The Focal Point

The Atlanta Astronomy Club
Established 1947
December 2016

Vol. 29 No. 7

Editor: Tom Faber

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December Holiday Potluck Meeting

by Sharon Carruthers

HO! HO! HO! 'Tis the time once again to plan for our Holiday Potluck for our Dec 17th, 2016 General Meeting. We will be holding it at the AFS building in Smyrna: Setup at 6 PM, Dining at 7 PM and Observing afterwards (weather permitting). We will supply ham, turkey, soft drinks & coffee and ask you to bring the sides and/or desserts for 6-10 people. Family favorites and ethnic dishes are especially welcome. If you could drop me a line (Treasurer@AtlantaAstronomy.org) or a call at 770-941-4640 to tell me what you plan to bring, it would help prevent too many duplicate dishes. Also, if you have any folding tables & chairs that you can bring, it would really help us out. Suggested dishes to bring are:

APPETIZERS: Deviled Eggs, Chips & Dip, Pretzels, Cheese & Crackers, Veggie Tray

SIDES: Pickles/Relish Tray, Buns & Rolls

VEGGIE SIDES: Mashed Potatoes, Stuffing, Sweet Potatoes, Pasta/Rice, Green Bean Casserole, Corn Pudding, Peas, Carrots, Tossed Salad, Jelled Salad, Coleslaw

DESSERTS: Cookies, Squares, Cake, Pies, Puddings

After we have dinner there will be a short program (topic TBA) and/or observing outside weather permitting.

LOCATION: Atlanta Freethought Hall, 4775 North Church Lane, Smyrna 30080 / Atlanta 30339

Please note: The zip code was recently changed, so dependent of what data base your GPS uses it may be either one. Also, please be aware, there is a lot of road construction in the area.

Directions to the Atlanta Freethought Hall: Take I-285 to the Atlanta Rd. exit (Exit 16). Go south (towards Atlanta) about ½ mile. Turn right on North Church Lane (at red light). The A.F.H. will be 100 yards on the left. It looks like a small red brick church.

The Next AAC Board Meeting

The next Board of Directors Meeting of the AAC is scheduled for Sunday, January 22nd, starting at 3PM at the home of Peter and Sharon, 1057 Trestle Drive, Austell. Contact AAC President Mark Banks or Board Chair Sharon Carruthers for more information. Any member of the club who has any questions, concerns, or issues about club operations is welcome to attend the meeting and address the Board.

The Astronomical League

As a member of the **Atlanta Astronomy Club** you are automatically also a member of the **Astronomical League**, a nation wide affiliation of astronomy clubs. Membership in the AL provides a number of benefits for you. They include:

* You will receive *The Reflector*, the AL's quarterly newsletter.

* You can use the Book Service, through which you can buy astronomy-related books at a 10% discount.

* You can participate in the Astronomical League's Observing Clubs. The Observing Clubs offer encouragement and certificates of accomplishment for demonstrating observing skills with a variety of instruments and objects. These include the Messier Club, Binocular Messier Club, the Herschel 400 Club, the Deep Sky Binocular Club, and many others.

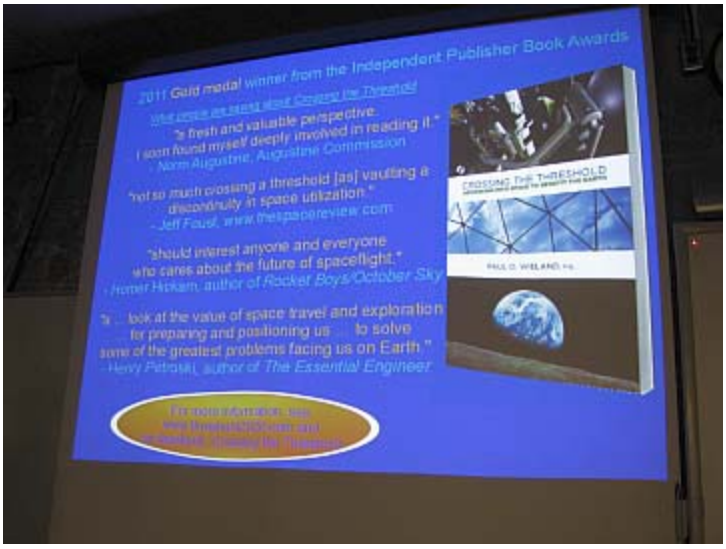
To learn more about the Astronomical League and its benefits for you, visit http://www.astroleague.org

