Star Dust

Newsletter of National Capital Astronomers, Inc.

capitalastronomers.org

December 2018 ***Volume 77, Issue 4***

Celebrating 81 Years of Astronomy

Next Meeting

When: Sat. Dec. 8th, 2018

Time: 7:30 pm

Where: UMD Observatory

Speaker: Dr. Peter Shawhan

Table of Contents

Directions to Dinner/Meeting

Our time and location for dinner with the speaker before this meeting is 5:30 pm at "Hunan Treasure" at 7537 Greenbelt Road, Greenbelt, MD 20770 in Greenway Center just east of where Greenbelt Road crosses over the Baltimore-Washington Parkway.

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

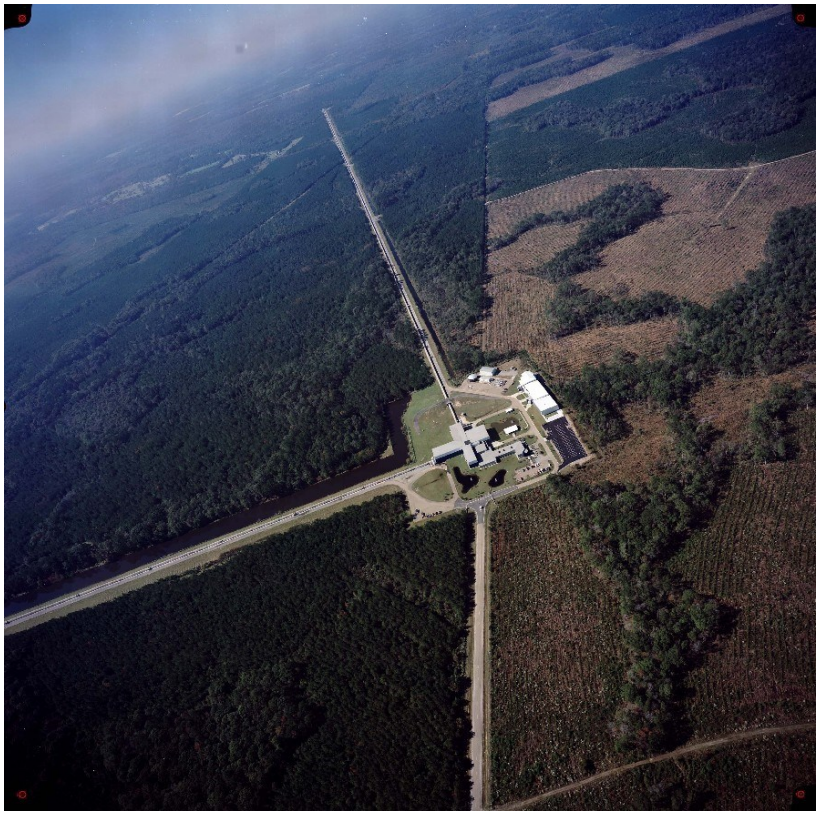
Following the meeting, members and guests are welcome to tour through the Observatory. Weather-permitting, several of the telescopes will also be set up for viewing.

New Astronomy with Gravitational Waves

Peter Shawhan

University of Maryland Department of Physics

Abstract: The exquisitely sensitive LIGO detectors succeeded in directly detecting gravitational waves for the first time in 2015, reaching a milestone in a new mode of astronomical observation. That first, remarkable signal told a story of two surprisingly heavy black holes spiraling into each other and merging. Further observing with LIGO and a similar European detector called Virgo has found five more black hole mergers so far, revealing a previously unseen population in our universe.



The LIGO G-wave Antenna at Livingston, Louisiana. Image Credit: LIGO Laboratory

But not all gravitational wave sources are dark! In August 2017, LIGO and Virgo also captured the signal of two neutron stars spiraling around each other merging, and the final merger was followed about two seconds

continued on page 2

Recent Astronomy Highlights

Comet Dust and Solar Winds
While we await the upcoming close encounter with Comet 46P/Wirtanen, data from the pass of Comet McNaught in 2007 is providing new insights into the interactions of the solar wind with comet dust. The research may lead to new theories about how the solar wind affected the formation of structures in the early Solar System. The researchers' paper can be found at: www.sciencedirect.com/science/article/pii/S0019103518301192?via%3Dihub

