

Star Dust

Newsletter of National Capital Astronomers, Inc.

capitalastronomers.org

February 2021

Volume 79, Issue 6

**Celebrating 84 Years
of Astronomy**

Next Meeting

When: Sat. Feb. 13th, 2021

Time: 7:30 pm

Where: Online (Zoom)

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

Speaker: Dr. Eliza Kempton

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The Atmospheres of Extrasolar Super-Earths

Eliza Kempton

University of Maryland

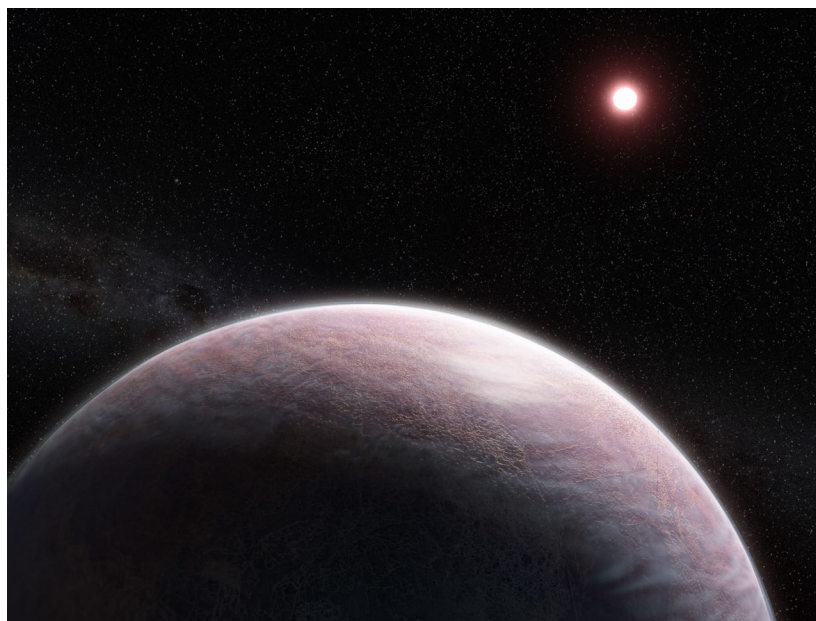


Image credit: L. Hustak and J. Olmsted (STScI)



Image Credit: NASA/JPL-Caltech STScI

The image of the Orion Nebula shown above comes from the Hubble Space Telescope and Spitzer Space Telescope. It was published at the end of 2020 and can be found at

bgr.com/2020/12/31/nebula-photo-orion-hubble-spitzer/

Abstract: Some planets around other stars are super-Earths: planets with masses and sizes intermediate between the Earth and Neptune. Super-Earths do not exist in our Solar System, and models of planet formation and evolution are unable to uniquely predict their bulk compositions. Whether these planets are primarily rocky, gassy, or icy — and, if all three possibilities exist, how the dividing lines between subclasses are sculpted — remains the subject of vigorous scientific investigation. The *atmospheres* of super-Earths are an astronomical observer's window into the composition of these planets. I will review the current state of atmospheric modeling and observations of super-Earth exoplanets, focusing on the challenges of uniquely inferring their key physical properties. I will then turn to a forward-looking view of the coming decade with regard to upcoming observational facilities, such as the *James Webb Space Telescope* and ground-based thirty-meter class telescopes, and how these facilities will revolutionize our understanding of super-Earths and their atmospheres.

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Recent Astronomy Highlights

Life Above Venus – On Second Thought, Probably Not

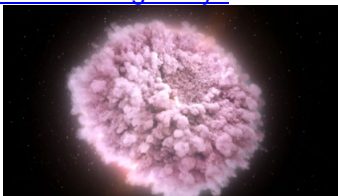
Last year, scientists reported detecting the presence of phosphine in the upper atmosphere of Venus. Since on Earth phosphine is generally created by biological processes, the inference was that perhaps there was some form of life in the clouds high above Venus.

However, a new study modeling our sister planet's atmosphere seems to indicate that the radio signal detected and initially used to claim the presence of phosphine can be explained by sulfur dioxide, a chemical already found in abundance there. One key piece of evidence is that the signal originated much higher above Venus than previously believed. More information can be found at

www.sciencedaily.com/releases/2021/01/210127140147.htm.

