Star Dust

Newsletter of National Capital Astronomers, Inc.

capitalastronomers.org

December 2021 ***Volume 80, Issue 4***

Celebrating 84 Years of Astronomy

Next Meeting

When: Sat. Dec. 11th, 2021

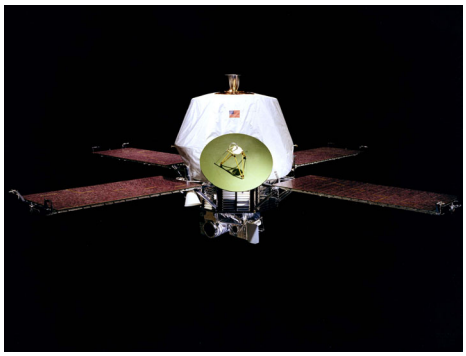
Time: 7:30 pm

Where: Online (Zoom)

See instructions for joining the meeting on Page 8.

Speaker: Dr. Brian J. Williams

Table of Contents



50 years ago, NASA launched *Mariner 9* on a voyage to Mars. An article on this intrepid explorer is on Page 2. Image Credit – NASA

Supernova Remnants

Brian J. Williams

NASA's Goddard Space Flight Center

Supernovae, the cataclysmic explosions of stars, are among the most powerful events in the universe. They are a major component of the cycle of interstellar matter, and shape the internal structures of galaxies, seeding the cosmos with the elements necessary for life itself. In their aftermath, expanding clouds of gas and dust known as supernova remnants are visible for thousands of years. Despite no nearby supernovae in centuries, these remnants allow us to study the explosion mechanisms "up-close," while simultaneously observing the reprocessing of the interstellar medium as the blast wave races outwards. I will give a general overview of some of the science of these remnants, showing many beautiful examples from telescopes such as Hubble, Chandra, Spitzer, and the VLA. I will also give a mission-level overview of an exciting mission in development: the X-ray Imaging and Spectroscopy Mission, or XRISM. XRISM is a JAXA/NASA collaborative mission with ESA participation and is targeted for launch during Japanese Fiscal Year 2022 (April 2022-March 2023).

Believed to be the remnant of the oldest "historical" supernova (observed by Chinese astronomers in 185 CE), the object now known as RCW86 is seen here in a composite X-ray/Infrared image. This image combines data from Chandra, XMM-Newton, Spitzer, and WISE. Image Credit - X-ray: NASA/CXC/SAO & ESA; Infrared: NASA/JPL-Caltech/B. Williams

continued on page 2

Recent Astronomy Highlights

Gangotri Wave

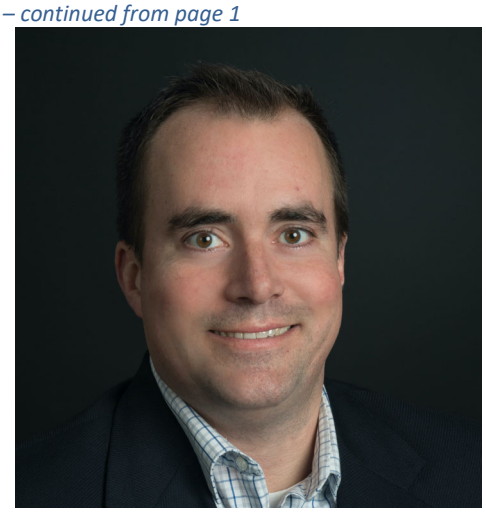
Astronomers have observed long streams of gas in other galaxies, streams that they have called feathers because they often have what look like barbs along the stream. But until now, none had been observed within the Milky Way Galaxy. However, recently researchers, using readings of carbon monoxide (CO) taken by the APEX telescope in Chile, have found evidence of just such a stream of gas. That stream is so long that it connects two spiral arms of our galaxy. Named the Gangotri wave, after the glacier at the head of the Ganges River, the formation is estimated to be between 4.4 and 6.5 kiloparsecs in length (between 14,000 and 21,000 light years) and have a mass equivalent to nine million Suns. There are mysteries about the formation still to be solved, including a so-far-inexplicable zig-zag pattern along its length. More information is available at phys.org/news/2021-11-gangotri-milky-spiral-arms.html and a paper discussing the discovery can be found at arxiv.org/pdf/2110.13938.pdf.

