Star Dust

Newsletter of National Capital Astronomers, Inc.

capitalastronomers.org

March 2024 ***Volume 82, Issue 7***

Celebrating 87 Years of Astronomy

Next Meeting

When: Sat. Mar. 9th, 2024

Time: 7:30 pm

Where: In-Person and Online (Zoom)

See instructions for joining the meeting via Zoom on Page 11.

Speaker: Dr. William McDonough

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Image Credits - NASA, ESA, CSA, STScI, D. Milisavljevic (Purdue University), T. Temim (Princeton University), I. De Looze (University of Gent)

The James Webb Space Telescope's NIRCam instrument captured the above image of Cassiopeia A, a supernova remnant approximately 11,000 light years away. More information is at https://www.nasa.gov/missions/webb/nasas-webb-stuns-with-new-high-

Multi-messenger Tomography of the Earth

Dr. William McDonough – University of Maryland

Abstract: Geoscientists and neutrino physicists are exploring new ways of combining their methodological approaches and data to yield a multi-messenger tomography of the Earth. For the last two decades, neutrino physicists have been detecting low-energy (MeV) electron anti-neutrinos being emitted from the Earth (geoneutrinos), produced via β- (electron) radioactive decay of Uranium and Thorium.

The radiogenic power driving the Earth's engine has recently been determined from the flux of geoneutrinos measured at detectors in Japan and Italy (soon to be announced in a report from Canada), and from data from China. More recently, particle physicists have been sensing the Earth's electron density via measurements of neutrino oscillations (thanks to quantum mechanics, a single neutrino will oscillate between being an electron-type neutrino, a muon-type neutrino, and a tau-type neutrino) using 2-8 GeV neutrinos (e.g., measured by the KM3NET detector), and the overall matter density state of the planet has been mapped via neutrino absorption studies using ≥10 TeV neutrinos (e.g., the IceCube detector). Neutrino oscillation studies can tighten our estimates of the chemical composition of Earth, specifically testing models for the hydrogen content of the core. Sources of these latter high energy neutrinos are high energy cosmic ray collisions with air in the atmosphere, and interstellar sources of cosmic rays that interact with matter during their transit through the Universe.

Biography: Understanding the composition, structure and evolution of the Earth and the other terrestrial planets are dominant themes of my

continued on page 2

definition-look-at-exploded-star/.

Recent Astronomy Highlights

Brightest Object Seen So Far In Our Universe

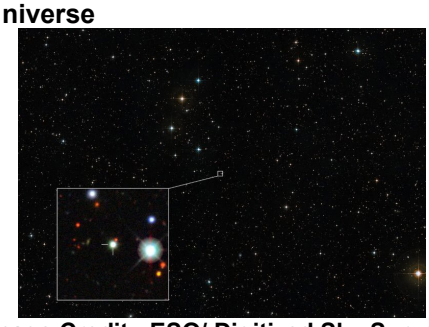

Image Credit - ESO/ Digitized Sky Survey 2/ Dark Energy Survey

A quasar designated, J0529-4351, that lies over twelve billion light years away, is now considered to be the brightest object ever seen by astronomers, so bright that since the 1980s it was considered to be a star, obviously much closer to Earth. Only last year did astronomers realize that it was a quasar. The quasar is measured to be over 500 trillion times as bright as the Sun. To maintain its brightness, or, more accurately, to have maintained its brightness twelve billion years ago, J0529-4351 would have had to consume the equivalent of our Sun's mass each and every day. That mass comes from an accretion disk of gas and dust that is estimated to have been seven light years in diameter. More information is available at https://phys.org/news/2024-02-brightest-universe-black-hole-star.html.

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New Source of Dust In Space

Astronomers have long known that Type II supernovae, the explosive death that comes to massive stars when they used up their fuel, are sources of the dust that permeates space. However, astronomers recently discovered that Type IA supernovae can also be the sources of such dust. Such supernovae occur when a white dwarf receives enough material from a companion star and explodes, destroying the white dwarf. A three-year effort at observing SN2018evt, a Supernova 1A which took place in a galaxy approximately 300 million light years away, provided the data for this revelation. More info is at https://www.technology.org/2024/02/16/astronomers-uncover-previously-unknown-source-of-star-dust-in-rare-supernova-explosion/

Abstract and Biography – continued from page 1

research. The differentiation of the Earth has created 3 separate and distinct reservoirs (i.e., the core, the mantle-crust system, and the atmosphere-hydrosphere system). These reservoirs are in turn themselves internally differentiated and powered in part by radioactively produced energy. Chemical and isotopic studies of terrestrial and meteoritic samples provide insights into the timing and details of the various differentiation processes occurring in these planetary domains.

My expertise is in analytical instrumentation and neutrino geophysics. Using laser ablation systems and plasma mass spectrometers for the chemical and isotopic analyses of samples I work with geologists, biologists, chemists, physicists and members of the US intelligence community. I am developing and improving upon methods of modeling and detecting the Earth's geoneutrino (electron antineutrino) flux and anti-neutrino detection for nuclear monitoring. With my students we provide chemical and isotopic data that constrain geological processes and data for forensics, nuclear chemistry and archaeology.

President's Corner

Guy Brandenburg

Jeff Norman and I have both wondered: "Should NCA and NOVAC Merge Into One Organization?" -- the title of a short opinion piece he wrote for Star Dust in January. He eventually concluded no, not right now, but maybe a regional umbrella group would be a good idea.

