Star Dust

Newsletter of National Capital Astronomers, Inc.

capitalastronomers.org

December 2017 ***Volume 76, Issue 4***

Celebrating 80 Years of Astronomy 1937-2017

Next Meeting

When: Sat. Dec 9th, 2017

Time: 7:30 pm

Where: UMD Observatory

Speaker: Dr. Mario Gliozzi

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Directions to Dinner/Meeting

Our time and location for dinner with the speaker before this meeting is 5:30 pm at "The Common", the restaurant in the UMD University College building located at 3501 University Blvd.

The National Capital Astronomers meeting is held at the UMD Astronomy Observatory on Metzerott Rd about halfway between Adelphi Rd and University Blvd.

Observing after the Meeting

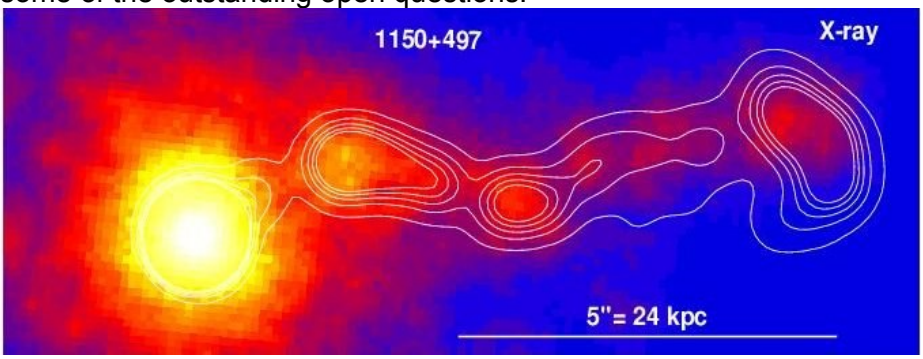
Following the meeting, members and guests are welcome to tour through the Observatory. Weather-permitting, several of the telescopes will also be set up for viewing.

Black Holes at All Scales: An X-Ray View

Mario Gliozzi

George Mason University

Abstract: Astrophysical black holes are thought to produce the most powerful phenomena of the Universe. They occur on very diverse scales, from stellar mass black holes in binary systems, to supermassive black holes at the center of active and quiescent galaxies. Using the X-ray perspective, I will describe some recent progress in this field, and discuss some of the outstanding open questions.



X-ray image of a jet from Quasar 1150+497

Biographical Sketch:

Dr. Mario Gliozzi is currently an Associate Professor in the Physics and Astronomy Department at George Mason University, where he teaches and does research in the field of X-ray extragalactic astronomy. He obtained his PhD in physics from the University of Torino (Italy), and worked for three years at the Max Planck Institute for Extraterrestrial Physics during the last years of the ROSAT satellite and the beginning of the XMM-Newton era. He moved to the US in 2001 and worked with Chandra, RXTE, and more recently Swift data on spatial, spectral, and temporal studies of Active Galactic Nuclei.

Recent Astronomy Highlights

Pulsar Alternately Emitting X-rays and Radio Waves

X-rays, with this month's speaker's talk, and radio waves, with the article to the right, are prominent in December's Star Dust. So why not highlight a pulsar that alternately emits both? Two of the three general categories of pulsars (the third being magnetars) are rotation-powered pulsars and accretion-powered pulsars. Rotation-powered pulsars generally emit radio waves. Accretion-powered pulsars usually, but not always, are powered by the infalling matter from a companion star and emit x-rays. But scientists are studying a pulsar that alternately emits radio waves and x-rays. It's a mystery as to what is causing this. To read more, their paper entitled **Simultaneous Chandra and VLA Observations of the Transitional Millisecond Pulsar PSR J1023+0038: Anti-Correlated X-ray and Radio Variability** is available at: arxiv.org/pdf/1709.08574.pdf

