Star Dust

National Capital Astronomers, Inc.

December 2011

Volume 70, Issue 4

http://capitalastronomers.org

Next Meeting

When: Sat. Dec. 10, 2011

Time: 7:30 pm

Where: UM Observatory

Speaker: Justin Finke, NRL

Table of Contents

Directions to Dinner/Meeting

Members and guests are invited to join us for dinner at the Garden Restaurant located in the UMUC Inn & Conference Center, 3501 University Blvd E. The meeting is held at the UM Astronomy Observatory on Metzerott Rd about halfway between Adelphi Rd and University Blvd.

Need a Ride?

Please contact Jay Miller, 240-401-8693, if you need a ride from the metro to dinner or to the meeting at the observatory. Please try to let him know in advance by e-mail at rigel1@starpower.net.

Observing after the Meeting

Following the meeting, members and guests are welcome to tour through the Observatory. Weather-permitting, several of the telescopes will also be set up for viewing.

December 2011: Dr. Justin Finke
Naval Research Laboratory

Gamma Rays from Supermassive Black Holes

Abstract: Supermassive black holes accelerate jets to relativistic speeds, which stretch for hundreds of kiloparsecs from the galaxies which host them. These jets are seen in the radio, and they terminate in giant radio lobes. When these objects have their jet pointed towards the Earth, their emission, throughout the electromagnetic spectrum from radio to gamma rays, is strongly Doppler shifted, and they are known as a blazars.

Blazars have long been known to be gamma-ray emitters. However, astronomers are discovering that off-axis jets can also emit gamma-rays which are detected by the Fermi Large Area Telescope. I will discuss recent gamma-ray observations of blazars and radio galaxies and their implications.

Biography: Justin Finke has been an astrophysicist at the Space Science Division of the Naval Research Laboratory for over a year. Before that, he was a postdoctoral research associate at the same place. His primary research interests are the theory of high-energy emission from active galactic nuclei and supernova remnants, and the interaction of gamma rays with the optical through infrared extragalactic background light. He is currently one of two coordinators for the active galactic nuclei science group of the Fermi Gamma-Ray Space Telescope Collaboration. Justin received his Ph.D. from Ohio University in 2007, where his thesis work was primarily on simulating radiation transport in the accretion disks of X-ray binaries.

Brooks Telescope Recoating

Michael Chesnes

On Friday November 18 Jim Edwards from the TriState Astronomers in Hagerstown, MD visited the NCA telescope making class to test and recoat the 12.5 inch f 9.3 primary mirror for TSA's recently acquired Brooks Telescope, which dates to the 1930s. As you can see from the first photo (courtesy TSA) it's quite an imposing telescope when fully assembled, and wouldn't be easy to bring into our class. However, Jim did bring the telescope's primary mirror in its cell to our class, as well as its secondary mirror. Dirt and oxidation are clearly visible on the primary's optical surface before recoating, although the rear of the mirror is still pristine, and bears a label advertising Clausing's Beryl coating. One unusual feature of this mirror is an irregular surface texture reminiscent of spaghetti wrapped around parts of its edge. The texture is barely visible in the lower right hand corner of the middle photo on page 3. Also notice the shaft which extends through a hole in the center of the mirror cell to facilitate removing and returning the primary mirror. (Remaining photos courtesy Guy Brandenburg)

Star Dust is published ten times yearly September through June, by the National Capital Astronomers, Inc. (NCA).

ISSN: 0898-7548

Editor: Michael Chesnes

Editorial Advisors:
Elizabeth Warner
Jeffrey Norman
Wayne Warren
Harold Williams
John D. Gaffey, Jr.
Marjorie Weissberg

PDF Distributor: Jay Miller

Please Get Star Dust Electronically

NCA members able to receive Star Dust, the newsletter of the NCA, via e-mail as a PDF file attachment, instead of hardcopy via U.S. Mail, can save NCA a considerable amount of money on the printing and postage in the production of Star Dust (the NCA's single largest expense) and also save some trees. If you can switch from paper to digital, please contact Michael L. Brabanski, the NCA Sec-Treasurer, at mlbrabanski@verizon.net or 301-649-4328 (h).

Thank you!