November AAC Meeting Report

Photos by Tom Faber unless noted

The November AAC general meeting was held on Saturday, November 19th at the Fernbank Science Center. About 45 members and guests were present. The general meeting began at 3PM. Our featured speaker was Paul Wieland. Paul was an engineer and worked for NASA from 1983 to 2005, on programs from the Hubble Space Telescope and the Spacelab 3 mission to the International Space Station for which he was primarily involved with developing the environmental control and life support system. After retiring from NASA he wrote a book, *Crossing the Threshold: Advancing into Space to Benefit the Earth*, that was awarded a gold medal in 2011 by the Independent Publisher Book Awards. He spoke about some of his experiences while working for NASA and what the future may hold for space development and possibilities for astronomy. Paul then answered a number of questions about his talk.

After the Q&A session there were announcements by club officers about upcoming events and activities. After the meeting adjourned, some of the attendees went to Athens Pizza for dinner and more discussions about astronomy.



The Next Charlie Elliott Meeting

Meeting Details

Potluck - Join us on December 10, 2016 at 3:30 p.m. for our quarterly potluck! If you've been to one of our potlucks, you're probably looking forward to the good food and good company these events have become known for. Note that we'll be meeting in the Campbell Building rather than the Shepard Building.

Potlucks take a lot of effort to organize, and ours are no different. In addition to banana pudding, barbecue sandwiches, and potato salad, we need help with set up and clean up. If you can bring food or offer a few minutes for setup or clean up, click here to find out how you can help: http://www.perfectpotluck.com/meals.php?t=VCUJ0684

All of the Above!

Charlie Elliott Astronomy Observing Supervisor David Whalen will reprise his stand up comedy routine and might even talk about what you can expect to see in the sky this month with binoculars and small telescopes, as well as the monthly observing challenge.

Observing After the Meeting

All are invited to Jon Wood Astronomy Field immediately after the meeting (weather-permitting). The event is free and everyone is welcome.

Minutes & Handouts: The minutes, handouts, and presentations from past meetings of Charlie Elliott Astronomy are available for download on our Past Events web page, http://ceastronomy.org/blog/events. Monthly sky maps are available from skymaps.com.

Upcoming meeting dates are December 10 (potluck), January 28, February 25, March 25 (potluck), April 22, May 27, June 24 (potluck), July 22.

Images by Dan Llewellyn

Here are some images that club member Dan Llewellyn made at the Deerlick Astronomy Village. Dan used an Esprit 150 APO Refractor with a field flattener and modified and cooled Sony A7S camera on September 7, 2016 to take these images.

The image to the right is a section of the Veil Nebula in Cygnus. It is a stack of 10 - 90 second subs with no guiding.

The image in the lower right is planetary nebula M27. This image is a stack of 5 - 2 minute subs with no guiding.

The image below is M31 (Andromeda Galaxy) with its satellite galaxies M32 and M110. Dan writes that "the cooling cable was intermittent, so I got a lot of thermal noise. Still turned out pretty good."

From the President's Desk

By Mark Banks, AAC President

It's that time of year again when all the schools are requesting our help with Astronomy related events and science projects. Please keep an eye on the club calendar and volunteer whenever possible. You don't need to be an expert. If you know some of the basic stuff, like the difference in a star and a planet, you know much more than most of the people you will be talking to. It's also a lot of fun and very rewarding to encourage the next generation of astronomers and science nerds. They will be very grateful for any help you can give them.

Help wanted: We need someone to take over as our Program Chair. As program chair you will schedule speakers for each monthly meeting and coordinate with them on their presentation. It's not a very difficult job. In the Atlanta area we have plenty of science professionals as well as graduate students that are happy to talk to us. If interested please contact any club officer.

Hubble Detects Giant 'Cannonballs' Shooting from Star

NASA/STScI News Release - October 6, 2016

Great balls of fire! NASA's Hubble Space Telescope has detected superhot blobs of gas, each twice as massive as the planet Mars, being ejected near a dying star. The plasma balls are zooming so fast through space it would take only 30 minutes for them to travel from Earth to the moon. This stellar "cannon fire" has continued once every 8.5 years for at least the past 400 years, astronomers estimate.

