Star Dust

Newsletter of National Capital Astronomers, Inc.

capitalastronomers.org

April 2021 ***Volume 79, Issue 8***

Celebrating 84 Years of Astronomy

Next Meeting

When: Sat. Apr. 10th, 2021

Time: 7:30 pm

Where: Online (Zoom)

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

Speaker: Dr. Tess Jaffe

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Image Credit – NASA and the Hubble Heritage Team (STScI/AURA)

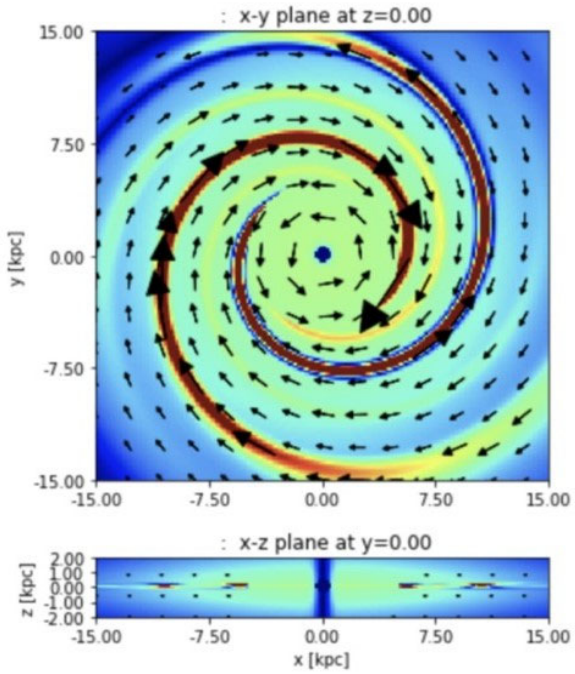
The iconic Sombrero Galaxy, known as Messier 104, as imaged by the Hubble Space Telescope, lies 28 million light years away in the constellation of Virgo. A larger image can be seen at www.nasa.gov/sites/default/files/thumbnails/image/sombrero-galaxy.jpg.

IMAGINE'ing Galactic Magnetic Fields

Dr. Tess Jaffe

NASA's Goddard Space Flight Center

Abstract: Magnetic fields are ubiquitous in the Universe, from compact objects to intergalactic space, and they play a central role in a variety of astrophysical processes. Surprisingly, the Galactic magnetic field (GMF) in our own Milky Way remains poorly understood because of the challenges of observing it and the complexity of the phenomena we use to study it. Though we still have too many models that might fit the data, this is not to say that the field has not developed in the last few years. Radio observations have been used since the 1970's to study the GMF and remain one of the most useful tracers. More recently, surveys of polarized dust have given us a new observable that is complementary to the more traditional radio tracers. A variety of other new tracers and related measurements are becoming available to improve current modeling. In this talk, I will summarize: the tracers available; the models that have been studied; what has been learned so far; what the caveats and outstanding issues are; one opinion of where the most promising future avenues of exploration lie.



Model of Galactic Magnetic Field of the Milky Way. Image Credit – Jaffe et al. (2013)

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Recent Astronomy Highlights

Unexpected Origin of Zodiacal Light

Zodiacal light appears as a triangular glow in very dark skies best seen before sunrise in autumn and after sunset in spring. The light is actually sunlight reflected off of interplanetary dust. Astronomers theorized that the dust came from comets and asteroids, however new evidence seems to point to an unexpected origin – Mars. NASA's Juno spacecraft provided the evidence. On its journey to Jupiter, between 2011 and 2016, the spacecraft's enormous solar panels experienced numerous strikes from minute dust particles. Cameras on the spacecraft recorded the streaks of debris coming off of those solar panels, allowing for calculation of the speed and trajectory of the particles. And measuring the frequency of the dust strikes at different times in the mission allowed for determining the location of the dust cloud creating the zodiacal light. The results indicate that the particles are in nearly circular orbits and that they are concentrated between Earth and a point just past the orbit of Mars. This data therefore points to Mars likely being the origin of the dust, perhaps from dust leaving the planet during its numerous globe-encompassing storms. More information can be found at www.nasa.gov/feature/goddard/2021/serendipitous-juno-spacecraft-detections-shatter-ideas-about-origin-of-zodiacal-light.