I agree that merging the two clubs right now is not a good idea, for several reasons:

1. NOVAC members' dues are several multiples of ours: currently either $5, $10 or $15 per year for NCA membership, versus $35 per year (plus $10 for each additional member at the same address) for membership in NOVAC.
2. NOVAC provides its members with an amazing amount of services and benefits:
   a. Like us, they have monthly meetings / lectures / talks. But they have 12 of them per year, as opposed to our 10.
   b. Unlike us, they have a free astro lending library stocked with the very latest books, videos, and software, which members can borrow either physically or digitally.
   c. A fleet of fully-functioning donated, high-quality telescopes of all types and diameters, many with full GoTo capability, stashed at various locations around the DMV, that any member can borrow (with a deposit; some of them have a waiting list).
   d. Access on many clear nights a month to a handful of Bortle 5 or better locations in northern VA like Sky Meadows State Park or Camp Highroad. (The Bortle scale goes from 1, indicating an extremely dark sky, to 9 which is a very bright sky, such as in a city. More information on the scale is available at https://en.wikipedia.org/wiki/Bortle_scale.)

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Exploring the Sky

2024 Exploring the Sky Sessions

6 April 8:00 P.M. Jupiter, Uranus, M45, Orion
6 May 9:00 P.M. M44, Leo, Arcturus, M13
1 June 9:00 P.M. Leo, Bootes, Hercules, M13
13 July 9:00 P.M. Venus, Mercury, Moon, Hercules, M13, Summer Triangle
10 Aug. 8:30 P.M. Venus, Moon, Hercules, M13, Summer Triangle, M57
7 Sep. 8:00 P.M. Venus, Moon, Summer Triangle, Great Square of Pegasus
5 Oct. 7:30 P.M. Summer Triangle, Great Square of Pegasus, M31, Saturn
2 Nov. 7:00 P.M. Venus, Summer Triangle, Pegasus, M31, Saturn

Exploring the Sky is a joint program between the National Capital Astronomers and the National Park Service Rock Creek Park Nature Center and has been run since 1948 at this location, the field at the corner of Glover and Military Roads in the District. There is an adjacent parking lot. It is free and all are welcome who have an interest in observing the heavens. It's not an ideal dark-sky location but we can see Solar System objects, open and globular clusters and maybe a fuzzy galaxy or two.

As an added feature, you can also come one hour early and see a planetarium program in the Nature Center. Also, if the sky is cloudy or it's raining there will still be a planetarium program at that one-hour earlier time so Exploring the Sky will no longer be canceled!

Planetarium programs can be found at: www.nps.gov/rocr/planyourvisit/calendar.htm. You can also search "astronomy", "dark skies" or call the Nature Center at: (202)-8985-6070.

President's Corner – continued from page 2

e. Access to a beautiful, high-elevation location with amazingly broad horizons, called the Spruce Knob Mountain Institute. This is darkest spot east of Mississippi. The Milky Way is fabulous there, and quite a few Messier objects can be seen with the naked eye

f. The privilege of camping at that site either in your tent (at no cost) or in their dorms (must pay a fee). The place even has hot showers and sometimes food! This is included as part of your membership! At Spruce Knob one can see the Milky Way in all of its glory and a bunch of Messier objects with the naked eye, if the weather is clear. But it's a 4-hour drive from DC, part of it on rough dirt roads.

g. They organize the annual Almost Heaven Star Party in late summer (again at that very same Spruce Knob Mountain Institute)

h. A very active special-interest group with absolutely astounding astrophotographers. See https://www.novac.com/wp/observing/member-images/.

Where I think NCA is better, or special:

1. NCA generally (but not always) has a better speaker selection.
2. NCA has a telescope making/maintenance/modification workshop going back to the 1930s. The workshop owns a lot of power and hand tools if you need anything tested or puzzled out, or want to make your own telescope, as well as a large assortment of glass blanks and ATM part of all sizes.
3. Members can look through the scopes at the University of Maryland's observatory after the monthly meetings, if the weather is good.
4. History: both Vera Rubin and Nancy Grace Roman were active members of NCA, the latter until her death.
5. The meeting location is much closer to my home.
6. More history: 'Exploring the Sky' in Rock Creek Park has been going on since World War 2, in conjunction with the National Park Service and the planetarium there. (Unfortunately, the sky glow is so intense that anything under 2nd magnitude is invisible to the naked eye.)

BUT: NCA as such has no organized way to take groups of people out to Bortle 4 or better skies, and no ongoing, permanent agreements with any darker-sky locations outside of the Beltway. There have been a few scouting expeditions to find such locations, but we found that it was not a simple process!

(Yes, the Hopewell Observatory (of which I am also the current President) was primarily built by members and officers of NCA starting about 50 years ago, but the two organizations are entirely different. NCA is a 501(3)b non-profit, as is NOVAC, but The Hopewell Corporation is a privately owned, stock-issuing company.)