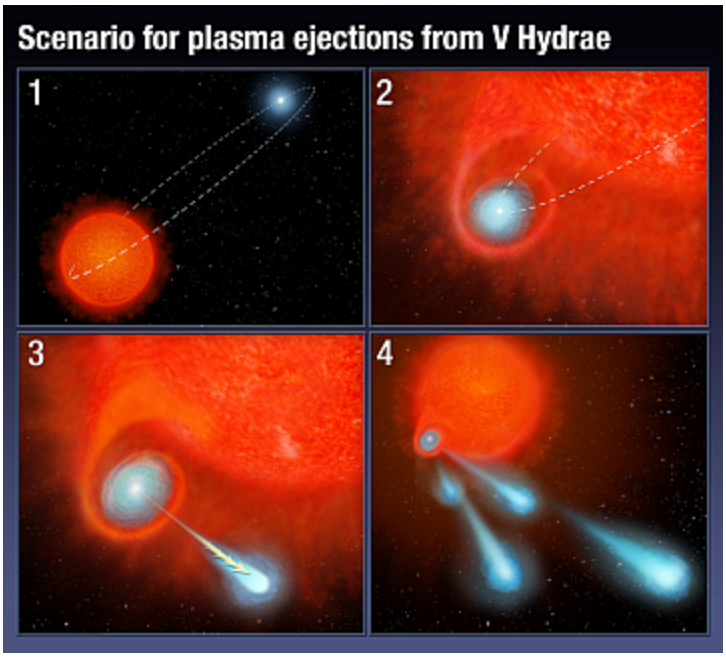
The fireballs present a puzzle to astronomers, because the ejected material could not have been shot out by the host star, called V Hydrae. The star is a bloated red giant, residing 1,200 light-years away, which has probably shed at least half of its mass into space during its death throes. Red giants are dying stars in the late stages of life that are exhausting their nuclear fuel that makes them shine. They have expanded in size and are shedding their outer layers into space.

The current best explanation suggests the plasma balls were launched by an unseen companion star. According to this theory, the companion would have to be in an elliptical orbit that carries it close to the red giant's puffed-up atmosphere every 8.5 years. As the companion enters the bloated star's outer atmosphere, it gobbles up material. This material then settles into a disk around the companion, and serves as the launching pad for blobs of plasma, which travel at roughly a half-million miles per hour.

This star system could be the archetype to explain a dazzling variety of glowing shapes uncovered by Hubble that are seen around dying stars, called planetary nebulae, researchers say. A planetary nebula is an expanding shell of glowing gas expelled by a star late in its life.

"We knew this object had a high-speed outflow from previous data, but this is the first time we are seeing this process in action," said Raghvendra Sahai of NASA's Jet Propulsion Laboratory in Pasadena, California, lead author of the study. "We suggest that these gaseous blobs produced during this late phase of a star's life help make the structures seen in planetary nebulae."

Hubble observations over the past two decades have revealed an enormous complexity and diversity of structure in planetary nebulae. The telescope's high resolution captured knots of material in the glowing gas clouds surrounding the dying stars. Astronomers speculated that these knots were actually jets ejected by disks of material around companion stars that were not visible in the Hubble images. Most stars in our Milky Way galaxy are members of binary systems. But the details of how these jets were produced remained a mystery.



This four-panel graphic illustrates how the binary-star system V Hydrae is launching balls of plasma into space.

Panel 1 shows the two stars orbiting each other. One of the stars is nearing the end of its life and has swelled in size, becoming a red giant.

In panel 2, the smaller star's orbit carries the star into the red giant's expanded atmosphere. As the star moves through the atmosphere, it gobbles up material from the red giant, which settles into a disk around the star.

The buildup of material reaches a tipping point and is eventually ejected as blobs of hot plasma along the star's spin axis, shown in panel 3.

This ejection process is repeated every eight years, the time it takes for the orbiting star to make another pass through the bloated red giant's envelope, shown in panel 4.

Credit: NASA, ESA, and A. Feild (STScI)

"We want to identify the process that causes these amazing transformations from a puffed-up red giant to a beautiful, glowing planetary nebula," Sahai said. "These dramatic changes occur over roughly 200 to 1,000 years, which is the blink of an eye in cosmic time."