Neutron-Star-Neutron-Star Collision Still Radiating Brightly

On August 17, 2017, scientists using the Laser Interferometer Gravitational-Wave Observatory (LIGO) recorded for the first time the gravitational waves from the collision of two neutron stars. Unlike the black hole collisions LIGO had previously observed, this collision created an explosion known as a kilonova which was observed by telescopes sensitive to wavelengths up and down the electromagnetic spectrum. Astronomers expected the light from that explosion to dim rapidly, however three years later, the region is still glowing brightly in the X-ray part of the spectrum. Those X-rays could be coming from the remnants or the kilonova, or they could be coming from a new, heavier neutron star created by the collision. More information can be found at www.space.com/neutron-star-crash-still-emitting-x-rays.



Artistic Image of a Neutron-Star Collision – Image Credit: NASA's Goddard Space Flight Center/CI Lab

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The Atmospheres of Extrasolar Super-Earths – continued from page 1



Biography: Eliza Kempton is an associate professor of astronomy at the University of Maryland. Her research is focused on the detection and classification of exoplanets, with a particular interest in theoretical modeling of the atmospheres of the small planets known as super-Earths. Dr. Kempton previously served as a NASA Sagan Postdoctoral Fellow at the University of California, Santa Cruz and then as an assistant professor of physics at Grinnell College. She has received numerous awards, including a Cottrell Scholar Award from the Research Corporation for Science Advancement and an NSF CAREER Award. Dr. Kempton earned her B.A. in physics from Middlebury College and her Ph.D. in astronomy at Harvard University.

Astronomical Mysteries

Who doesn't love a good mystery? Astronomy certainly has more than its share of them, from the origin of the Universe, to the nature of Dark Matter and Dark Energy. Below are a couple of mysteries where the solutions may, or may not, be near.

Why is the Sun's Corona So Hot?

For decades astronomers have known that while the temperature of the Sun's surface is approximately 6000K, the corona shining above the surface experiences temperatures in the millions of degrees. How is that possible? The mystery is known as the Coronal Heating Problem.

Magnetic reconnection, where magnetic field lines suddenly realign, releasing enormous amounts of energy, has long been suspected as the cause of the high coronal temperature. Nearly fifty years ago, Eugene Parker, after whom the Parker Solar Probe is named, theorized the existence of nanoflares, magnetic-reconnection events billions of times smaller than the typical solar flares that have been observed, as a possible mechanism for the observed heating of the corona.

Unfortunately, because nanoflares would be so small, and extremely

continued on page 4

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

Clear Skies!

Sky Watchers

February/March

Mars will be the only visible planet in the sky after sunset, while Mercury and Venus are in the morning sky, along with Jupiter and Saturn which will rise shortly before dawn. Mercury joins the two gas giants for another conjunction (see below) similar to the one in January, before racing to Greatest Western Elongation in March (see below).

2/13	Triple Conjunction – The same three planets, Jupiter, Saturn and Mercury, that had a triple conjunction in January, will have another one, but now in the pre-dawn sky.
2/27	Full Moon at 3:19 a.m.
3/6	Mercury at Greatest Western Elongation. This will be the best time to see the planet as it will be 27.3° from the Sun.

All times are in EST (Eastern Standard Time)

The 237th Meeting of the American Astronomical Society, January 11-15, 2021

John Hornstein

This Zoom-based meeting had so many wonderful talks that any attempt at an overall summary would far exceed the space available here. So, what follows mentions only a few items that are of special interest to those who attend meetings of the National Capital Astronomers.

There were multiple sessions on the Nancy Grace Roman Space Telescope and on the Vera Rubin Observatory. The names of those facilities are tributes to two of our long-term members who have contributed mightily to the advancement of our understanding of the Universe.

There were many sessions on exoplanets. One of the speakers on this topic was Eliza Kempton (University of Maryland), who is our speaker this month.

There was a superb plenary talk by Sheperd Doelman on the Event Horizon Telescope, on how to interpret the radio-astronomical synthesized images obtained by a world-wide network of radio telescopes, showing the shadow of the super-massive black hole in the galaxy M87. The shadow is surrounded by a halo of light from the disk of material that is spiraling around the black hole. A smile-shaped part of the halo is much brighter than the rest. The image is unlike that of any other kind of astronomical object. It occurs because rays of (radio) light from that disk are wildly deformed by the black hole’s gravity: some of the light rays orbit the black hole multiple times before heading toward us.

Many more people attended this Zoom-based meeting than attend in-person meetings. That is relevant to our present discussions on the type of meetings we should have when in-person meetings become possible again, because our Zoom-based meetings have attendees who cannot attend in-person meetings.