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Sky Watchers

March/April

Mercury will appear higher in the evening sky as the period progresses, reaching Greatest Eastern Elongation on March 24th (see below) then lowering in the sky until beginning its transit to the morning sky on April 11th. Venus and Mars will both appear lower throughout the period. Jupiter remains in the western sky after sunset, setting before midnight. Saturn will be very low in the sky at sunrise, probably not very visible.	
3/19	Vernal Equinox – The Sun will be directly overhead at the equator at 11:04 p.m. local time, ushering in Spring in the Northern Hemisphere.
3/24	Mercury at Greatest Eastern Elongation – The planet will be 18.7° from the Sun in the evening sky.
3/25	Full Moon at 3:02 a.m. and Penumbral Lunar Eclipse, when the Moon is in Earth's penumbra or partial shadow. The Moon begins to enter the penumbra at 12:53 a.m. and fully exits it at 5:32 a.m.
4/8	Total Solar Eclipse – The eclipse will happen first in the Pacific Ocean, then cross parts of Mexico and the United States.

Time is in EDT (Eastern Daylight Savings Time).

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A few months before Jeff's short op-ed in Star Dust, I happened to compare notes on membership with a NOVAC officer. He told me that NOVAC has around 900 members, making it either the first or second largest astro club in the US (the other one is in Spokane, Wa). NCA has roughly 100 members. However, if I recall correctly, over 2/3 of its members only join for a single year and don't renew. NOVAC has a much larger contingent of active volunteers than we do.

Our group has not always been welcoming to recruit new or younger members. Once upon a time, NCA even had a constitution that expressly forbade the entry of African-American members! Those days are gone, thankfully, but when some of our talks are pitched at such a high level of difficulty that even someone like myself cannot follow them, then I bet any newcomer would not want to return for more. I think we should also do more telescope viewing events in all 8 wards of DC, in Prince George's County, and other locations with high proportions of immigrants and minorities.

My personal solution has been to pay my personal dues to both NOVAC and NCA for about the past 30+ years. I've not been an officer of NOVAC, but I've spoken at two of their meetings about telescope making and brought my scopes to their public viewing events.

If NCA were to decide to disband because we couldn't recruit new officers or volunteers for public viewing events, then we would need to turn over all of our assets to some other local astronomy non-profit, such as NOVAC.

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Recent Astronomy Highlights – continued from page 2

Neutron-Star Remnant of Supernova 1987A May Have Been Detected

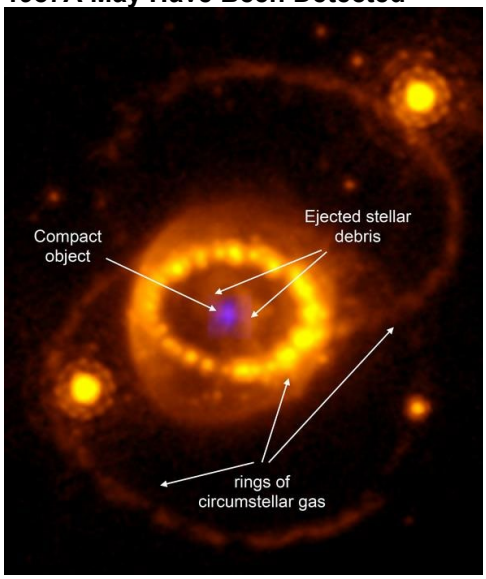

Image Credit - Hubble Space Telescope WFPC-3/James Webb Space Telescope NIRSpec/J. Larsson

In 1987, the brightest supernova seen in over 400 years was spotted in the Large Magellanic Cloud. In the 37 years since then, there have been many searches for the remnant left behind by that supernova. Was it a neutron star or black hole? The James Webb Space Telescope's MIRI and NIRSpec instruments may have given the answer by detecting radiation from ionized heavy argon and sulphur atoms. The radiation could only come about if the atoms were near a compact ionizing source, which is most likely a neutron star. More information is available at https://www.eurekalert.org/news-releases/1034307

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Occultation Notes

- D following the time denotes a disappearance, while R indicates that the event is a reappearance.
- 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. E indicates a lunar eclipse is in progress, and the value is the percent of the Moon's disk that is NOT in the umbra. So 0E means during the total phase.
- 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". Often, rather than the separation, I give “dTime” or “dT”, the time difference of the secondary star occultation relative to the primary star’s occultation.
- 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

2024 Date	Day	EST/ EDT	Star	Mag.	Asteroid	dmag	dur. s	Ap. "	Location
Mar 8	Fri	19:47	SAO 137725	7.4	Youngrokkim	9	0.9	2	sMD,nVA,sWV,nKY
Mar 9	Sat	20:20	4UC59325195	11.9	Metis	0.2	14	8	nwOH,nPA,NY,nNJ
*** Dates and times above are EST, those below are EDT ***									
Mar 12	Tue	3:14	4UC42764453	10.3	Tunis	8.3	3	3	nSC,cNC,Norfolk
Mar 12	Tue	5:02	TYC73610465	9.3	Furmanov	7.9	0.7	4	cOH,Roanoke,eNC
Mar 12	Tue	21:26	4UC54012075	12.0	2000 AK120	7.8	0.7	5	sOH,nVA,cMD,sNJ
Mar 18	Mon	0:16	TYC18821356	12.3	1987 RC1	6.4	1.9	5	neOH,PIT,cMD,sDE
Mar 19	Tue	0:21	SAO 95919	8.0	1994 PV	12	1.7	2	neOH,PA,nNJ,NYC
Mar 19	Tue	23:11	TYC01391063	10.3	2001 FK160	8.9	0.6	3	sw-ecPA,nNJ,sLI
Mar 21	Thu	21:47	4UC55222816	12.3	Altona	3.5	6	5	nVA,cMD,DC,sNJ
Mar 21	Thu	21:50	TYC08510276	10.6	Machin	5.1	2.2	4	NYC,nNJ,cPA,cOH
Mar 22	Fri	23:54	4UC59228811	11.6	Metis	0.4	10	5	w+seNY,n+ePA,NJ
Mar 23	Sat	0:08	SAO 61571	7.7	2001 TZ226	10	1.3	2	scNY,wPA,nwWV
Mar 24	Sun	23:03	TYC01092677	8.0	3298 T-1	12	0.3	2	sAZ,sOK,nTN,sVA
Mar 26	Tue	1:28	TYC13521052	10.1	1999 TB112	10	0.8	4	nOH,ColPk+Gbt,MD
Mar 28	Thu	0:37	TYC02392223	11.2	1998 QJ27	7.7	0.3	5	Kentn,MD;Srlg,VA
Mar 28	Thu	5:42	TYC63180054	10.5	Bavaria	5.3	1.8	5	swOH,sWV,cVA
Apr 7	Sun	2:44	SAO 204686	8.4	2000 DQ20	10	0.9	3	eNC,sSC,nGA,nTX