Sahai's team used Hubble's Space Telescope Imaging Spectrograph (STIS) to conduct observations of V Hydrae and its surrounding region over an 11-year period, first from 2002 to 2004, and then from 2011 to 2013. Spectroscopy decodes light from an object, revealing information on its velocity, temperature, location, and motion.

The data showed a string of monstrous, superhot blobs, each with a temperature of more than 17,000 degrees Fahrenheit — almost twice as hot as the surface of the sun. The researchers compiled a detailed map of the blobs' location, allowing them to trace the first behemoth clumps back to 1986. "The observations show the blobs moving over time," Sahai said. "The STIS data show blobs that have just been ejected, blobs that have moved a little farther away, and blobs that are even farther away." STIS detected the giant structures as far away as 37 billion miles away from V Hydrae, more than eight times farther away than the Kuiper Belt of icy debris at the edge of our solar system is from the sun.

The blobs expand and cool as they move farther away, and are then not detectable in visible light. But observations taken at longer sub-millimeter wavelengths in 2004, by the Submillimeter Array in Hawaii, revealed fuzzy, knotty structures that may be blobs launched 400 years ago, the researchers said.

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Based on the observations, Sahai and his colleagues Mark Morris of the University of California, Los Angeles, and Samantha Scibelli of the State University of New York at Stony Brook developed a model of a companion star with an accretion disk to explain the ejection process.

"This model provides the most plausible explanation because we know that the engines that produce jets are accretion disks," Sahai explained. "Red giants don't have accretion disks, but many most likely have companion stars, which presumably have lower masses because they are evolving more slowly. The model we propose can help explain the presence of bipolar planetary nebulae, the presence of knotty jet-like structures in many of these objects, and even multipolar planetary nebulae. We think this model has very wide applicability."

A surprise from the STIS observation was that the disk does not fire the monster clumps in exactly the same direction every 8.5 years. The direction flip-flops slightly from side-to-side to back-and-forth due to a possible wobble in the accretion disk. "This discovery was quite surprising, but it is very pleasing as well because it helped explain some other mysterious things that had been observed about this star by others," Sahai said.

Astronomers have noted that V Hydrae is obscured every 17 years, as if something is blocking its light. Sahai and his colleagues suggest that due to the back-and-forth wobble of the jet direction, the blobs alternate between passing behind and in front of V Hydrae. When a blob passes in front of V Hydrae, it shields the red giant from view.

"This accretion disk engine is very stable because it has been able to launch these structures for hundreds of years without falling apart," Sahai said. "In many of these systems, the gravitational attraction can cause the companion to actually spiral into the core of the red giant star. Eventually, though, the orbit of V Hydrae's companion will continue to decay because it is losing energy in this frictional interaction. However, we do not know the ultimate fate of this companion."

The team hopes to use Hubble to conduct further observations of the V Hydrae system, including the most recent blob ejected in 2011. The astronomers also plan to use the Atacama Large Millimeter/submillimeter Array (ALMA) in Chile to study blobs launched over the past few hundred years that are now too cool to be detected with Hubble.

The team's results appeared in the August 20, 2016, issue of The Astrophysical Journal.

The Hubble Space Telescope is a project of international cooperation between NASA and the European Space Agency. NASA's Goddard Space Flight Center in Greenbelt, Maryland, manages the telescope. The Space Telescope Science Institute (STScI) in Baltimore, Maryland, conducts Hubble science operations. STScI is operated for NASA by the Association of Universities for Research in Astronomy in Washington, D.C.