Implications of Discovery of Two Previously Invisible Galaxies

Astronomers at the University of Copenhagen recently discovered two new ancient galaxies, light from which has been traveling toward Earth for 13 billion years. The galaxies appeared in images taken by ALMA, the Atacama Large Millimeter/submillimeter Array, of regions previously imaged by the Hubble Space Telescope. While other neighboring galaxies were evident in the Hubble images, the two new galaxies were not. The reason for this invisibility is cosmic dust surrounding both of those galaxies. Extrapolating from this find by ALMA, the researchers theorize that as many as one in five of the galaxies in the Universe may still remain hidden from us. The James Webb Space Telescope, due to be launched in late December, is expected to be able to search for these hidden galaxies. More information on the discovery and its implications can be found at www.eurekalert.org/news-releases/935672.

continued on page 4

Abstract and Biography – continued from page 1

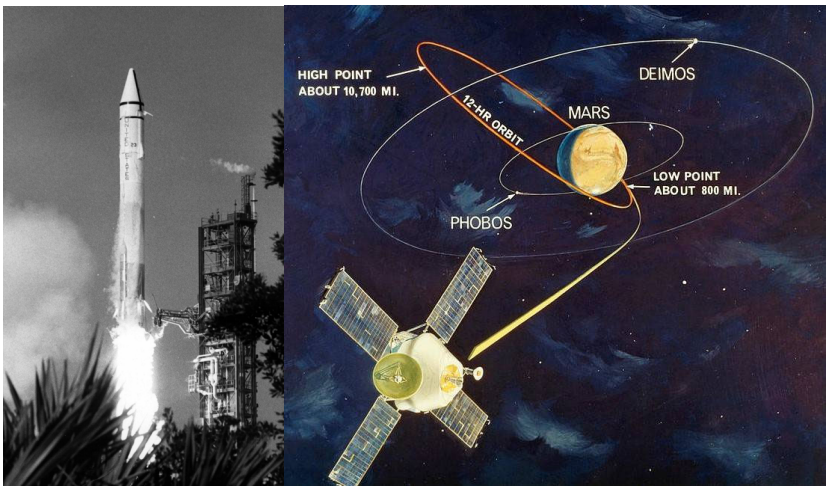


Biography: Dr. Brian Williams is a Research Astrophysicist in the X-ray Astrophysics Laboratory at NASA's Goddard Space Flight Center. He earned a B.S. in Physics from Florida State University and a Ph.D. in Physics from North Carolina State University. He came to Goddard as a NASA Postdoctoral Program Fellow in 2012. In 2017, he was hired at the Space Telescope Science Institute in Baltimore, MD, where he worked in mission support for both the Hubble and JWST missions. In 2018, he returned to Goddard, where he currently works as Project Scientist for XRISM. Since 2020, he has also served as Acting Chief Scientist for the Physics of the Cosmos Program Office at NASA. Dr. Williams was a 2020 recipient of the NASA Early Career Achievement Medal. He has approximately 70 refereed publications with approximately 2500 citations.

Mariner 9 (1971 & 1972) Remembered @ Fifty, Part 1

Daniel J. Costanzo – NCA Past President (1991-1992)

In this year 2021, an unprecedented international flotilla of robotic spacecraft is now exploring Mars, operating both in orbit as orbiters and on the surface as landers and rovers, pouring data Earthward at an unprecedented rate.



Left: *Mariner 9* being launched in 1971 – Image Credit – NASA
Right: *Mariner 9* being inserted into Mars orbit in 1971 – Image Credit - NASA

continued on page 3

Exploring the Sky

*"**Exploring the Sky**"* is an informal program that, for over 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

Due to the ongoing Coronavirus Pandemic, Exploring the Sky sessions are canceled. When the situation changes, sessions will once again be scheduled.

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 article-submission deadline for January's issue of Star Dust, is December 21st.

Clear Skies!

Mariner 9 (1971 & 1972) Remembered @ 50, Part 1 – continued from page 1

So, it's all too easy to forget that exactly fifty years ago, at the Apollo Moonshot Era's height during the Cold War competition between the United States and the Soviet Union in one-upping each other via space technology feats and firsts that often (though not always) were also scientifically valuable, a lone intrepid NASA robotic explorer named *Mariner 9* quietly arrived at Mars, slipped into Mars orbit, and became humanity's first spacecraft to orbit another planet.