Reminder

After the meeting, everyone is invited to join us at Plato's Diner in College Park. Plato's is located at 7150 Baltimore Ave. (US Rt. 1 at Calvert Rd.), just south of the university's campus. What if it's clear and you want to stick around and observe? No problem -- just come over when you're through. This is very informal, and we fully expect people to wander in and out.

2011-2012 Officers

President:
Joseph C. Morris
j.c.morris@verizon.net
703-620-0996 (h)
703-983-5672 (w)

Vice-President:
John Hornstein
jshgwave@yahoo.com
301-593-1095 (h)

Secretary-Treasurer:
Michael L. Brabanski
mlbrabanski@verizon.net
301-649-4328 (h)

Asst. Secretary-Treasurer:
Jeffrey B. Norman
jeffreynorman@comcast.net

Trustees:

- Walter Faust (2012)
- Benson Simon (2013)
- Andrew Seacord (2014)
- Wayne Warren (2015)

Appointed Officers and Committee Heads:

Exploring the Sky
Joseph C. Morris
j.c.morrris@verizon.net

Telescope Making
Guy Brandenburg
gbrandenburg@yahoo.com
202-635-1860

NCA Webmaster
Harold Williams
Harold.Williams@montgomerycollege.edu
240-567-1463 (w)
301-565-3709 (h)

Meeting Facilities
Jay H. Miller
rigel1@starpower.net
240-401-8693

Star Dust Editor
Michael Chesnes
m.chesnes@verizon.net
301-313-0588

Recent Astronomy: Supermassive Black Holes[1]
December 2011

Nancy Grace Roman

(continued from October 2011)

A giant black hole in the constellation Draco bit off more than it could chew. On 25 March, NASA's Swift satellite detected an x-ray flare when a black hole 3.9 billion light-years from Earth tore a passing star to shreds. The x-ray data as well as radio observations indicate the fireworks caused a narrow jet of material to shoot away from the black hole's outskirts. Similar jets emerge from other black holes, but this is the first time that astronomers have witnessed the birth of one. This discovery means just one wayward star can spark a spectacle. The flow of hot gas toward a black hole has been clearly imaged for the first time in x-rays. The observations from NASA's Chandra X-ray Observatory will help tackle two of the most fundamental problems in modern astrophysics: understanding how black holes grow and how matter behaves in their intense gravity.

The black hole is at the center of a large galaxy known as NGC 3115, which is located about 32 million light years from Earth. A large amount of previous data has shown material falling toward and onto black holes, but none with this clear a signature of hot gas. By imaging the hot gas at different distances from this supermassive black hole, astronomers have observed a critical threshold where the motion of gas first becomes dominated by the black hole's gravity and falls inward. This distance from the black hole is known as the "Bondi radius."

As gas flows toward a black hole, it becomes squeezed, making it hotter and brighter, a signature now confirmed by the X-ray observations. The researchers found the rise in gas temperature begins about 700 light years from the black hole, giving the location of the Bondi radius. This suggests the black hole in the center of NGC 3115 has a mass about two billion times that of the sun, making it the closest black hole of that size to Earth.

The Chandra data also show the gas close to the black hole in the center of the galaxy is denser than gas further out, as predicted. Using the observed properties of the gas and theoretical assumptions, the observing team estimated that each year gas weighing about 2 percent the mass of the Sun is being pulled across the Bondi radius toward the black hole.

Astronomers using NASA's Chandra X-ray Observatory discovered the first pair of supermassive black holes in a spiral galaxy similar to the Milky Way. Approximately 160 million light years from Earth, the pair is the nearest known such phenomenon. The black holes are located near the center of the spiral galaxy NGC 3393. Separated by only 490 light years, the black holes are likely the remnant of a merger of two galaxies of unequal mass a billion or more years ago. Since this galaxy was right under our noses by cosmic standards, it makes us wonder how many of these black hole pairs we've been missing.

Previous observations in X-rays and at other wavelengths indicated that a single supermassive black hole existed in the center of NGC 3393. However, a long look by Chandra allowed the researchers to detect and separate the dual black holes. Both black holes are actively growing and emitting X-rays as gas falls towards them and becomes hotter.

When two equal-sized spiral galaxies merge, astronomers think it should result in the formation of a black hole pair and a galaxy with a disrupted appearance and intense star formation. A well-known example is the pair of supermassive black holes in NGC 6240, which is located about 330 million light years from Earth.

