The Prairie Astronomer

August 2015 Volume 56, Issue #8

Beautiful Pluto

A Color Enhanced LORRI image taken on July 13, 2015

August Program

Michael Sibbernsen
"The Sky is Falling"

In this Issue:

Night Sky Network

The Newsletter of the Prairie Astronomy Club

NEXT PAC MEETING:
August 25, 7:30pm

Program

Our guest speaker this month will be Michael Sibbernsen from the Department of Physics and Astronomy at the University of Nebraska- Lincoln. Michael will be presenting “The Sky is Falling,” and will share with us his wonderful collection of meteorites and impactites. During the program, you will learn about the three main types of meteorites, and even get a chance to hold one of these artifacts from the formation of our solar system. Michael will also give us updates on Branched Oak Observatory and the Eclipse-Nebraska Consortium.

PAC E-Mail:
info@prairieastronomyclub.org

PAC-LIST:
Subscribe through GoogleGroups. To post messages to the list, send to the address:

pac-list@googlegroups.com

The Prairie Astronomer is published monthly by the Prairie Astronomy Club, Inc. Membership expiration date is listed on the mailing label. Membership dues are: **Regular $30/yr, Family $35/yr**. Address all new memberships and renewals to: **The Prairie Astronomy Club, Inc., PO Box 5585, Lincoln, NE 68505-0585**. For other club information, please contact one of the club officers listed to the right. Newsletter comments and articles should be submitted to: **Mark Dahmke, P. O. Box 5585, Lincoln, NE 68505 or** mark@dahmke.com**,** no less than ten days prior to the club meeting. The Prairie Astronomy Club meets the last Tuesday of each month at Hyde Memorial Observatory in Lincoln, NE.

Events

PAC Meeting
Tuesday August 25th, 2015, 7:30pm
Hyde Observatory

PAC Meeting
“Beginning Astrophotography” Brett Boller
Tuesday Sept 29th, 2015, 7:30pm
Hyde Observatory

PAC Meeting
“Filters” (tentative), Dave Knisely
Tuesday October 27th, 2015, 7:30pm
Hyde Observatory

Newsletter submission deadline Aug 16

PAC Star Party Dates

Dates in bold are closest to the new moon

2015 Star Party Dates
Jan 16,**23**, Feb 13,**20**
Mar 13,**20**, Apr 10,**17**
May 8,**15**, Jun 12,**19**
Jul 10,**17**
NSP **Jul 12-17**
Aug 7,**14**, Sep 4,**11**
Oct **9**,16, Nov 6,**13**
Dec 4,**11**

Lunar Party Dates
Mar 27, Apr 24, Jul 24, Aug 21

(Lunar party dates are tentative, sites to be determined.)

Address

The Prairie Astronomer
c/o The Prairie Astronomy Club, Inc.
P.O. Box 5585
Lincoln, NE 68505-0585

Club Membership Info

REGULAR MEMBER - $30.00 per year. Includes club newsletter, and 1 vote at club meetings, plus all other standard club privileges.

FAMILY MEMBER - $35.00 per year. Same as regular member except gets 2 votes at club meetings.

STUDENT MEMBER - $10.00 per year with volunteer requirement.

If you renew your membership prior to your annual renewal date, you will receive a 10% discount.

Club members are also eligible for special subscription discounts on Sky & Telescope Magazine.

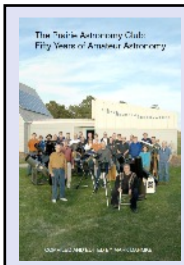
Club Telescopes

To check out one of the club telescopes, contact Dave Churilla. If you keep a scope for more than a week, please check in once a week, to verify the location of the telescope and how long you plan to use it. The checkout time limit will be two weeks, but can be extended if no one else has requested use of a club scope.

100mm Orion refractor: Available

10 inch Meade Dobsonian: Available

13 inch Truss Dobsonian: Available



Buy the book! The Prairie Astronomy Club: Fifty Years of Amateur Astronomy. Order online from Amazon or lulu.com.

Club Officers

President	Jim Kvasnicka (402) 423-7390 jim.kvasnicka@yahoo.com
Vice President	Brett Boller proboller86@yahoo.com
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Secretary	Lee Taylor otaylor88@gmail.com
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Club Observing Chair	Jim Kvasnicka jim.kvasnicka@yahoo.com
Outreach Coordinator	Dan Delzell dan@delzell.net
Website and Newsletter Editor	Mark Dahmke mark@dahmke.com

Websites

www.prairieastronomyclub.org
https://nightsky.jpl.nasa.gov
www.hydeobservatory.info
www.nebraskastarparty.org
www.OmahaAstro.com
Panhandleastronomyclub.com
www.universetoday.com/
www.planetary.org/home/
http://www.darksky.org/

Club Apparel

Order club apparel from cafepress.com:

Shop through Amazon Smile to automatically donate to PAC:

PAC Meeting Minutes

Minutes for the meeting of July 28, 2015

President Jim Kvasnicka called the meeting to order, 10 members, 7 Guests

Jim welcomed new visitors, and members to the meeting.

Upcoming Events

The next PAC meeting will be at 7:30PM on Tuesday September 29 at Hyde.

Hyde Memorial Observatory is open every Saturday night, except major holidays.

We have several requests for outreach events in the coming months.

August 15, Girl Scouts at Hilltop House in Lincoln from 7-10 PM. We have a few volunteers for this.

Sept. 12 NE City's Wildwood Historic Center

September 26 & 27 Spring Creek Prairie has asked us to be a part of their Twilight on the Tall Grass this year. They would also like a representative from PAC for the Eclipse.

Sept 27 Homestead National Monument has requested help for an event on the evening of the eclipse as well.

October 24, Homestead will present its annual Howling Homestead, and again has invited us to participate.

Jim gave his monthly Observing Report

Treasurer's Report

John mentioned the funds available for the Earl Moser memorial, and presented an accounting of club funds. We have found a suitable item for this and have a committee to work on what is necessary for completing this project. The committee consists of: Ron Veys, Mark Dahmke, and Lee Taylor.

Jim's Mother-in-Law has sold the land we currently use for our observing site, to her son. No change in our arrangements with Jim's family is anticipated, but Jim will keep us posted.

Adjourn to program, NSP review.

Respectfully Submitted by,

Lee Taylor

PAC Board Meeting Minutes

PAC Board of Directors Meeting

August 11, 2015

Members Present

President, Jim Kvasnicka

Vice President, Brett Boller

2nd VP, Dave Churilla

Secretary, Lee Taylor

Treasurer, John Reinert

Outreach Coordinator, Dan Delzell

Newsletter editor, Mark Dahmke

Jim called the meeting to order.

Dave reviewed the programs for the upcoming months. The tentative schedule is as follows:

- August: Michael Sibbernsen, 'The Sky Is Falling' on meteors.
- September: Dan Delzell on outreach.
- October: Brett Boller on beginning astrophotography
- November: How to buy a telescope.
- December: PAC Holiday gathering.
- January: How to use a telescope.

Dan had a suggestion about the format of the November meeting. The idea of having stations with each of the different types of telescopes to allow people to see them, ask questions, etc. Dave mentioned a station for accessories, budgets, and so on. Mark said eliminating as much jargon as possible could be helpful. Terms such as aperture, and collimation can be confusing and intimidating to a beginner. Using things like diameter, and alignment can be more useful. We discussed ways to increase attendance at meetings as well. We will put notices on our usual outlets. Mark also mentioned that we could “revive an old tradition” of door prizes, as well as use of the informal survey we have used in the past. Dave recommended having a club star party at Hyde sometime.

Outreach requests.

Dan presented a list of outreach requests we have for the next couple of months. Dan has a list of volunteers who have signed up for each of the events. He has people for everything except the eclipse requests.

Jim wanted to put an article in the newsletter about outreach and all the events we do for the community.

Jim asked about elections for next year. And whether any of us are considering running for office again.

Solar Eclipse preparation

Jim wanted to discuss preparations for the total solar eclipse in 2017. Our priority currently is to decide how to train those outside the club who want our help to properly observe the eclipse, and lead others in the experience. Essentially, provide them with the expertise they seek when they ask one of us to be present at their function. Mark noted that Mike Sibbernsen has a website and is coordinating resources for such activities. Mark suggested we work with Mike on this. Dave had an idea to get information out through media outlets with members making appearances to discuss and educate the public about how, where and when to observe the eclipse. Dave also suggested putting together a committee to prepare for the eclipse.

Treasurer's report

John presented a brief financial report and an update on memberships with additions and recent drops, as well as reports to the State of Nebraska and IRS. John wanted our opinions on how much personal information on members to share with other organizations like the Astronomical League. After some discussion, we decided to not change what John does in this regard.

Jim reminded us that his mother-in-law has sold the land we use for our observing site to her son. While he currently doesn't expect any changes to our use of it, we may have to consider other options in the future. Several ideas were discussed about this.

We also discussed progress and plans for the Earl Moser memorial sundial.