The Water of Mars

Scientists have long believed that Mars lost most of its ancient waters to space, however new research shows that most of that water may still be on the planet, locked up in minerals. The research team making this claim used evidence from Martian meteorites found on Earth, as well as data from telescopes, probes sent to the planets and samples taken by rovers, all measuring the ratio of water containing deuterium, a heavy isotope of hydrogen, to water without deuterium. More information can be found at www.sciencedaily.com/releases/2021/03/210316132106.htm.

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IMAGINE'ing Galactic Magnetic Fields – continued from page 1

Biography: Tess Jaffe earned a PhD in astrophysics from the Ludwig-Maximilians University of Munich in 2006, studying the morphology of the cosmic microwave background (CMB) radiation. She used this tracer to study the shape of the Universe, but this led to a parallel interest in the Galactic foreground emission. In addition to the information about the early Universe, the microwave bands have diffuse Galactic emission from the magnetized interstellar medium (ISM). She then took a postdoctoral research position at the Jodrell Bank Centre for Astrophysics at the University of Manchester in the UK to focus on this these Galactic processes. She developed an infrastructure for simulating and modeling the Galactic magnetic field (GMF) using radio and microwave-band tracers. This joint analysis was able to constrain the GMF including its turbulent component for the first time. She continued this work as a collaborator on the Planck mission at the Institute de Recherche en Astrophysique et Planétologie in Toulouse, France, before moving to NASA in 2016.

She is currently the Chief Archive Scientist for the High Energy Astrophysics Science Archive Research Center, supporting the community through maintaining and improving the infrastructure and data access tools for data from NASA astrophysics missions. She helped create the IMAGINE Consortium, bringing together the diverse theoretical and observational experts whose work relies on - and provides insight into - the GMF, from radio emission to ultra-high energy cosmic rays. The project's ambition is to bring together all of the data sets that contain information about the GMF into a self-consistent and robust Bayesian analysis that will inform studies of diverse phenomena in the ISM.

New EHT Image of M87 Gives Information About the Supermassive Black Hole's Magnetic Field

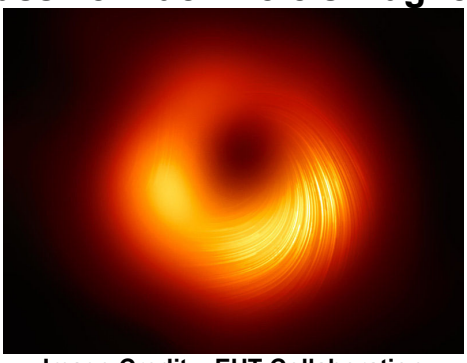

Image Credit – EHT Collaboration

The Event Horizon Telescope Collaboration, which used eleven radio telescopes around the world to create the first image of supermassive black hole M87's shadow, has now released the above image mapping the polarization of light coming from around the black hole. Such polarized light gives indications of the magnetic fields within the gas and plasma of M87's accretion disk. More information can be found at www.sciencenews.org/article/black-hole-picture-magnetic-fields-event-horizon-telescope. Papers explaining the image are at iopscience.iop.org/article/10.3847/2041-8213/abe71d (Polarization of the Ring) and iopscience.iop.org/article/10.3847/2041-8213/abe4de (Magnetic Field Structure Near the Event Horizon).

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 May's issue of Star Dust, is April 21st.

Clear Skies!

Sky Watchers

April/May

Mars remains in the night sky, technically joined by Mercury and Venus, however both of them will be very close to the horizon at sunset. Jupiter and Saturn will rise in the pre-dawn sky.	
4/22-23	The peak of the Lyrids Meteor Shower which produces about 20 meteors/hour. Unfortunately, the waxing Moon will interfere with seeing some of the meteors.
4/26	Full Moon, a Supermoon, at 11:33 p.m.
5/6-7	The peak of the Eta Aquarids Meteor Shower which produces about 30 meteors/hour in the Northern Hemisphere, with more in the Southern Hemisphere. A quarter Moon, rising in the early morning, will interfere with seeing some of the predawn meteors.