However, NGC 3393 is a well-organized spiral galaxy, and its central bulge is dominated by old stars. These are unusual properties for a galaxy containing a pair of black holes. Instead, NGC 3393 may be the first known instance where the merger of a large galaxy and a much smaller one, dubbed a "minor merger" by scientists, has resulted in the formation of a pair of supermassive black holes. In fact, some theories say that minor mergers should be the most common way for black hole pairs to form, but good candidates have been difficult to find because the merged galaxy is expected to look so typical.

The NGC 3393 discovery has some similarities to a possible pair of supermassive black holes found recently also using Chandra data. Two X-ray sources, which may be due to supermassive black holes in a galaxy about two billion light years from Earth, are separated by about 6,500 light years. As in NGC 3393, the host galaxy shows no signs of disturbance or extreme amounts of star formation. However, no structure of any sort, including spiral features, is seen in the galaxy. Also, one of the sources could be explained by a jet, implying only one supermassive black hole is located in the galaxy.

1. This article is based on NASA press releases.

NASA News from Frank Reddy

In the Heart of Cygnus, NASA's Fermi Reveals A Cosmic-ray Cocoon11.28.11

The constellation Cygnus, now visible in the western sky as twilight deepens after sunset, hosts one of our galaxy's richest-known stellar construction zones. Astronomers viewing the region at visible wavelengths see only hints of this spectacular activity thanks to a veil of nearby dust clouds forming the Great Rift, a dark lane that splits the Milky Way.

Located in the vicinity of the second-magnitude star Gamma Cygni, the star-forming region was named Cygnus X when it was discovered as a diffuse radio source by surveys in the 1950s. Now, a study using data from NASA's Fermi Gamma-ray Space Telescope finds that the tumult of star birth and death in Cygnus X has managed to corral fast-moving particles called cosmic rays.

Cosmic rays are subatomic particles -- mainly protons -- that move through space at nearly the speed of light. In their journey across the galaxy, the particles are deflected by magnetic fields, which scramble their paths and make it impossible to backtrack the particles to their sources.

Gamma-ray emission detected by Fermi LAT fills bubbles of hot gas created by the most massive stars in Cygnus X. The turbulence and shock waves produced by these stars make it more difficult for high-energy cosmic rays to traverse the region. When the particles strike gas nuclei or photons of starlight, gamma rays result.
Credit: NASA/DOE/Fermi LAT Collaboration/I. A. Grenier and L. Tibaldo

Continued on Page 6

Mid-Atlantic Occultations and Expeditions

David Dunham

Asteroidal Occultations

Date	Day	EDT	Star	Mag.	Asteroid	dmag	dur. s	Ap. "	Location
Dec 10	Sat	18:49	2UC40968695	13.0	Brouwer	2.3	8	10	NJ,ePA,MD,DC,eVA
Dec 10	Sat	6:07	PPM 158230	9.9	Marlu	6.6	4	4	sON,n&ePA,NJ
Dec 14	Wed	18:53	SAO 40349	7.6	Adele	7.5	1	2	NY,PA,OH
Dec 14	Wed	22:45	SAO 165804	5.7	Mavis	9.2	1	1	SC
Dec 16	Fri	18:21	2UC43086905	11.7	Titania	0.9	7	7	NJ,DE,MD,VA,NC
Dec 18	Sun	4:35	TYC24430742	10.3	1999 XS136	5.3	1	5	NY,PA,NJ
Dec 18	Sun	21:18	2UC36787600	11.4	Alexandra	3.5	3	7	DE,VA,MD,DC,PA
Dec 20	Tue	18:08	TYC24190877	11.8	Eurydike	1.3	4	7	NJ,DE,MD,VA,NC
Dec 25	Sun	22:20	TYC13140863	11.4	Xanthippe	1.7	8	7	VA,NC,SC
Dec 26	Mon	17:29	TYC58171375	9.7	Astronomia	7.0	2	4	NY,PA; Sun -7
Dec 27	Tue	18:54	SAO 109778	9.0	Pielinen	6.9	1	4	NY,NJ,DE,MD,VA
Dec 29	Thu	4:39	2UC40655371	12.0	Fredegundis	0.5	5	8	NJ,DE,MD,VA,PA
2012									
Jan 8	Sun	19:22	TYC29380818	11.6	Zerbinetta	2.5	5	7	NJ,PA,MD,VA,NC
Jan 8	Sun	22:13	SAO 58363	8.3	Eurydike	4.8	5	2	NC,SC
Jan 9	Mon	23:24	TYC13110868	10.1	Solvejg	5.3	2	5	NJ,DE,MD,VA,PA
Jan 11	Wed	23:18	TYC18870067	9.9	Sodankyla	5.1	3	4	NJ,DE,MD,VA
Jan 13	Fri	21:18	2UC36787600	11.4	Geldonia	3.5	3	7	NY,PA