Astronomical Mysteries – continued from page 2

short lived, it has been impossible to image them until the advent of current telescopes and solar probes. An article documenting the possible imaging of just such a nanoflare, along with speculation on how such events might provide an answer to the Coronal Heating Problem can be found at www.nasa.gov/feature/this-may-be-the-first-complete-observation-of-a-nanoflare.

Why 'Seven' Sisters?

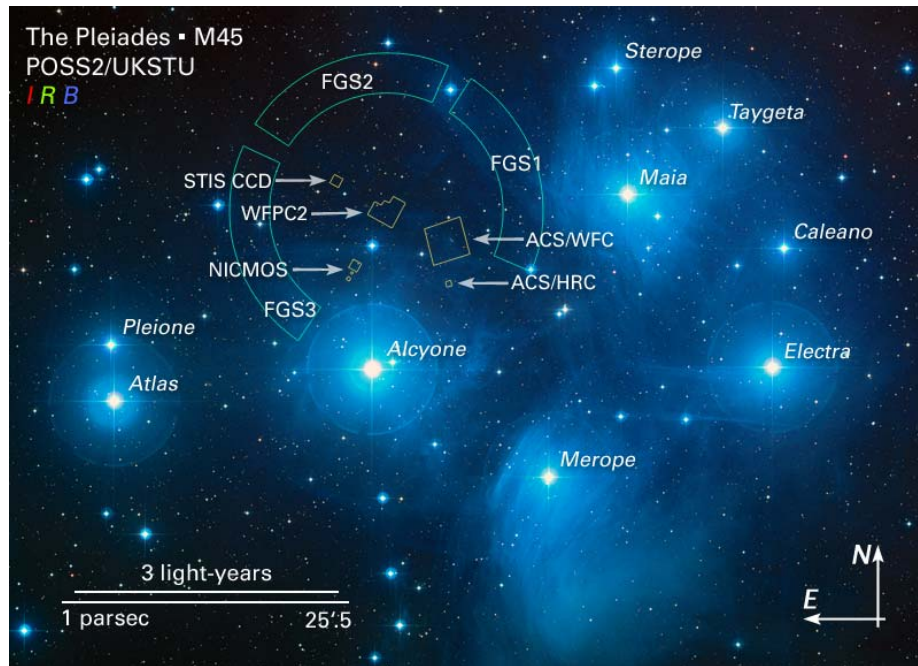


Image Credit - NASA, ESA and AURA/Caltech

Although the open cluster known as the Pleiades contains over a thousand stars, and ten stars in the cluster are considered to be naked-eye visible, if you look up at it some clear winter night, and if you have reasonably good eyesight, you are likely to only see six stars. Yet, throughout many cultures, the formation has been referred to as the Seven Sisters or some similar title, with some stories also including mention about one of the sisters dying or hiding, explaining why only six stars are now visible. Such stories include those of the ancient Greeks and the Aborigines of Australia, which apparently have not had contact for approximately 50,000 years. Why such similar stories?

Two astronomers now theorize that there may be a common origin of these stories dating back around 100,000 years, to a time when the star Pleione appeared much farther from the star named Atlas (both are to the left in the image above) and therefore would have appeared as a seventh star to most observers of that time. A paper describing the theory, along with an examination of a number of the myths from around that world concerning the Pleiades, can be found at www.dropbox.com/s/np0n4v72bd137gr/sevensisters.pdf?dl=0.

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Thank you!