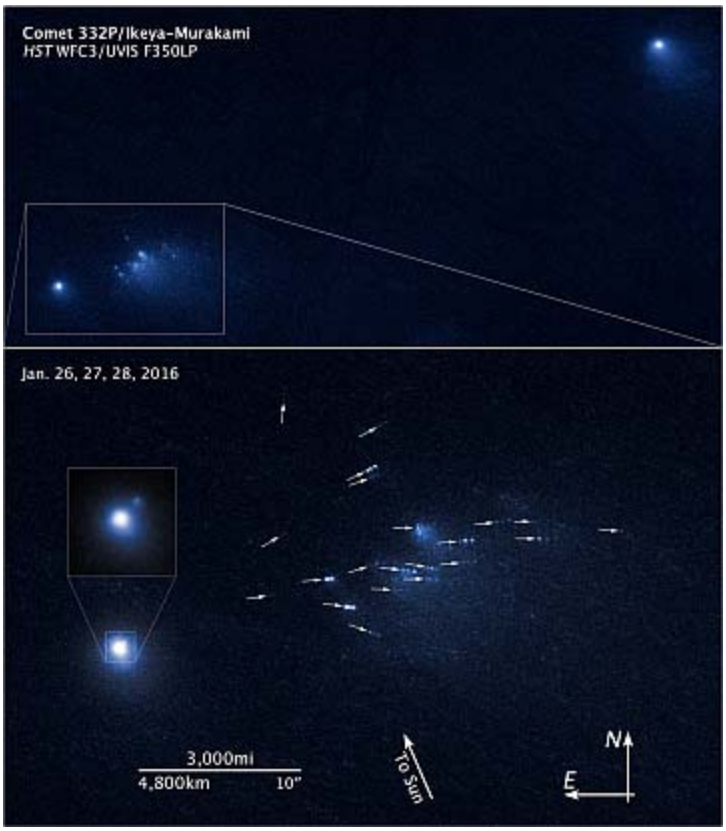
Hubble Takes Close-up Look at Disintegrating Comet

NASA/STScI News Release - September 15, 2016

NASA's Hubble Space Telescope has captured one of the sharpest, most detailed observations of a comet breaking apart, which occurred 67 million miles from Earth.

In a series of images taken over a three-day span in January 2016, Hubble revealed 25 building-size blocks made of a mixture of ice and dust that are drifting away from the comet at a leisurely pace, about the walking speed of an adult.

The observations suggest that the roughly 4.5-billion-year-old comet, named 332P/Ikeya-Murakami, or Comet 332P, may be spinning so fast that material is ejected from its surface. The resulting debris is now scattered along a 3,000-mile-long trail, larger than the width of the continental U.S.



Credit: NASA, ESA, and D. Jewitt (UCLA)

These observations provide insight into the volatile behavior of comets as they approach the sun and begin to vaporize, unleashing dynamical forces. Comet 332P was 150 million miles from the sun, slightly beyond the orbit of Mars, when Hubble spotted the breakup.

"We know that comets sometimes disintegrate, but we don't know much about why or how they come apart," explained lead researcher David Jewitt of the University of California at Los Angeles. "The trouble is that it happens quickly and without warning, and so we don't have much chance to get useful data. With Hubble's fantastic resolution, not only do we see really tiny, faint bits of the comet, but we can watch them change from day to day. And that has allowed us to make the best measurements ever obtained on such an object."

The three-day observations reveal that the comet shards brighten and dim as icy patches on their surfaces rotate into and out of sunlight. Their shapes change, too, as they break apart. The icy relics comprise about 4 percent of the parent comet and range in size from roughly 65 feet wide to 200 feet wide. They are moving away from each other at a few miles per hour.

The Hubble images show that the parent comet also changes brightness cyclically, completing a rotation every two to four hours. A visitor to the comet would see the sun rise and set in as little as an hour. The comet is also much smaller than astronomers thought, measuring only 1,600 feet across, about the length of five football fields.

Comet 332P was discovered in November 2010, after it surged in brightness and was spotted by two Japanese amateur astronomers, Kaoru Ikeya and Shigeki Murakami.

Based on the Hubble data, the research team suggests that sunlight heated up the comet, causing jets of gas and dust to erupt from its surface.

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Because the nucleus is so small, these jets act like rocket engines, spinning up the comet's rotation. The faster spin rate loosened chunks of material, which are drifting off into space.

The research team calculated that the comet probably shed material over several months, between October and December 2015. Jewitt suggests that even some of the ejected pieces have themselves fallen to bits in a kind of cascading fragmentation. "Our analysis shows that the smaller fragments are not as abundant as one might expect based on the number of bigger chunks," he said. "This is suggestive that they're being depleted even in the few months since they were launched from the primary body. We think these little guys have a short lifetime."