Lunar Grazing Occultations (*, Dunham plans no expedition)

Date	Day	EDT	Star	Mag.	%	alt	CA	Location	
Dec 16	Fri	5:20	ZC 1495	5.8	67-	53	10S	135	41
Dec 22	Thu	5:58	SAO 183826	9.0	7-	7	7S d	17	32
Dec 29	Thu	19:34	ZC 3340	7.7	28+	29	5S c	99	338
2012									
Jan 5	Thu	22:45	ZC 657	5.3	90+	68	7N S	159	186
Jan 14	Sat	5:52	SAO 138378	7.5	71-	42	5S c	41	222
Jan 15	Sun	1:59	SAO 138830	7.2	62-	25	5S c	99	28
Jan 15	Sun	3:55	SAO 138854	9.0	61-	39	7S	25	220
Jan 18	Wed	4:12	ZC 2206	7.0	27-	13	6S	136	0

Under Location, if two numbers are given, the first is the distance of the northern (for cusp angles, or CA, with N) or southern (for CA with S) limit (the graze line) from Greenbelt, MD and the second number is the bearing (azimuth) of that distance in deg.

Total Lunar Occultations

DATE	Day	EDT	Ph	Star	Mag.	%	alt	CA	Sp.	Notes
Dec 13	Tue	6:37	R	74 Gem	5.0	92-	31	22N	M0	Sun -8,ZC1158,dbl
Dec 14	Wed	5:00	R	29 Cancri	5.9	86-	55	79S	A5	ZC1271,dbl
Dec 16	Fri	1:23	R	14 Sex	6.2	69-	35	53S	K1	ZC1482,dbl
Dec 16	Fri	4:16	R	SAO 118150	7.3	68-	56	76N	K0	dbl
Dec 17	Sat	0:15	R	55 Leonis	5.9	58-	11	71S	F2	Az. 98,ZC1587,dbl
Dec 17	Sat	3:28	R	SAO 118620	7.3	57-	43	75S	A2	dbl
Dec 17	Sat	4:41	R	62 Leonis	6.0	57-	50	35N	K3	ZC1605
Dec 22	Thu	11:10	D	del Sco	2.3	6-	27	-83S	B0	Sun 26,ZC2290,dbl,ZC2290
Dec 22	Thu	12:26	R	del Sco	2.3	6-	20	76S	B0	Sun 28,ZC2290,dbl,ZC2290
Dec 26	Mon	17:55	D	SAO 163399	7.3	6+	13	71S	A0	Az.237
2012										
Jan 1	Sun	22:00	D	ZC 163	7.3	58+	36	68N	F2	dbl
Jan 4	Wed	1:47	D	40 Arietis	5.8	76+	14	39S	K1	Az.282,ZC 415,dbl
Jan 5	Thu	17:22	D	51 Tauri	5.6	89+	36	78S	F0	Sun -5,ZC 631,dbl
Jan 5	Thu	18:08	D	56 Tauri	5.3	89+	44	74N	A0	ZC 634
Jan 6	Fri	19:20	D	108 Tauri	6.3	95+	48	72N	A2	ZC 784,dbl
Jan 6	Fri	21:51	D	109 Tauri	5.0	95+	72	51S	G8	ZC 792
Jan 7	Sat	2:56	D	114 Tauri	4.9	96+	31	70S	B2	ZC 817,dbl
Jan 8	Sun	5:40	D	16 Gem	6.2	99+	10	46S	A2	Az.288,ZC 991,TmD 9
Jan 13	Fri	5:55	R	ZC 1582	6.4	81-	40	50N	A3	dbl
Jan 14	Sat	5:58	R	SAO 138378	7.5	71-	41	15S	F4	dbl
Jan 15	Sun	0:12	R	ZC 1788	6.8	62-	8	28S	G0	Az.108
Jan 15	Sun	3:47	R	21 Vir	5.5	61-	38	42S	A0	ZC1800

Explanations & more information is at http://iota.jhuapl.edu/exped.htm. David Dunham, dunham@starpower.net, phone 301-526-5590. Timing equipment and even telescopes can be loaned for most expeditions that we actually undertake; we are always shortest of observers who can fit these events into their schedules, so we hope that you might be able to.