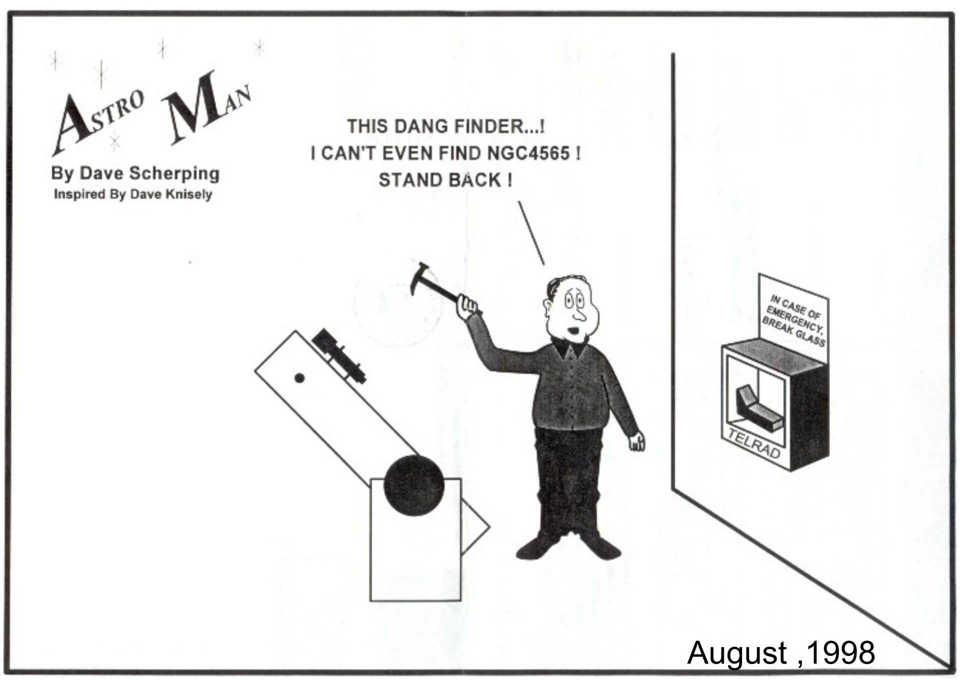
Finally, we discussed ways to make attendees to club meetings feel more welcome, and keep better track of attendance. One idea suggested was to begin taking attendance, ie: passing around a sign-up sheet at meetings and noting members, visitors, etc.

Mark mentioned the bylaws which require a published list of the membership. In the current time of email, and online newsletters, this has become impractical. Mark suggested some change in the bylaws and/or changing the way we record and publish our materials.

Meeting Adjourned

Respectfully submitted by,

Lee Taylor



Outreach: It's What We Do

Jim Kvasnicka, Club President

Outreach has been and continues to be one of the core values of the Prairie Astronomy Club. It is written in the Prairie Astronomy Club Bylaws under the Purpose:

The purpose of the club is to encourage, and to participate in the study of astronomy and related subjects for the benefit of its members and of the general public…

Outreach is an important part of what we do and an excellent way to promote the club to the public. To do outreach requires club members to volunteer. In September and October we have a number of requests for The Prairie Astronomy Club to help with public outreach events.

For the past couple of years we have had a small core group of members who have been doing most of the outreach events. We need some of our other members to step up and help as well. If you have never done an outreach event you will find it to be a rewarding and uplifting experience. I strongly encourage you to volunteer and help. If you are worried that you have never helped with an outreach event we will pair you up with another club member to help you get started and show you what to expect.

Please consider the opportunity to share your love of astronomy with others. The look on children's faces when they look through your telescope makes it all worthwhile.

Curiosity Rover's View of Alluring Martian Geology Ahead

A southward-looking panorama combining images from both cameras of the Mast Camera (Mastcam) instrument on NASA's Curiosity Mars Rover shows diverse geological textures on Mount Sharp.

Three years after landing on Mars, the mission is investigating this layered mountain for evidence about changes in Martian environmental conditions, from an ancient time when conditions were favorable for microbial life to the much-drier present.

Gravel and sand ripples fill the foreground, typical of terrains that Curiosity traversed to reach Mount Sharp from its landing site. Outcrops in the midfield are of two types: dust-covered, smooth bedrock that forms the base of the mountain, and sandstone ridges that shed boulders as they erode. Rounded buttes in the distance contain sulfate minerals, perhaps indicating a change in the availability of water when they formed. Some of the layering patterns on higher levels of Mount Sharp in the background are tilted at different angles than others, evidence of complicated relationships still to be deciphered.

Astronomy with the Girl Scouts at the Hilltop House

Dan Delzell

The Lincoln Girl Scouts had an astronomy themed event August 15th at the Hilltop House in north Lincoln. They'd asked the Prairie Astronomy Club to help. The leader, Renae Ninneman, attended the June PAC meeting to discuss the event. I was very pleased by the creative ideas suggested by the club.

As you know, an event that runs from 7:00 to 10:00 pm in August isn't ideal since sunset is about 8:30 and it's well after 9:00pm before it gets dark enough for astronomy. But Dave Churilla and Jim Kvasnicka volunteered to start the night with solar observing. John Reinert came early to help. Even though the sun was pretty quiet with just a few sunspots the girls were impressed with the views through Dave's Lunt, Hyde's Coronado and Jim's 10" Dobsonian.

When the sun was too low to observe, Dave Churilla gave a talk about the sun and stars, explaining fusion reactions and the stellar life cycle to the death of stars. The girls asked excellent questions.

Renae planned activities while we waited for it to get dark. We showed the Summer Constellation show and had a craft activity. They came back to the observing field about 9:15. Beth Jenckes operated my 12" Lightbridge, John had his 11" Celestron and Jim had his 10" Dobsonian to show the girls Saturn and other deep sky objects. I pointed out

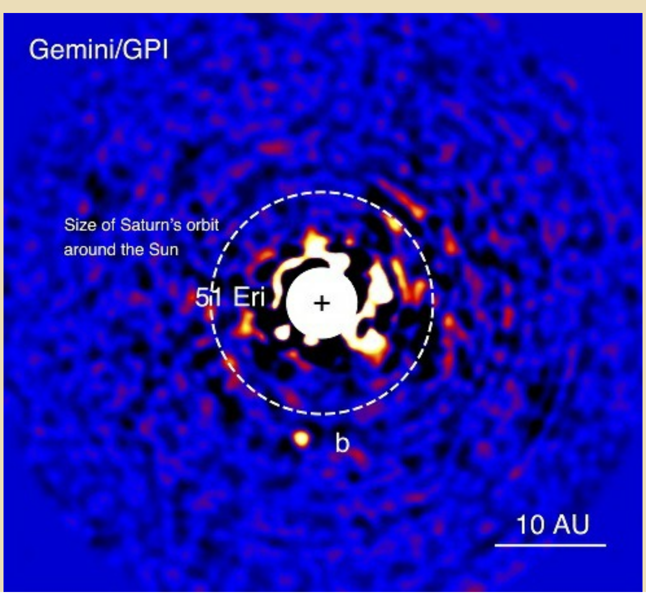
constellations, stars and explained the ISS pass.

The Hilltop House is a Girl Scout facility just north of 14th and Superior, so it's not the best place for astronomy. The Lincoln light dome dominated the southern sky and residential street lighting shined into the parking lot where we set up. But we still had a good time viewing what we could. The girls were excited and the parents and leaders were impressed. The girls were very smart. One asked me about the speed of time difference for the ISS astronauts. That's getting into Einsteinian physics, pretty advanced stuff for a 6th or 7th grader!

These events are what PAC is about; sharing the love of astronomy with the community. It's especially fun working with children. I find it a very rewarding part of the hobby. If you've never had the opportunity to help with an outreach even I encourage you to try to attend one of the upcoming events. You'll find it very fulfilling and that it enhances your love for astronomy.

Thank you Dave, Beth, John and Jim for helping! Renae is already talking about next year. We encouraged her to look at September or October so we can do more observing. But even with the short time and the light pollution it was a very fun night.

51 Eridani b Imaged



Discovery image of 51 Eri b with the Gemini Planet Imager taken in the near-infrared light on December 18, 2014. The bright central star has been mostly removed by a hardware and software mask to enable the detection of the exoplanet one million times fainter. Credits: J. Rameau (UdeM) and C. Marois (NRC Herzberg).

The planet, known as 51 Eridani b, orbits its host star at about 13 times the Earth-Sun distance (equivalent to being between Saturn and Uranus in our Solar System). The system is located about 100 light years away. The Gemini data also provide scientists with the strongest-ever spectroscopic detection of methane in the atmosphere of a planet outside of our Solar System, adding to its similarities to giant planets in our Solar System.