An Observatory of Water Tanks Studies Local Pulsar Gamma Rays

Located in the Mexican state of Puebla at over 13,000 feet above sea level, HAWC, the High-Altitude Water Cherenkov Observatory, has 300 water tanks each containing nearly 50,000 gallons of water. Sensors in each tank look for Cherenkov radiation caused by the particles created when gamma rays hit the upper atmosphere. Using gamma-ray counts from the region of two of the nearest pulsars, HAWC results seem to favor dark-matter annihilation over pulsars as the source of the positron excess observed by the PAMELA and AMS detectors. To read more, a paper entitled **Extended gamma-ray sources around pulsars constrain the origin of the positron flux at Earth** can be found at arxiv.org/ftp/arxiv/papers/1711/1711.06223.pdf

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Digging Deep and Seeing Far

The University of Maryland Amateur Radio Astronomy Team

Chances are if you were to come to the University of Maryland Observatory on Wednesday or Saturday afternoons, you'd see NCA Member Sarah Brown as well as Duane Bratlie, and sometimes others, working around the radio telescope beside the Observatory's lecture hall. Over the past three years that work has included spray painting the dish, pulling new wire and working at the computers controlling and monitoring the dish inside the lecture hall. And digging a very deep hole. (More on that below.)

Sarah Brown and Duane Bratlie alongside a 30-foot U-shaped pipe and the auger for digging the hole the pipe will go in.

Manual labor seems to be something of a tradition in radio astronomy from Karl Jansky building an antenna for Bell Laboratories in New Jersey in the early 1930s, to Grote Reber building the first parabolic-dish radio antenna specifically for astronomy in a lot near his home in Wheaton, Illinois, to Jocelyn Bell Burnell, the discoverer of radio pulsars, spending a summer as a graduate student stringing wire for a 4 ½ -acre radio telescope, claiming that afterward she could "swing a 20-pound hammer."

Physical fitness aside, the labor of those pioneers and others has opened eyes onto parts of the Universe that might have remained forever unseen if humans had only optical telescopes with which to look outward. Radio waves are a form of light, but with very long wavelengths. While the light we see with our eyes can be measured in wavelengths of 400 to 700 nanometers (one nanometer being a billionth of a meter) radio wavelengths are measured in a range from millimeters (thousandths of a meter) to hundreds of kilometers. The longer wavelengths of radio waves allow them to pass by material such as gas or dust that block the light we

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Exploring the Sky

*"**Exploring the Sky**"* is an informal program that, for over 60 years, has offered monthly opportunities for anyone in the Washington area to see the stars and planets through telescopes from a location within the District of Columbia.

Presented by the National Park Service and National Capital Astronomers, sessions are held in Rock Creek Park once each month on a Saturday night from April through November. Beginners (including children) and experienced stargazers are all welcome—and it's free!

Hosted by: National Capital Astronomers, Inc and Rock Creek Park

With the winter months, the Exploring the Sky program will take a hiatus until April of 2018. With the great results from the October 21st session, it was almost inevitable that the November session wouldn't turn out so well.

As Jay Miller reports – "The last Exploring the Sky of the year on 18 November was, unfortunately, clouded out. Only Tony Linforth, the NPS Park Ranger, and I were there and the only telescope was the one Tony brought. The only guests we had was a group of 1st and 2nd graders and their chaperones. Tony told them the story of Andromeda, Perseus, Cassiopea, etc. And that was it. No observing. It looks like the next EtS will be the first Saturday in April. You have been warned!"

So, what's the long-range forecast for early April? Knowing the luck of astronomers - probably lots and lots of clouds.

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see with our eyes, allowing us to explore regions such as the center of Milky Way. Radio telescopes can also see the light from long ago that has been redshifted into the radio part of the spectrum by the expansion of the Universe. In addition, there are some atomic processes, such as the flipping of the spin state of the electron in a hydrogen atom, which generate radio waves, in the hydrogen-electron case radio waves that are 21 centimeters in length. This 21-centimeter line allows radio astronomers to locate atomic hydrogen throughout the Universe and study structures it forms, such as galaxies. (See the sidebar on Page 7 for a few of the astronomical discoveries that have come from radio astronomy.)

