

Star Dust

Newsletter of National Capital Astronomers, Inc.

capitalastronomers.org

November 2020

Volume 79, Issue 3

**Celebrating 83 Years
of Astronomy**

Next Meeting

When: Sat. Nov. 14th, 2020

Time: 7:30 pm

Where: Online (Zoom)

See instructions for registering to participate in the meeting on Page 4.

Speaker: Dr. Anat Shahar

Table of Contents

Preview of Nov. 2020 Talk.....	1
Recent Astronomy Highlights.....	2
Occultations by Phaethon.....	2
Exploring the Sky.....	3
Sky Watchers.....	3
2020 Nobel Prize in Physics.....	3
On the Web.....	4
Zoom Meeting Registration.....	4
Occultations.....	5
Occultation by Umbriel.....	6
Calendar of Events.....	7



Image Credit: Myron Wasiuta, MSRO

Want to know what's being shown in the image above? You can find out in the article by NCA members David and Joan Dunham on page 6.

A Geochemist's Perspective on Planetary Differentiation

Anat Shahar

Earth and Planets Laboratory of the Carnegie Institution for Science

Adjunct Professor, University of Maryland

Abstract: Planetary differentiation occurred at high temperature, high pressure, and on bodies with varying compositions. The specific conditions at which bodies differentiated can be probed and the chemical fingerprints of that differentiation can be found in stable isotope ratios measured today in natural samples. Experiments are key to understanding the mechanisms behind the fractionations seen in nature as the pressure, temperature and compositional space can be interrogated systematically. In this talk I will focus on how pressure, temperature and composition affect the partitioning of isotopes between metal and silicate. I will then discuss how the interior of a planet can be seen on the surface and what this means for planetary habitability in general.

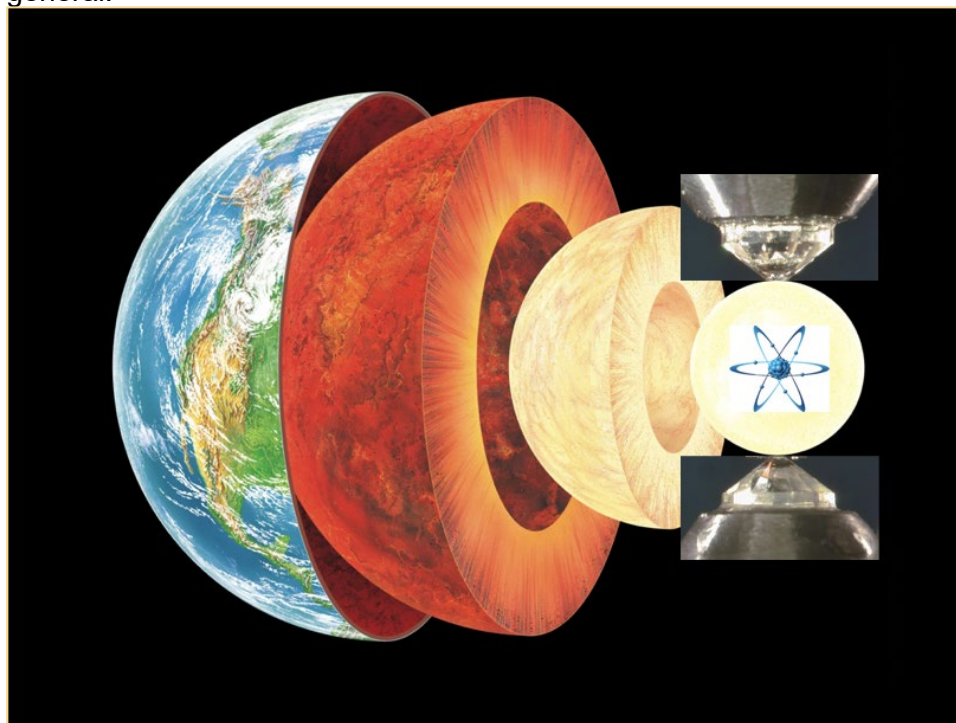


Image Credit: Vadim Sadovski, additional imagery courtesy of Anat Shahar”
(Note, the additional image is that of the diamond anvil.)