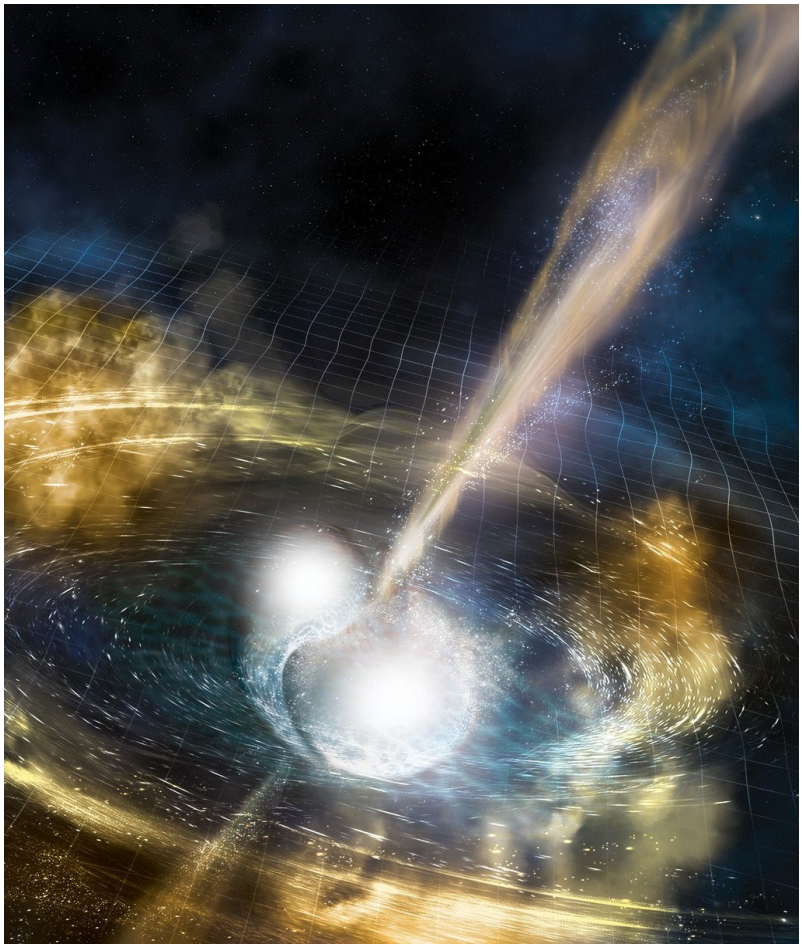
Oldest Star Discovered So Far
The star designated 2MASS J18082002-5104378 B is part of a binary star system. At 0.14 times the mass of the Sun, it is designed an ultra metal-poor star, indicating that it formed over 13 billion years ago. (To astronomers 'metals' are any material that is not hydrogen or helium.) While the star is not one of the first generation of stars (Population III stars), its existence opens the possibility that low-mass, first-generation stars might have formed because of disk fragmentation in the gas clouds from which they formed. Such stars could still be shining to this day. The researchers' paper can be found at: arxiv.org/pdf/1811.00549.pdf

Oumaumau May Be Smaller and Brighter Than Previously Suspected
Two months after the mysterious interstellar visitor Oumaumau made its closest approach to Earth, NASA scientists unsuccessfully tried to image the object using the Spitzer Space Telescope which measures infrared emissions. This seems to indicate that Oumaumau, possibly a comet, is smaller than previously suspected. Also, outgassing as it passed near the Sun may have removed dust and caused brightening of its surface, making it as much as ten times brighter than comets in our Solar System. More information is available at: www.sciencedaily.com/releases/2018/11/181115093324.htm

continued on page 4

Abstract – continued from page 1

later by a gamma-ray burst detected by the Gamma-ray Burst Monitor on board the Fermi satellite. Quick analysis of the LIGO and Virgo data pointed to a 31-square-degree region of the sky, and within hours astronomers located a distinctive transient in the UV, visible and infrared. Later, radio and X-ray afterglows added to the view of this truly remarkable event. This talk will cover the rapid succession of discoveries and insights gained from the gravitational wave signals and the complementary astronomical data.



Artist's illustration of two merging neutron stars. The rippling space-time grid represents gravitational waves that travel out from the collision, while the narrow beams show the bursts of gamma rays that are shot out just seconds after the gravitational waves. Swirling clouds of material ejected from the merging stars are also depicted. The clouds glow with visible and other wavelengths of light. Image and Image Caption Credit: NSF/LIGO/Sonoma State University/A. Simonnet

Biography: Peter Shawhan is a Professor in the University of Maryland Department of Physics, where he has been on the faculty since 2006. He received his Ph.D. from the University of Chicago and then spent 7 years at Caltech as a Postdoctoral Fellow and Staff Scientist before moving to Maryland.