Mariner 9 was utterly primitive by today's high technology standards. Yet, then, she was circa-1971 state-of-the-art American deep space technology, and achieved far more than the Space Age's first ever orbiting of Mars. For this pioneering spacecraft became among the most successful planetary missions of all time by discovering a Mars of surprising grandeur and mystery that proved truly worthy as a new world to explore.

Mariner 9 paved the way for future generations of robotic explorers (and maybe even missions of humans to Mars), thus contributing tremendously to continuing humanity's grand adventure of Cosmic Discovery.

NCA Telescope Making, Maintenance, and Modification Workshop (TM3W)

Guy Brandenburg

Our classes/workshops have resumed at the Chevy Chase Community Center (5601 Connecticut Avenue NW, WDC 20015), from 5:00 to 8:30 pm on Tuesdays and Fridays. Face masks are currently mandatory in all DC buildings.

At this workshop, you can:

(1) Get help in diagnosing and fixing a mechanical or optical problem with an existing telescope; or

(2) Modify an existing telescope by, say, adding a finder scope, converting from an alt-az mount to an equatorial mount, or vice-versa, or motorizing your scope via OnStep; or

(3) Grind, polish and figure (or re-figure) a disk of glass into a parabolic astronomical mirror of phenomenal accuracy, anywhere from 3 to 18 inches diameter; or

(4) Use woodworking and other tools to construct the optical tube assembly and mount for a telescope around an existing lens or mirror; or

(5) Aluminize or silver a telescope mirror for the first time, or after the old one has gotten tarnished; or

(6) Hang out with friendly people who like astronomy.

Instruction is free. You only pay for materials, with which we are well-stocked. There is normally plenty of parking. Pre-registration is not required. The closest Metro stops are Friendship Heights or Van Ness-UDC; the CCCC itself is served by the L2 and E4 bus lines. Enter the building via the doorway closest to the library.

For more information, contact Guy Brandenburg at 202-262-4274 or gfbrandenburg@yahoo.com, or look at guysmathastro.com. For a whole raft of information about telescope making, go to stellafane.org.

Guy Brandenburg, Washington, DC gfbrandenburg.wordpress.com/ guysmathastro.wordpress.com/

Sky Watchers

December/January

Mercury will be rise in the evening sky as the days progress, reaching Greatest Eastern Elongation in early January (see below). Venus will remain in the evening sky, but will be lower as December passes. Mars will be in the morning sky, but will still not be very visible due to being on the opposite side of the Sun from Earth. Jupiter and Saturn will in the western sky at sunset.	
12/13-14	The Geminids Meteor Shower peaks on the evening of the 13th into the morning of the 14th with approximately 120 meteors/hour. Unfortunately, a waxing gibbous Moon will interfere with seeing some of the dimmer meteors. Best viewing conditions will be in the early morning hours.
12/18	Full Moon at 11:37 p.m.
12/21	Winter Solstice - At 10:50 a.m. EST, the Sun will shine directly over the Tropic of Capricorn at 23° 26'.
12/21-22	The Ursids Meteor Shower peaks on the 21st into the morning of the 22nd with 5-10 meteors/hour. Unfortunately, a nearly full Moon will make it difficult to see all but the brightest meteors.
1/3-4	Peak of the Quadrantids Meteor Shower – Approximately 40 meteors/hour. An early-setting crescent Moon will make for ideal viewing conditions after midnight.
1/7	Mercury reaches Greatest Eastern Elongation, 19.2 degrees from the Sun and at its highest in the evening sky.

All times are in EST (Eastern Standard Time)

(84522) 2002 TC302 - A Good Kuiper-Belt-Object Occultation Recorded in the DMV

David and Joan Dunham

On 2021 November 11, around 2:55 UT, (84522) TC302, an approximately 500-km Kuiper Belt Object (KBO) 42.76 AU from the Earth, occulted an 11.7-mag. star in Triangulum, about 70° high in the southeast, for our area. Although the UT date was Veteran's Day, the local time was 9:55pm EST of Nov. 10. The predicted path crossed western Europe as well as a wide swath of North America; a record 150 observers signed up to observe the occultation, expected to last up to 21 seconds, using IOTA's Occult Watcher tool, to provide good coverage across the path and its uncertainty, which was wider than the path itself. The IOTA prediction had the path over the southeastern Great Lakes, but another prediction by the Lucky Star Project (Paris Observatory) put the path rather centrally over Washington, DC, but with larger errors. Bad weather plagued many, but a high pressure area kept the sky clear over most areas east of the Appalachian Mountains.