One other advantage of radio telescopes over optical telescopes is that they can be used 24 hours a day. And cloudy days are no problem. Just as radio signals pass unhindered through dust and gas in space, they pass right through clouds.

Radio Telescope at the University of Maryland Observatory.

The radio telescope at the UMD Observatory is a parabolic dish, much like the one designed by Grote Reber, and is 2 ½ meters in diameter. Radio waves hitting the dish are focused back up onto a Yagi antenna at the point of focus. (For those who remember the analog-television days, the old roof antennas were a form of Yagi antenna.) While the UMD telescope can be pointed manually, it does not have a drive to keep it fixed on one spot in the sky. But a lot can be seen and studied as the telescope system records signals from the parts of the Universe that sweep over it as the hours go by. So far, the team has been able to use the telescope to get readings of the Milky Way and Cygnus A, a radio galaxy in the constellation of Cygnus (see the chart on page 4).

Lately the main effort of the team has been digging a 30-foot hole beside the dish. The purpose of the hole is to install a U-shaped pipe (shown on

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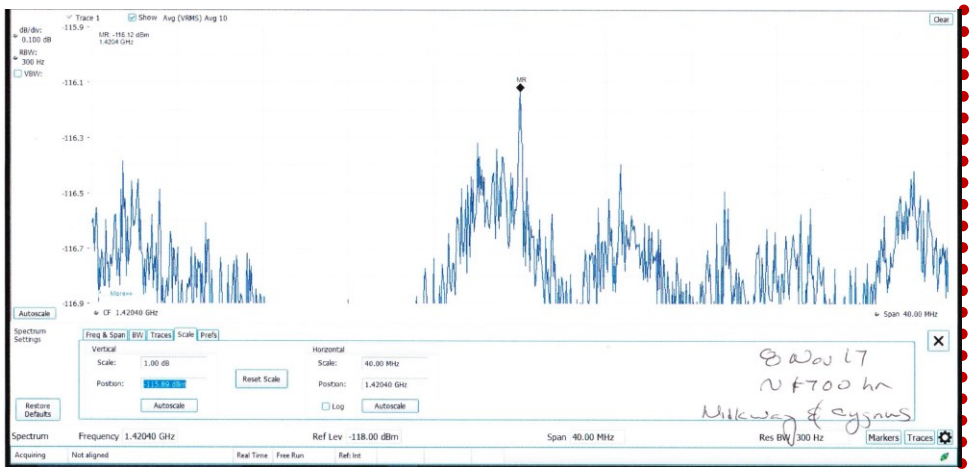
Page 2) that will circulate distilled water (possibly another coolant later) down into the ground and back up, operating as a geothermal heat exchanger in order to keep the radio telescope's preamplifier at a constant temperature. The preamplifier boosts the signal received by the antenna. Having it at a constant temperature means that the gain (the intensification of the signal), will remain constant over varying environmental temperatures.

But it's not all manual labor. Over the past three years, the team has acquired and improved equipment, such as the three computers which the team built themselves. They are affectionately known as Karen, Suzi and Little Girl. They are used to support two Tektronix spectrum analyzers (which are the site receivers).

So, what's the goal of all of this work? As Sarah puts it, "A working radio telescope that can be used to show radio astronomy to anybody from kindergarten up through grad student. And even the occasional professional astronomer." Toward that goal, a couple of grad students from the University of Maryland came out recently and actually began using the telescope. "It was a joy watching them take over," Sarah said.

Work continues, and help is always welcome. So, if you're interested, whether your talents are painting, digging, computer programming, experience with radio equipment or just about any technical ability, or even if you simply want to learn more about radio astronomy, details of the team's meetings are available in the Calendar of Events on Page 7.



The chart shows the intensity of the radio emissions (in a logarithmic scale) across a range of 40 Megahertz (millions of cycles per second) centered on the frequency of 1.4204 Gigahertz (billions of cycles per second) when the UMD radio telescope was pointed in the direction of the Milky Way and Cygnus A, a radio galaxy and one of the strongest sources of radio waves in the sky. Note the peak at 1.4204 Gigahertz which is the frequency of the 21-centimeter line from hydrogen mentioned above.