Lunar Grazing Occultations

2024 Date	Day	EDT	Star	Mag	% alt	CA	Location, Notes
Mar 12	Tue	21:17	SAO 92633	9.5	10+ 9	0S	Bthsda,nDC,E.Rivrdl,sBowie,MD
Mar 17	Sun	23:54	ZC 1022	6.0	59+ 40	10N	path 1.5 km n. of X 91013.
Mar 17	Sun	23:54	X 91013	7.8	59+ 40	10N	nCulpepr,sStevnsbg,Wildrns,VA
Apr 12	Fri	20:39	SAO 77034	9.2	22+ 41	14N	Laytnsvil,Laurel,sAnapolis,MD
Apr 14	Sun	23:59	SAO 79264	8.0	43+ 25	11N	nClrksbg,nColgPrk,sWoodmor,MD

Lunar Total Occultations

2024 Date	Day	EDT	Ph	Star	Mag	% alt	CA	Sp.	Notes
Mar 12	Tue	21:17	G	SAO 92633	9.5	10+ 9	0S	G5	MD graze
Mar 14	Thu	20:50	D	ZC 524	6.7	27+ 42	19S	A0	
Mar 14	Thu	21:03	D	SAO 76056	7.8	27+ 39	61S	A0	
Mar 14	Thu	23:52	D	SAO 76156	6.9	28+ 9	72S	A0	Az.293,mg2 10 3"dT-2.4s
Mar 16	Sat	20:54	D	SAO 77314	8.2	48+ 65	54S	B8	
Mar 16	Sat	23:15	D	SAO 77383	8.2	49+ 38	34S	F5	
Mar 16	Sat	23:52	D	SAO 77415	8.3	49+ 31	39S	B9	Close double??
Mar 17	Sun	0:51	D	ZC 868	7.5	50+ 21	44S	A0	mag2 10 sep 9" dT -10s
Mar 17	Sun	21:06	D	49 Aurigae	5.3	59+ 72	41S	A0	ZC 1008
Mar 17	Sun	21:06	D	SAO 78530	7.8	59+ 73	78N	B9	Close double
Mar 17	Sun	23:28	D	SAO 78580	7.3	59+ 46	25S	A2	mg2 10 sep 29" dT +106s
Mar 18	Mon	2:18	D	ZC 1035	6.7	60+ 15	85S	K3	Az. 293, close double??
Mar 19	Tue	3:49	D	76 Gem	5.3	70+ 8	72S	K5	Az.297, ZC 1169
Mar 22	Fri	1:21	D	ZC 1485	7.1	92+ 53	76N	G0	
Mar 22	Fri	22:51	D	53 Leonis	5.3	96+ 58	78N	A2	ZC 1576
Mar 30	Sat	3:07	R	SAO 184209	7.7	78- 21	63N	K0	
Apr 1	Mon	4:25	R	SAO 186391	7.8	58- 15	44N	A2	Az. 150, close double
Apr 1	Mon	4:52	R	SAO 186422	7.6	58- 17	34S	G8	mag2 12 sep 4" dT -26s
Apr 1	Mon	5:32	R	SAO 186445	7.8	58- 20	62S	B9	
Apr 4	Thu	6:10	R	SAO 190165	7.2	25- 13	79S	K0	Sun -8 deg, Az. 133 deg
Apr 7	Sun	12:34	D	Venus	-3.8	2- 51	-49N		Sun +57 deg., elong. 16
Apr 7	Sun	13:45	R	Venus	-3.8	2- 46	76N		Sun +57 deg. deg. west
Apr 10	Wed	21:00	D	zeta Ari	4.9	7+ 14	87N	A1	Az286,ZC472,close dbl??
Apr 10	Wed	21:25	D	SAO 75819	7.9	7+ 9	71N	F2	Azimuth 290 degrees
Apr 12	Fri	20:35	D	SAO 77034	9.2	22+ 41	16N	F8	MD graze
Apr 13	Sat	22:30	D	SAO 78191	7.7	33+ 33	55S	A0	
Apr 13	Sat	22:47	D	SAO 78206	8.0	33+ 30	74S	K0	
Apr 14	Sun	0:27	D	SAO 78291	7.7	33+ 12	84N	K0	Azimuth 296 deg.
Apr 14	Sun	20:49	D	X 99111	7.2	42+ 62	37S		ZC1093 companion
Apr 14	Sun	20:49	D	ZC 1093	6.6	42+ 62	37S	F8	Close dbl dTime -2s
Apr 14	Sun	23:22	D	SAO 79256	7.8	43+ 33	74N	K0	
Apr 14	Sun	23:58	D	SAO 79279	8.3	43+ 27	86N	F0	
Apr 14	Sun	23:59	G	SAO 79264	8.0	43+ 26	11N	G2	MD graze
Apr 15	Mon	0:12	D	ZC 1108	7.0	43+ 24	60S	G8	Close double?
Apr 15	Mon	0:59	D	SAO 79304	8.1	44+ 15	35S	K2	Azimuth 292 deg.