Dr. Shawhan has made gravitational wave detection his primary research focus since 1999 and has held numerous leadership positions within the

continued on page 3

Exploring the Sky

*"**Exploring the Sky**"* is an informal program that, for 70 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 2019.

More information can be found at NCA's web site, www.capitalastronomers.org or the Rock Creek Park web site, www.nps.gov/rocr/planyourvisit/expsky.htm. You can also call the Nature Center at (202) 895-6070. For general information on local astronomical events visit www.astronomyindc.org

The November 17th session of Exploring the Sky was quite a success. As Guy Brandenburg reports – "It was a lot of fun. There were six scopes, including my home-made 12.5" dobsonian, and somebody counted nearly 200 people. The moon was bright enough to cast shadows, which made finding stars below first magnitude difficult. But folks had fun looking at the Moon, at Mars and at Pleiades. I should do this more often!"

The submission deadline for January's Star Dust, is December 21st.

Clear Skies!

Biography – continued from page 2

LIGO Scientific Collaboration. He currently serves as Data Analysis Coordinator for LIGO and is a member of the LSC Executive Committee.

Shawhan received the Richard A. Ferrell Distinguished Faculty Fellowship from the UMD Dept. of Physics in 2016, and received both the University System of Maryland Board of Regents' Faculty Award for Excellence in Scholarship, Research, or Creative Activity and the Kirwan Faculty Research and Scholarship Prize in 2018 for his contributions to LIGO's breakthrough discoveries of gravitational waves and the development of multi-messenger astronomy.

Multi-Messenger Astronomy

The term "multi-messenger astronomy" became more commonly used in scientific circles with the 2017 detection of a neutron star-neutron star collision. As mentioned in the Abstract above, that collision was detected by gravitational-wave detectors (LIGO and VIRGO). In addition, light from the collision was subsequently detected by a number of telescopes in wavelengths up and down the electromagnetic spectrum. Light, from radio waves to gamma rays, and gravitational waves are now two of the 'messengers' being detected by astronomers to study the Universe.

The third such messenger are cosmic rays, charged particles such as protons, electrons, positrons and even charged atomic nuclei, travelling through space, often at nearly the speed of light. Such fast moving particles seem to have their origin in violent events such as supernovae and active galactic nuclei (AGN). Probes that have studied these particles include the Alpha Magnetic Spectrometer on the International Space Station. On the Earth there are observatories, such as HAWC, the High-Altitude Water Cherenkov Gamma-Ray Observatory, located in Mexico, which looks for the Cherenkov radiation given off as the secondary particles from collisions of cosmic rays with the upper atmosphere pass through the large tanks of water that are part of the observatory. One difficulty with cosmic rays is that because of their charge, they are deflected by the magnetic fields permeating space

continued on page 6

Sky Watchers

December/January

Mercury, Venus and Jupiter dominate the morning sky, with Saturn transiting from the night sky to join them at the end of December. Mercury and Venus will each reach their greatest elongation during this period - 12/15/18 for Mercury and 1/6/19 for Venus. Mars will remain visible in the night sky until around 11:30 p.m.	
12/13-14	The Geminids Meteor Shower peaks from the night of 12/13 into the morning of 12/14 with approximately 120 meteors/hour. Best viewing conditions will be after midnight when the Moon has set.
12/16	Closest approach of Comet 46P/Wirtanen. It is still uncertain whether or not it will be naked-eye visible. But it should be great to look at through binoculars or a small telescope for many days before and after closest approach. For more information, go to wirtanen.astro.umd.edu/.
12/21-22	The Ursids Meteor Shower peaks from the night of 12/21 into the morning of 12/22. Approximately 5 – 10 meteors/hour. Unfortunately, the near full Moon will interfere with viewing.
12/22	The Full Moon will appear at 12:49 p.m.
1/3 - 4	The Quadrantids Meteor Shower reaches its peak the night of the 3rd into the morning of the 4th. Approximately 40 meteors/hour. A waning crescent Moon rising pre-dawn should provide little interference.

