

Star Dust

Newsletter of National Capital Astronomers, Inc.

capitalastronomers.org

January 2021

Volume 79, Issue 5

**Celebrating 84 Years
of Astronomy**

Next Meeting

When: Sat. Jan. 9th, 2021

Time: 7:30 pm

Where: Online (Zoom)

See instructions for registering to participate in the meeting on Page 8.

Speaker: Dr. Tony Farnham

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Jupiter and Saturn approaching, prior to the Great Conjunction of 2020, seen over a tree at the University of Maryland Observatory.

Image Credit: Elizabeth Warner

Spontaneous Outbursts: New Studies of Cometary Activity

Tony Farnham
University of Maryland

Abstract: Comets are the most primitive objects available for study in the Solar System, and they will provide insight into the conditions that were present in the proto-solar nebula, *if* we can understand what causes a comet's behavior to vary along its orbit, and how a comet evolves.

Cometary activity takes many forms, but the most spectacular activity tends to be explosive outbursts, where the comet rapidly brightens for a brief period of time. These events range from barely detectable blips in the comet's brightness as a function of time, to the massive explosion that caused comet 17P/Holmes to increase in brightness by ~14(!) magnitudes in 2007. Explosive outbursts have been observed for over a century, in comets of all family types, under a wide variety of conditions and heliocentric distances, and have even been imaged *in situ* by spacecraft.

However, despite this record of observations, little is known about explosive outbursts. Given that sunlight is the only energy source driving a comet's activity (with the exception of the occasional asteroid impact), the explosive nature of outbursts suggests that this energy is applied in a different manner from that producing normal activity, and understanding why it is different promises to reveal important information about the physical properties of cometary nuclei.

Recent developments in astronomical observing capabilities have opened a new era in the study of outbursts, and the Small Bodies Group at the University of Maryland is taking advantage of these capabilities to begin more detailed investigations into the physics of outbursts. This talk will

continued on page 2



Rosetta images of comet 67P/Churyumov-Gerasimenko from Aug 12, 2015 showing a small, short-duration outburst, consisting of a narrow jet accompanied by a broader fan.

Image credit: ESA/Rosetta/MPS for OSIRIS Team

Recent Astronomy Highlights

Meteorite Fragment Thought to Be From Unknown Ceres-Sized Parent

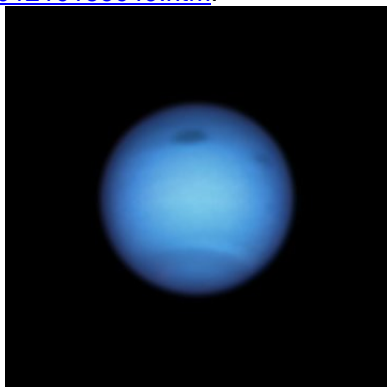
In 2008, scientists collected remnants from a 9-ton meteor, which was named Almahata Sitta, that exploded over Sudan after entry into Earth's atmosphere. The remnants showed that Almahata Sitta was a carbonaceous chondrite meteorite. Recent analysis of a small fragment showed the presence of amphibole, a mineral that so far is only known to form with long-term exposure to water. Based on this new data, scientists speculate that Almahata Sitta came from an unknown parent body that was 640 to 1800 kilometers in diameter. More information can be found at

www.livescience.com/mysterious-giant-asteroid-evidence.html.

Neptune Storm Turns Away From Oblivion

Just as hurricanes would tend to become disorganized and die if they approached Earth's equator, due to the lessening of Coriolis forces, astronomers were expecting a large vortex on Neptune to die out as it approached the planet's equator. However, recent images show the storm, approximately the size of the Atlantic Ocean, making a turn away from the equator, buying it a new lease on life. Simulations show such turns are to be expected, however this is the first time that astronomers have seen one.

More information can be found at www.sciencedaily.com/releases/2020/12/20201216183649.htm.



Credit: NASA, ESA, STScI, M.H. Wong (University of California, Berkeley), and L.A. Sromovsky and P.M. Fry (University of Wisconsin-Madison)

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Spontaneous Outbursts: New Studies of Cometary Activity – continued from page 1

review the history and current status of our understanding of these unique events, and will preview the new era of studies.