More information at http://iota.jhuapl.edu/exped.htm.

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President's Corner– continued from page 4

While a Washington Area Astronomy Association is a good idea, we actually do have a couple of regional umbrella astronomy super-groups like that already:

- AstronomyInDC.org (set up by Elizabeth Warner about 15 years ago) and the
- Mid East Region of the Astronomical League, or MERAL.

Whether the officers of HAL, NOVAC, NCA, and the Goodard and Greenbelt clubs would like yet another required meeting each month or two for yet another umbrella organization is another question, but we certainly could do better at getting our message out to the public.

Upcoming Outreach Events for NCA

Guy Brandenburg

NCA members are requested to volunteer and bring telescopes to the following events:

Lake Artemisia, Sunday, March 10th (evening) (see additional details below)

Maury Elementary School, Thursday, March 28th (6 – 8:30 pm)

Eisenhower Under the Stars, Friday, April 5th (evening)

Exploring the Sky, Saturday, April 6th (evening)

Rockville Science Day, Sunday, April 21 (10 am - 4 pm)

We have also been requested to provide judges for the DC online science/STEM fair coming up this month. It's entirely online, which will be weird. We judges review the exhibits remotely, during the week or so before the official date of March 16. You can still register here:

DC4STEM Fair & Competition: Judge, Volunteer, Exhibitor and Sponsor Registration (google.com)

Lake Artemisia Event Details

Date, Time, Location: The night after the NCA March 2024 meeting, starting at 6:30. Official address: 8200 55th Ave, College Park, MD 20740. Parking is available at Berwyn Road and 55th Avenue. You absolutely must use GPS to get to this park for your first time! Or even your fifth time! You can drop off your scope, then go park, then come back. Starts at 6:30 pm, but feel free to come and get set up beforehand.

Lake Artemisia is a very pleasant place, tucked in a mile-long park between a highway and a train line, created when they were building Metro. It doesn't have too many lights, and it has great southern and SW horizons, except for the lights of DC itself. The only bright night-sky naked-eye objects visible that weekend to old farts like me will be Jupiter and the very brightest stars of Orion, Canis Major, etc. It obviously is not a dark-sky site, but it's much better than most areas inside the Beltway, according to light pollution maps I've looked at. No electrical hookups, so bring your own battery if you need power.

This park has always seemed to me like a great family place. People of all walks of life and literally from all over the world come to walk on nice days, and are always very appreciative of any attempts to bring them closer to the world and universe around us.

I plan to go, and am planning to bring one two donated Celestron SCTs that Elizabeth Warner and I recently took delivery of instead of any of my own and customary home-built dobs.

A Science Fair Experience

For anyone who might be thinking about volunteering to judge science fairs in the future, John Hutzell wrote the following comments to NCA President, Guy Brandenburg, after doing so at the Junior Science and Humanities Symposium on February 24th at Catholic University, where students are doing long-term research for Department of Defense institutions in the DC region.

Hi Guy,

The day was amazing. They had both morning and afternoon sessions for posters and presentations. I judged the afternoon oral presentations, and they were truly impressive. I knew I was in for some really serious science when the first presentation was: "Bio-inspired Flapping Fin Unmanned Underwater Vehicles: Cycle by Cycle Constraint Guided Deep Learning Inverse Search Model Optimizing Vehicle Effectiveness" The student who presented the project is a senior at Thomas Jefferson High School for Science and Technology, and has been working with the NRL for over 1 1/2 years. His presentation really impressed me.

The other presenters were similarly amazing! The topics were diverse, including health care, such as inexpensive cancer treatments that poor populations can perform themselves, to music and medical devices.

Thanks for the opportunity to participate as a judge representing NCA!

John

Grazing Occultation of the Triple Star Zeta Piscium, February 13, 2024

David and Joan Dunham, Richard Kelley, and Myron Wasiuta

On February 13, around 6:36 pm EST (23:36 UT), a spectacular grazing occultation of 5th-magnitude zeta Piscium occurred on the dark southern limb of the 22% sunlit waxing crescent moon in two narrow paths (4 miles apart, one for each of the two brighter components) crossing the southern part of the DMV, as shown in Fig. 1 (green line for zeta Psc A and lower dark gray line for 6th-mag. zeta Psc B).