Information on timing occultations is at: http://iota.jhuapl.edu/timng920.htm.

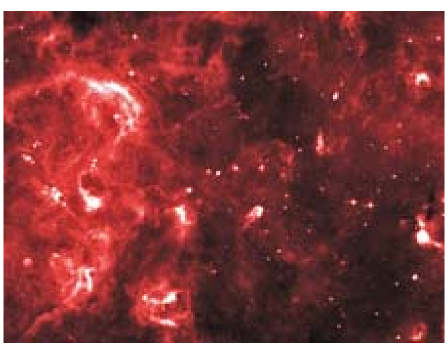
Continued from Page 5

Yet when cosmic rays collide with interstellar gas, they produce gamma rays -- the most energetic and penetrating form of light -- that travel to us straight from the source. By tracing gamma-ray signals throughout the galaxy, Fermi's Large Area Telescope (LAT) is helping astronomers understand the sources of cosmic rays and how they're accelerated to such high speeds. In fact, this is one of the mission's key goals.

The galaxy's best candidate sites for cosmic-ray acceleration are the rapidly expanding shells of ionized gas and magnetic field associated with supernova explosions. For stars, mass is destiny, and the most massive ones -- known as types O and B -- live fast and die young.

Which brings us back to Cygnus X. Located about 4,500 light-years away, this star factory is believed to contain enough raw material to make two million stars like our sun. Within it are many young star clusters and several sprawling groups of related O- and B-type stars.

Intense light and outflows from the monster stars in Cygnus OB2 and from several other nearby associations and star clusters have excavated vast amounts of gas from their vicinities. The stars reside within cavities filled with hot, thin gas surrounded by ridges of cool, dense gas where stars are now forming. It's within the hollowed-out zones that Fermi's LAT detects intense gamma-ray emission, according to a paper describing the findings that was published in the Nov. 25 edition of the journal Science.



Cygnus X hosts many young stellar groupings, including the OB2 and OB9 associations and the cluster NGC 6910. The combined outflows and ultraviolet radiation from the region's numerous massive stars have heated and pushed gas away from the clusters, producing cavities of hot, lower-density gas. In this 8-micron infrared image, ridges of denser gas mark the boundaries of the cavities. Bright spots within these ridges show where stars are forming today. **Credit:** NASA/IPAC/MSX

Supermassive Black Holes and Precision Cosmology with Megamasers

Date: Wednesday, December 14, 2011

Speaker: Jim Braatz, National Radio Astronomy Observatory, Charlottesville, VA

Topic: Supermassive Black Holes and Precision Cosmology with Megamasers

Time and Location: 1:00 PM, with Q&A to follow; in a 1st floor conference room at the American Center for Physics, 1 Physics Ellipse, College Park, MD-- off River Rd., between Kenilworth Ave. and Paint Branch Parkway.

Abstract: In the gaseous and dusty accretion disks that surround supermassive black holes in the nuclei of nearby galaxies, water molecules emit maser radiation at a wavelength of 1.3 cm. Applying the technique of Very Long Baseline Interferometry, we can map the distribution of individual maser clouds in these disks and determine their positions with an accuracy better than 0.01 milli-arcseconds, and their line-of-sight velocities with an accuracy better than 1 km/s. The masers thus provide a powerful tool for tracing the dynamics of the disk. We use these data to measure precise masses of the central black holes, a measurement which has important implications in understanding how galaxies evolve. In some cases we can also use them to measure direct, geometric distances to the host galaxies, and thereby get a geometric measurement of the expansion rate of the universe. Complementing other observations, these measurements will help to place significant constraints on models of dark energy.