All times are in EDT (Eastern Daylight Savings Time)

On the Internet

With the vaccines, hopefully we'll be able to start getting out and going to astronomy activities in person in coming months. To help tide NCA members over until then, here are some resources that can be found on the Internet.

NASA's Ebook Collection - From books containing incredible images, to ones explaining the operations of various missions, there is something of interest for almost everyone, from novice to expert, at this site. www.nasa.gov/connect/ebooks/index.html.

The most recent addition to NASA's Ebook collection is Not Yet Imagined – A Study of Hubble Space Telescope Operations, by Christopher Gainor. It tells the story of the Hubble Space telescope, from concept to launch to repairs and beyond. And, yes, it does include mention of long-time NCA member, and mother of the Hubble Space Telescope, Nancy Grace Roman. www.nasa.gov/connect/ebooks/not-yet-imagined.html

Meanwhile, Hubble Focus – Galaxies Through Space and Time provides many beautiful images of galaxies and brief explanations of what is being shown. www.nasa.gov/feature/hubble-focus-galaxies-through-space-and-time.

Speaking of beautiful images, a collection of Hubble images of nearly all of the objects in the Messier Catalogue can be found at www.nasa.gov/content/goddard/hubble-s-messier-catalog#images.

The creators of the movie 'LIGO', also produced a series of video episodes concerning the history and discoveries of the Laser Interferometer Gravitational-Wave Observatory. Those episodes are at www.youtube.com/channel/UCVpvE6dOtP58hyzYaBDi8nQ/channels.

Finally, coming back to Earth, a stunning compilation of winning images in the 2020 Northern Lights Photographer of the Year contest of the capturetheatlas.com/ photography website, can be found at capturetheatlas.com/northern-lights-photographer-of-the-year/.

The First Observed Occultation by (99942) Apophis

David and Joan Dunham

Since its discovery in 2004, the asteroid (99942) Apophis, found to be about 350 meters across from Arecibo radar observations made in 2011, has been of concern to the planetary defense community. A very close approach to the Earth in April 2029 was quickly identified and for a short time, had a non-zero risk of impact, until further observations showed that the closest approach would be near the ring of geostationary satellites. It will provide a great view, and opportunity for extensive study, but will pose no risk that year. However, it could pass through a "keyhole" such that the heliocentric period could be a rational fraction of a year, allowing Apophis to encounter the Earth in the future. At first, it was thought that the 2036 encounter could be threatening, but again, more observations showed the asteroid would pass far from the Earth then. But a small chance of an impact in 2068 remained. It wasn't until radar observations made in March this year, in a Greenbank/Goldstone collaboration, that the 2068 risk was finally retired.

It turned out that the new radar observations also allowed the orbit of Apophis to be known well enough to predict the paths of occultations with enough accuracy to deploy a reasonable number of stations with a good chance of securing observations. In a collaboration with the Southwest Research Institute (SwRI), IOTA already had one success with a near-Earth asteroid, (3200) Phaethon, with several occultations observed in 2019. But Phaethon is over 5 km across; Apophis is more than an order of magnitude smaller and the occultation was expected to last no more than 0.09s; could the small systems that IOTA observers can deploy, record such a short event?

The Lucky Star Project found that on March 7th, Apophis would occult 8.4-mag. NY Hydrae in a path crossing the central USA. Clouds threatened much of the path, but it was expected to be clear over western Louisiana. IOTA observers converged on Oakdale, La., and deployed telescopes along the taxiway of the Allen Parish Airport south of town, as well as along the wide shoulder of the US 165 highway; see Figure 1.

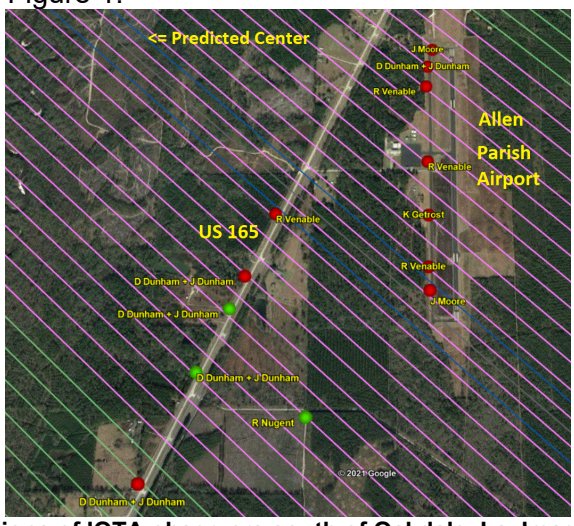

Figure 1. Locations of IOTA observers south of Oakdale, La. Image Credit - John Moore, IOTA; Marc Buie, SwRI; and Google Earth

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Thank you!