The actual path was only about 0.3 path-width north of the Lucky Star prediction. In Maryland, the event was timed by Steve Conard, Kevin Hartnett, Andrew Scheck, and an anonymous eVscope user near Parkton. Mike Skrutskie, a UVA astronomer, recorded a 5s occultation from his home in Earlysville, only a mile northwest of the Charlottesville Airport. Observers at Fan Mtn. Observatory, a little farther south, as well as near Louisa and Fredericksburg, had no occultation, determining the location of the southern limit well. The central and northern part of the object were covered well mainly

continued on page 6

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

ISSN: 0898-7548

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

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), save some trees and have one-click access to all the embedded links in the document. If you can switch from paper to digital, please contact Henry Bofinger, the NCA Secretary-Treasurer, at hbofinger@earthlink.net

Thank you!

Recent Astronomy Highlights – continued from page 2

Stranger and Stranger Rocky Exoplanets

Astronomers at the National Science Foundation's NOIRLab (National Optical-Infrared Astronomy Research Laboratory), working with a geologist from California State University, have inferred that many exoplanets are made of minerals that do not exist anywhere in our Solar System. They made this inference based on studies of the composition of the atmospheres of "polluted" white dwarfs, white dwarfs that appear to have consumed some of the exoplanets previously orbiting them. The various amounts of elements also seem to indicate that most of the material is actually from the cores of the exoplanets. More information is at www.sciencedaily.com/releases/2021/11/211102180527.htm.

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

Asteroidal Occultations

2021/22 Day	EST	Star	Mag.	Asteroid	dmag	dur. s	Ap. "	Location
Dec 10 Fri	17:27	TYC11740404	10.1	1990 RE5	8.2	1.4	5	cVA,sMD,cDE,sNJ
Dec 12 Sun	0:59	4UC61645959	14.0	Hale	2.2	5	11	eVA,s&cMD,DC,wPA
Dec 14 Tue	2:14	TYC08081422	10.5	Carestia	5.8	4	4	sNJ,cMD,DC,n&cVA
Dec 14 Tue	18:05	1B867540852	17.0	Mentor	0.4	3	18	nVA,DC,MD,DE,sNJ
Dec 15 Wed	6:23	4UC47146395	13.8	Porvoo	4.0	0.5	9	eWV,c&seMD,nDC
Dec 16 Thu	22:59	4UC68123113	14.2	Filipenko	0.8	7	11	sePA,cMD,DC,nVA
Dec 18 Sat	21:35	TYC24130612	10.4	Pakhmutova	4.8	3	4	ecMD,sDC,nVA,cWV
Dec 22 Wed	2:57	TYC19041383	11.6	Libya	2.9	7	5	sNJ,neMD,sPA,nOH
Dec 23 Thu	20:33	4UC54939653	12.2	Kythera	1.7	8	6	sNJ,cMD,DC,n&cVA
Dec 23 Thu	22:09	4UC66936703	14.0	Thuringia	0.5	6	11	sePA,wMD,n-swVA
Dec 29 Wed	19:58	TYC07451179	11.5	Wilkens	5.9	1.0	5	cNJ,nDE,nMD,nVA
Dec 31 Fri	6:27	PPM 98603	9.3	Nihondaira	7.2	0.6	3	s-ncNC,swVA,swOH
Dec 31 Fri	19:45	4UC57104291	13.6	Cloelia	1.7	9	10	ncVA,OH;DC,swMD?
*** Dates and times above are in 2021, those below are in 2022 ***								
Jan 2 Sun	18:56	TYC18942233	10.6	Peraga	1.0	12	4	sNJ,cMD,DC,n&cVA
Jan 2 Sun	20:56	4UC66232746	13.2	Thuringia	0.9	6	9	ePA,cMD,DC,n&cVA
Jan 5 Wed	18:46	TYC12951742	12.0	Anahita	0.8	6	5	sNJ,cMD,DC,n&cVA
Jan 7 Fri	3:59	TYC18930322	11.5	Peraga	0.6	12	5	s&wMD,DC,nVA,cOH
Jan 9 Sun	1:25	4UC61233094	13.8	Zeuxo	0.8	5	11	s&wMD,DC,nVA,OH

Lunar Grazing Occultations (none in late Dec. 2021)