Biography: Tony Farnham is a Senior Research Scientist in the Department of Astronomy at the University of Maryland. His primary research attempts to use both ground-based observations and spacecraft data to understand the mechanisms involved in the formation and development of the comas of comets, and the relationships between the coma and physical and dynamical properties of the nucleus. His other interests include the evolutionary processes that link the different comet families, Centaurs and Trans-Neptunian Objects, and the dynamics involved in active asteroids. Farnham earned BS and MS degrees in Aerospace Engineering at the University of Southern California, and MS and PhD degrees in Astronomy at the University of Hawaii at Manoa. He worked at the Lowell Observatory in Flagstaff, Arizona, and was the Harlan J. Smith Planetary Postdoc at the University of Texas, Austin, before coming to the University of Maryland in 2002. He was on the science teams for the Deep Impact mission to comet 9P/Tempel 1, the DIXI mission to comet 103P/Hartley2, and the Stardust-Next mission that returned to Tempel 1. He was the Project Scientist for the NASA Discovery Comet Hopper Mission (Phase A study), and has participated in numerous other proposed cometary missions. He is currently on the Double Asteroid Redirection Test (DART) team, developing the plans for the spacecraft approach and ground-based follow up observations. Asteroid 16946 Farnham is named in his honor.

The Great Conjunction of 2020

It was the Great Conjunction of Jupiter and Saturn, and the closest such conjunction in over 400 years. NCA members watched and recorded as the two planets appeared closer to each other night after night. Below are but a few of the images they captured.



The long-exposure image above captures the ISS passing between Saturn (upper left) and Jupiter (lower right) on Dec. 11 around 5:52 p.m. Zoom in close on Jupiter to see its moons.

Image Credit – Eliud Bonilla using a Nikon D5000, Lens: 200mm, ISO: 1EV under 200, Exposure: f5.6/4secs

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 February’s issue of Star Dust, is January 21st.

Clear Skies!

Sky Watchers

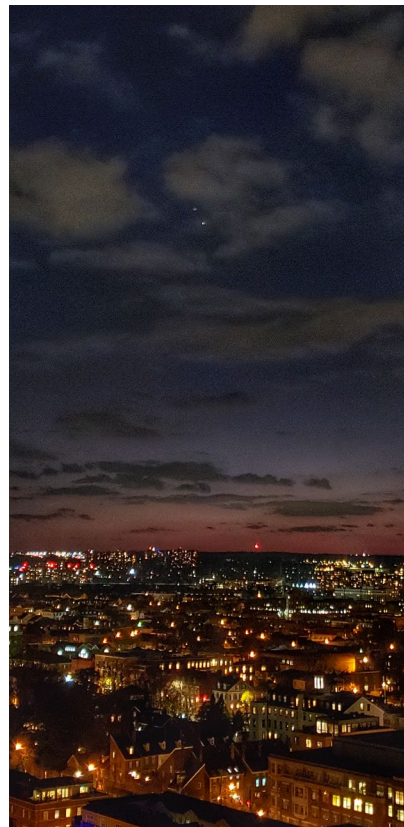
January/February

With Jupiter and Saturn having gone through their Great Conjunction in the skies of Earth, they begin a 20-year cycle of separating then approaching until the next Great Conjunction in early November of 2040. As they continue to separate, they can be seen low in the post-sunset sky until they transit to the morning sky in late January. Mercury remains in the evening sky and reaches greatest Eastern Elongation late in January (see below), before transiting to the morning sky in early February. Mars remains high in the evening sky as well. Venus is the only naked-eye-visible planet visible in the predawn sky until joined by Jupiter and Saturn in late January and then Mercury in February.

1/9	The night of the NCA meeting will start with a ‘triple conjunction’, with Mercury joining Jupiter and Saturn to form a planetary triangle low to the horizon just after sunset.
1/24	Mercury at Greatest Eastern Elongation. This will be the best time to see the planet as it will be 18.6° from the Sun.
1/28	Full Moon at 2:08 p.m.

All times are in EST (Eastern Standard Time)

The Great Conjunction of 2020 – continued from page 2



Jupiter and Saturn over Alexandria, VA on Dec. 14. Image Credit: Elizabeth Warner, Samsung Galaxy 9+

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NCA an IOTA Affiliate Member

Joan Dunham, IOTA Secretary/Treasurer

The National Capital Astronomers, Inc., has been granted an Affiliate Membership in the International Occultation Timing Association (IOTA). As most NCA members are aware, IOTA is a volunteer organization whose purpose is to promote, collect, and analyze timings of astronomical occultations. The Affiliate Membership category, freely offered to organizations, is intended to help distribute information on occultation observing, on major upcoming occultation events, and to provide notices of IOTA meetings.