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Editor: Todd Supple

Editorial Advisors:

- Michael Chesnes
- John D. Gaffey, Jr.
- Jeffrey Norman
- Elizabeth Warner
- Wayne Warren
- Marjorie Weissberg
- Harold Williams

Electronic Distributor: Jay Miller

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Thank you!

Recent Astronomy Highlights – continued from page 2

Visitor from Outside the Solar System (Part 2)

News of the first interstellar visitor seems to come almost as fast as it is moving through the solar system. Now confirmed to be an asteroid, either rocky or having high-metal content, the object appears to have an unusual cigar shape, with its length of approximately 400 meters being ten times as long as its width. The asteroid is red in color and spins on its axis every 7.3 hours. Now officially designated as 1I/2017 U1, the asteroid is named `Oumuamua. (Somebody's going to be buying a lot of vowels when that name shows up as an answer on Wheel of Fortune.) More information can be found at numerous sites on the web, including the following: www.sciencedaily.com/releases/2017/11/171120120935.htm

Occultation Notes

- D following the time denotes a disappearance, while R indicates that the event is a reappearance.
- When a power (x; actually, zoom factor) is given in the notes, the event can probably be recorded directly with a camcorder of that power with no telescope needed.
- The times are for Greenbelt, MD, and will be good to within +/-1 min. for other locations in the Washington-Baltimore metropolitan areas unless the cusp angle (CA) is less than 30 deg., in which case, it might be as much as 5 minutes different for other locations across the region.
- Some stars in Flamsteed's catalog are in the wrong constellation, according to the official IAU constellation boundaries that were established well after Flamsteed's catalog was published. In these cases, Flamsteed's constellation is in parentheses and the actual constellation is given in the notes following a /.
- Mag is the star's magnitude.
- % is the percent of the Moon's visible disk that is sunlit, followed by a + indicating that the Moon is waxing and - showing that it is waning. So 0 is new moon, 50+ is first quarter, 100+ or - is full moon, and 50- is last quarter. The Moon is crescent if % is less than 50 and is gibbous if it is more than 50.
- Cusp Angle is described more fully at the main IOTA Web site.
- Sp. is the star's spectral type (color), O,B,blue; A,F,white; G,yellow; K,orange; M,N,S,C red.
- Also in the notes, information about double stars is often given. "Close double" with no other information usually means nearly equal components with a separation less than 0.2". "mg2" or "m2" means the magnitude of the secondary component, followed by its separation in arc seconds ("), and sometimes its PA from the primary. If there is a 3rd component (for a triple star), it might be indicated with "mg3" or "m3". Double is sometime abbreviated "dbl".
- Sometimes the Watts angle (WA) is given; it is aligned with the Moon's rotation axis and can be used to estimate where a star will reappear relative to lunar features. The selenographic latitude is WA -270. For example, WA 305 - 310 is near Mare Crisium.