Cassini to Make Last Close Flyby of Saturn Moon Dione

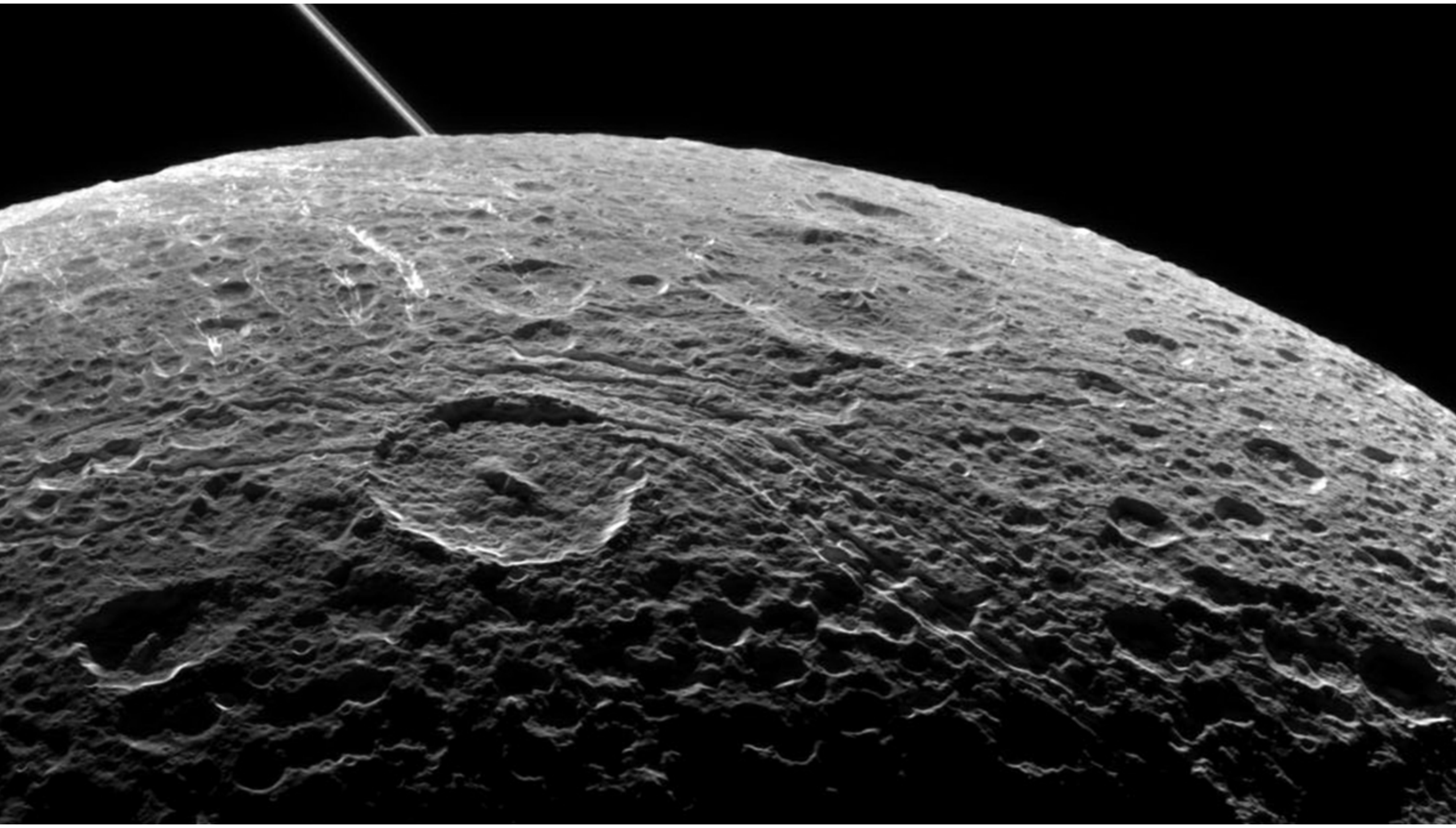
NASA's Cassini spacecraft will zip past Saturn's moon Dione on Monday, Aug. 17 -- the final close flyby of this icy satellite during the spacecraft's long mission.

Cassini's closest approach, within 295 miles (474 kilometers) of Dione's surface, will occur at 11:33 a.m. PDT (2:33 p.m. EDT). Mission controllers expect fresh images to begin arriving on Earth within a couple of days following the encounter.

Cassini scientists have a bevy of investigations planned for Dione. Gravity-science data from the flyby will improve scientists' knowledge of the moon's internal structure and allow comparisons to Saturn's other moons. Cassini has performed this sort of gravity science investigation with only a handful of Saturn's 62 known moons.

During the flyby, Cassini's cameras and spectrometers will get a high-resolution peek at Dione's north pole at a resolution of only a few feet (or meters). In addition, Cassini's Composite Infrared Spectrometer instrument will map areas on the icy moon that have unusual thermal anomalies -- those regions are especially good at trapping heat. Meanwhile, the mission's Cosmic Dust Analyzer continues its search for dust particles emitted from Dione.

This flyby will be the fifth targeted encounter with Dione of Cassini's tour at Saturn. Targeted encounters require maneuvers to precisely steer the spacecraft toward a desired path above a moon. The spacecraft executed a 12-second burn using its thrusters on Aug. 9, which fine-tuned the



A view of Saturn's moon Dione captured by NASA's Cassini spacecraft during a close flyby on June 16, 2015. The diagonal line near upper left is the rings of Saturn, in the distance. Image credit: NASA/JPL-Caltech/Space Science Institute.

trajectory to enable the upcoming encounter.

Cassini's closest-ever flyby of Dione was in Dec. 2011, at a distance of 60 miles (100 kilometers). Those previous close Cassini flybys yielded high-resolution views of the bright, wispy terrain on Dione first seen during the Voyager mission. Cassini's sharp views revealed the bright features to be a system of braided canyons with bright walls. Scientists also have been eager to find out if Dione has geologic activity, like Saturn's geyser-spouting moon Enceladus, but at a much lower level.

"Dione has been an enigma, giving hints of active geologic processes, including a transient atmosphere and evidence of ice volcanoes. But we've never found the smoking gun. The fifth flyby of Dione will be our last chance," said Bonnie Buratti, a Cassini science team member at NASA's Jet Propulsion Laboratory in Pasadena, California.

Cassini has been orbiting Saturn since 2004. After a series of close moon flybys in late 2015, the spacecraft will depart Saturn's equatorial plane -- where moon flybys occur most frequently -- to begin a year-long setup of the mission's daring final year. For its grand finale, Cassini will repeatedly dive through the space between Saturn and its rings.

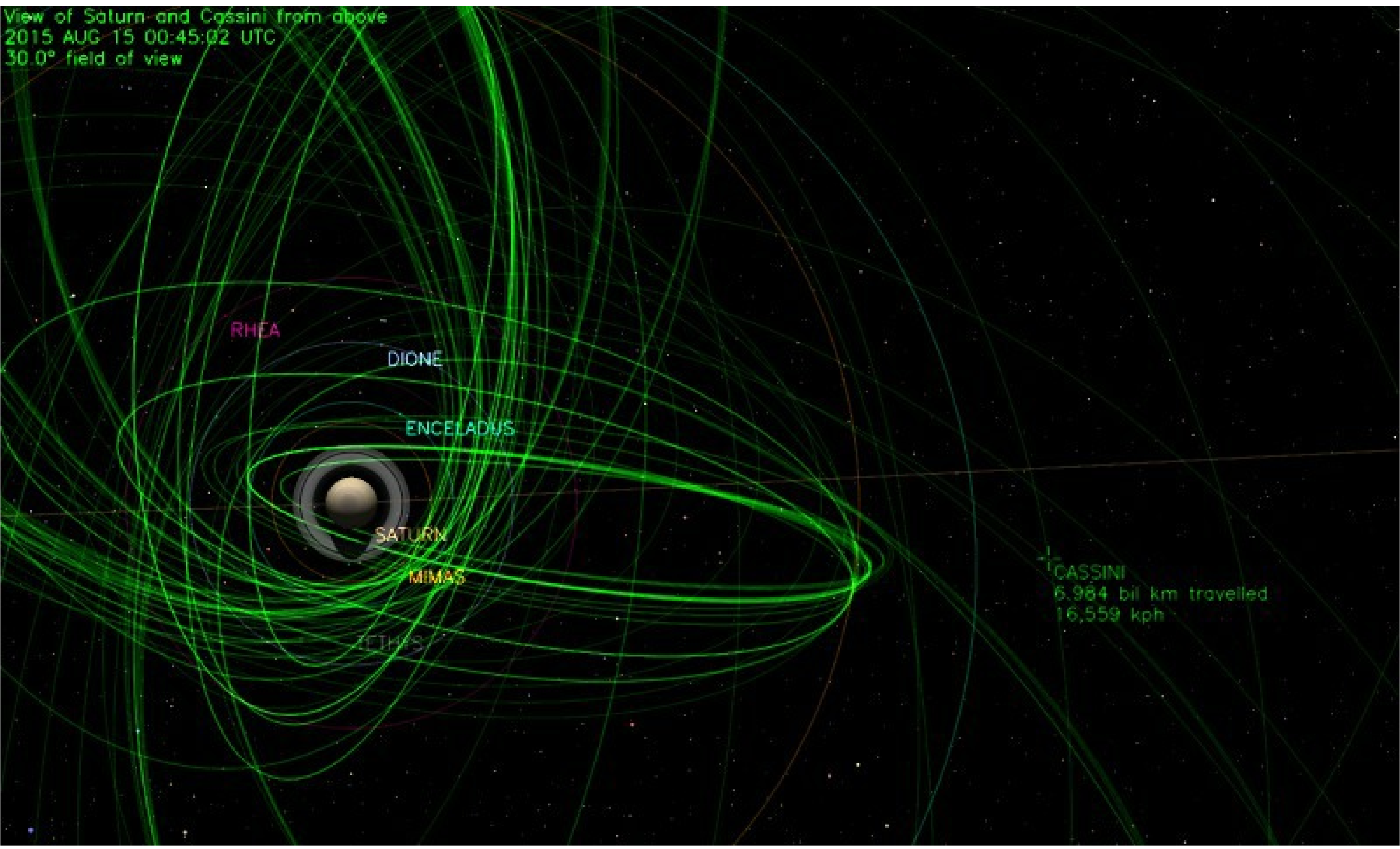
"This will be our last chance to see Dione up close for many years to come," said Scott Edgington, Cassini mission deputy project scientist at JPL. "Cassini has provided insights into this icy moon's mysteries, along with a rich data set and a host of new questions for scientists to ponder."