In this time of COVID-19 pandemic, our plans for events and functions have been severely curtailed. All of our meetings have transitioned to fully online, and development of materials and programs specific to Affiliate Members has not happened. However, we do have considerable resources to offer on occultation observing, freely available to all. Please feel free to use them. Some of them are described in the following paragraphs.

The members' site, www.occultations.org/, provides information on occultation observing, has links to download programs for predicting and recording occultations, as well as instructions on observing techniques. The software access page occultations.org/observing/software/ is a particularly valuable resource, providing links to prediction, capture, and data reduction packages that are all freely available to observers.

IOTA and its members support many resources available to occultation observers. One of the more important is the Journal for Occultation Astronomy (JOA), published by IOTA, IOTA/ES and RANZ. This is available via our IOTA members website at occultations.org/pub/newsletters/ or directly via the IOTA/ES posting, www.iota-es.de/joafree.html.

You can generate lunar occultation predictions for yourself with the Occult software. A download link and information on using the software is available from the website occultations.org/observing/software/occult/.

Observers are strongly encouraged to join our IOTA occultations group on Groups.io, IOTAoccultations@groups.io, by sending a message to iotaoccultations+subscribe@groups.io.

Other sources of information are Steve Preston's www.asteroidoccultation.com/ website, lunar-occultations.com/iota/iotandx.htm, and Derek Breit's website at www.poyntsource.com. There are multiple other resources available, just search through these sites to find them.

The Affiliate Membership category is for organizations such as clubs, planetariums, museums, and public observatories. It is not a replacement for individual IOTA membership.

(Editor's Note – A preview of this announcement appeared in the December 2020 issue of Star Dust.)

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Thank you!

Recent Astronomy Highlights – continued from page 2

Closer and Faster

Japanese astronomers, using the radio telescopes of VERA (VLBI Exploration of Radio Astrometry, where VLBI stands for Very Long Baseline Interferometry), have determined that our Solar System lies approximately 25,800 light years from Sagittarius A*, the supermassive black hole at the center of the Milky Way Galaxy. That is 2000 light years closer than previous measurements indicated. In addition, the astronomers discovered that our Solar System is orbiting around the Milky Way's center at approximately 227 km/hour, 7 km/hour faster than previous measurements indicated. More information about the study can be found at

www.nao.ac.jp/en/news/science/2020/20201126-mizusawa.html.

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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	Day	EST	Star	Mag.	Asteroid	dmag	dur.	Ap.	Location
Jan 9	Sat	21:17	4U435121273	14.2	Silesia	1.3	3 12	sNJ,MD,DC,nVA	
Jan 10	Sun	20:31	4U446140659	14.3	Edith	1.2	3 12	wV,MD,NJ;nVA,DC?	
Jan 10	Sun	21:37	SAO 80257	9.4	Tucson	6.9	2 4	sDE, sMD, CVA, sWV	
Jan 17	Sun	1:05	4UC38756747	12.9	Aspasia	0.3	30 8	wPA,MD.n&eVA;DC?	
Jan 17	Sun	23:57	4UC52605916	14.1	Sidonia	0.4	15 11	nVA,nMD.sePA,CNJ	
Jan 19	Tue	23:03	TYC14011416	10.1	Roxane	3.1	1.6 3	sVA,KY;sat. DC??	
Jan 24	Sun	21:17	4UC55028600	14.5	Christa	0.5	9 14	sDE,MD,DC,nVA,OH	
Jan 28	Thu	5:08	4UC30880940	12.1	Hedwig	1.9	5 6	wPA,MD,DC,n&eVA	
Feb 14	Sun	0:31	4UC48020569	13.4	Elektra	0.3	16 10	CVA,DC,MD,e&cPA	