2022 Day	EST	Star	Mag	% alt	CA	Location, Notes
Jan 6 Thu	18:12	SAO 165471	8.9	22+ 30	17S	UVA,Clftn,VA;SilvSpg,Balto,MD
Jan 6 Thu	18:36	ZC 3387	8.2	22+ 28	16S	ShnHl,Musto,VA;Malcm,Qnstn,MD
Jan 7 Fri	17:56	ZC 3516	8.4	32+ 42	16S	CrmlChrch,VA;Shilo,nWyeMls,MD

Lunar Total Occultations

2021/22 Day	EST	Ph	Star	Mag	% alt	CA	Sp.	Notes
Dec 10 Fri	22:16	D	ZC 3458	6.2	50+ 17	68S	K0	
Dec 11 Sat	21:10	D	ZC 25	7.4	60+ 38	83S	G6	
Dec 12 Sun	20:55	D	ZC 128	7.0	69+ 49	13N	G5	
Dec 13 Mon	0:15	D	SAO109613*	7.6	70+ 18	8N	F6	close double??
Dec 14 Tue	0:59	D	ZC 269	7.0	79+ 21	46S	K0	mag2 12, 12",dTime -57s
Dec 15 Wed	19:34	D	ZC 466	7.3	91+ 54	38N	A2	
Dec 16 Thu	19:40	D	ZC 595	6.8	96+ 50	86S	K1	close double??
Dec 17 Fri	21:22	D	ZC 734	6.6	99+ 62	67S	K0	Terminator Dist. 16"
Dec 18 Sat	0:45	D	99 Tauri*	5.8	99+ 66	38N	G8	ZC 742, Term.Dist. 6"
Dec 23 Thu	2:55	R	ZC 1390*	7.7	85- 70	78N	G0	
Dec 23 Thu	22:48	R	eta Leonis	3.5	78- 19	70S	A0	ZC1484,mg2 8 dT -0.2s
Dec 24 Fri	3:31	R	ZC 1499	7.1	77- 66	89S	K0	
Dec 25 Sat	1:01	R	ZC 1598*	6.5	68- 32	82S	F5	close double??
Dec 26 Sun	0:06	R	nu Vir	4.0	59- 10	86N	M0	Azimuth 90, ZC 1702
Dec 27 Mon	4:47	R	SAO 138923	8.0	46- 45	12N	F5	
Dec 28 Tue	2:25	R	LU Vir	7.9	36- 11	86S	A0	Az 107, SAO 139342
Dec 28 Tue	3:10	R	ZC 1933*	7.1	36- 19	33N	K0	
Dec 28 Tue	4:32	R	72 Vir	6.1	35- 32	87N	F2	ZC1937,mg2 11 dT -10s
Dec 28 Tue	6:59	R	SAO 139423	8.2	35- 44	8N	K2	Sun altitude -5 deg.
Dec 29 Wed	3:28	R	SAO 158500	8.1	25- 9	42S	K0	Az. 114, close double?
Dec 30 Thu	5:42	R	28 Librae	6.2	15- 18	80N	G8	ZC 2192
Dec 31 Fri	6:37	R	SAO184366*	8.0	7- 13	22N	F6	Sun alt. -9 deg.
*** Dates and times above are in 2021, those below are in 2022 ***								
Jan 6 Thu	18:29	D	ZC 3387	8.2	22+ 29	28S	K0	VA, sMD graze
Jan 6 Thu	18:43	R	ZC 3387	8.2	22+ 27	5S	K0	
Jan 7 Fri	17:47	D	ZC 3516	8.4	32+ 43	30S	K0	Sun altitude -9 degrees
Jan 7 Fri	18:05	R	ZC 3516	8.4	32+ 42	5S	K0	VA, sMD graze
Jan 7 Fri	21:11	D	SAO 147000	8.1	33+ 16	69N	F8	
Jan 8 Sat	21:39	D	ZC 95	7.0	43+ 23	82S	F8	close double??
Jan 8 Sat	22:23	D	SAO109441*	7.7	43+ 15	55N	G5	Azimuth 258 degrees
Jan 8 Sat	22:42	D	SAO109458	8.4	43+ 12	54S	F5	Azimuth 261 degrees
Jan 9 Sun	19:28	D	95 Piscium	7.2	52+ 53	88S	G0	ZC 212, close double

*in Kepler2 program so occultation light curves are sought.