Recent Astronomy Highlights – continued from page 2

Super-Puff

WASP-107, a star 212 light years from Earth, has a planet that is calling into question assumptions about the formation of gas giants. Studies of the planet, designated WASP-107b, indicate that it is the size of Jupiter, but only has one-tenth of Jupiter's mass and a rocky core perhaps only four times as massive as Earth. Scientists have believed that in order to form a gas giant, there must be a rocky core at least ten times the Earth's mass. The planet also orbits extremely close to its star, causing scientists to wonder how it has held onto its atmosphere. One possible explanation is that WASP-107b formed much farther out from the star and migrated in later. More information is at phys.org/news/2021-01-super-puff-planet.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/EDT	Star	Mag.	Asteroid	dmag	dur.	Ap. s	Location
Feb 14	Sun	0:31	4UC48020569	13.4	Elektra	0.3	16	10	CVA,DC,MD,e&cPA
Feb 17	wed	5:29	4UC36388965	13.7	Smuts	3.1	2	10	OH,nWV,nVA,DC,MD
Feb 17	wed	20:25	TYC19001152	11.4	Orma	5.8	3	5	CVA,swV,SKY,nOK
Feb 20	Sat	6:01	TYC61901154	12.1	Hestia	1.9	8	6	SOH,MD,DC,n&cVA
Feb 27	Sat	0:36	4UC63443761	13.5	Scheila	0.8	12	10	SNJ,nMD,SPA,nOH
Mar 4	Thu	4:02	4UC36673045	14.1	Liberatrix	0.5	3	11	OH,MD,nVA,DC,DE
Mar 4	Thu	5:05	4U334193630	11.7	Ariadne	1.0	2	7	swPA,MD,nVA,DC
Mar 10	wed	5:32	4U342116605	14.3	Jugurtha	1.4	1	12	nOH,swPA,MD,nVA
Mar 11	Thu	5:01	4UC42254780	12.7	Tata	2.1	5	9	nOH,PA,NJ;MD,DC?
Mar 12	Fri	19:22	4UC52719779	9.6	Ilsebill	6.9	2.5	4	c&swVA,seKY,nTN
Mar 12	Fri	20:48	4UC59415861	13.1	Nordenmarkia	2.9	1.9	8	COH,nVA;DC,SMD?
Mar 13	Sat	3:30	4UC47242080	13.7	Asterope	0.4	10	11	EMD,PA;nVA,DC?
Mar 13	Sat	20:02	TYC07220041	10.5	La Serena	8.3	0.6	4	wNC,cVA,seMD;DC?
*** Dates and times above are EST, those below are EDT ***									
Mar 15	Mon	5:41	4U328125039	13.4	Reddish	5.0	1.5	9	nVA,SMD;DC,nMD?

Lunar Grazing Occultations

2021	Day	EST	Star	Mag	% alt	CA	Location, Notes
Feb 23	Tue	19:37	kappa Gem	3.6	87+	62-10N	Tysonscorner,VA;nDC;sBowie,MD

Lunar Total Occultations

2021	Day	EST	Ph Star	Mag	% alt	CA	Sp.	Notes
Feb 14	Sun	19:31	D ZC 44	7.4	10+	13	82S F8	Azimuth 255 degrees
Feb 15	Mon	21:12	D 29 Ceti	6.4	17+	5	22S K0	Azimuth 269, ZC 165
Feb 16	Tue	20:10	D SAO 110154	7.4	25+	28	37N G1	
Feb 17	wed	19:34	D ZC 376	7.0	33+	45	71S A0	
Feb 17	wed	22:16	D SAO 93029	7.6	34+	15	29N G5	Azimuth 274 degrees
Feb 19	Fri	19:40	D SAO 93778*	7.8	52+	64	51N A2	Close triple?
Feb 19	Fri	20:00	D omega1 Tau	5.5	52+	61	85S K2	ZC 614
Feb 21	Sun	0:15	D SAO 76962*	7.1	63+	24	63S B9	
Feb 21	Sun	22:27	D ZC 898	6.0	72+	55	82S A0	
Feb 23	Tue	0:54	D ZC 1058	6.8	81+	37	88N K0	
Feb 23	Tue	3:35	D omega Gem	5.2	82+	8	43S G5	Azimuth 295, ZC1070
Feb 23	Tue	18:45	D ZC 1168	7.1	87+	51	55N A5	Sun altitude -11 deg.
Feb 23	Tue	23:18	D SAO 79739	7.1	88+	65	10N F0	Terminator Dist. 10"
Feb 24	wed	1:59	D ZC 1195	6.8	89+	35	70N B8	
Feb 24	wed	1:59	D SAO 79804	7.4	89+	35	55N G0	Close double
Feb 24	wed	3:44	D ZC 1200	6.9	89+	15	67S K0	Azimuth 288 deg.
Feb 28	Sun	22:21	R ZC 1783	7.3	95-	29	73N A0	Axis Angle 278 deg.
Mar 2	Tue	0:53	R 65 Virginis	5.9	88-	38	88S K3	ZC 1921
Mar 2	Tue	1:28	R SAO 139325	7.4	88-	42	50N K2	Close double?
Mar 2	Tue	1:44	R 66 Virginis	5.8	88-	43	84S F3	ZC1924, close double?
Mar 2	Tue	4:51	R ZC 1933*	7.1	87-	38	84S K0	
Mar 2	Tue	6:32	R 74 Virginis	4.7	87-	23	72N M3	Sun alt. -2, ZC 1941
Mar 2	Tue	22:27	R kappa Vir	4.2	81-	3	81S K3	Azimuth 106, ZC 2033
Mar 3	wed	3:14	R SAO 158507	7.8	79-	39	69N A3	
Mar 3	wed	4:40	R 2 Librae	6.2	79-	38	64N G7	ZC 2060
Mar 3	wed	4:50	R ZC 2064	6.3	79-	37	8N F4	Close dbl,TermDist 16"
Mar 4	Thu	0:17	R ZC 2170*	6.7	70-	9	74S K1	Azimuth 119,close dbl?
Mar 5	Fri	2:59	R ZC 2330	6.4	58-	20	79S B9	
Mar 5	Fri	4:27	R ZC 2337	6.6	57-	28	85N B9	
Mar 6	Sat	3:16	R SAO 185189	8.2	46-	13	74N A2	Azimuth 136 deg.
Mar 6	Sat	4:34	R ZC 2491	6.6	46-	22	11N G3	
Mar 6	Sat	5:02	R SAO 185237	6.7	46-	24	68N G8	Close companion, 39 Oph
Mar 6	Sat	5:02	R 39 Oph	5.2	46-	24	69N K*	ZC2490, SAO 185237 +12s
Mar 7	Sun	4:42	R ZC 2652	6.5	35-	15	38N K0	Azimuth 142 deg.
Mar 7	Sun	4:52	R SAO 186628	7.9	35-	16	67S K3	
Mar 7	Sun	6:11	R ZC 2657*	6.9	34-	23	52S A6	Sun alt. -5 deg.
Mar 8	Mon	5:37	R SAO 187998	8.3	25-	15	31N F5	Sun alt. -11,Azimuth142

