. In short, black matter and dark energy are two mysteries that have had astronomers stumped for over 80 years and 20 years respectively.

A new model based on the scale invariance of the empty space

The way we represent the universe and its history are described by Einstein's equations of general relativity, Newton's universal gravitation and quantum mechanics. The model-consensus at present is that of a big bang followed by an expansion. "In this model, there is a starting hypothesis that hasn't been taken into account, in my opinion," says André Maeder, honorary professor in the Department of Astronomy in UNIGE's Faculty of Science. "By that I mean the scale invariance of the empty space; in other words, the empty space and its properties do not change following a dilatation or contraction." The empty space plays a primordial role in Einstein's equations as it operates in a quantity known as a "cosmological constant," and the resulting universe model depends on it. Based on this hypothesis, Maeder is now re-examining the model of the universe, pointing out that the scale invariance of the empty space is also present in the fundamental theory of electromagnetism.

Do we finally have an explanation for the expansion of the universe and the speed of the galaxies?

When Maeder carried out cosmological tests on his new model, he found that it matched the observations. He also found that the model predicts the accelerated expansion of the universe without having to factor in any particle or dark energy. In short, it appears that dark energy may not actually exist since the acceleration of the expansion is contained in the equations of the physics.

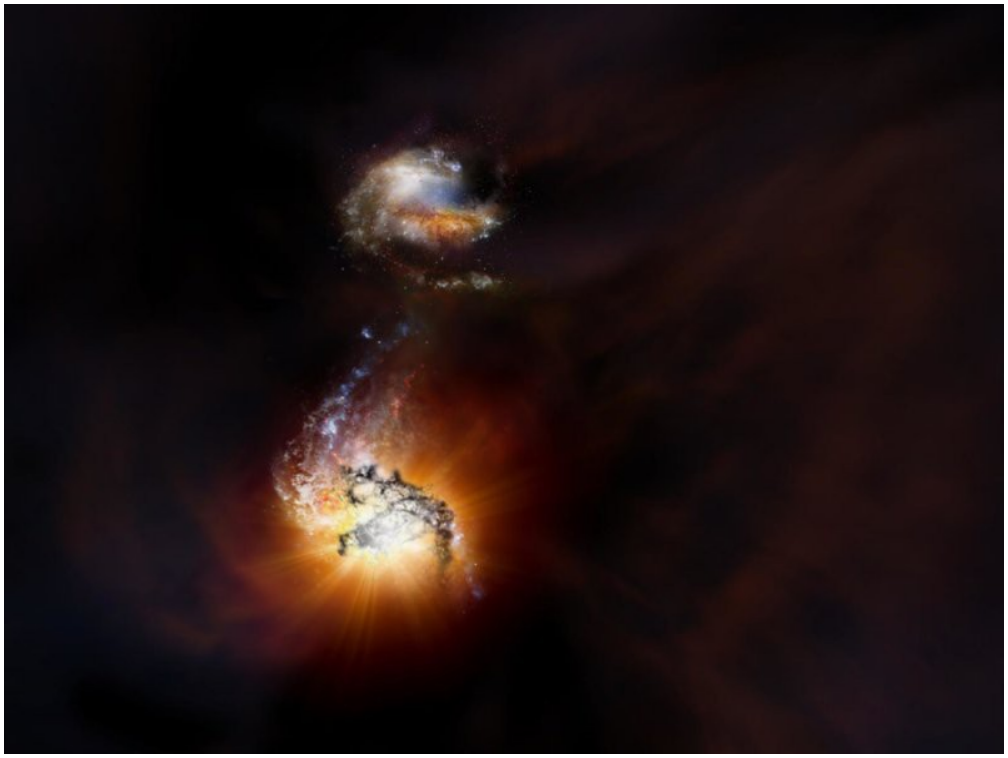
In a second stage, Maeder focused on Newton's law, a specific instance of the equations of general relativity. The law is also slightly modified when the model incorporates Maeder's new hypothesis. Indeed, it contains a very small outward acceleration term, which is particularly significant at low densities. This amended law, when applied to

clusters of galaxies, leads to masses of clusters in line with that of visible matter (contrary to what Zwicky argued in 1933): this means that no dark matter is needed to explain the high speeds of the galaxies in the clusters. A second test demonstrated that this law also predicts the high speeds reached by the stars in the outer regions of the galaxies (as Rubin had observed), without having to turn to dark matter to describe them. Finally, a third test looked at the dispersion of the speeds of the stars oscillating around the plane of the Milky Way. This dispersion, which increases with the age of the relevant stars, can be explained very well using the invariant empty space hypothesis, while there was before no agreement on the origin of this effect.

Maeder's discovery paves the way for a new conception of astronomy, one that will raise questions and generate controversy. "The announcement of this model, which at last solves two of astronomy's greatest mysteries, remains true to the spirit of science: nothing can ever be taken for granted, not in terms of experience, observation or the reasoning of human beings," concluded André Maeder.