Recent Astronomy Highlights

Water, water... Everywhere? The first two articles concern recent discoveries of the possible presence of water in places that future generations may explore – Mars and the Moon.

Subsurface Lakes on Mars?

Scientists working for the European Space Agency have presented data from the Mars Express spacecraft in orbit around the red planet which seems to confirm the presence of a lake below the surface of Mars, originally discovered in 2018. It has also found evidence of three additional lakes spread across a region about a fifth the size of Germany. The instrument that made the discovery is named MARSIS, the Mars Advanced Radar for Subsurface and Ionosphere Sounding. Some scientists theorize that the water must be extremely salty in order to remain liquid while others question the claim. With more spacecraft set to take up orbit around Mars in the near future, additional results will likely follow. More information can be found at

www.nature.com/articles/d41586-020-02751-1.

Water on the Moon

Near the beginning of Wikipedia's article entitled "Lunar Water" (at the time this issue of Star Dust was written) is the following sentence – "Liquid water cannot persist at the Moon's surface, and water vapor is decomposed by sunlight, with hydrogen quickly lost to outer space." Well, apparently, Nature has found a way to get around these problems. NASA's SOFIA, Stratospheric Observatory for Infrared Astronomy, has discovered an infrared signature specific to water coming from Clavius Crater which lies in the southern highlands of the Moon. How this water manages to survive the harsh lunar conditions is the subject of much speculation. Perhaps it came from meteorites and was trapped in small bead of glass created when those meteorites impacted with the lunar surface. Or it could simply be caught in between grains of lunar soil. More information can be found at www.nasa.gov/press-release/nasa-s-sofia-discovers-water-on-sunlit-surface-of-moon/

continued on page 4



Biography: Anat Shahar is a staff scientist at the Earth and Planets Laboratory of the Carnegie Institution for Science and adjunct Professor at the University of Maryland. Anat Shahar obtained a B.S. and a M.E. in geological engineering from Cornell University in 2002 and 2003, respectively. She earned her Ph.D. in geochemistry from the University of California, Los Angeles in 2008. She went on to complete her postdoctoral research at the Geophysical Laboratory, Carnegie Institution for Science and in 2009 was appointed staff scientist. Her work uses high-pressure, high-temperature experiments and stable isotope geochemistry to understand the formation of planets in the solar system.

Results of Occultations by Phaethon presented at the 2020 AAS/DPS Meeting

David Dunham

During the last week of October, the American Astronomical Society's Division for Planetary Science held their 52nd annual meeting, held virtually due to COVID-19. I had a presentation, "(3200) Phaethon, First Successful Observations of Occultations by a Small Near-Earth Object", assigned as Paper 01 in Session 412, Asteroids, NEO Physical Characteristics 2. My abstract caught the eye of the meeting press officer, suggesting that it could be the subject of a press release during the meeting. That was accomplished in the Oct. 29th press briefing. The IOTA press release about this is at aas.org/sites/default/files/2020-10/IOTA_Dunham_Press_Release.pdf with much supporting material given at iota.jhuapl.edu/PhaethonLinksAndGraphics.htm. The start of the press release is below:

Eclipses of Stars by Near-Earth Asteroids Might Be Used to Save Earth and Gain Science

On July 29th, 2019, amateur and professional astronomers swarmed the countryside from California to Colorado to capture the shadow of a small asteroid. David Dunham, of the International Occultation Timing Association (composed mainly of dedicated amateur astronomers), and Marc Buie, Southwest Research Institute, coordinated the efforts of scores of astronomers to deploy more than 60 telescopes with cameras and recorders in the tightest "fence" ever set up to observe an occultation (eclipse) of a bright star by the mysterious small active asteroid (3200) Phaethon.

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 December’s issue of Star Dust, is November 21st.

Clear Skies!

Sky Watchers

November/December

The inner planets, Mercury and Venus remain in the morning sky, while Mars, Jupiter and Saturn are prominent in the evening sky. The latter two continue to draw closer to each other, heading for their Great Conjunction on December 21st.