Times in EST

Recordings from Apollo 11 Mission Now Available Online

July 20, 2019 will mark the 50th Anniversary of the Apollo 11 Moon Landing. In the lead up to the celebration, NASA has released supplemental audio recordings of communications between various NASA personnel involved in that historic mission. Getting the recordings, made on long-since outmoded analog equipment, into a format that could be available on line is a tale involving luck and a lot of hard work. An article detailing those efforts is available at: arstechnica.com/science/2018/11/now-you-can-listen-to-behind-the-scenes-audio-from-the-apollo-11-mission/

The actual recordings are available at: archive.org/search.php?query=Apollo+11+MOCR+ACR+Collection&page=3

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

ISSN: 0898-7548

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Thank you!

Recent Astronomy Highlights – continued from page 2

Further Proof that Sagittarius A* is a Supermassive Black Hole

The European Space Agency's near infrared Very Large Telescope Interferometer detected three flares near Sagittarius A* in May and July 2018 as well as their motions in microarcseconds across the sky. With this data, astronomers calculated that the gas creating the flares was moving at 30% of the speed of light near the region known as the innermost stable circular orbit (ISCO) of Sagittarius A* provided that, as theorized, Sag A* is indeed a supermassive black hole of 4 million solar masses, something few now doubt. The report submitted by the research team can be found at: www.eso.org/public/archives/releases/sciencepapers/eso1835/eso1835a.pdf

continued on page 7

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 Axis angle (AA) is given. It is the angle measured around the Moon's disk, from the Moon's axis of rotation. It can be used with a lunar map to tell where a star will reappear relative to lunar features.

Mid-Atlantic Occultations

David Dunham

Planetary and Asteroidal Occultations

2018/2019	Day	EST	Star	Mag.	Asteroid	dmag	dur. s	Ap. "	Location
Dec 10	Mon	21:13	TYC58190972	11.5	Bellona	1.6	6	7	nVA,w&nMD,sePA
Dec 14	Fri	3:07	4UC57316277	13.2	Germania	0.2	13	11	seNY,NJ,PA;nMD
Dec 18	Tue	19:11	4UC486-1314	13.8	Karin	2.3	2	12	cVA,sMD,sNJ;DC?
Dec 21	Fri	7:02	ZC 2110	5.9	Venus	831	1		most USA; Sun -4
Dec 22	Sat	6:26	TYC01591393	11.1	Alfaterna	4.0	3	8	MD,DC,swPA;nVA?
Dec 22	Sat	19:18	TYC52410378	11.6	Fides	1.1	4	7	w&nVA,DC,eMD,sNJ
Dec 23	Sun	0:54	4UC46130466	13.1	Gerlinde	1.1	8	11	sePA,cMD,DC,nVA
Dec 24	Mon	23:26	2UC35191469	12.4	Arethusa	0.6	12	8	seMD,c&wVA,wNC
Jan 2	Wed	17:52	4UC51825559	12.1	Adrastea	2.0	4	9	sDE,sMD,cVA;low
Jan 7	Mon	2:17	TYC24380328	11.8	Burdigala	1.1	4	7	e&nVA,sMD,nWV,OH
Jan 7	Mon	19:41	TYC13622254	11.2	Swetlana	3.5	3	7	NJ,DE,cMD,DC,nVA
Jan 7	Mon	20:15	4UC48328244	11.5	Patria	3.2	3	7	sFR,seMD,cVA,sKY
Jan 7	Mon	21:39	SAO 43854	8.0	Swings	7.2	3	2	NJ,DE,cMD,DC,nVA
Jan 10	Thu	20:13	4UC48923621	12.5	Alfaterna	2.7	3	9	sNJ,neMD,s&wPA

Event details at http://www.asteroidoccultation.com/

Lunar Grazing Occultations

2018/2019	Day	EST	Star	Mag	% alt	CA	Location, Notes
Dec 14	Fri	18:53	psi3 Aqr	5.0	45+ 42	9S	Wilson,NC;Chesapeake&VA Beach,VA
Dec 27	Thu	5:17	53 Leonis	5.3	72- 59	7S	Erie,Lebann,Coatsv,PA;Claymnt,DE
Dec 28	Fri	6:26	SAO 119032	8.4	60- 54	7S	Germntn,Rockvil,Hyatsvl,Largo,MD
Dec 31	Mon	4:33	ZC 2043	6.5	28- 25	7S	sBarboursvil,Louisa,sDoswell,VA
Jan 9	Wed	18:21	ZC 3271	7.2	13+ 20	10S	Roanoke,Charlotsvl,VA;Clinton,MD