*in Kepler2 program so occultation light curves are sought.

More information is at <http://iota.jhuapl.edu/exped.htm>
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Occultations – continued from page 5

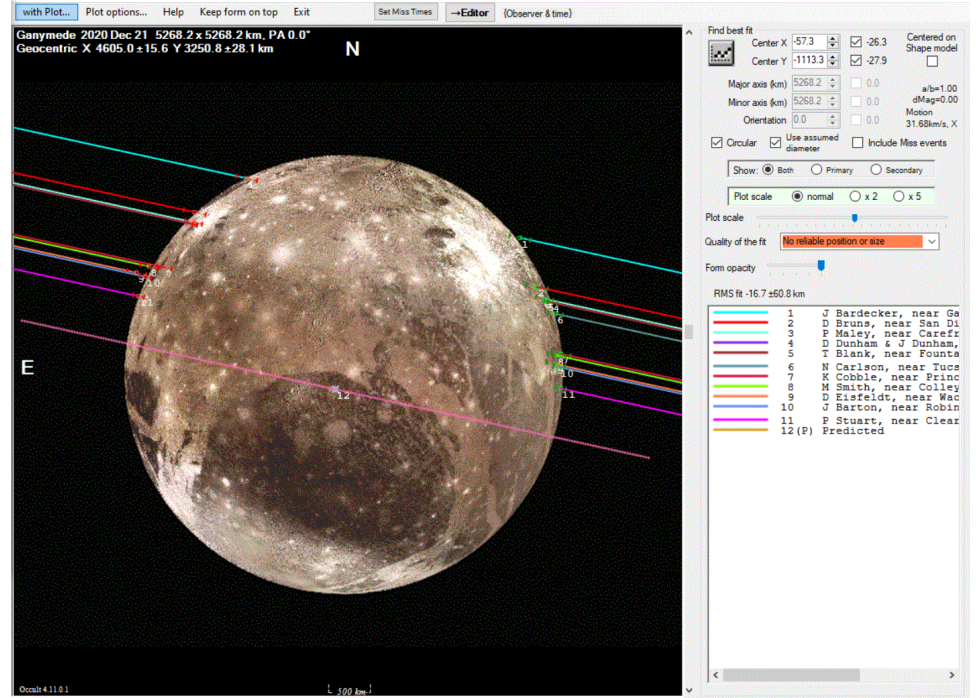


Image Credit: John Moore, IOTA

In the last (Jan.) Star Dust, Vol. 79, #5, for the image at the top of p. 5, the star just below Ganymede was mis-identified as ZC 2838. It was actually ZC 2938 = HIP 99314, magnitude 7.4. As noted in that caption, that star was occulted by Ganymede 23 minutes before. The times determined from our recording of that event, along with those of 10 other observers in California, Arizona, and Texas, were analyzed by John Moore to plot the observed chords on the sky plane at Ganymede. A shape model of Ganymede is fitted to the observations in the plot shown above. This provides an accurate astrometric point for Ganymede that will help improve its orbit for ESA's Jupiter ICy moons Explorer (JUICE) mission that is planned to launch next year.