Hubble's sharp vision also spied a chunk of material close to the comet, which may be the first salvo of another outburst. The remnant from still another flare-up, which may have occurred in 2012, is also visible. The fragment may be as large as Comet 332P, suggesting the comet split in two. But the icy remnant wasn't spotted until Dec. 31, 2015, by the Pan-STARRS (Panoramic Survey Telescope and Rapid Response System) telescope in Hawaii, in work supported by the Near-Earth Object Observations program in NASA's Planetary Defense Coordination Office. That discovery prompted Jewitt and colleagues to request Hubble time to look at the comet in detail. Around the same time, astronomers around the world began to notice a cloudy patch of material near the comet, which Hubble later resolved into the 25 pieces.

"In the past, astronomers thought that comets die when they are warmed by sunlight, causing their ices to simply vaporize away," Jewitt said. "Either nothing would be left over or there would be a dead hulk of material where an active comet used to be. But it's starting to look like fragmentation may be more important. In Comet 332P we may be seeing a comet fragmenting itself into oblivion."

"Hubble's best previous glimpse at a fragmenting comet came during Advanced Camera for Surveys (ACS) observations of 73P/Schwassmann-Wachmann 3 (73P) in April 2006," said collaborator Harold Weaver of the Johns Hopkins University Applied Physics Laboratory in Laurel, Maryland. "In those observations, Hubble witnessed a comet with more than 60 named pieces. The Hubble images showed unprecedented detail of 73P's breakup, but the comet wasn't observed long enough to document the evolution of the fragments over time, unlike the case of 332P."

The researchers estimate that Comet 332P contains enough mass to endure another 25 outbursts. "If the comet has an episode every six years, the equivalent of one orbit around the sun, then it will be gone in 150 years," Jewitt said. "It's the blink of an eye, astronomically speaking. The trip to the inner solar system has doomed it."

The icy visitor hails from the Kuiper Belt, a vast swarm of objects at the outskirts of our solar system. These icy relics are the leftover building blocks from our solar system's construction. After nearly 4.5 billion years in this icy deep freeze, chaotic gravitational perturbations from Neptune kicked Comet 332P out of the Kuiper Belt.

As the comet traveled across the solar system, it was deflected by the planets, like a ball bouncing around in a pinball machine, until Jupiter's gravity set its current orbit. Jewitt estimates that a comet from the Kuiper Belt gets tossed into the inner solar system every 40 to 100 years.

The results will appear in the Sept. 15, 2016, issue of The Astrophysical Journal Letters.

The Hubble Space Telescope is a project of international cooperation between NASA and the European Space Agency. NASA's Goddard Space Flight Center in Greenbelt, Maryland, manages the telescope. The Space Telescope Science Institute (STScI) in Baltimore, Maryland, conducts Hubble science operations. STScI is operated for NASA by the Association of Universities for Research in Astronomy in Washington, D.C.

A Stellar Circle of Life

NASA/Chandra X-ray Center News Release - November 21, 2016

A snapshot of the stellar life cycle has been captured in a new portrait from NASA's Chandra X-ray Observatory and the Smithsonian's Submillimeter Array (SMA). A cloud that is giving birth to stars has been observed to reflect X-rays from Cygnus X-3, a source of X-rays produced by a system where a massive star is slowly being eaten by its companion black hole or neutron star. This discovery provides a new way to study how stars form.

In 2003, astronomers used Chandra's high-resolution X-ray vision to find a mysterious source of X-ray emission located very close to Cygnus X-3. The separation of these two sources on the sky is equivalent to the width of a penny at a distance of 830 feet away. In 2013, astronomers reported that the new source is a cloud of gas and dust.

In astronomical terms, this cloud is rather small – about 0.7 light years in diameter. Astronomers realized that this cloud was acting as a mirror, reflecting some of the X-rays generated by Cygnus X-3 towards Earth.

"We nicknamed this object the 'Little Friend' because it is a faint source of X-rays next to a very bright source that showed similar X-ray variations," said Michael McCollough of the Harvard-Smithsonian Center for Astrophysics (CfA) in Cambridge, Massachusetts, who led the most recent study of this system.

The Chandra observations reported in 2013 suggested that the Little Friend had a mass between two and 24 times that of the Sun. This suggested that the cloud was a "Bok globule," a small dense cloud where infant stars can be born. However, more evidence was needed.