Interactive and static maps are at http://iota.jhuapl.edu/exped.htm

Lunar Total Occultations

2018/2019	Day	EST	Ph	Star	Mag	%	alt	CA	Sp.	Notes
Dec 10	Mon	17:47	D	ZC 2929	7.1	12+	18	56S	G8	Sun-12, close double??
Dec 11	Tue	20:28	D	20 Cap	6.3	19+	2	70S	Ap	Az. 243, ZC3069= AO Cap
Dec 12	Wed	20:19	D	delta Cap	2.9	27+	13	35N	A5	Az. 237, Deneb Algedi
Dec 12	Wed	21:04	R	delta Cap	2.9	27+	5	-46N	A5	Az. 244, AA 316, ZC3190
Dec 13	Thu	21:51	D	SAO 165197	7.5	36+	7	31S	K3	Az.247,mg2 10 42",PA 94
Dec 14	Fri	18:35	D	psi3 Aqr	5.0	45+	41	36S	A0	ZC3428,good NC,VA graze
Dec 14	Fri	20:22	D	SAO146650*	7.9	45+	31	43N	A0	
Dec 14	Fri	22:40	D	ZC 3446*	7.2	46+	9	26N	K0	Az.251,mg2 8 7",PA 147
Dec 16	Sun	19:30	D	SAO129007*	8.2	65+	51	88S	G0	
Dec 16	Sun	22:55	D	ZC 126	7.6	66+	28	75N	K0	dbl, mag2 11,sep. 0.04"
Dec 18	Tue	17:30	D	xi2 Ceti	4.3	82+	37	76S	B9	Sun alt. -8, ZC 364
Dec 18	Tue	19:06	D	SAO 110566	7.0	83+	53	27N	A5	
Dec 20	Thu	17:33	D	ZC 627	6.6	96+	23	17S	K1	Sun -9, Term.Dist. 7"
Dec 20	Thu	18:59	D	55 Tauri	7.0	96+	39	29S	F7	ZC636,mg2 9, 0.6",PA 12
Dec 20	Thu	21:52	D	delta2 Tau	4.8	96+	67	22N	A7	ZC 653, Term.Dist. 10"
Dec 20	Thu	22:30	D	SAO 93927*	7.5	96+	69	66N	F0	
Dec 21	Fri	0:25	D	SAO 93962*	7.0	97+	59	83S	F7	Maybe close double
Dec 24	Mon	22:38	R	ZC 1287*	6.7	91-	36	64N	A5	outer Praesepe star
Dec 25	Tue	2:53	R	ZC 1312*	6.8	91-	70	88S	F2	
Dec 25	Tue	6:40	R	SAO 98190*	7.3	90-	35	73S	F0	Sun altitude -8 degrees
Dec 26	Wed	6:59	R	SAO 98832	7.7	81-	41	68S	G0	Sun altitude -5 degrees
Dec 30	Sun	4:17	R	SAO 139336	7.1	39-	33	51N	K0	
Dec 31	Mon	2:43	R	ZC 2035	7.2	29-	6	29S	K0	Az. 106, close double?
Dec 31	Mon	4:47	R	ZC 2043	6.5	28-	27	30S	K0	double?; good VA graze
*** Dates and times above are for 2018; those below are for 2019 ***										
Jan 1	Tue	4:37	R	ZC 2158	7.5	20-	15	74S	A0	Azimuth 121 degrees
Jan 2	Wed	6:04	R	49 Librae	5.5	12-	18	47N	F7	ZC2291,mg2 11 sep 144"
Jan 9	Wed	18:15	D	ZC 3271	7.2	13+	21	18S	F5	
Jan 9	Wed	18:27	R	ZC 3271	7.2	13+	19	1S	F5	Terminator Dist. 13"
Jan 10	Thu	19:47	D	ZC 3392	7.3	20+	17	87S	A2	

*in Kepler2 program so occultation light curves are sought.

More, esp. total lunar occultations, at http://iota.jhuapl.edu/exped.htm

David Dunham, dunham@starpower.net

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John Graham, former NCA President, dies

Jeff Norman

John A. Graham, Staff Scientist Emeritus of the Department of Terrestrial Magnetism of the Carnegie Institution for Science, died at the age of 79 of a brain tumor on Thursday, September 13, 2018 in his home in Chevy Chase, Maryland.