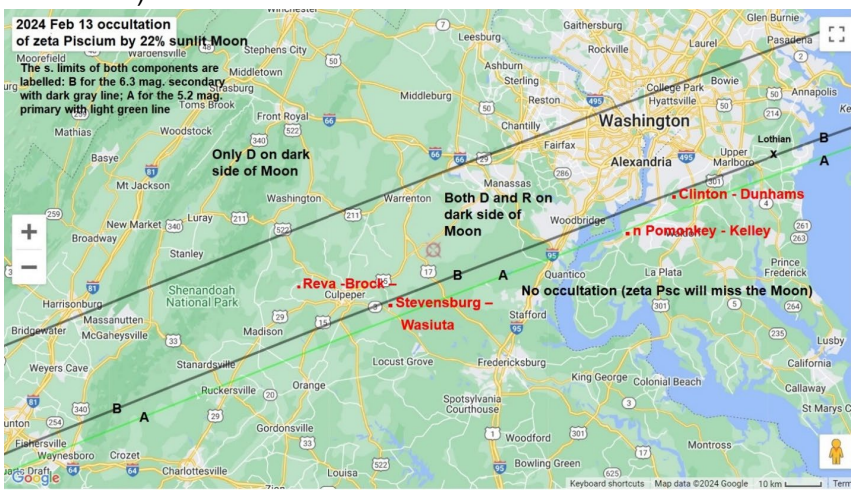

Figure 1. The path of the graze, and the zone where the R as well as the D occurred on the dark side of the moon. Towns and last names of observers are in red. Image Credit - D. Dunham, S. Preston & Google

The Dunhams recorded the graze with an 8-in. SCT and a Runcam video camera, set up in a cul-de-sac in Clinton, MD, with a nearby resident's permission. ZC (Zodiacal Catalog) 180 is the reporting designation for zeta Psc A, mag. 5.2, while the 6.3-mag. B star (ZC 181) is 22″ (arc seconds) away. The B star is itself double, with 12.2-mag. zeta Psc C only 2.1″ away in position angle (PA) 62.5°, according to the Washington Multiple Star (WMS) catalog. At the Dunham's location, there was only one rather long occultation of zeta Psc A, but four of zeta Psc B and three of the C star, which must have actually been at least mag. 11.0 to appear as well as it did in our video. The video was accurately time-stamped with an International Occultation Timing Association Video Time Inserter (IOTA VTI) that uses GPS 1PPS signals. The timings of the A and B component events were determined with IOTA's PyMovie and PyOTE software, while those for C, too faint for that detailed analysis, were determined within one or two frames simply by viewing the video frames with Virtual Dub. A compressed version of the video, portraying it well, will be posted soon on IOTA's page for 2024 North American lunar grazing occultations at https://occultations.org/publications/rasc/2024/nam24grz.htm. The full .avi version can be made

continued on page 8

Grazing Occultation of the triple star zeta Piscium, February 13, 2024Highlights – continued from page 7

available via a DropBox share for those wanting to analyze it.

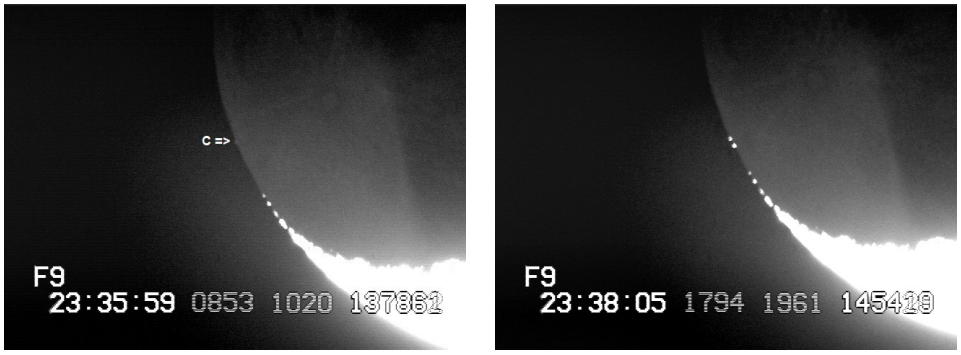

Figure 2. Two frames from the Dunham's video, with only the faint C star visible on the left, shortly before the 1st reappearance of zeta Psc B, while on the right, both the A and B stars are visible after the reappearance of zeta Psc A. Image Credit - D. and J. Dunham

The Dunham's timings were analyzed against the lunar profile predicted from a vast lunar digital terrain model from years of laser altimeter measurements by NASA's Lunar Reconnaissance Orbiter. The fit is very good, as shown in Figure 3, where the horizontal axis is the angle measured from the lunar north pole around the lunar disk, and the vertical axis is height in arc seconds (scaled to the lunar mean distance) above the spherical lunar reference sphere. Each of zeta Piscium's components traces a parabolic curve on the plot, with the motion of the star on the figure from right to left. Red dots mark disappearances and green dots are reappearances, for components A (ZC 180) and B (ZC 181). The C component isn't in the ZC, so its data are generated from the WMS data offset from ZC 181; hence, the colors for its events are different, tan for Ds and light blue for Rs. The initial plot showed that the WMS data for C were wrong. To get the good fit shown, we kept the 2.1″ separation of C from B, but had to decrease the PA by 10°, using 52.5° instead of the WMS's 62.5°.