Recent Astronomy Highlights – continued from page 2

Dwarf Galaxies in the Cosmic Web

Pointing the European Southern Observatory's Very Large Telescope at one region of the sky, in the Hubble Ultra Deep Field, for 140 hours, and using the VLT's MUSE (Multi Unit Spectroscopic Explorer) instrument, astronomers imaged several filaments in the Cosmic Web. The Cosmic Web was theorized to be made up of filaments of gas feeding into nodes where galaxies and galaxy clusters form. However, the team making the finding observed that most of the light coming from the filaments seemed to be coming from stars, hinting at the presence of millions of dwarf galaxies already formed in those filaments only a couple billion years after the Big Bang. More info is at www.sciencedaily.com/releases/2021/03/210318085621.htm.

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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	EDT	Star	Mag.	Asteroid	dmag	dur. s	Ap. "	Location
Apr 11	Sun	5:48	4U288156226	13.7	Carnegia	2.3	9	11	cPA,MD,DC,n&eVA
Apr 12	Mon	23:03	4UC38759434	13.8	Shouichi	2.9	2	11	nwOH,MD;DC,nVA?
Apr 13	Tue	4:40	4U347169452	11.9	Eltigen	4.6	2	6	OH,nVA,DC,MD;PA?
Apr 16	Fri	3:29	4U268162601	10.6	Juewa	2.3	20	8	cNY,ePA,NJ;DE?
Apr 16	Fri	4:04	4U304109278	15.1	Cohnia	0.8	25	14	MD,DC,nVA,NJ,PA
Apr 17	Sat	0:00	4UC48752238	14.0	Lucia	1.0	8	11	sMD,nVA,WV
Apr 19	Mon	4:42	4U358131480	13.1	Aneas	2.4	22	10	c&nVA,MD,cPA;DC?
Apr 19	Mon	5:14	4UC31079642	13.5	Polyxena	0.4	8	12	NJ,eMD,cVA;DC?
Apr 19	Mon	5:41	4U367161489	13.9	Cantabia	1.3	10	11	WV,nVA,DC,MD,sNJ
Apr 21	Wed	0:56	4UC32582963	12.3	Gaibaldi	4.7	4	6	NJ,PA,nOH;MD,DC?
Apr 21	Wed	20:32	26Sextantis	5.8	2002 RC93	13.	3	3	cVA,wMD,cPA;nVA?
Apr 21	Wed	22:50	4UC64521602	13.9	Dysona	2.3	2	12	PA,MD,n-seVA;DC?
Apr 24	Sat	3:55	4U317201103	13.3	Sigrid	2.9	3	10	PA,neMD;DC,nVA?
Apr 27	Tue	0:44	4UC60541023	14.1	Genevieve	2.3	1.6	13	wPA,MD,DC;nVA?
May 1	Sat	21:30	4UC41249470	10.5	Koranna	5.2	2.4	4	wMD,c-nePA,ecNY
May 4	Tue	5:11	4U256138028	10.0	Maria	3.8	8	3	ePA,cMD,DC,n&cVA
May 7	Fri	2:09	4UC47683454	13.5	Leuschneria	2.7	4	10	eMD,DE,ePA;DC?