Lunar Total Occultations

2021	Day	EST	Ph Star	Mag	%	alt	CA	Sp.	Notes
Jan 11	Mon	6:17	R 63 Oph	6.2	4-	2	75N	O7	Azimuth 124, ZC 2577
Jan 16	Sat	18:01	D ZC 3387	8.2	15+	28	59S	K0	Sun alt. -10 deg.
Jan 16	Sat	20:01	D ZC 3396	7.7	16+	9	36S	A8	Azimuth 247 deg.
Jan 17	Sun	19:26	D ZC 3516	8.4	23+	26	69N	K0	
Jan 19	Tue	17:40	D SAO 109805	7.5	41+	55	32N	K0	Sun altitude -5 deg.
Jan 20	wed	17:33	D SAO 110316	7.2	51+	58	76N	F5	Sun alt. -4 deg.
Jan 20	wed	19:25	D WZ Piscium	6.3	51+	55	53S	M4	ZC 308, mag. range 0.2
Jan 20	wed	21:03	D 110353	7.8	51+	42	45N	F5	
Jan 20	wed	21:21	D ZC 315	7.3	52+	39	66N	A0	mag2 8.8 D 0.8s earlier
Jan 21	Thu	18:10	D ZC 417	8.2	60+	62	67S	F2	Sun alt. -11 deg.
Jan 22	Fri	0:41	D ZC 437	7.3	62+	12	52S	G5	Azimuth 278 deg.
Jan 22	Fri	22:59	D ZC 532*	7.1	70+	42	32S	G0	maybe close double
Jan 23	Sat	20:24	D ZC 670*	7.7	78+	72	63N	B8	
Jan 24	Sun	0:41	D ZC 690*	8.0	79+	34	45N	F8	
Jan 25	Mon	17:59	D 5 Gem	5.8	92+	38	32N	K0	Sun -8,ZC 936,spec.bin.
Jan 26	Tue	17:48	D ZC 1080	6.7	96+	26	29S	M1	Sun -6, Term.Dist. 17"
Jan 26	Tue	21:24	D ZC 1097	6.9	97+	66	37N	A1	
Jan 27	wed	22:09	D ZC 1239	6.6	99+	63	68N	A4	Terminator Distance 8"
Jan 30	Sat	22:39	R ZC 1598*	6.5	93-	33	74N	F5	AA 278, close double?
Feb 1	Mon	1:36	R ZC 1725	7.6	85-	49	77S	K0	close dbl, Tdiff 0.3s
Feb 2	Tue	1:04	R ZC 1840	8.0	76-	33	71N	F8	
Feb 2	Tue	3:37	R ZC 1848	7.7	76-	49	44N	K5	
Feb 3	wed	6:35	R SAO139556*	7.7	64-	38	37S	G0	Sun alt. -7 deg.
Feb 4	Thu	2:46	R ZC 2088	6.2	54-	24	9N	F5	close double??
Feb 4	Thu	4:18	R SAO 158686	7.5	54-	34	81S	G2	
Feb 5	Fri	2:07	R 33 Librae*	6.7	43-	6	59S	AP	Azimuth 118, ZC 2211
Feb 5	Fri	4:32	R SAO 159355	8.2	42-	26	45N	A0	
Feb 5	Fri	6:40	R IV Librae	8.4	41-	33	82S	K1	Sun -6, SAO 159385
Feb 7	Sun	6:27	R ZC 2530	7.7	21-	20	74N	F5	Sun alt. -8 deg.
Feb 8	Mon	6:31	R ZC 2703	7.4	12-	13	71N	G5	Sun -7, Azimuth 139
Feb 14	Sun	19:31	D ZC 44	7.4	10+	13	82S	F8	Azimuth 255 degees

*in Kepler2 program so occultation light curves are sought.

There are no lunar grazing occultations good enough and close enough to DC, between Jan. 9 and Feb. 15, to list here.

More information is at iota.jhuapl.edu/exped.htm

David Dunham, dunham@starpower.net

Occultation by Ganymede during the "Great Conjunction"

David and Joan Dunham

During the recent close conjunction of Jupiter and Saturn, the largest Galilean satellite Ganymede occulted 7.4-mag. ZC 2838 = HIP 99314 = SAO 188965. The event actually occurred the evening of December 20th local time (shortly before 1h UT of Dec. 21 UT) and was visible from much of the western USA; predictions for the event, and for 4 other occultations of stars by Jupiter and the large Jovian moons, were posted at iota.jhuapl.edu/GreatConjunctionOccultations.htm. We were able to record the Ganymede occultation in rather bright twilight from our winter home in Fountain Hills, Arizona. Analysis of the observations is in progress, so we should have more to report next month.