The Cassini-Huygens mission is a cooperative project of NASA, ESA (European Space Agency) and the Italian Space Agency. JPL, a division of the California Institute of Technology, manages the mission for NASA's Science Mission Directorate in Washington.

For more information about Cassini, visit:

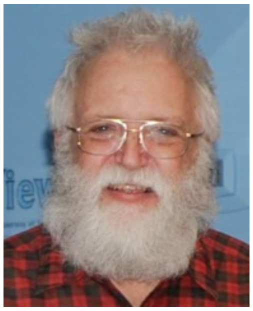
http://www.nasa.gov/cassini

http://saturn.jpl.nasa.gov



NGC 5247 A 3 Arm Unsymmetrical Spiral

Rick Johnson



NGC 5247 is a rather nearby galaxy in southern Virgo below my 15 degree limit. Due to clouds in the north I had open sky only to the south and seeing was above average allowing me to give it a try. It was on my list for two reasons. One it has two main arms but a third arm just floats not connected to the other two. Several spurs come off the two arms but this one seems unconnected to either. Arp had a category for such three armed spiral so it went on my Arp-like to-do list. The other reason is the very odd small but sharply defined dust cloud that cut right across the gap between the northern arm and the core coming to a point near the core then expanding in a puff beyond the bright core region after disappearing for a bit. While I found many papers on this galaxy not one mentions this odd dust lane.

A few HII regions appear faintly in my image. It is a bit over 70 million light-years distant by both redshift and a single non redshift estimate. Including the faint plumes to the east and west it is some 150,000 light-years across. Measuring just the main arms it is about 95,000 light-years across. It was discovered by William Herschel on March 17 1787. With its somewhat faint surface brightness it didn't make either of the Herschel 400 observing programs nor have I any record of trying to see it visually.

Located this low it is out of the Sloan and many other galaxy survey fields so it was the only

galaxy besides 2 2MASS galaxies which, since I was making an annotated image for the two asteroids I included. Unfortunately the pair of galaxies at the upper right I'd liked to have information on weren't listed as galaxies. The bluer one (upper right face on) was listed as an Ultraviolet source seen by GALEX but not identified further. Also another pair west and a bit south of the center of NGC 5247 isn't listed at all but NED does show a quasar candidate about half way between the two where I see nothing but overlapping galaxy. They give no magnitude nor size. But with an error circle of 5" it's hard to pin down what exactly it is seeing. Apparently not either galaxy. Considering several hundred UvS were seen by GALEX, most of which are stars I didn't try to determine which were galaxies.

Rosetta Comet In Action

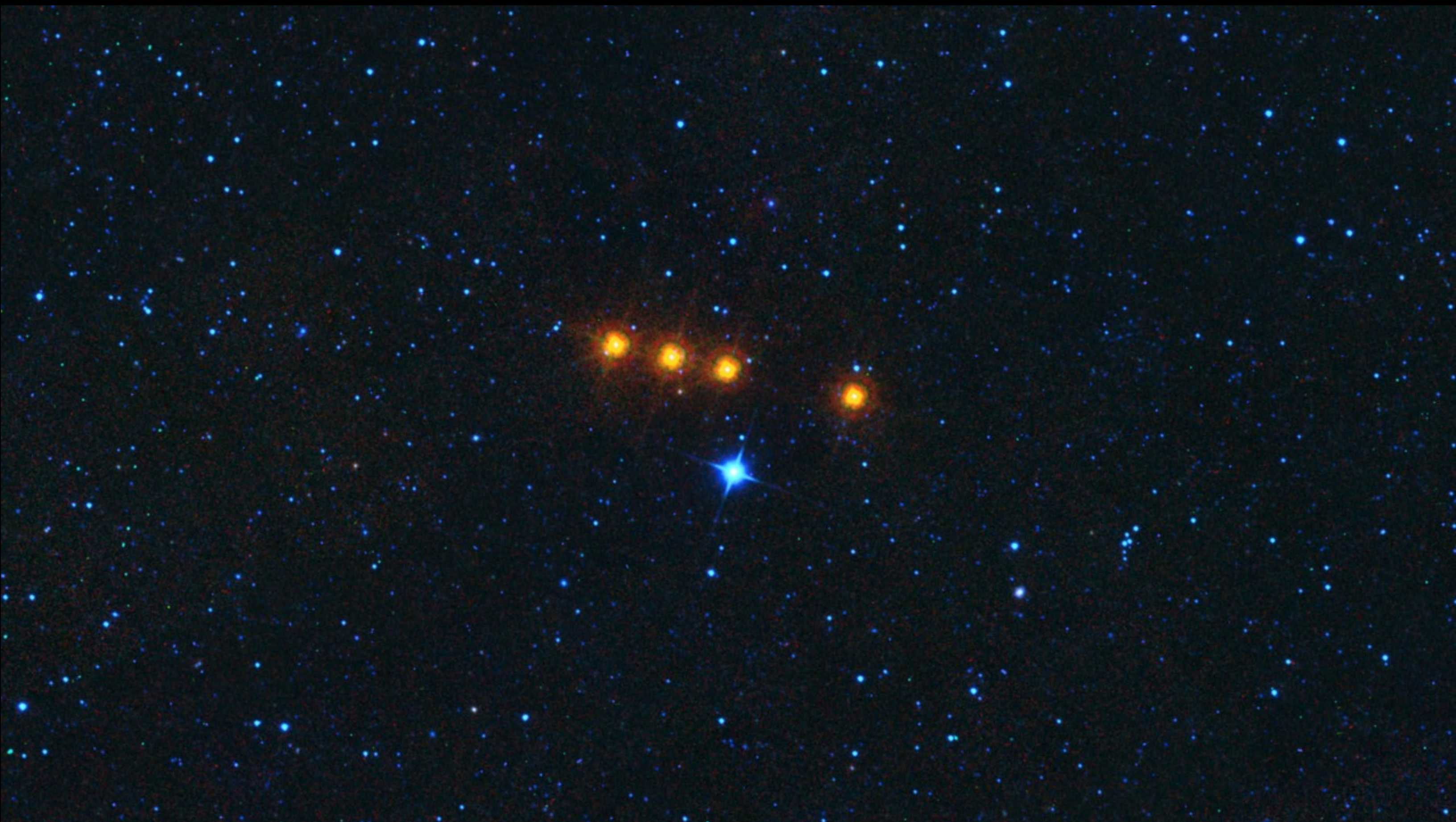
A short-lived outburst from comet 67P/Churyumov-Gerasimenko was captured by Rosetta's OSIRIS narrow-angle camera on July 29, 2015. The image at left was taken at 13:06 Greenwich Mean Time (GMT) (6:06 a.m. PDT), and does not show any visible signs of the jet. It is very strong in the middle image captured at 13:24 GMT (6:24 a.m. PDT). Residual traces of activity are only very faintly visible in the final image taken at 13:42 GMT (6:42 a.m. PDT).

The images were taken from a distance of 116 miles (186 kilometers) from the center of the comet. The jet is estimated to have a minimum speed of 33 feet per second (10 meters per second) and originates from a location on the comet's neck.

Rosetta is a European Space Agency mission with contributions from its member states and NASA. Rosetta's Philae lander is provided by a consortium led by the German Aerospace Center, Cologne; Max Planck Institute for Solar System Research, Gottingen; French National Space Agency, Paris; and the Italian Space Agency, Rome. NASA's Jet Propulsion Laboratory, a division of the California Institute of Technology, Pasadena, manages the U.S. participation in the Rosetta mission for NASA's Science Mission Directorate in Washington.

To view the animation go to: http://rosetta.jpl.nasa.gov/

Asteroid Euphrosyne as Seen by WISE



The asteroid Euphrosyne glides across a field of background stars in this time-lapse view from NASA's WISE spacecraft. WISE obtained the images used to create this view over a period of about a day around May 17, 2010, during which it observed the asteroid four times.

Because WISE (renamed NEOWISE in 2013) is an infrared telescope, it senses heat from asteroids. Euphrosyne is quite dark in visible light, but glows brightly at infrared wavelengths.

This view is a composite of images taken at four different infrared wavelengths: 3.4 microns (color-coded blue), 4.6 microns (cyan), 12 microns (green) and 22 microns (red).