Mid-Atlantic Occultations

David Dunham

Asteroidal Occultations

Date	Day	EST	Star	mag.	Asteroid	dmag	dur. s	Ap. "	Location, Notes
2017									
Dec 13	Wed	3:58	SAO 77548	7.9	Frieda	7.4	1	2	se&cVA,cWV,cOH
Dec 14	Thu	23:11	TYC13991829	11.8	Aquilegia	3.3	5	7	nVA,WV;DC,sMD?
Dec 15	Fri	6:20	4UC40654911	13.6	Tercidina	0.7	4	12	wPA,MD,DC,DE
Dec 17	Sun	22:31	TYC18760044	10.8	El Djezair	3.7	2	6	NJ,sPA,cOH;nMD?
Dec 18	Mon	5:43	TYC24310133	9.9	Athor	3.0	3	4	sNJ,ePA,wNY,sON
Dec 18	Mon	22:33	TYC17252069	11.7	*Interamnia	0.5	19	7	NJ,e&nMD,PA,sNY
Dec 19	Tue	21:18	4UC55433739	13.5	Memoria	2.4	3	12	NJ,MD;DC,nVA?
Dec 20	Wed	23:24	TYC13160147	12.2	Virginia	0.6	10	8	cNC,nSC,nGA,nAL
Dec 25	Mon	23:58	2UC38207226	12.3	Cybele	0.7	16	8	NJ,MD,DC,nVA,PA
Dec 31	Sun	20:54	2UC38194304	12.0	Hannibal	3.2	4	8	swPA,MD,DC;nVA?
2018									
Jan 5	Fri	4:13	SAO 57165	9.0	Georgia	4.1	7	3	eLI,swCT,se&cNY
Jan 6	Sat	1:36	4UC44921678	13.9	Rockefellia	1.0	4	12	DE,MD,DC,nVA,OH
Jan 6	Sat	1:40	2UC32174469	12.4	Wilhelmina	1.7	6	8	sVA,sKY,sIL,sMO
Jan 8	Mon	1:05	TYC13180406	10.0	Grubba	5.0	1	5	cVA,sWV,nKY,sIN
Jan 13	Sat	19:39	TYC52401315	11.7	Anahita	1.7	1.1	9	nMD,sePA,nDE,NJ
Jan 13	Sat	20:13	4UC58436541	13.9	Leonora	0.4	7	12	NJ,eMD,DC,n&wVA

* before the asteroid name indicates an event in the list of high-interest asteroidal occultations of the ESO Large Programme.

Lunar Grazing Occultations

Date	Day	EST	Star	Mag	% alt	CA	Location & Remarks
2017							
Dec 10	Sun	1:27	SAO 118803	8.1	50- 19	5N	n.Woodbrdge,VA;s.Brndywine,MD
Dec 25	Mon	19:16	SAO 128560	8.9	46+ 44	7S	*Maidens,Bagdad,VA;Hollywd,MD
2018							
Jan 9	Tue	2:51	80 Vir	5.7	45- 23	4S	*Getysbg&Litlstn,PA;Aberdn,MD

* No expedition from the DC region expected
Interactive detailed maps at http://www.iota.timerson.net/

Total Lunar Occultations

Date	Day	EST	Ph	Star	Mag	%	alt	CA	Sp.	Notes
Dec 10	Sun	2:28	R	ZC 1645	6.7	49-	30	64S	F8	
Dec 10	Sun	3:33	R	ZC 1648	6.9	49-	41	88N	G5	
Dec 11	Mon	3:45	R	ZC 1758	6.9	39-	32	58N	G5	
Dec 11	Mon	6:59	R	ZC 1767*	7.6	38-	53	87N	A2	Sun altitude -4 deg.
Dec 14	Thu	5:15	R	ZC 2089	6.7	13-	16	84N	G5	
Dec 23	Sat	18:03	D	SAO165061*	9.0	26+	34	56N	F8	close double??
Dec 23	Sat	18:31	D	SAO 165070	8.2	26+	31	72N	K0	
Dec 23	Sat	19:46	D	SAO165098*	8.4	27+	21	87N	F3	close double star
Dec 25	Mon	20:00	D	ZC 7	7.6	46+	38	90N	K0	
Dec 25	Mon	23:29	D	ZC 20	6.7	47+	4	59S	G5	Azimuth 263 degrees
Dec 26	Tue	20:11	D	SAO109532*	8.1	57+	47	62N	G5	
Dec 27	Wed	18:15	D	SAO 110095	7.8	67+	53	72N	K0	
Dec 27	Wed	23:18	D	SAO 110166	7.7	68+	30	38N	K0	
Dec 28	Thu	22:40	D	mu Ceti	4.3	78+	48	77S	F1	ZC 405, close triple
Dec 29	Fri	20:40	D	ZC 526	6.7	87+	64	81N	G5	
Dec 30	Sat	17:18	D	ZC 685	6.6	93+	24	47S	F0	Sun altitude -5 deg.
Dec 30	Sat	18:19	D	Aldebaran	0.9	93+	36	50S	K5	ZC 692
Dec 30	Sat	19:09	R	=alpha Tau	0.9	93+	46	-49S	K5	Axis Angle 219 deg.
Dec 31	Mon	19:49	D	127 Tauri	6.7	98+	43	83S	B9	ZC 863
2018										
Jan 5	Fri	1:53	R	1481	7.4	86-	58	59N	A5	
Jan 5	Fri	7:16	R	1501	7.2	84-	32	81S	G5	Sun altitude -2 deg.
Jan 7	Sun	4:16	R	ZC 1728*	6.7	66-	53	66S	M4	
Jan 7	Sun	4:47	R	7 Virginis	5.4	66-	55	25N	A1	ZC 1733
Jan 9	Tue	2:49	R	SAO139427*	8.7	45-	23	54N	F8	mg2 12 sep. 4" PA 350
Jan 10	Wed	7:02	R	ZC 2072	6.6	34-	41	54S	K0	Sun alt. -5 deg.
Jan 11	Thu	6:42	R	SAO 159140	8.0	25-	35	51N	A7	Sun -8, close double
Jan 12	Fri	5:54	R	SAO 159659	8.3	18-	22	41S	G8	