11/16 - 17	The Leonids Meteor Shower peaks on the evening of the 16 th into the morning of the 17 th with approximately 15 meteors/hour. With the crescent Moon setting within an hour of sunset, viewing conditions will be ideal, especially during the morning hours.
11/30	Full Moon - 4:32 a.m. A Full Moon and a Penumbral Eclipse during which nearly all of the Moon will pass through the Earth’s penumbra. The entire eclipse will be visible throughout the United States, with it beginning after 2:00 a.m. and lasting 4 hours and 21 minutes.

All times are in EST (Eastern Standard Time)

2020 Nobel Prize in Physics Goes to Black Hole Pioneers

For the second time in four years, the Nobel Prize in Physics has been awarded for work involving black holes. The 2017 prize went to Rainer Weiss, Kip Thorne and Barry Barish for their work on the theory and detection of gravitational waves. While Einstein predicted the existence of gravitational waves back in 1916, it would take nearly a century to confirm that prediction. That confirmation came in 2015 with the first detection of the collision of two orbiting black holes by LIGO, the Laser Interferometer Gravitational-Wave Observatory.

Now in 2020 the Nobel Prize in Physics has gone to Sir Roger Penrose, Reinhard Genzel and Andrea Ghez. Starting in the 1960s, Penrose made many contributions to the theory of black hole formation while Genzel and Ghez led teams that discovered Sagittarius A*, the supermassive black hole at the center of the Milky Way Galaxy, by observing the orbits of the stars surrounding it.

The awards will be presented to recipients on December 10. The press release from The Nobel Committee for Physics announcing the award can be found at www.nobelprize.org/uploads/2020/10/press-physicsprize2020.pdf. In addition, the committee published a paper on the scientific background for the award, including the history of black-hole research. It is at www.nobelprize.org/uploads/2020/10/advanced-physicsprize2020.pdf.

On the Web

With the ongoing pandemic canceling most in-person astronomy lectures and events, the web has become an indispensable source to fill the gap. Below are some astronomy and physics-related resources.

A video of the September 2020 NCA meeting, including the talk, **The Evolution of Galaxies Over Cosmic Time**, by Dr. Tommy Wiklind is available at capitalastronomers.org/. The plan is to have all of the meetings that take place over Zoom posted on this website.

An article about observing the night sky in cities during the current pandemic appeared in the Washington Post recently. The article features quotes by NCA member Guy Brandenburg and can be found at the following link - [A guide to urban stargazing: What you need to start exploring the skies close to home.](#)

Looking for a website that can tell you the rising and setting times for the planets and the Moon? One place where you can specify your location and gets those times is in-the-sky.org/ephemeris.php

In June, NASA celebrated the 10-year anniversary of the Solar Dynamics Observatory, which monitors the Sun from Earth Orbit, by putting out an hour-long video compilation of images covering the decade of SDO's operation. That video can be found at www.nasa.gov/feature/goddard/2020/watch-a-10-year-time-lapse-of-sun-from-nasa-s-sdo.

Ever wonder what it would take to get a high-resolution image of an exoplanet and look for signs of life? The video at the following link explains a concept that would use the Sun as a gravitational lens to magnify the image of such a planet by 100 billion. www.youtube.com/watch?v=NQFqDKRAROI

If you want to learn Special Relativity, Professor Brian Greene has put out an 11-hour course on the subject, equations and all. It is available at www.youtube.com/watch?v=XFV2feKDK9E&t=37253s.

For those looking for a real challenge, there is a 9½-hour course on Quantum Physics, heavy on the equations, available at www.youtube.com/watch?v=K4BF7MD69_U&t=492s.

Registration for NCA Meetings on Zoom

Elizabeth Warner

The NCA Zoom meetings are open to anyone, however, to attend, you must register ahead of time. To register, go to the following link: umd.zoom.us/meeting/register/tJAlc-6sqjsiHdfRNCJnu_I3iawoOyahnYPh. 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 in the meetings, share the link above instead.