The moving asteroid appears as a string of red dots because it is much cooler than the distant background stars. Stars have temperatures in the thousands of degrees, but the asteroid is cooler than room temperature. Thus the stars are represented by shorter wavelength (hotter) blue colors in this view, while the asteroid is shown in longer wavelength (cooler) reddish colors.

The WISE spacecraft was put into hibernation in 2011 upon completing its goal of surveying the entire sky in infrared light. WISE cataloged three quarters of a billion objects, including asteroids, stars and galaxies. In August 2013, NASA decided to reinstate the spacecraft on a mission to find and characterize more asteroids.

Tracking A Mysterious Group of Asteroid Outcasts

High above the plane of our solar system, near the asteroid-rich abyss between Mars and Jupiter, scientists have found a unique family of space rocks. These interplanetary oddballs are the Euphrosyne (pronounced you-FROH-seh-nee) asteroids, and by any measure they have been distant, dark and mysterious -- until now.

A new study conducted by scientists at NASA's Jet Propulsion Laboratory in Pasadena, California, used the agency's orbiting Near-Earth Object Wide-field Infrared Survey Explorer (NEOWISE) telescope to look at these unusual asteroids to learn more about Near Earth Objects, or NEOs, and their potential threat to Earth.

Fast Facts:

› A new NASA study has traced some members of the near-Earth asteroid population back to their likely source.

› The source may be the Euphrosyne family of dark, asteroids on highly inclined (or tilted) orbits in the outer asteroid belt.

› The study used data from NASA's NEOWISE space telescope, which has a second life following its reactivation in 2013.

Distributed at the outer edge of the asteroid belt, the Euphrosynes have an unusual orbital path that juts well above the ecliptic, the equator of the solar system. The asteroid after which they are named, Euphrosyne -- for an ancient Greek goddess of mirth -- is about 156 miles (260 kilometers) across and is one of the 10 largest asteroids in the main belt. Current-day Euphrosyne is thought to be a remnant of a massive collision about 700 million years ago that formed the family of smaller asteroids bearing its name. Scientists think this event was one of the last great collisions in the solar system.

NEOs are bodies whose orbits around the sun approach the orbit of Earth; this population is short-lived on astronomical timescales and is fed by other reservoirs of bodies in our solar system. As they orbit the sun, NEOs can occasionally have close approaches to Earth. For this reason alone -- the safety of our home planet -- the study of such objects is important.

As a result of their study, the JPL researchers believe the Euphrosynes may be the source of some of the dark NEOs found to be on long, highly inclined orbits. They found that, through gravitational interactions with Saturn, Euphrosyne asteroids can evolve into NEOs over timescales of millions of years.

NEOs can originate in either the asteroid belt or the more distant outer reaches of the solar system. Those from the asteroid belt are thought to evolve toward Earth's orbit through collisions and the gravitational influence of the planets. Originating well above the ecliptic and near the far edge of the asteroid belt, the forces that shape their trajectories toward Earth are far more moderate.

"The Euphrosynes have a gentle resonance with the orbit of Saturn that slowly moves these objects, eventually turning some of them into NEOs," said Joseph Masiero, JPL's lead scientist on the Euphrosynes study. "This particular gravitational resonance tends to push some of the larger fragments of the Euphrosyne family into near-Earth space."

By studying the Euphrosyne family asteroids with NEOWISE, JPL scientists have been able to measure their sizes and the amount of solar energy they reflect. Since NEOWISE operates in the infrared portion of the spectrum, it detects heat. Therefore, it can see dark objects far better than telescopes operating at visible wavelengths, which sense reflected sunlight. Its heat-sensing capability also allows it to measure sizes more accurately.

The 1,400 Euphrosyne asteroids studied by Masiero and his colleagues turned out to be large and dark, with highly inclined and elliptical orbits. These traits make them good candidates for the source of some of the dark NEOs the NEOWISE telescope detects and discovers, particularly those that also have highly inclined orbits.

NEOWISE was originally launched as an astrophysics mission in 2009 as the Wide-field Infrared Survey Explorer, or WISE. It operated until 2011 and was then shut down. But the spacecraft, now dubbed NEOWISE, would get a second life. "NEOWISE is a great tool for searching for near-Earth asteroids, particularly high-inclination, dark objects," Masiero said.

There are over 700,000 asteroidal bodies currently known in the main belt that range in size from large boulders to about 60 percent of the diameter of Earth's moon, with many yet to be discovered. This makes finding the specific point of origin of most NEOs extremely difficult.

With the Euphrosynes it's different. "Most near-Earth objects come from a number of sources in the inner region of the main belt, and they are quickly mixed around," Masiero said. "But with objects coming from this family, in such a unique region, we are able to draw a likely path for some of the unusual, dark NEOs we find back to the collision in which they were born."

A better understanding of the origins and behaviors of these mysterious objects will give researchers a clearer picture of asteroids in general, and in particular the NEOs that skirt our home planet's neighborhood. Such studies are important, and potentially critical, to the future of humanity, which is a primary reason JPL and its partners continue to relentlessly track these wanderers within our solar system. To date, U.S. assets have discovered more than 98 percent of the known NEOs.

NASA's Jet Propulsion Laboratory in Pasadena, California, manages the NEOWISE mission for NASA's Science Mission Directorate in Washington. The Space Dynamics Laboratory in Logan, Utah, built the science instrument. Ball Aerospace & Technologies Corp. of Boulder, Colorado, built the spacecraft. Science operations and data processing take place at the Infrared Processing and Analysis Center at the California Institute of Technology in Pasadena. Caltech manages JPL for NASA.

NASA's Near-Earth Object Program at NASA Headquarters, Washington, manages and funds the search, study and monitoring of asteroids and comets whose orbits periodically bring them close to Earth. JPL manages the Near-Earth Object Office for NASA's Science Mission Directorate in Washington.

For more information about NEOWISE, visit:

http://www.nasa.gov/neowise

More information about asteroids and near-Earth objects is available at:

http://neo.jpl.nasa.gov

http://www.jpl.nasa.gov/asteroidwatch

Dawn Surveys Ceres

This image, taken by NASA's Dawn spacecraft on June 25, 2015, shows a portion of the southern hemisphere of dwarf planet Ceres from an altitude of 2,700 miles (4,400 kilometers) with a resolution of 1,400 feet (410 meters) per pixel.

The Dwarf Planet Haumea

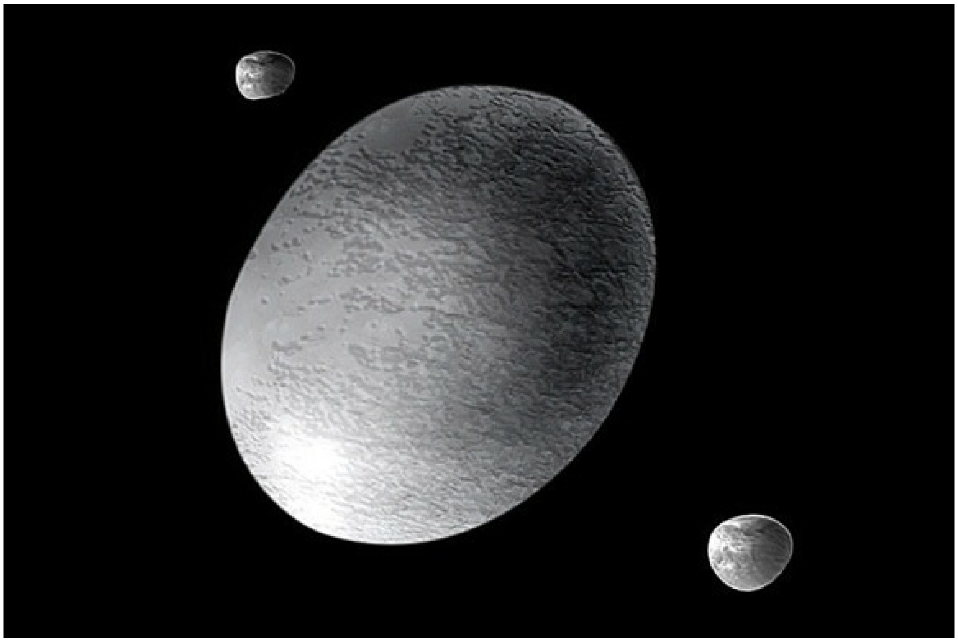
Matt Williams, Universe Today

The Trans-Neptunian region has become a veritable treasure trove of discoveries in recent years. Since 2003, the dwarf planets and "plutoids" of Eris, Sedna, Makemake, Quaoar, and Orcus were all observed beyond the orbit of Pluto. And in between all of these, Haumea – that odd, oblong-shaped dwarf planet that has its own system of moons – was also discovered.

In addition to being the largest member of its particular family of Trans-Neptunian Objects (TNOs), Haumea is unique amongst known dwarf planets. This is due to its elongation, an unusually rapid rotation, two known moons, high density, and high albedo – all of which make Haumea something of an oddity when it comes to dwarf planets.