Biography: Jim Braatz is an astronomer at the National Radio Astronomy Observatory (NRAO) in Charlottesvile, VA. A native Marylander, Jim received a B.A. in Physics from the Johns Hopkins University and a Ph.D. in Astronomy from the University of Maryland. Subsequently he was a postdoc at Harvard and then a Jansky Fellow with NRAO in Green Bank, WV. Jim has worked on development of the Green Bank Telescope and is also a member of the North American ALMA Science Center, helping the astronomical community use the new Atacama Large Millimeter/Submillimeter Array (ALMA). Jim's research is centered on observations of radio emission from active galaxies. He is the PI of the Megamaser Cosmology Project.

The Howard B. Owens
Science Center
Planetarium
9601 Greenbelt Road
Lanham-Seabrook, MD 20706
http://www1.pgcps.org/howardbowens/

All Programs held the second Friday of the month unless otherwise indicated.
Doors open by 7:15 p.m.
Program begins at 7:30 p.m.
Call 301-918-8750 during school hours to confirm program topic.
Cost is $5.00 for adults; $3.00 for students/teachers/seniors. Children 3 and under are free.

December 9, 2011:
Terrible Teddy

In this timeless tale, Santa has made a Teddy Bear too big to fit in the sleigh. But Teddy doesn't want to be in a department store. Come learn how Teddy uses the stars to find his way back to Santa! A tour of the current night sky follows the presentation. Special: bring a teddy bear to donate to Toys for Tots, and receive $1 off your admission fee!

Calendar of Events

NCA Mirror- and Telescope-making Classes: Tuesdays Dec. 6, 13, 20, 27 and Fridays, Dec. 2, 9, 16, 6:30 to 9:30 pm at the Chevy Chase Community Center, at the northeast corner of the intersection of McKinley Street and Connecticut Avenue, N.W. Contact instructor Guy Brandenburg at 202-635-1860 or email him at gfbrandenburg@yahoo.com. In case there is snow, call 202-282-2204 to see if the CCCC is open. No classes on Dec. 23 or 30.

Open house talks and observing at the University of Maryland Observatory in College Park on the 5th and 20th of every month at 8:00 pm (Nov-Apr) or 9:00 pm (May-Oct). There is telescope viewing afterward if the sky is clear.

Dinner: Saturday, Dec. 10 at 5:30 pm, preceding the meeting, at the *Garden Restaurant* in the University of Maryland University College Inn and Conference Center.

Montgomery College Planetarium: Wednesday, 21 Dec. 2011 at 5 pm. 7621 Fenton Street, Takoma Park, MD (240) 567-1463. "The Day of the Sun's Return, The Winter Solstice" For more information, see planetarium website: http://www.mc.cc.md.us/Departments/planet/

Upcoming NCA Meetings at the University of Maryland Observatory

Nov. 12, 2011 **Dan Wik** (GSFC) - Merging Galaxies and Clusters of Galaxies
Dec. 10, 2011 **Justin Finke** (NRL) - *Gamma Rays from Radio Galaxies*
Jan. 14, 2011 **Guy Brandenburg** (DCPS ret.) - Making Your Own Telescope

National Capital Astronomers Membership Form

Name: ____ **Date:** ___/___/___

Address: ____ **ZIP Code:** ______

Home Phone: ____-____-_____ **E-mail:** ______________________ **Age:** __________

Present or Former Occupation (Or, If Student, Field of Study): ________________________

Academic Degrees: _________________ **Field(s) of Specialization:** ___________________

Employer or Educational Institution: ____

Student Membership: ……….. $ 5

Standard Individual or Family Membership: ……………………..……..…… $10

Optional additional contribution to NCA: ……………………………..……….. $__

Total Payment (circle applicable membership category above): ………….................... $___

Members receive Stardust*, the monthly newsletter announcing NCA activities, by e-mail. If you would like to receive a paper copy of* Stardust *via regular mail, please check here:* ____

Please mail this form with check payable to National Capital Astronomers to:
Michael L. Brabanski, NCA Treasurer; 10610 Bucknell Drive; Silver Spring, MD 20902

National Capital Astronomers, Inc.

If undeliverable, return to
NCA c/o Michael L. Brabanski
10610 Bucknell Dr.
Silver Spring, MD 20902-4254

First Class
Dated Material

Next NCA Mtg:

Dec. 10

7:30 pm

@ UM Obs

Dr. Justin Finke

Inside This Issue