*The star is in the Kepler 2 exoplanet search program so lightcurves of the occultation are desired to check for close stellar duplicity

Further explanations & more information is at
http://iota.jhuapl.edu/exped.htm .
David Dunham, dunham@starpower.net

2017-2018 Officers

President:
Harold Williams
haroldwilliams@me.com or Harold.Williams@montgomerycollege.edu

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

Secretary-Treasurer:
Henry Bofinger
hbofinger@earthlink.net
202-675-1075

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

Trustees:
- Benson Simon (2017)
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Appointed Officers and Committee Heads:

Exploring the Sky
Jay Miller
jhmiller@me.com

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

NCA Webmaster
Elizabeth Warner
warnerem@astro.umd.edu
301-405-6555

Star Dust Editor
Todd Supple
NCAStardust@gmail.com
301-595-2482 (h)

Social Media
Liz Dervy
Twitter: @NatCapAstro

Star Designations (Part 2)

The October issue of Star Dust contained an explanation of the difference between star designations and names. It should be noted that the designations discussed, with a Greek Letter followed by a Latinized name of the constellation in which they belong (e.g. β Pictorus or beta Pictoris), are known as Bayer designations, named after Johann Bayer who created the designations in the early 1600s.

But readers of astronomical publications may have seen star designations that don't follow the Bayer convention, such as 51 Pegasi, the star of the first exoplanet ever discovered. These are generally Flamsteed designations, named for John Flamsteed who devised them in the early 1700s. The numbers in Flamsteed designations were assigned to stars in each constellation in order of increasing Right Ascension. (Similar to longitude on Earth, Right Ascension is a longitudinal coordinate in the sky. It starts at 0 hours, currently in the constellation of Pisces, and increases eastward around the celestial sphere up to 24 hours.) Unfortunately, due to proper motions of stars, as well as axial precession, in which the Earth's axis changes direction in a 26,000-year cycle, some Flamsteed designations no longer match the Right Ascension order of those stars. It should also be noted that Flamsteed designations were only created for stars visible in Southern England. Gould numbers, designations created by Benjamin Gould, were assigned to southern stars, also based on Right Ascension, however Gould numbers are no longer in widespread use.