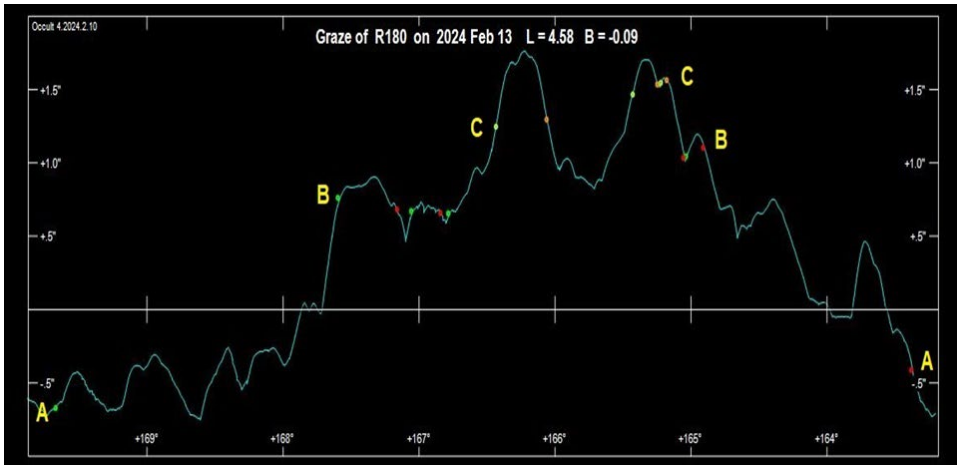

Figure 3. The reduction profile of the Dunham's timings computed with IOTA's Occult4 software. See text for explanation. Image Credit - D. and J. Dunham, and D. Herald

So far, only the Dunham's timings have been analyzed. M. Wasiuta obtained a similar recording of occultations of all three components from Stevensville, VA, from a location that was only about 100m different from the Dunham's distance from the ZC 181 southern limit. R. Kelley recorded three occultations of the A star (ZC 180) near Pomonkey, MD, selecting a location that optimized for that star rather than for ZC 181. Although he then had no occultations of B or C (both missed the lunar profile) at his location, his observations, when considered with those by the others, will be better for establishing the relative positions of the A and B stars. A careful analysis of Kelley's observations might reveal the Ab star (a 4th component of the system very close to A whose estimated mag. is 6.4), since Kelley's more grazing geometry for ZC 180 was better for that. There is some doubt as to the reality of Ab, apparently based on an earlier (possibly visual) occultation observation; no sign of it is apparent in Dunham's recording. The A star (properly "Aa") has an official (IAU-sanctioned) proper name of Revati, one of the Indian nakshatra (lunar mansions). The B star is itself a spectroscopic binary, with a period of only 9 days, so the separation between those two stars will be too small, about 0.001″, to ever be resolved by lunar occultation observations.

Two Asteroidal Occultations Recorded in the DMV Last Month

David and Joan Dunham, and Norm Carlson

On February 13, just after 8:18 pm EST (1:18 Feb. 14 UT), the 14th-magnitude asteroid (498) Tokio occulted a similarly-bright star in Taurus for several seconds in a path extending from southern Texas (Steve Messner) to central Maryland. Some observers instead traveled to observe the lunar grazing occultation of zeta Piscium about 2 hours earlier, but Andrew Scheck and Kevin Hartnett stayed home to record the Tokio occultation. Fig. 2a shows their timings projected onto the sky plane at Tokio, making a good fit to DAMIT shape model 8124 determined from rotational light curve observations. Then six days later, clear skies prevailed again as the large 10th-magnitude asteroid (9) Metis covered a fainter 11th-magnitude star again in Taurus across a wide path including most of Maryland and the northern half of Virginia. We recorded the 17.8s event with an Astrid camera on an 8-in. SCT telescope from our home in Greenbelt, as shown in Fig. 1 (left), an image showing Metis and the star close together 20 min. before the occultation, while Fig. 1 (right) shows the light curve of the occultation fitted with a square wave by IOTA's analysis program PyOTE. Also observing in Maryland were K. Hartnett, A. Scheck, Richard Kelley, and Elizabeth Warner, while Matt Nelson and UVA students recorded the occultation from two locations in Charlottesville; also, B. Heimes in Kansas. Fig. 2b shows the preliminary sky plane fit of most of the chords to the DAMIT 111 shape model.

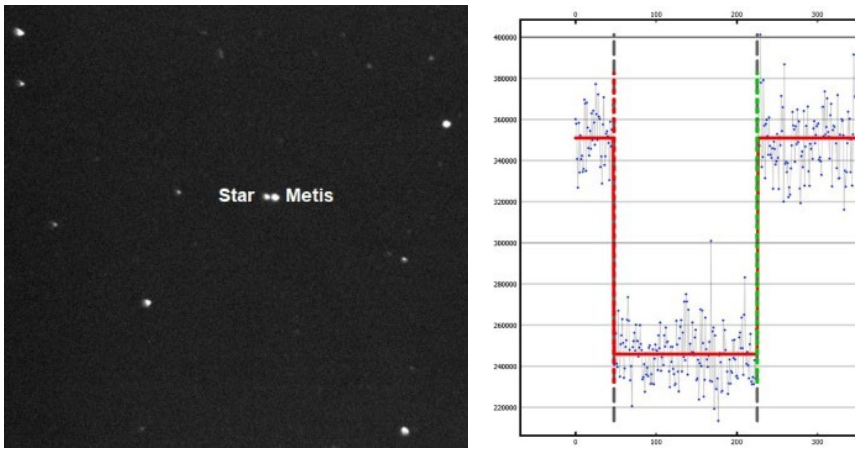

Figure 1. On the left, image of Metis approaching the star (TYC 1873-00489-1) and on the right, the occultation light curve, observed in Greenbelt, MD. Image Credit - J. and D. Dunham