NASA's Juno Mission and ESA's JUICE Mission

The largest planet in the Solar System, as well as its largest moons, are going to get a considerable amount of attention in the next couple of years and then again at the end of the decade and into the next. First, NASA's Juno spacecraft is about to go into tighter orbits around Jupiter, leading to closeups of three of the Jovian moons – Ganymede, Europa and Io - over the next couple of years, the first such closeup views since the Galileo spacecraft's mission ended in 2003. The mission page is at [Juno - Mission to Jupiter | NASA](https://www.nasa.gov/juno).

Meanwhile the European Space Agency is preparing to launch its JUICE spacecraft in 2022. JUICE will take seven years on a rather circuitous route, involving three flybys of Earth, interspersed with a flyby each of Venus and Mars before arriving in 2029 at Jupiter where it will study three of Jupiter's moons – Ganymede, Europa and Callisto. In 2033, JUICE will actually go into orbit around Ganymede, the largest moon in the Solar System. This will be the first time a spacecraft will orbit a moon other than Earth's. Finally, in 2034, when it runs out of propellant, it is scheduled to deorbit and impact on Ganymede. More information can be found at [ESA Science & Technology - JUICE](https://esa-sci.esa.int/esa/sci/stories/06/06_juice.html).

Recent Astronomy Highlights – continued from page 4

Dying Galaxy

“Red and Dead” is how astronomers sometimes describe galaxies that have lost their gas and therefore can no longer form new stars. Such a dead galaxy tends to have only smaller, longer-lived and cooler stars, thus those galaxies’ reddish color. Now astronomers have found a galaxy, designated ID2299, which appears to be in the process of dying. Approximately nine billion light years away, ID2299 is losing gas at a rate of around 10,000 times the mass of our Sun per year. This extreme rate of gas loss may have been started by the collision of two galaxies which then formed ID2299. In addition, the collision may have triggered a massive amount of star formation, which is also consuming much of the galaxy’s reservoir of cold gas, likely leaving the galaxy dead within tens of millions of years. More information can be found at www.sciencedaily.com/releases/2021/01/210111112147.htm.

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 Mar. 7:30 p.m., Tom Field (Field Tested Systems), **Astronomical Spectra with Your Own Telescope**

The APS Mid-Atlantic Senior Physicists Group: (Zoom Meeting) Feb. 17th at 1:00 p.m., Dr. Jacob Lowenstern, US Geological Survey, will give a talk entitled "Volcanoes, Calderas, and Eruptions: What we Know and What we Don't Know." More information is available at www.aps.org/units/maspg/meetings/meeting.cfm?name=SENIOR0221 To attend the meeting, use the following link and meeting info: apsphysics.zoom.us/j/97977553433?pwd=R2NzOEY0YTVKWEFrd0ZrV0J5YUpmQT09
Meeting ID: 979 7755 3433 Passcode: 648296
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.?

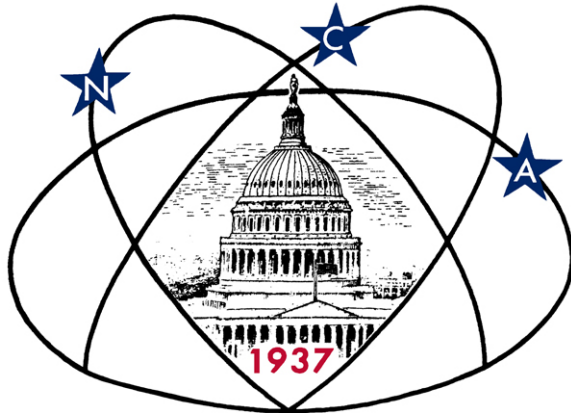
Are you interested in volunteering for: Telescope making, Exploring the Sky, Star Dust, NCA Officer, etc.?

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

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Celebrating 84 Years of Astronomy

Next NCA Meeting:

2021 February 13th

7:30 pm

(On Zoom)

Dr. Eliza Kempton

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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