More information is at iota.jhuapl.edu/exped.htm
David Dunham, dunham@starpower.net

2021-2022 Officers

(84522) 2002 TC302, A Good Kuiper-Belt-Object Occultation Recorded in the DMV– continued from page 4

by European observers (and two in Texas), while the northernmost observer who had an occultation was George Viscome in Lake Placid, NY. The observations are fit well by a 467 km by 530 km ellipse, as shown in Fig. 1. The stations in eastern North America are shown on the map in Fig. 2.

Although we were visiting Maryland in this timeframe, on Nov. 10, we were with friends staying in Corolla, on the Outer Banks of NC. We used a 12-cm refractor to video record the target star for the miss that we had. While we were busy working to acquire the target, Tom Odt came out to see what we were doing. At about 9:10 pm, Tom looked up and asked, what's that comet moving from right to left? We were surprised to see a "star" with a parabolic plume behind it, and learned later that it was the Crew Dragon 3 taking 4 astronauts to the ISS.

Although we had a miss for this event, the night before, we recorded an occultation of a 9.6-mag. star by (535) Montague from three sites extending from Nags Head to Avon, NC. Two observers in Arizona also added to the determination of Montague's size and shape.

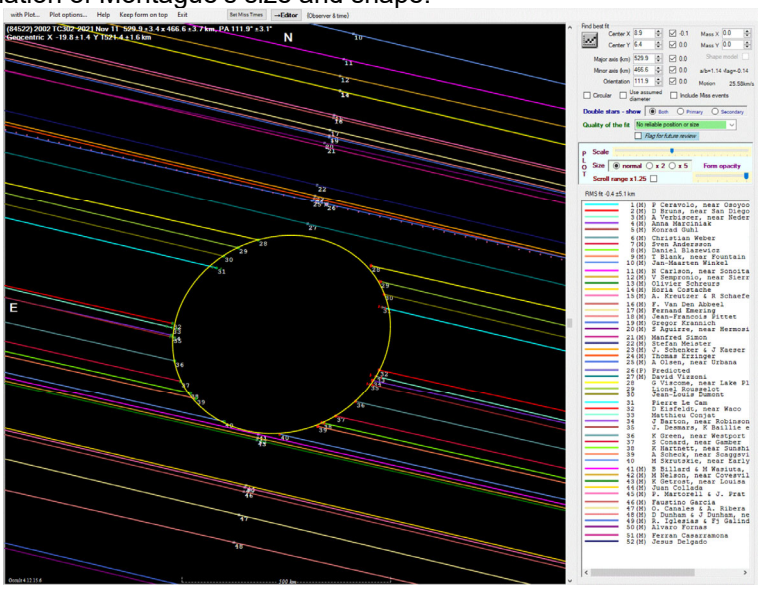


Figure 1: Sky plane Plot of timings of the occultation of 11.7-mag. UCAC4 616-007599 by the KBO 2002 TC302 on 2021 Nov. 10/11. Image Credit: John Moore, IOTA and Eric Frappa, Euraster.net

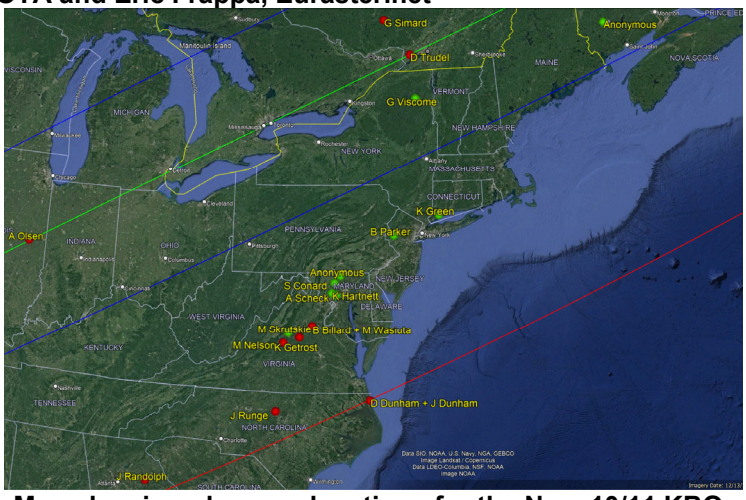


Figure 2: Map showing observer locations for the Nov. 10/11 KBO occultation in eastern North America. Green dots show stations from which an occultation was recorded, while red dots show miss stations. Image Credit: John Moore, IOTA and Google Earth