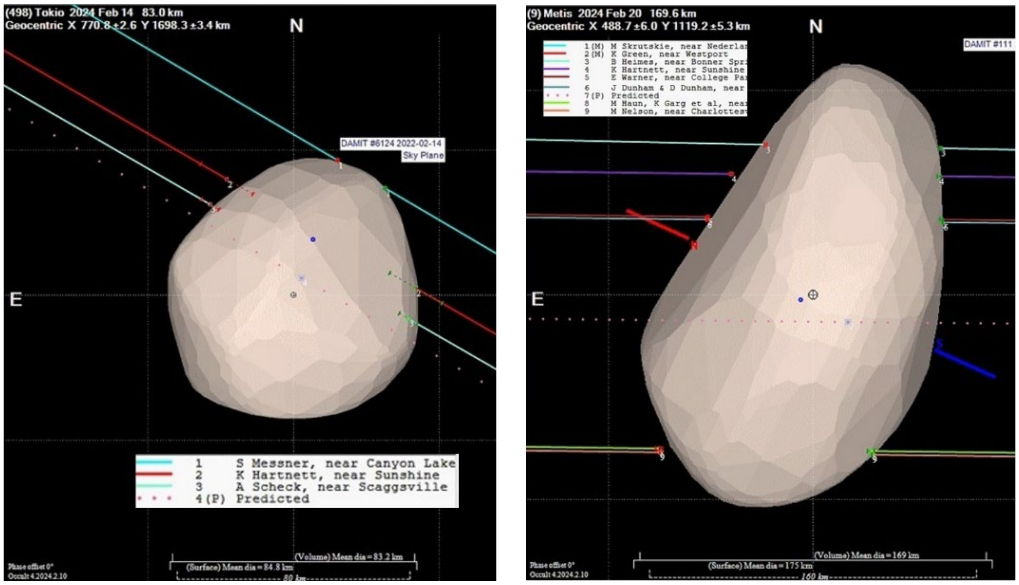

Figure 2. Sky Plane Plots; On the left, occultation by Tokio on Feb. 14, 2024 UT and on the right, the preliminary plot for the occultation by Metis on Feb. 21, 2024 where data for Scheck and Kelley are not yet available. Image Credit - N. Carlson and D. Dunham

Recent Astronomy Highlights – continued from page 4

Water Discovered on Surfaces of Asteroids

Water has already been detected on the sunlit surface of the Moon and in asteroid samples that have been brought back to Earth. Now it has also been detected on the surfaces of two asteroids, Iris and Massalia, both silicate-rich asteroids. The finding goes against previous theory that asteroids in their locations could not hold onto water so close to the Sun. The observations were made by SOFIA, the Stratospheric Observatory for Infrared Astronomy, a Boeing 747 jet with a telescope on board. SOFIA has been retired in the time since the observations were made. These finding, as well as future observations of asteroid surfaces, may give insights into how water was delivered to Earth when it was first forming. More information on the discovery is available at https://phys.org/news/2024-02-scientists-molecules-asteroids.html.

Calendar of Events

NCA Telescope Making, Maintenance, and Modification Workshop (TM3W) (previously the NCA Mirror- or Telescope-making Classes): *The Chevy Chase Community Center has reopened and classes have resumed*. Classes will be Tuesdays and Fridays, from 6:00-9:00 pm at the Chevy Chase Community Center (intersection of McKinley Street and Connecticut Avenue, N.W.) Please contact instructor Guy Brandenburg at 202-635-1860 (leave message) or at gfbrandenburg@yahoo.com if you plan to attend. Info is at guysmathastro.com.

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: **13 April** 7:30 p.m. Benedikt Diemer (UMD) **Where and How Should We Look For Dark Matter?**

The APS Mid-Atlantic Senior Physicists Group: **(at the American Center for Physics and on Zoom)** March 20th at 1:00 p.m., Dr. Ariel Stein, Director, NOAA / OAR / Air Resources Laboratory, will give a talk entitled "NOAA,s Air Resources Laboratory - 75 Years of Research Linking Earth and Sky: A Historical Perspective". A link to the meeting via Zoom is at https://apsphysics.zoom.us/j/83580602474?pwd=twFymZE1HVLW4lvLpWy309IY6awGmw.1 Meeting ID: 835 8060 2474 Passcode: 955339

National Capital Astronomers Membership Form

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

Address: _____ **ZIP Code:** _____

Home Phone: ____-____-_____ **E-mail:** _____ **(necessary for delivery of Star Dust)**

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:
Jim Simpson, NCA Treasurer; 3845 Wayson Road, Davidsonville, MD 21035

Celebrating 87 Years of Astronomy

Image Credit – ESA/Webb, NASA and CSA, M. Miexner

JWST provided the image above of a star-forming region in the Large Magellanic Cloud. More information is available at https://phys.org/news/2024-01-webb-telescope-captures-massive-star.html.

To join or renew online, visit capitalastronomers.org and look in the right column for the Membership Form and PayPal links.

Next NCA Meeting:

2024 March 9th

7:30 pm

Dr. William McDonough

To join the meeting via Zoom, use the following link:
https://umd.zoom.us/j/95154535739?pwd=cERBUE9XM3AvNE40TXYrNUptVEtzUT09

Please download and import the following iCalendar (.ics) files to your calendar system:
https://umd.zoom.us/meeting/tJEscu2trT4tGd1QOonrqcTNP3fs8VY-InJt/ics?icsToken=98tyKuCtrz4uH9eQtxqORowMBY_4LO_ztiVajacMrTDqDTJCYTfYBrFEIepJKZX5

Please note that NCA Zoom meetings are often recorded.

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