To determine the nature of the Little Friend, astronomers used the SMA, a series of eight radio dishes atop Mauna Kea in Hawaii. The SMA found molecules of carbon monoxide, an important clue that the Little Friend is indeed a Bok globule. Also, the SMA data reveals the presence of a jet or outflow within the Little Friend, an indication that a star has started to form inside.

"Typically, astronomers study Bok globules by looking at the visible light they block or the radio emission they produce," said co-author Lia Corrales of the Massachusetts Institute of Technology in Cambridge, Mass. "With the Little Friend, we can examine this interstellar cocoon in a new way using X-rays – the first time we have ever been able to do this with a Bok globule."

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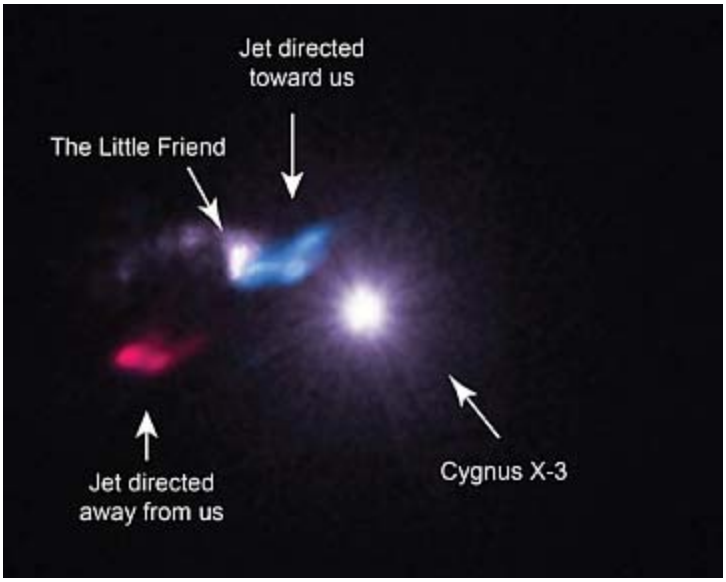

Credit: X-ray: NASA/CXC/SAO/M.McCollough et al, Radio: ASIAA/SAO/SMA

At an estimated distance of almost 20,000 light years from Earth, the Little Friend is also the most distant Bok globule yet seen.

The properties of Cygnus X-3 and its proximity to the Little Friend also give an opportunity to make a precise distance measurement – something that is often very difficult in astronomy. Since the early 1970s, astronomers have observed a regular 4.8-hour variation in the X-rays from Cygnus X-3. The Little Friend, acting as an X-ray mirror, shows the same variation, but slightly delayed because the path the reflected X-rays take is longer than a straight line from Cygnus X-3 to Earth.

By measuring the delay time in the periodic variation between Cygnus X-3 and the Little Friend, astronomers were able to calculate the distance from Earth to Cygnus X-3 of about 24,000 light years.

Because Cygnus X-3 contains a massive, short-lived star, scientists think it must have originated in a region of the Galaxy where stars are still likely to be forming. These regions are only found in the Milky Way's spiral arms. However, Cygnus X-3 is located outside any of the Milky Way's spiral arms.

"In some ways it's a surprise that we find Cygnus X-3 where we do," said co-author Michael Dunham of CfA and the State University of New York at Fredonia. "We realized something rather unusual needed to happen during its early years to send it on a wild ride."

The researchers suggest that the supernova explosion that formed either the black hole or neutron star in Cygnus X-3 kicked the binary system away from its original birthplace. Assuming that Cygnus X-3 and the Little Friend formed near each other, they estimate that Cygnus X-3 must have been thrown out at speeds between 400,000 and 2 million miles per hour.

A paper describing these results appeared in a recent issue of The Astrophysical Journal Letters and is available online.

NASA's Marshall Space Flight Center in Huntsville, Alabama, manages the Chandra program for NASA's Science Mission Directorate in Washington. The Smithsonian Astrophysical Observatory in Cambridge, Massachusetts, controls Chandra's science and flight operations.

The **Atlanta Astronomy Club, Inc**., one of the South's largest and oldest astronomical society, meets at **3:00 P.M.** on the 2nd Saturday of each month at the Fernbank Science Center in Decatur, or occasionally at other locations or times. Membership fees are **$30** for a family or single person membership. College Students membership fee is **$15**. These fees are for a one year membership.