Discovery and Naming:

While bodies that are designated as dwarf planets tend to attract their share of controversy, dissension over Haumea began as soon as it was discovered. In fact, two teams claim credit for its discovery: Mike Brown and his team at Caltech and Jose Luis Ortiz Moreno and his team from the Instituto de Astrofísica de Andalucía at Sierra Nevada Observatory in Spain.



Artist's impression of the dwarf planet Haumea and its moons, Hi'aka and Namaka. Credit: NASA

The former discovered Haumea in December of 2004 from images they had taken on May 6th, 2004 from the W.M. Keck Observatory. They published an online abstract about their discovery on July 20th, 2005, and announced their discovery at a conference in September of that year. Meanwhile, Ortiz and his team emailed the IAU Minor Planet Center of the discovery of Haumea on July 27th, 2005, claiming they had found it on images taken from March 7th to 10th, 2003.

The IAU announcement on September 17th, 2008, that Haumea had been accepted as a dwarf planet, did not mention a discoverer. The location of discovery was listed as the Sierra Nevada Observatory of the Spanish team, but the chosen name, Haumea, was proposed by the Caltech team.

The name Haumea comes from Hawaiian mythology, specifically from the goddess of fertility who is also the matron goddess of the island of Hawaii where the W. M. Keck Observatory is located. Hence, the name was not only consistent with IAU guidelines – that classical Kuiper Belt Objects (KBOs) be given names of mythological beings associated with creation – but was also an homage to the facility that made the discovery.

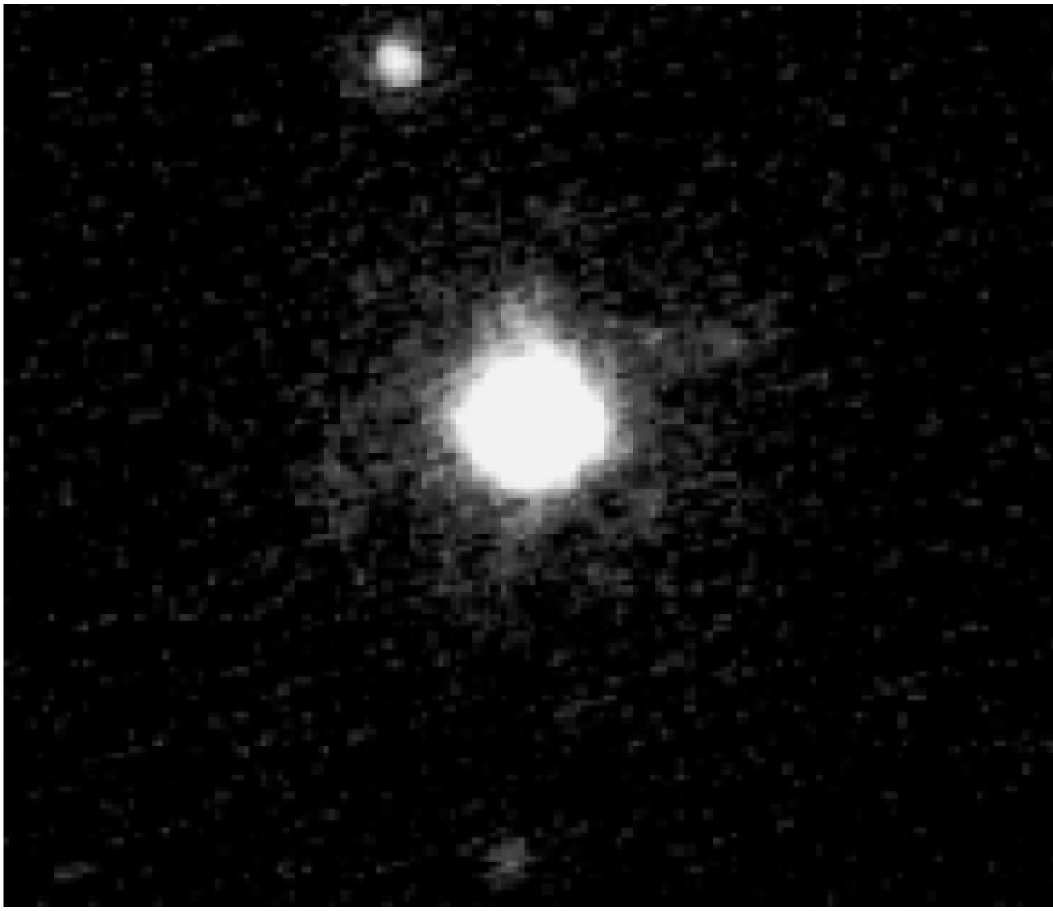
Ortiz's team had proposed "Ataecina", named for the ancient Iberian goddess of Spring; but not meet the IAU requirements since she is not a creation goddess, and hence was rejected. Until it was given a permanent name, the Caltech discovery team used the nickname “Santa” among themselves, because they had discovered Haumea on December 28th, 2004, just after Christmas.

Because the Spanish team had filed their claim with the Minor Planet Center first, Haumea was given the provisional designation 2003 EL61 (based on the date of the Spanish discovery image) on July 29th, 2005.

Size, Mass and Orbit:

Calculating Haumeau’s size, mass and density is somewhat complicated. Whereas it is large enough and bright enough for its albedo (and thus its size) to be measured, the calculations of its dimensions are made difficult by its rapid rotation. However, several ellipsoid-model calculations have been conducted using the Keck telescopes, the Spitzer Space Telescope, and the Herschel Space Telescope that have provided estimates.

The first calculations, conducted by Brown et al., provided the approximate dimensions of 2,000 x 1,500 x 1,000 km. Meanwhile, the Spitzer measurements gave it a diameter of 1050 – 1400 km, while subsequent light-curve analyses suggested an equivalent circular diameter of 1,450 km. In 2010 an analysis of measurements taken by Herschel Space Telescope together with the older Spitzer Telescope measurements yielded a new estimate of ~1300 km.

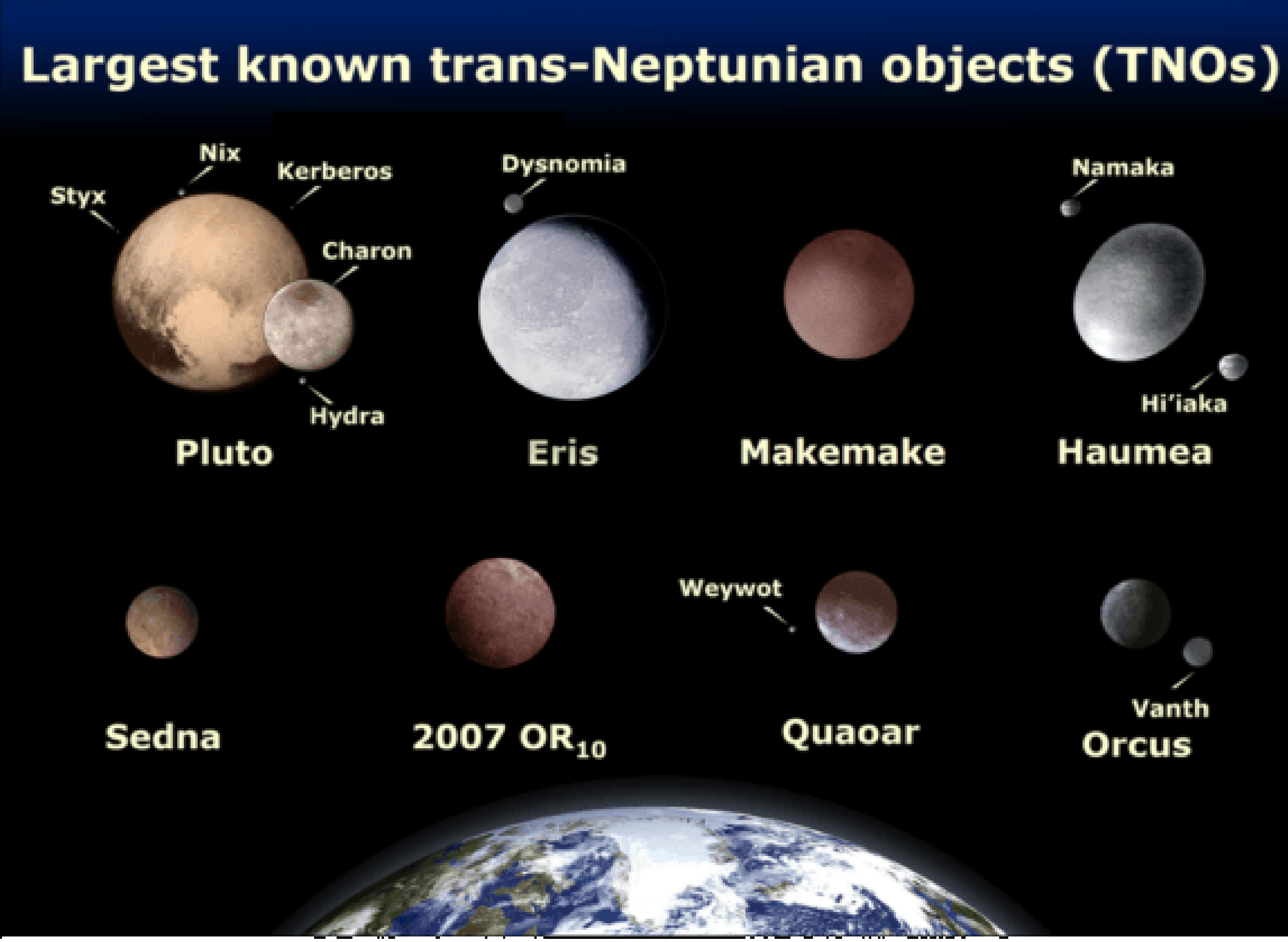


Keck image of 2003 EL61 Haumea, with moons Hi’iaka and Naumaka. Credit: CalTech/Mike Brown et al.