Lunar Grazing Occultations

2021	Day	EDT	Star	Mag	% alt	CA	Location, Notes
Apr 18	Sun	21:32	SAO 79025	8.4	37+ 47	6N	Madison,Arcadia,Topping,VA

Lunar Total Occultations

2021	Day	EDT	Ph	Star	Mag	%	alt	CA	Sp.	Notes
Apr 15	Thu	21:26	D	SAO 76611*	8.6	13+	19	54S	G5	
Apr 17	Sat	22:04	D	SAO 78081	7.8	28+	32	72N	G5	probable close double
Apr 18	Sun	20:02	D	ZC 1068	7.1	37+	65	41N	A2	Sun altitude -4 deg.
Apr 18	Sun	20:04	D	SAO 78995	7.4	37+	65	58N	A3	Sun alt. -4 deg.
Apr 18	Sun	20:40	D	SAO 79004	8.3	37+	58	54N	A2	Sun alt. -11 deg.
Apr 18	Sun	20:49	D	SAO 79012	8.1	37+	56	53N	K0	
Apr 18	Sun	20:49	D	SAO 79014	7.9	37+	56	69S	G8	
Apr 18	Sun	22:33	D	SAO 79054	6.9	38+	36	41S	K8	mag2 12 sep. 7" dT +9s
Apr 19	Mon	0:53	D	SAO 79140	8.0	39+	11	52S	M*	Azimuth 293 degrees
Apr 19	Mon	22:32	D	SAO 79868	7.4	48+	46	88N	K0	mag2 11 sep.1.3" dT +1s
Apr 20	Tue	0:19	D	SAO 79917	8.4	48+	26	82S	G5	
Apr 20	Tue	21:18	D	SAO 80499	8.2	58+	67	57N	K0	
Apr 20	Tue	22:16	D	SAO 80514*	8.5	58+	57	51N	A	probably close double
Apr 21	Wed	0:02	D	ZC 1342*	7.6	59+	38	81S	G5	
Apr 21	Wed	21:18	D	ZC 1444	7.8	68+	69	88N	K0	
Apr 22	Thu	23:44	D	ZC 1569*	6.9	79+	53	84S	A2	
Apr 25	Sun	20:54	D	65 Vir	5.9	98+	26	90S	K3	Sun alt. -12, ZC1921
Apr 25	Sun	21:41	D	66 Vir	5.8	98+	33	84S	F3	ZC1924, close double??
Apr 26	Mon	2:08	D	72 Vir	6.1	99+	38	33S	F2	ZC1937, Term. Dist. 7"
Apr 26	Mon	2:22	D	74 Vir	4.7	99+	37	56N	M3	ZC1941, Term. Dist. 16"
May 3	Mon	2:43	R	ZC 3018	6.4	55-	3	68S	G8	Azimuth 124 deg.
May 3	Mon	4:42	R	SAO 189617	8.0	55-	19	69N	F6	

*in Kepler2 program so occultation light curves are sought.

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

The First Observed Occultation by (99942) Apophis – continued from page 4

We thank Joel Johnson, manager of the airport, for allowing us to set up scopes at the edge of the taxiway. Red dots mark stations that had no occultation, while 3 green dots mark 3 that recorded an occultation. The station locations were selected to be close to the diagonal tracks shown on the map, 107 meters apart as projected on the ground. They were 80 meters apart on the plane of the sky, which gave us a good chance of recording the occultation at 3 stations. A dark blue line, passing over the southern end of the airport taxiway, marks the predicted central line. Some of the lines were covered by observers in Oklahoma and Colorado.

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2020-2021 Officers

The First Observed Occultation by (99942) Apophis – continued from page 5

The actual path was farther south; we were fortunate that two of our stations recorded the occultation, both using pre-pointed 80mm short-tube refractors, small sensitive video cameras, 1PPS GPS video time inserters, and small iView "stick" Windows 10 computers. The setups, as tested 4 nights before, are shown in Figures 2 and 3.

Figure 2. (left) Dunham equipment deployed on line A30 (northern).

Figure 3. (right) Dunham equipment deployed on line A28 (southern).

In addition, Richard Nugent recorded the occultation from the line between our stations using an 8-in. SCT. The observations plotted in the sky plane are shown in Figure 4.