Duo of titanic galaxies captured in extreme starbursting merger

Science Daily – November 13, 2017 - New observations with the Atacama Large Millimeter/submillimeter Array (ALMA) have uncovered the never-before-seen close encounter between two astoundingly bright and spectacularly massive galaxies in the early universe. These so-called hyper-luminous starburst galaxies are exceedingly rare at this epoch of cosmic history -- near the time when galaxies first formed -- and may represent one of the most-extreme examples of violent star formation ever observed.



This is an artist impression of two starbursting galaxies beginning to merge in the early universe.
Credit: NRAO/AUI/NSF

Astronomers captured these two interacting galaxies, collectively known as ADFS-27, as they began the gradual process of merging into a single, massive elliptical galaxy. An earlier sideswiping encounter between the two helped to trigger their astounding bursts of star formation. Astronomers speculate that this merger may eventually form the core of an entire galaxy cluster. Galaxy clusters are among the most massive structures in the universe.

"Finding just one hyper-luminous starburst galaxy is remarkable in itself. Finding two of these rare galaxies in such close proximity is truly astounding," said Dominik Riechers, an astronomer at Cornell University in Ithaca, New York, and lead author on a paper appearing in the *Astrophysical Journal*. "Considering their extreme distance from Earth and the frenetic star-forming activity inside each, it's possible we may be witnessing the most intense galaxy merger known to date."

The ADFS-27 galaxy pair is located approximately 12.7 billion light-years from Earth in the direction of the Dorado constellation. At this distance, astronomers are viewing this system as it appeared when the universe was only about one billion years old.

Astronomers first detected this system with the European Space Agency's Herschel Space Observatory. It appeared as a single red dot in the telescope's survey of the southern sky. These initial observations suggested that the

apparently faint object was in fact both extremely bright and extremely distant. Follow-up observations with the Atacama Pathfinder EXperiment (APEX) telescope confirmed these initial interpretations and paved the way for the more detailed ALMA observations.

With its higher resolution and greater sensitivity, ALMA precisely measured the distance to this object and revealed that it was in fact two distinct galaxies. The pairing of otherwise phenomenally rare galaxies suggests that they reside within a particularly dense region of the universe at that period in its history, the astronomers said.

The new ALMA observations also indicate that the ADFS-27 system has approximately 50 times the amount of star-forming gas as the Milky Way. "Much of this gas will be converted into new stars very quickly," said Riechers. "Our current observations indicate that these two galaxies are indeed producing stars at a breakneck pace, about one thousand times faster than our home galaxy."

The galaxies -- which would appear as flat, rotating disks -- are brimming with extremely bright and massive blue stars. Most of this intense starlight, however, never makes it out of the galaxies themselves; there is simply too much obscuring interstellar dust in each.

This dust absorbs the brilliant starlight, heating up until it glows brightly in infrared light. As this light travels the vast cosmic distances to Earth, the ongoing expansion of the universe shifts the once infrared light into longer millimeter and submillimeter wavelengths, all thanks to the Doppler effect.

ALMA was specially designed to detect and study light of this nature, which enabled the astronomers to resolve the source of the light into two distinct objects. The observations also show the basic structures of the galaxies, revealing tail-like features that were spun-off during their initial encounter.

The new observations also indicate that the two galaxies are about 30,000 light-years apart, moving at roughly several hundred kilometers per second relative to each other. As they continue to interact gravitationally, each galaxy will eventually slow and fall toward the other, likely leading to several more close encounters before merging into one massive, elliptical galaxy. The astronomers expect this process to take a few hundred million years.

"Due to their great distance and dustiness, these galaxies remain completely undetected at visible wavelengths," noted Riechers. "Eventually, we hope to combine the exquisite ALMA data with future infrared observations with NASA's James Webb Space Telescope. These two telescopes will form an astronomer's 'dream team' to better understand the nature of this and other such exceptionally rare, extreme systems."

Schedule of Coming Events

Date	Event
1 December Friday Night 7:30PM	**Monthly General Meeting** **Topic: "**TBA**"** **Speaker:** TBA
3 December	**Super Moon** Full moon arrives at Lunar perigee.
6 December Monday Night 7:30 PM	**Monthly Planning Meeting** See directions on Page 4.
9 December	**Last Quarter Moon**
9 December Saturday Evening	**In Town Dark Sky Observing Session at Ridgecrest Middle School–** 28915 NortbBay Rd. RPV, Weather Permitting**:** Please contact Greg Benecke to confirm that the gate will be opened.
13 December	**Geminids Meteor Shower Peak** The Geminids are a meteor shower caused by object 3200 Phaethon, which is thought to be a Palladian asteroid with a "rock comet" orbit. This would make the Geminids, together with the Quadrantids, the only major meteor shower not originating from a comet. This shower has been intensifying every year and 120-160 meteors/hour have been seen under optimal conditions.
16 December Saturday Night	**Out of Town Dark Sky Observing Session** Contact Greg Benecke to coordinate a location.
17 December	**New Moon**
22 December	**Ursids Meteor Shower Peak** A relatively minor meteor shower with a ZHR of 10.
26 December	**First Quarter Moon**

South Bay Astronomical Society

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Next General Meeting at El Camino College Planetarium

Friday, December 1st 7:30 PM

"TBA"

TBA

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South Bay Astronomical Society
P.O. Box 1937
Redondo Beach, CA 90278