These independent size estimates overlap at an average geometric mean diameter of roughly 1,400 km. In essence, this means that Haumea is comparable in diameter to Pluto along its longest axis and about half that at its poles. It’s mass, meanwhile, is estimated to be approximately 4.0 ×1021 kg – one-third the mass of Pluto and 1/1400th that of Earth.

This makes Haumea one of the largest trans-Neptunian objects discovered, smaller than Eris, Pluto, probably Makemake, and possibly 2007 OR10, but larger than Sedna, Quaoar, and Orcus. Combined with estimates of its density, Haumea is massive enough to have achieved hydrostatic equilibrium. Although Haumea appears to be far from spherical, its ellipsoidal shape is thought to result from its rapid rotation.

Haumea has a typical orbit for a classical KBO, with an eccentric orbit that takes it from 34.952 AU (5.23 trillion km) at perihelion to 51.483 AU (7.7 trillion km) at aphelion. Also consistent with other KBOs, it has an orbital period of 284 Earth years, an orbital inclination of 28°, and completes a sidereal rotation every 3.9 hours (0.163 Earth days).



Comparison of Sedna with the other largest TNOs and with Earth (all to scale). Credit: NASA/Lexicon

Composition:

Much like its size, Haumea's rotation and the amplitude of its light curve make judging its composition rather difficult. If its density were consistent with Pluto and other KBOs (2.0 g/cm³) then its rapid rotation would have elongated it to a greater extent than current estimates allow for. As such, Haumea's density is believed to range between 2.6 – 3.3 g/cm³, which is comparable to Earth's Moon (also 3.3 g/cm³).

Haumea's possible density covers the values for silicate minerals such as olivine and pyroxene, which make up many of the rocky objects in the Solar System. This suggests that the bulk of Haumea is rock covered with a relatively thin layer of ice. It is possible that a thicker ice mantle that is more typical of Kuiper belt objects existed in the past, but was blasted off during the impact that formed the Haumean collisional family.

Haumea is as bright as snow, with an high albedo that is consistent with crystalline ice.

Spectral modelling of the surface suggested that 66% to 80% of the Haumean surface appears to be pure crystalline water ice, with the possible presence of hydrogen cyanide or phyllosilicate clays. Inorganic cyanide salts such as copper potassium cyanide may also be present.

A large dark red area on Haumea's bright white surface, possibly an impact feature, has also been observed which could indicate an area rich in minerals and organic (carbon-rich) compounds – or possibly a higher proportion of crystalline ice. Thus Haumea may have a mottled surface similar to that of Pluto.

Classification:

Haumea has been classified as a plutoid and dwarf planet residing beyond Neptune's orbit. This classification means that it is presumed to be massive enough to have been rounded by its own gravity, but not to have cleared its neighborhood of similar objects.

Although Haumea appears to be far from spherical, its ellipsoidal shape is thought to result from its rapid rotation and not from a lack of sufficient gravity to overcome the compressive strength of its material.

Although Haumea appears to be far from spherical, its ellipsoidal shape is thought to result from its rapid rotation and not from a lack of sufficient gravity to overcome the compressive strength of its material. Haumea was initially listed as a classical Kuiper Belt Object in 2006 by the Minor Planet Center, but that has since been revised.

Moons:

Haumea has two known moons, which are named after the daughters of the Hawaiian goddess – Hi'iaka and Namaka. Both were discovered in 2005 by Brown's team while conducting observations of Haumea at the W.M. Keck Observatory. Hi'iaka, which was initially nicknamed "Rudolph" by the Caltech team, was discovered January 26th, 2005.

It is the outer and – at roughly 310 km in diameter – the larger and brighter of the two, and orbits Haumea in a nearly circular path every 49 days. Infrared observations indicate that its surface is almost entirely covered by pure crystalline water ice. Because of this, Brown and his team have speculated that the moon is a fragment of Haumea that broke off during a collision.

Namaka, the smaller and innermost of the two, was discovered on June 30th, 2005, and nicknamed "Blitzen". It is a tenth the mass of Hiʻiaka and orbits Haumea in 18 days in a highly elliptical orbit. Both moons circle Haumea is highly eccentric orbits. No estimates have been made yet as to their mass.

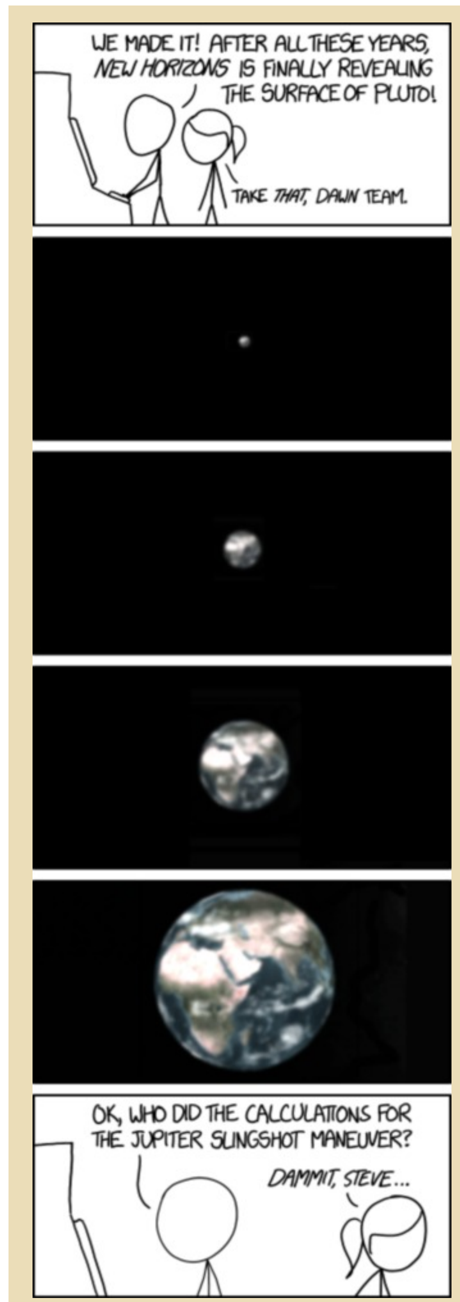
Exploration:

So far, no missions have been mounted to Haumea and none are currently planned. However, numerous scenarios have been calculated using hypothetical launch dates. For example, if a probe were launched on September 25th, 2025, a flyby mission could take place within 14.25 years, when Haumea would be 48.18 AU from the Sun. Based on a launch date of Nov. 1st, 2026, September 23rd, 2037, and October 29th, 2038, a flyby mission would take 16.45 years to get to Haumea.

So if the budget environment remains stable and scientists decide to make close-up observations of Haumea a priority, a flyby could be taking place no sooner than December of 2039. And with luck, we might learn more about this distant and odd little ball of rock and ice that stands out from its peers.

We have many interesting articles on Haumea, its surface features, the Kuiper Belt, Dwarf Planets, and Trans-Neptunian Objects here at Universe Today.

And here is What is the Kuiper Belt, KBOs, and What Has the Kuiper Belt Taught Us About The Solar System?



Xkcd.com

September Observing: What to View

Jim Kvasnicka

This is a partial list of objects visible for the upcoming month.

Planets

Mercury: Just above the western horizon in bright twilight, difficult to see.
Saturn: In Libra at magnitude 0.6. The rings remain tilted 24°.
Neptune and Uranus: In Aquarius and Pisces.
Mars and Venus: Both are in the eastern sky just before dawn.
Jupiter: About 20° to the lower left of Venus.
Moon: Total eclipse the night of September 27th. See page 26 in the September issue of Sky & Telescope.

Messier List

M13: The Great Hercules Cluster, Class V globular cluster.
M14: Class VIII globular cluster in Ophiuchus.
M22: Class VII globular cluster in Sagittarius.
M28: Class IV globular cluster in Sagittarius.
M54: Class III globular cluster in Sagittarius.
M69: Class V globular cluster in Sagittarius.
M70: Class V globular cluster in Sagittarius.
M92: Class IV globular cluster in Hercules.
Last Month: M6, M7, M8, M9, M10, M12, M19, M20, M21, M23, M62, M107
Next Month: M11, M16, M17, M18, M24, M25, M26, M55, M75

NGC and other Deep Sky Objects

NGC 7293: The Helix Nebula, planetary nebula in Aquarius.
NGC 7331: Brightest galaxy in the Deer Lick Group in Pegasus.
NGC 7662: The Blue Snowball, planetary nebula in Andromeda.
NGC 40: The Bow-Tie Nebula in Cepheus.