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

Black Widow Pulsar Discovered to Be Source of Mysterious Gamma Rays

First discovered in 1999, a gamma ray source turns out to be a tight binary star system consisting of a neutron star approximately two times the mass of the sun and the remnant of a dwarf star with one twentieth of that mass. The neutron star is designated a "Black Widow" pulsar because the gamma rays it generates strip material from the companion star. The companion orbits the pulsar at approximately 1.3 times the Earth-Moon distance, but does so in only 75 minutes. More about this strange system can be found at scitechdaily.com/galactic-mystery-source-of-gamma-rays-identified-record-setting-black-widow-pulsar/

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

2020	Day	EDT	Star	Mag.	Asteroid	dmag	dur.	Ap.	Location
Nov 10	Tue	22:30	4UC50108896	13.3	Chryseis	0.3	9	11	ePA,NJ,MD,DC,nVA
Nov 11	wed	23:53	SAO 92209	8.8	Malytheatre	1.9	2	3	ne-scPA,wMD,nwV
Nov 17	Tue	23:36	4UC68843619	14.2	Fini	1.0	7	12	DE,MD,DC,nVA,SOH
Nov 27	Fri	23:23	SAO 78165	7.2	Badenia	6.6	8	2	NJ,sePA,nMD,nwV
Nov 29	Sun	1:21	4UC61039948	13.7	Alexandra	0.4	17	11	sNJ,DE,MD,DC,nVA
Dec 1	Tue	2:28	TYC12250915	11.5	Zappala	3.6	3	5	SMD,CVA;DC,nVA?
Dec 3	Thu	22:11	TYC13041027	9.9	Helga	4.2	8	3	NJ,ePA,MD,DC,nVA

Lunar Grazing Occultations

2020	Day	EST	Star	Mag	% alt	CA	Location, Notes
Oct 9	Fri	6:17	SAO 78634	8.5	56- 76	9N	Manasas,Francnia,VA;Andrws,MD
Nov 9	Mon	4:15	eta Leonis	3.5	41- 49	1N	winfry,Stafford,VA;Newburg,MD
Nov 11	wed	5:47	ZC 1725	7.6	19- 39	2S	nYork,Buck,nOxfrd,PA;N.StarDE
Nov 13	Fri	6:01	ZC 1976	7.0	4- 15	2N	scPA,neMD; Sun alt. -10 deg.
Nov 13	Fri	6:28	88 Virginis	6.6	4- 19	2N	scPA,nDE,sNJ; Sun alt. -5 dg.
Dec 7	Mon	5:29	ZC 1569*	6.9	56- 66	10S	N.Garden,Chester,Chsapeake,VA

*in Kepler2 program so occultation light curves are sought.

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

Lunar Total Occultations

2020	Day	EST	Ph Star	Mag	% alt	CA	Sp. Notes
Nov 13	Fri	6:11	R ZC 1976	7.0	4- 16	18N	A3 Sun -8 deg.; sPA graze
Nov 13	Fri	6:39	R 88 Vir	6.6	4- 21	20N	K0 Sun -2, ZC1978, double?
Nov 17	Tue	18:00	D SAO 186484	7.9	10+ 10	19N	A0 Azimuth 227 deg.
Nov 18	wed	17:45	D SAO 187898	7.1	18+ 18	58S	K0 Sun alt. -11 deg.
Nov 19	Thu	19:18	D SAO 189132	7.8	28+ 16	89N	K1
Nov 20	Fri	19:39	D SAO 190168	8.2	38+ 22	48S	G5
Nov 21	Sat	17:21	D SAO 164841	8.1	47+ 32	84N	K0 Sun alt. -7
Nov 23	Mon	17:36	D ZC 3484	6.9	67+ 35	16N	G5 Sun alt. -9
Nov 24	Tue	18:35	D SAO 128739	7.4	76+ 42	39N	A0 mag2 10,sep3", dT +1.2s
Nov 24	Tue	22:57	D ZC 60	6.9	77+ 35	53S	K2
Nov 25	wed	23:01	D 35 Ceti*	6.6	84+ 44	49N	F8 ZC178,mag2 9.5,dT -1.5s
Nov 26	Thu	1:38	D ZC 188	7.6	85+ 18	56S	F0
Nov 26	Thu	18:08	D SAO 110166	7.7	90+ 33	24S	K0
Nov 27	Fri	2:45	D ZC 298	7.1	91+ 16	67S	F2 close double??
Nov 28	Sat	1:47	D UV Arietis	5.2	96+ 38	80N	A7 ZC 404, close double
Dec 2	wed	5:51	R 5 Gem	5.8	96- 34	51N	K0 AA 305,ZC 936,close dbl
Dec 2	wed	23:39	R ZC 1058	6.8	92- 54	85N	K0
Dec 3	Thu	20:48	R SAO 79688	7.5	87- 12	70S	K0 Azimuth 69 deg.
Dec 4	Fri	1:24	R ZC 1195	6.8	86- 63	58S	B8
Dec 4	Fri	1:25	R SAO 79804	7.4	86- 63	74S	G0 mag2 8.6, dT +0.4sec
Dec 4	Fri	4:40	R ZC 1208	6.4	85- 66	83N	K1 mag2 10, 2", dT -4sec
Dec 5	Sat	5:56	R ZC 1342*	7.6	77- 61	62N	G5
Dec 6	Sun	2:58	R ZC 1444	7.8	68- 57	72N	K0
Dec 7	Mon	5:44	R ZC 1569*	6.9	56- 64	35S	A2 cen. & se VA graze
Dec 8	Tue	10:36	R nu vir	4.0	43- 28	71N	M0 Sun +25, ZC 1702
Dec 9	wed	7:16	D SAO119462*	8.1	33- 52	6S	G5 Sun alt. -1 deg.
Dec 10	Thu	5:03	R SAO139311	8.4	23- 29	11N	K2
Dec 10	Thu	6:09	R ZC 1923	7.0	23- 38	53N	K0 mag2 11,sep ".3,dT -.4s
Dec 10	Thu	6:19	R SAO 139316	7.7	23- 39	78S	K0 Sun alt. -11 deg.