Magazine subscriptions to ***Sky & Telescope*** or ***Astronomy*** can be purchased through the club for a reduced rate. The fees are **$33** for Sky & Telescope and **$34** for Astronomy. Renewal forms will be sent to you by the magazines. Send the renewal form along with your check to the Atlanta Astronomy Club treasurer.

The Club address: Atlanta Astronomy Club, Inc., P.O. Box 76155, Atlanta, GA 30358-1155. AAC Web Page: **http://www.AtlantaAstronomy.org.** Send suggestions, comments, or ideas about the website to webmaster@AtlantaAstronomy.org. Also send information on upcoming observing events, meetings, and other events to the webmaster.

Atlanta Astronomy Club Online

While this newsletter is the official information source for the Atlanta Astronomy Club, it is only up to date the day it is posted. So if you want more up to date information, go to our club's website. The website contains pictures, directions, membership applications, events, updates, and other information. http://www.atlantaastronomy.org You can also follow the AAC on Facebook by joining the AAC group, and on Twitter at http://twitter.com/atlastro.

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PSSG Co-Chair: Open

Sidewalk Astronomy: Brad Isley sidewalkastronomy@AtlantaAstronomy.org

Light Tresspass: Ken Edwards, Contact info TBA

Woodruff Observ. Coordinator: Sharon Carruthers Treasurer@AtlantaAstronomy.org

AAC Webmaster: Daniel Herron

Observing@AtlantaAstronomy.org

Calendar by Tom Faber (Times EDT/EST unless noted)

AAC Events are listed in BOLD

Dec 4th, Sunday: Moon near Mars.
Dec 7th, Wednesday: Moon First Quarter.
Dec 8th, Thursday: Earliest Sunset in Atlanta: ~5:27PM EST.
Dec 10th, Saturday: **CE Chapter Meeting & Potluck 3:30PM.**
Dec 10th, Saturday: Saturn in conjunction with the Sun. Mercury at greatest elongation east.
Dec 12th, Monday: Moon occults Aldebaran: Disappears at 10:53PM, Reappears at 12:00AM.
Dec 13th, Tuesday: Full Moon. Geminid Meteor Shower peaks.
Dec 17th, Saturday: **AAC Holiday Potluck/Meeting at the AFS Building beginning at 6PM.**
Dec 20th, Tuesday: Moon Last Quarter.
Dec 21st, Wednesday: Winter Solstice at 5:44AM EST.
Dec 28th, Wednesday: Mercury at inferior conjunction.
Dec 29th, Thursday: New Moon.
Jan 1st, Sunday: Moon near Venus.
Jan 2nd, Monday: Moon between Mars and Venus.
Jan 4th, Wednesday: Earth at Aphelion. Latest Sunrise in Atlanta: ~7:42 AM.
Jan 5th, Thursday: Moon First Quarter.
Jan 12th, Thursday: Full Moon.
Jan 19th, Thursday: Moon Last Quarter.
Jan 21st, Saturday: **AAC Meeting at Fernbank Science Center 3:00PM.**
Jan 24th, Tuesday: Moon near Saturn morning.
Jan 25th, Wednesday: Thin crescent moon low in the SE at dawn.
Jan 27th, Friday: New Moon.
Jan 28th, Saturday: **CE Chapter Meeting.**

For more event listings see the calendar at www.atlantaastronomy.org

Atlanta Astronomy Club Listserv

Subscribe to the Atlanta Astronomy Club Mailing List**:** The name of the list is: AstroAtlanta. The address for messages is: AstroAtlanta@yahoogroups.com . To add a subscription, send a message to: AstroAtlanta-subscribe@yahoogroups.com .

Focal Point Deadline and Submission Information

Please send articles, pictures, and drawings in electronic format on anything astronomy, space, or sky related to Tom Faber at focalpoint@atlantaastronomy.org. Please send images separate from articles, not embedded in them. Articles are preferred as plain text files but Word documents or PDF's are okay. You can submit articles anytime up to the deadline. **The deadline for January is Saturday, December 31. Submissions after the deadline will go in the following issue**.

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The Focal Point

Newsletter of The Atlanta Astronomy Club, Inc.

FROM:
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We're here to help! Here's how how to reach us:

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