He was born on 1939 in Australia, and earned a Ph.D. from the Australian National University in 1964. Prior to joining Carnegie, he was an astronomer at the Cerro Tololo Inter-American Observatory in Chile. He was hired as a staff scientist in Astronomy at Carnegie in 1985 and retired in 2002. His research mostly focused on star formation in the Milky Way and other galaxies.

During his years of retirement, he continued to live in Chevy Chase; but he often made trips back to Australia where he still had many friends and colleagues.

Dr. Graham was active in numerous astronomical societies including NCA where he served as Vice President from 1990 to 1992 and President from 1992 to 1994. We fondly remember his excellent scholarship, his kindly demeanor and his great enthusiasm. As Vice President, he recruited many excellent speakers on a variety of topics for NCA's monthly lecture series.

Multi-messenger Astronomy – continued from page 3

before reaching Earth, making it difficult, if not impossible in most cases, to determine their point of origin. Despite this, the amount, type and energy of cosmic rays detected can give us information with implications for the nature of the Universe and some of its mysteries, such as Dark Matter.

The fourth type of messenger in multi-messenger astronomy are neutrinos, which are like cosmic rays in that they are particles, however they have no charge and therefore are not deflected. Because of this, when they are detected, often by Cherenkov radiation produced after collision with subatomic particles within a detector, the trajectory can be used to determine their point of origin. Neutrinos have been detected coming from the Sun and, a little over three decades ago, from Supernova 1987A, a supernova that took place in the Large Magellanic Cloud. In addition, the detection of an extremely energetic neutrino in September 2017 by the IceCube facility at the South Pole, led to the confirmation that the blazar TXS 0506+056 is a producer of such neutrinos. A talk about the IceCube detection was given by Dr. Erik Blaufuss at the September 2018 NCA Meeting. A video of that talk is available at: www.youtube.com/watch?v=gQGN0KmZVzs&t=41s

Often studied separately, but sometimes together, light, gravitational waves, cosmic rays and neutrinos from space have given us a deeper understanding of the Universe and certainly will continue to do so. And perhaps some day they will be joined by other messengers, such as particles of Dark Matter.

Recent Astronomy Highlights – continued from page 4

Large, Dim Galaxy Discovered on the Far Side of the Milky Way

RR Lyrae variable stars are often, but not always, found in globular clusters. So, the discovery of 3 RR Lyrae variable stars approximately 420,000 light years away on the far side of the Milky Way led astronomers to speculate that there was a cluster or galaxy that contained those stars. Using data from the Gaia probe to 'remove' foreground stars, the researchers discovered a galaxy approximately the size of the Large Magellanic Cloud. However, the new galaxy, named Antlia 2, seems to be much dimmer and lighter than the LMC. Why the galaxy is so diffuse and dim is a matter of speculation, one theory being that massive stars formed early in Antlia 2's life may have gone supernova, clearing much of the matter from the galaxy and restricting further star formation. For more information, go to: https://www.sciencemag.org/news/2018/11/large-strangely-dim-galaxy-found-lurking-far-side-milky-way

Calendar of Events

NCA Mirror- or Telescope-making Classes: Tuesdays AND Fridays, from 6:30 to 9:30 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. Additional information is at guysmathastro.wordpress.com/ and home.earthlink.net/~gfbranden/GFB_Home_Page.html

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: www.astro.umd.edu/openhouse

Mid-Atlantic Senior Physicists Group: "Femptosecond Lasers", by Dr. Joseph Penano, Naval Research Laboratory, Wed., December 19, at 1:00 p.m. at the American Center for Physics (1st floor conference room) with Q&A to follow. 1 Physics Ellipse, College Park, MD-- off River Rd., between Kenilworth Ave. and Paint Branch Parkway. www.aps.org/units/maspg/

Next NCA Meeting at the University of Maryland Observatory: **12 January:** 7:30 p.m., Dean Howarth & Colleague, *Einstein and Eddington*

Montgomery College's Planetarium – "The Day of the Sun's Return, the Winter Solstice", Dec. 21st at 5:00 p.m. (Note earlier time.) For more information and directions, go to: www2.montgomerycollege.edu/departments/planet/

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 81 Years of Astronomy

Next NCA Meeting:

2018 December 8th

7:30 pm

@ UMD Observatory

Dr. Peter Shawhan

Inside This Issue