Recent Astronomy Highlights – continued from page 4

A Possible Unexpected Source for Much of Earth's Water

The abundance of water on Earth has been a mystery to scientists for many years. But that mystery may have been solved with the results of the study of some very special dust samples Those dust samples were collected by the Japanese space probe Hayabusa from the asteroid Itokawa over a decade ago and brought back to Earth. The dust samples show a surprising high amount of water. How did that water get there? Apparently, it was formed using the hydrogen ions from the solar wind given off by the Sun. Astronomers theorize that such dust particles would collect on asteroids that would have collided with Earth early in its history. This also implies that such dust would provide an abundant supply of water that could be used by colonists of such places as the Moon. More information can be found at www.eurekalert.org/news-releases/935922.

Calendar of Events

NCA Telescope Making, Maintenance, and Modification Workshop (TM3W) (previously the NCA Mirror- or Telescope-making Classes): The Chevy Chase Community Center is reopening and classes are resuming. Classes will be Tuesdays and Fridays, from 5:00 to 8:30 pm at the Chevy Chase Community Center (intersection of McKinley Street and Connecticut Avenue, N.W.) Please contact instructor Guy Brandenburg at 202-262-4274 (leave message) or at gfbrandenburg@yahoo.com if you plan to attend. Note that masks are mandatory, as in all DC government buildings. More info is at guysmathastro.com. (See article on Page 3.)

Open house talks and observing at the University of Maryland Observatory in College Park are temporarily suspended. When they resume, they will be on the 5th and 20th of every month at 8:00 pm (Nov.-Apr.) or 9:00 pm (May-Oct.). Updates are posted at www.astro.umd.edu/openhouse.

Next NCA Meeting: **8 January** 7:30 p.m. Peter Driscoll (Carnegie Earth and Planets Lab) **Planetary Magnetic Fields and Habitability**

The APS Mid-Atlantic Senior Physicists Group: **(Zoom Meeting)** December 14th at 3:00 p.m., Brian Berlanger, National Capital Radio and TV Museum, will give a talk entitled "Supporting a New Industry: NBS' Measurements and Standards for Radio". **Please note that this is on a Tuesday instead of the third Wednesday, and at a different meeting time than normal as well.** More information on the meeting is available at www.aps.org/units/maspg/meetings/meeting.cfm?name=SENIOR1221. If you're interested in attending the meeting, please email units@aps.org.

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.?

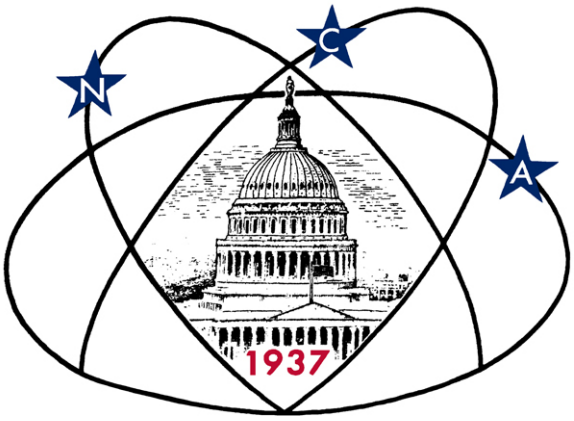
Are you interested in volunteering for: Telescope making, Exploring the Sky, Star Dust, NCA Officer, etc.?

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

National Capital Astronomers, Inc.

If undeliverable, return to
NCA c/o Elizabeth Warner
400 Madison St #2208
Alexandria, VA 22314

First Class
Dated Material



Celebrating 84 Years of Astronomy

Next NCA Meeting:

2021 December 11th
7:30 pm
(On Zoom)
Dr. Brian J. Williams

To join the Zoom meeting, use the following link: umd.zoom.us/j/96856095178?pwd=cWhyNE92bGFYUkYxZnl6eWVIK0lKdz09

Please download and import the following iCalendar (.ics) files to your calendar system: umd.zoom.us/meeting/tJIlcu-opz4rHdxfgBb8Lh5wRlgETFQ8lnI5/ics?icsToken=98tyKuCupj4sGt2QsR6PRowAGo_4M_TxmCVcgqdFmhjHAXh_albhBO5FF4ZZIYDc

Please note that NCA Zoom meetings are often recorded.

Inside This Issue