Double Star Program List

Otto Struve 525: Yellow and blue pair in Lyra.
Gamma Delphinus: Yellow primary with a yellow-green secondary.
Zeta Aquarii: Yellow and white pair.
94 Aquarii: Yellow primary with a pale blue secondary.
Alpha Capricornus: Wide pair of yellow stars.
Beta Capricornus: Yellow and blue stars.
36 Ophiuchi: Pair of yellow-orange stars.
Omicron Ophiuchi: Yellow primary with a light yellow secondary.
70 Ophiuchi: Yellow and orange stars.

Challenge Object

Stephan's Quintet: Galaxy group in Pegasus containing NGC 7317, NGC 7318A, NGC 7318B, NGC 7319, and NGC 7320. This group is 300 million light years distant. Large aperture is required to identify the individual galaxies.

NGC Objects: IC 5146

Jim Kvasnicka

Deer Lick Group
NGC 7331

NGC 7331 is an elongated galaxy in Pegasus and the brightest member of the Deer Lick Group. It was discovered by William Herschel in 1784 and American amateur astronomer Tom Lorenzin gave the galaxy group its common name after the Deer Lick Gap in the mountains of North Carolina.

NGC 7331 is one of the brightest galaxies not to make the Messier Catalog. It is 46 million light years distant from us. Larger aperture telescopes will reveal four faint galaxies to the east of NGC 7331.

NGC 7331 has a listed magnitude of 9.5 and through a 10 inch telescope has an apparent size of 6' x 1.5' extending N-S. NGC 7331 is part of the Herschel 400 List and Caldwell Object 30.

NGC 7331 spiral galaxy. 24 inch telescope on Mt. Lemmon, AZ. Acquired with the Schulman Telescope at the Mount Lemmon SkyCenter.jpg Credit: Adam Block/Mount Lemmon

Solar Wind Creates—and Whips—a Magnetic Tail Around Earth

Ethan Siegel

As Earth spins on its axis, our planet's interior spins as well. Deep inside our world, Earth's metal-rich core produces a magnetic field that spans the entire globe, with the magnetic poles offset only slightly from our rotational axis. If you fly up to great distances, well above Earth's surface, you'll find that this magnetic web, called the magnetosphere, is no longer spherical. It not only bends away from the direction of the sun at high altitudes, but it exhibits some very strange features, all thanks to the effects of our parent star.

The sun isn't just the primary source of light and heat for our world; it also emits an intense stream of charged particles, the solar wind, and has its own intense magnetic field that extends much farther into space than our own planet's does. The solar wind travels fast, making the 150 million km (93 million mile) journey to our world in around three days, and is greatly affected by Earth. Under normal circumstances, our world's magnetic field acts like a shield for these particles, bending them out of the way of our planet and protecting plant and animal life from this harmful radiation.

But for every action, there's an equal and opposite reaction: as our magnetosphere bends the solar wind's ions, these particles also distort our magnetosphere, creating a long magnetotail that not only flattens and narrows, but whips back-and-forth in the onrushing solar wind. The particles are so diffuse that collisions between them practically never occur, but the electromagnetic interactions create waves in Earth's magnetosphere, which grow in magnitude and then transfer energy to other particles. The charged particles travel within the magnetic field toward both poles, and when they hit the ionosphere region of Earth’s upper atmosphere, they collide with ions of oxygen and nitrogen causing aurora. Missions such as the European Space Agency and NASA Cluster mission have just led to the first accurate model and understanding of equatorial magnetosonic waves, one such example of the interactions that cause Earth's magnetotail to whip around in the wind like so.

The shape of Earth's magnetic field not only affects aurorae, but can also impact satellite electronics. Understanding its shape and how the magnetosphere interacts with the solar wind can also lead to more accurate predictions of energetic electrons in near-Earth space that can disrupt our technological infrastructure. As our knowledge increases, we may someday be able to reach one of the holy grails of connecting heliophysics to Earth: forecasting and accurately predicting space weather and its effects. Thanks to the Cluster Inner Magnetosphere Campaign, Van Allen Probes, Mars Odyssey Thermal Emission Imaging System, Magnetospheric Multiscale, and Heliophysics System Observatory missions, we're closer to this than ever before.

Kids can learn about how solar wind defines the edges of our solar system at NASA Space Place. http://spaceplace.nasa.gov/interstellar

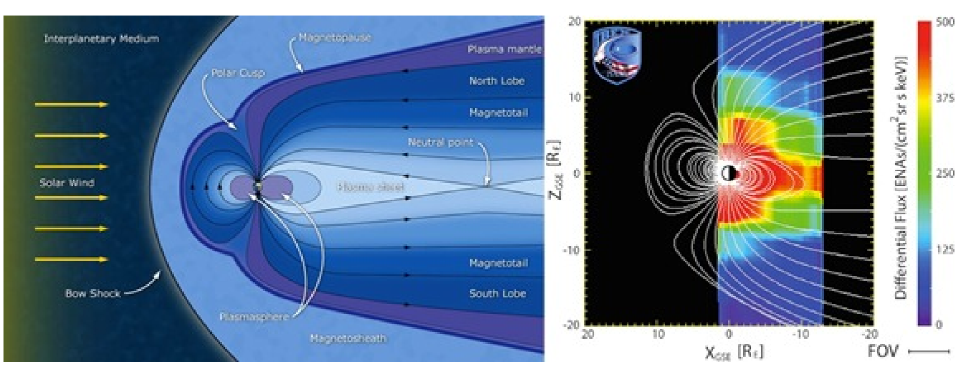


Image credit: ESA / C. T. Russell (L), of Earth's magnetic tail and its cause: the solar wind; Southwest Research Institute / IBEX Science Team (R), of the first image of the plasma sheet and plasmasphere created around Earth by the solar wind.

From the Archives: February 1989

Yet Another Solar System Scale by Rick Johnson

In my years of taking school kids through Hyde Memorial Observatory I have tried many different ways of getting across to the kids the true scale of the universe. I tried all the various ways I found in texts but none seemed to be getting across the vast empty void of space. Finally one evening about 8 years ago I came up with a new scale that has worked for me ever since. one of our members thought the club members might find it useful, so here goes.

First I came up with a new unit of measurement. Light years are just too big for the kids to comprehend and don't work in the solar system anyway. So I came up with the unit of an Astronaut Year. It is based on the average speed the lunar astronauts traveled when they went to the moon. I used round values through out so settled on the time of three days to reach the moon. Based on multiplying this by 3/365.24 I came up with the distance a hypothetical astronaut would travel in one year. Now for the odd coincidence. It turns out that if you scale the universe by a factor of 2 trillion an Astronaut year equals almost precisely 1 inch. So now I had both a scale that would fit the solar system into the Hyde classroom and would also show about how long it would take an astronaut traveling at the rate we went to the moon, to reach each object. It is the coupling of both distance and time that seems to get across the emptiness of space.

When the scale is used the sun becomes a speck of dust .027" across that the kids could just see with difficulty. The planets become invisible dust specks. The Earth is only .00025" across. Next I borrow 10 kids to use as pointers to the invisible solar system. Each holds up a finger to represent where the dust speck is for each object. On this scale Mercury is 1 inch from the sun, Venus 2", Earth 3" and Mars 4.5" so now you have quite a close knit group of kids in the middle of the room. Jupiter, Saturn, Uranus and Pluto are 16 inches, 29 inches, 5 feet and 12 feet away respectively. For Pluto I use the tallest kid and have him hold his hand way up in the air to show that Pluto is not in the same plane as the rest of the planets. Of course now Pluto is closer to the sun than Neptune so I then walk "Pluto" to the current position of 7.3 feet from the sun making sure his finger pointing to Pluto's dust speck stays well above Neptune so they can't collide.

Next I ask them how long it would take to reach Pluto traveling one inch a year. Now they get the message of why the astronauts haven't visited Pluto or the other planets for that matter. Also I point out how if they looked into the room and it had hanging in it 10 dust specks the size of these representing the solar system that they would consider the room empty as they would see nothing without very close inspection. The idea of how small the solar system's inhabitants are begins to sink in.

The next question really hits them hard. I ask where to put an 11th kid representing the closest star besides the sun. Most are under the impression that all the stars are inside the solar system! Since the schools start with the solar system the kids are under the impression that it is the universe that contains everything. Some teachers seem to be under this impression also! Many therefore want to put the stars in the gap between the bunch of kids representing the inner solar system from the outer solar system. Finally they get the idea the 11th kid will be outside the building. Some will even vote for as far away as the bus in the parking lot. One will usually go for "across the lake." So far no one has gotten the right answer which is 5 miles beyond the airport (nearly 13 total miles!). At one inch a year the vast distance to the stars begins to sink in. Sirius is the nearest naked eye star visible from Nebraska and its distance on this scale would be nearly 30 miles or about the distance from Lincoln to Wahoo. That's a lot of Astronaut years. Now they can start to appreciate the distance a light year really is; 3 miles on this scale (6 trillion miles / 2 trillion) or 190,000 Ay. At this point they are so blown away it is time to start a slide show. I hope you find this scale as useful as I have.