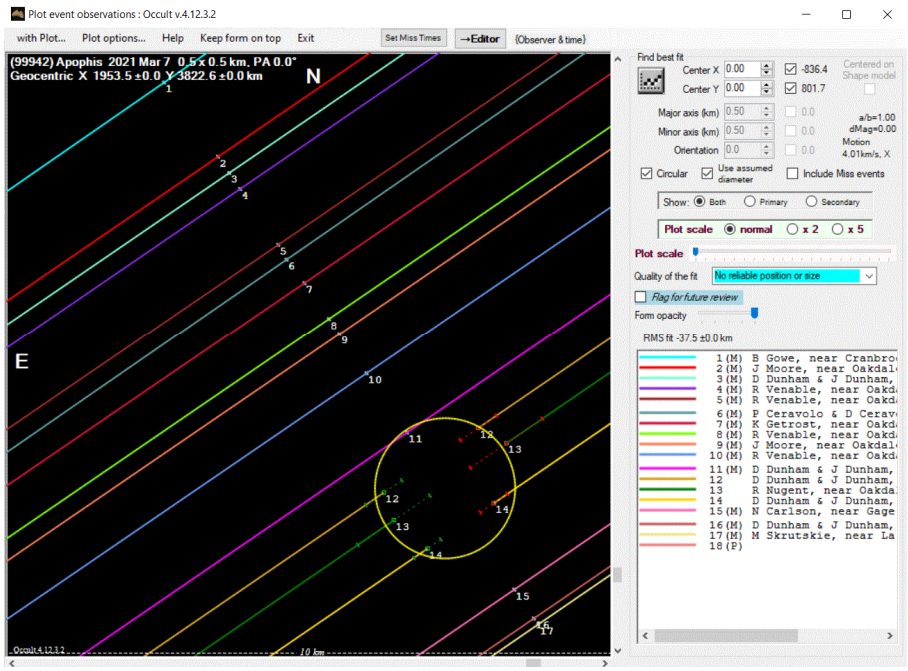

Figure 4. Image Credit - John Moore, IOTA

The result provided a highly accurate astrometric point in the sky plane, nicely complementing the line-of-sight radar data to refine Apophis' orbit. It helped us predict another occultation, of a 10.0-mag. star, that could be observed with larger telescopes in the eastern USA on March 22. We tried that in n.e. Alabama, where we had a miss. Roger Venable deployed 5 telescopes near Yeehaw Junction, Fla. Only his easternmost scope recorded the occultation. The observations, along with new radar data, are being analyzed, to try to predict two more Apophis occultations, of 11.0 and 10.1-mag. stars, that will occur on similar paths that extend from w. New Mexico to Saskatchewan on April 4 and 11.

Recent Astronomy Highlights – continued from page 4

Exoplanet Gets a Second Atmosphere

Gliese 1132b is a planet in a close 1.6-day orbit of a red dwarf star approximately 41 light years away from Earth. Thought to have originally been a sub-Neptune, with a thick atmosphere, the planet apparently lost that atmosphere due to its close proximity to the red dwarf. However, using the Hubble Telescope to study the planet as it transits its star, astronomers have found evidence of a second atmosphere, composed of molecular hydrogen, methane, hydrogen cyanide and other chemicals forming a soot. The source of the new atmosphere is likely volcanos. Like Io, it is theorized that Gliese 1132b experiences tidal stretching and compression, leading to heating that induces the volcanic activity feeding the atmosphere. More information can be found at www.universetoday.com/150527/a-planet-lost-its-atmosphere-so-its-volcanoes-made-it-a-new-one/.

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): **8 May** 7:30 p.m., Joe Hemboldt (NRL), **Radio Astronomy Observes the Earth's Ionosphere**

The APS Mid-Atlantic Senior Physicists Group: **(Zoom Meeting)** Apr. 21st at 1:00 p.m., Dr Timothy A. Livengood, University of Maryland and CRESST, NASA GSFC, will give a talk entitled " Where Has All the Atmosphere Gone? Isotope Ratios and Atmosphere Loss from Mars." More information is available at www.aps.org/units/maspg/meetings/meeting.cfm?name=SENIOR0421. To attend the meeting, use the following link and meeting info:
apsphysics.zoom.us/j/96223316882?pwd=OW9CQUZOZE90blJtZjlQV0QycURZUT09
Meeting ID: 962 2331 6882 Passcode: 260481
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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First Class
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Celebrating 84 Years of Astronomy

Next NCA Meeting:

2021 April 10th

7:30 pm

(On Zoom)

Dr. Tess Jaffe

The NCA Zoom meetings are open to anyone, however, you must register ahead of time. To register, go to: 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, share the link above instead.

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