Sky Watchers

December/January

Saturn transitions to the morning sky in mid-December while Venus goes from morning to evening sky in early January. Mars and Jupiter rise in the early morning hours while Mercury rises before dawn.	
12/15	Conjunction – Mercury will be 2° 14' north of Venus at 11:04 a.m.
12/23, 24	The Ursids Meteor Shower is expected to peak from the evening of the 23rd into the morning of the 24th. Approximately 10 meteors per hour.
11/25	Conjunction – Venus will be 1° 8' south of Saturn. 12:49 a.m.
1/1	Mercury will be at its greatest elongation from the Sun in the morning sky, 22.7°.
1/2	Full Moon. The first of two Supermoons in 2018. It is known as the Full Wolf Moon and Old Moon.
1/3, 1/4	The Quadrantids meteor shower peaks from the evening of the 3rd into the morning of the 4th. Approximately 40 meteors per hour at peak, but a nearly full moon will interfere with viewing.
1/6	Conjunction – Mars will be 13' south of Jupiter. 10:41 p.m.

Radio Astronomy and Radio Waves – Several Key Discoveries

Using his original radio telescope, Karl Jansky identified regions in the center of the Milky Way that gave off intense radio signals. One of those regions proved to contain Sagittarius A*, the supermassive black hole at the center of the galaxy.

Microwaves, a form of radio waves, from the Cosmic Microwave Background, were accidentally discovered by Arno Penzias and Robert Wilson using a radio antenna in 1964.

Joseph Taylor and Russell Hulse used the Arecibo telescope in Puerto Rico to discover a binary-pulsar system, two neutron stars orbiting each other. Studying that system led to indirect proof of the existence of gravitational waves over 40 years before they were directly observed by LIGO.

The submission deadline for January's Star Dust, is Dec. 27th.

Clear Skies!

Calendar of Events

NCA Mirror- or Telescope-making Classes: Tuesdays AND Fridays, from 6:30 to 9:45 pm at the Chevy Chase Community Center (intersection of McKinley Street and Connecticut Avenue, N.W.) Contact instructor Guy Brandenburg at 202-635-1860 or at gfbrandenburg@yahoo.com.

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.). Details can be found at: www.astro.umd.edu/openhouse

Mid-Atlantic Senior Physicists Group: "Future Science, Brilliant Engineering for the James Webb Telescope" with Dr. John C. Mather, NASA's Goddard Space Flight Center. Wed. Dec. 20th, at 1 pm at the American Center for Physics (1st floor conference room). 1 Physics Ellipse, College Park, MD-- off River Rd., between Kenilworth Ave. and Paint Branch Parkway. www.aps.org/units/maspg/

Upcoming NCA Meeting at the University of Maryland Observatory:

13 January: Dean Howarth & Jeff Jones, *Newton and Halley*

UMD Amateur Radio Astronomy Team Meetings: Wednesdays and Saturdays 2:00 p.m. to 5:00 p.m. (and other times when interesting phenomena occur.) at the University of Maryland Observatory. For further information, contact Sarah Brown at Sarah.E.Brown@verizon.net.

National Capital Astronomers Membership Form

Name: _____ **Date:** ___/___/___

Address: _____ **ZIP Code:** _____

Home Phone: ____-____-_____ **E-mail:** _____ **Print / E-mail Star Dust (circle one)**

Membership (circle one): Student….. $ 5; Individual / Family…..$10; Optional Contribution…..$__

Please indicate which activities interest you:

- Attending monthly scientific lectures on some aspect of astronomy ____
- Making scientific astronomical observations ____
- Observing astronomical objects for personal pleasure at relatively dark sites ____
- Attending large regional star parties ____
- Doing outreach events to educate the public, such as Exploring the Sky ____
- Building or modifying telescopes ____
- Participating in travel/expeditions to view eclipses or occultations ____
- Combating light pollution ____

Do you have any special skills, such as videography, graphic arts, science education, electronics, machining, etc.?

Are you interested in volunteering for: Telescope making, Exploring the Sky, Star Dust, NCA Officer, etc.?

Please mail this form with check payable to ***National Capital Astronomers*** to:
Henry Bofinger, NCA Treasurer; 727 Massachusetts Ave. NE, Washington, DC 20002-6007

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First Class
Dated Material

Celebrating 80 Years of Astronomy
1937-2017

Next NCA Meeting:

2017 December 9th

7:30 pm

@ UMD Observatory

Dr. Mario Gliozzi

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