*in Kepler2 program so occultation light curves are sought.

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

2020-2021 Officers

President:

Harold Williams
haroldwilliams@me.com or
Harold.Williams@montgomerycollege.edu
 240-461-4948

Vice-President:

John Hornstein
jshgwave@yahoo.com
 301-593-1095 (h)

Secretary-Treasurer:

Henry Bofinger
hbofinger@earthlink.net
 202-675-1075

Asst. Secretary-Treasurer:

Jeffrey B. Norman
jeffreynorman@comcast.net

Trustees:

- Benson Simon (2021)
- Michael Brabanski (2022)
- Guy Brandenburg (2023)
- Jack Gaffey (2024)

Appointed Officers and Committee Heads:

Exploring the Sky

Jay Miller
jhmillier@me.com

Telescope Making

Guy Brandenburg
gfbrendenburg@yahoo.com
 202-635-1860 (leave message)

NCA Webmaster

Elizabeth Warner
warnerem@astro.umd.edu
 301-405-6555

Star Dust Editor

Todd Supple
NCAStardust@gmail.com
 301-595-2482 (h)

Social Media

Twitter: [@NatCapAstro](https://twitter.com/NatCapAstro)

An Occultation by Uranus' Moon Umbriel Observed Across the USA

David and Joan Dunham

Umbriel (Uranus II) was discovered in 1851 by William Lassell in England. The satellite was imaged by Voyager2, and found to be round with a diameter of 1169 km. On 2020 Sept. 21, Umbriel occulted 13.5-mag. UCAC4-004081 in Aries. Since Umbriel was mag. 15.0, there was a strong 1.7-mag. drop when the occultation occurred. The predicted path crossed the n. USA, with the s. limit expected to be near Richmond. But positive observations from there and Arizona showed that the s. limit was farther south, over N. Carolina. Joan and I recorded the occultation from our home in Greenbelt, MD, as did Andrew Scheck from Laurel, MD; Myron Wasiuta and Bart Billard from the Mark Slade Remote Observatory (MSRO) in Wilderness, VA, and 17 other IOTA observers across the USA. The longest chords were a little more than a minute.



Image Credit: Myron Wasiuta, MSRO

An image from the MSRO recording is above, where the combined image of Umbriel and the star is below and left of the overexposed image of Uranus, while Uranus' larger moons Titania and Oberon (fainter) are in the lower left part of the image. The observations plotted in the sky plane at Umbriel are shown in the figure below by IOTA and John Moore.