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The Great Conjunction of 2020 – continued from page 3



Image Credit: David and Joan Dunham – Saturn is in the upper right. To the right and a little below it is dim Titan. The objects in a line on the left, from top to bottom, are Callisto, Ganymede, ZC 2838, Jupiter, Io, and Europa. Image from video taken Dec. 21 UT with a Runcam camera on a 127mm Nexstar scope & UT stamped with an IOTA-VTI 23 min. after we recorded the occultation of ZC 2838 by Ganymede.



Image Credit: Joan and David Dunham - Saturn and Jupiter setting on Dec. 21 – taken from our home in Fountain Hills, AZ as the pair set behind a neighboring hill. Taken with a Sony Alpha 6000 DSLR on an Orion 115mm refractor.



Jupiter and Saturn as they were beginning to move away from each other on Dec. 22. Image Credit: Bernard Kaufman, taken with a Nikon D750 set to DX format. 600mm with a 1.4 extender.

Recent Astronomy Highlights – continued from page 4

50-Million-Light-Year-Long Intergalactic Gas Filament Discovered

Astronomers using the eROSITA (extended Roentgen Survey with an Imaging Telescope Array) Space Telescope have discovered a ‘filament’ of gas connecting galaxy clusters in a system of such clusters designated Abell 391/95 which lies 700 million light years away. Scientists have long believed such filaments exist, and that they contain a sizable portion of the baryonic matter in the Universe, but such structures have been difficult to detect because the gas within them is extremely tenuous. An estimate puts the density of gas in these filaments at only 10 particles per cubic meter. Nevertheless, eROSITA’s wide-angle lens captured X-rays radiated by the gas within the filament. The paper describing the finding is available at arxiv.org/pdf/2012.08491.pdf.

Calendar of Events

NCA Mirror- or Telescope-making Classes: The Chevy Chase Community Center is currently closed due to the coronavirus pandemic. When it reopens, classes will be 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 (leave message) or at gfbrandenburg@yahoo.com. More info 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 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 (Zoom): 13 Feb. 7:30 p.m., Eliza Kempton (UMd) Atmospheres of Extra-Solar Super-Earths

The APS Mid-Atlantic Senior Physicists Group: (Zoom Meeting) Jan. 27th at 1:00 p.m., Megan Hochstrasser, Innovative Genomics Institute (IGI), will give a talk entitled "CRISPR: Rewriting DNA and the Future of Humanity." **Please note that this is the 4th Wednesday of the month, not the 3rd.** More info is at www.aps.org/units/maspg/meetings/meeting.cfm?name=SENIOR0121
To attend the meeting, use the following link and meeting info:
apsphysics.zoom.us/j/93315447855?pwd=blFPZlVrUFFhVTJYUTN2YjBEZWZuZz09
Meeting ID: 933 1544 7855 Passcode: 233558
Dial in access 301 715 8592 (Washington DC).

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.?

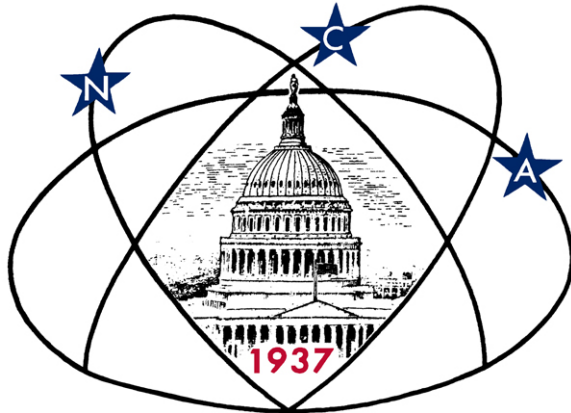
Are you interested in volunteering for: Telescope making, Exploring the Sky, Star Dust, NCA Officer, etc.?

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
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First Class
Dated Material



Celebrating 84 Years of Astronomy

Next NCA Meeting:

2021 January 9th

7:30 pm

(On Zoom)

Dr. Tony Farnham

The NCA Zoom meetings are open to anyone, however, you must register ahead of time. To register, go to: umd.zoom.us/meeting/register/tJA1c-6sqjsiHdfRNCJnuI3iawoOyahnYPh. The website is set up so that you can register for any or all of the NCA meetings scheduled for this year. After registering, you will receive a confirmation email containing logon information for the meeting. Do not share the logon you receive in the confirmation email. Instead, if there is somebody you know who wants to participate, share the link above instead.

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