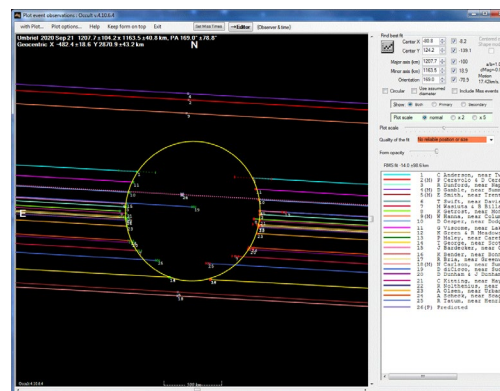


Image Credit: John Moore and IOTA

A major goal of the occultation was to obtain an accurate position of Umbriel in the sky, to improve its orbit, which could be useful especially for any future space mission to Uranus (although none is currently planned, some astronomers would like one). That's come full circle from my 1971 doctoral dissertation from Yale University, "The Motions of the Satellites of Uranus", based mainly on an analysis of photographic observations made between 1948 and 1966. Voyager 2 was launched 6 years after my thesis and arrived at Uranus 9 years later, in 1986.

Recent Astronomy Highlights – continued from page 4

Squeezars

Research involving Sagittarius A*, for which the 2020 Nobel Award in Physics was given (see Page 2), continues. Astronomers are still cataloguing the stars that orbit closest to the supermassive black hole. A couple decades ago, scientists came up with the concept of squeezars, stars in highly eccentric orbits that get so close to a black hole that the tidal forces of Sag A* squeeze them, causing them to heat up and shine brighter. Several candidates for this title, designated S4711 through S4715, have been discovered. Their orbits may also cause these stars to reach up to 8% of the speed of light on closest approach to the supermassive black hole. More info is at www.sciencealert.com/the-fastest-star-in-the-galaxy-zooms-as-high-as-8-percent-of-the-speed-of-light. In addition, the original paper proposing the existence of squeezars is at iopscience.iop.org/article/10.1086/376671/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): 12 Dec. 7:30 p.m., Bethany Cobb Kung (GWU) **Shedding Light on Gravitational Waves**

The APS Mid-Atlantic Senior Physicists Group: (Zoom Meeting) Oct. 21st at 1:00 p.m., Michael Blanpied, U.S. Geological Survey, will give a talk entitled "Progress and Pitfalls in Earthquake Prediction and Forecasting." More information may become available at www.aps.org/units/maspg/meetings/meeting.cfm?name=SENIOR1120. To attend the meeting, use the following link and meeting info: apsphysics.zoom.us/j/98807125320?pwd=ZFFTTUVSb1ppMnFNWitjdVNiZFN4UT09 Meeting ID: 988 0712 5320 Passcode: 825108 Dial in access 301 715 8592 (Germantown).

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.?

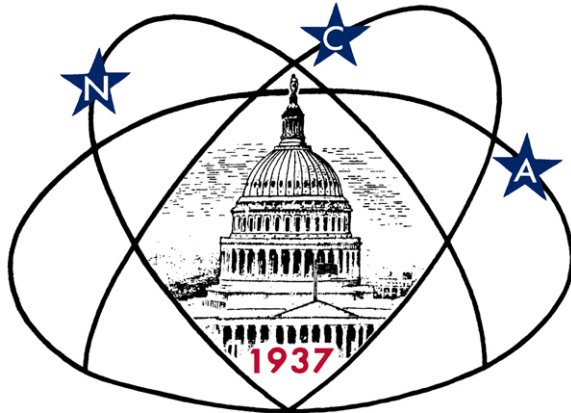
Are you interested in volunteering for: Telescope making, Exploring the Sky, Star Dust, NCA Officer, etc.?

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 83 Years of Astronomy

Next NCA Meeting:

2020 November 14th

7:30 pm

(On Zoom)

Dr. Anat Shahar

(See Zoom registration instructions
on Page 4.)

Inside This Issue

Preview of Nov. 2020 Talk.....	1
Recent Astronomy Highlights.....	2
Occultations by Phaethon.....	2
Sky Watchers.....	3
Exploring the Sky.....	3
2020 Nobel Prize in Physics.....	3
On the Web.....	4
Zoom Meeting Registration.....	4
Occultations.....	5
Occultation by Umbriel.....	6
Calendar of Events.....	7