Star Dust

Newsletter of National Capital Astronomers, Inc.

capitalastronomers.org

April 2019 ***Volume 77, Issue 8***

Celebrating 82 Years of Astronomy

Next Meeting

When: Sat. Apr. 13th, 2019

Time: 7:30 pm

Where: UMD Observatory

Speaker: Dr. Noam Izenberg

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Directions to Dinner/Meeting

Our time and location for dinner with the speaker before this meeting is 5:30 pm at "Hunan Treasure" at 7537 Greenbelt Road, Greenbelt, MD 20770 in Greenway Center just east of where Greenbelt Road crosses the Baltimore-Washington Parkway.

The National Capital Astronomers meeting is held at the UMD Astronomy Observatory on Metzerott Rd about halfway between Adelphi Rd and University Blvd.

Observing after the Meeting

Following the meeting, members and guests are welcome to tour through the Observatory. Weather-permitting, several of the telescopes will also be set up for viewing.

Optimized Broadband Colors for Discriminating Earth-like Exoplanets

Noam R. Izenberg

Johns Hopkins University Applied Physics Laboratory

Abstract: A three-color photometer, precisely pointed, with an angular resolution better than an arc-second, would enable us to distinguish Earth-like exoplanets from other rocky, gassy, or icy worlds - if we had the right three wavelengths, and the ability to block out the primary star's glare. Color-color discrimination of Earth-like planets has been sought for quite some time. Broadband filters would not enable measuring the fine spectral features that might indicate the presence of life, but would affordably provide precise overall indications of similarity to, or difference from, the one habitable planet we know.

We conducted an optimization exercise to arrive at a set of three broadband filters that reliably separate modeled Earth-like (hence possibly habitable) planets from other possible exoplanets. The optimized bands resemble the results of previous work for exoplanets and the Solar System, but underscore the advantage of including UV wavelengths, and indicate their potential utility for exoplanet identification and/or discrimination, when used in concert with other exoplanet observations.

Biography: Noam Izenberg has been a planetary scientist at Johns Hopkins University's Applied Physics Laboratory since 1997, and has

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Recent Astronomy Highlights

Lunar Water Cycle
Results from the Lunar Reconnaissance Orbiter (LRO) show that small amounts of water actually exist on the surface of the Moon. The water molecules generally settle on the lunar surface during lunar night, but during lunar day, especially the latter part of the day, they can heat up enough to leave the surface and enter the tenuous lunar atmosphere. One theory was that the hydrogen for this water comes from the solar wind. However, observations when the Moon passed into Earth's shadow showed no change in the amount of water. More information can be found at: phys.org/news/2019-03-lro-lunar-movement.html

Dust Ring Discovered in Mercury's Orbit and New Theory About the Origin of Venus' Dust Ring
Scientists, who ironically were searching for dust-free regions close in toward the Sun, found a ring of dust 9.3 million miles wide through which Mercury orbits. While such rings of dust exist in the orbits of Venus and Earth, many believed the solar wind would keep a ring of dust from existing in Mercury's orbit. Meanwhile scientists have theorized that there might be asteroids in Venus' orbit that could be the origin of the dust ring through which that planet travels. More information can be found at: www.sciencedaily.com/releases/2019/03/190312123629.htm

Hubble Discovers New Neptunian Storm
A newly formed storm in Neptune's atmosphere (upper center in image below), imaged by Hubble, is allowing scientists to better understand how such storms form. For more information, go to: phys.org/news/2019-03-hubble-captures-birth-giant-storm.html

Image Credit: NASA/ESA/GSFC/JPL

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Biography – continued from page 1

been involved in research and missions across the Solar System, and recently beyond. He's interested in the processes that change the appearance and compositions of planetary surfaces. From the solar wind and cosmic rays of "space weather" to the atmospheres, winds and waves of planetary weather systems, to impact craters and the internal processes of volcanism and tectonism, the surfaces of Solar System bodies are always evolving; the different processes change the appearance of a surface in many different, and sometimes surprising, ways. The processes at and below the surface, and how they affect the atmosphere (if any) of a body are critical to understanding how planets appear telescopically. Thus, comparative planetology of our own Solar System is an important tool for understanding the ever-increasing menagerie of exoplanets we are finding. Dr. Izenberg has been an Instrument Scientist on the NEAR Shoemaker mission to the asteroid 433 Eros, and the MESSENGER mission to Mercury, and is the deputy chair of NASA's Venus Exploration Analysis Group. He is leading an Exoplanet Identifier Space Telescope (ExiST) study at APL.

Solving a Cosmological Crisis

No, the Universe is not in trouble, at least not yet, but our current understanding of it may be. The 'crisis' involves the measurement of the Hubble Constant, H_o, the current speed of expansion of the Universe. Two scientific teams have come up with very precise values for H_o, very precise values that don't agree.

The SHOES (Supernovae, H0, for the Equation of State of dark energy) project, which uses measurements of Type 1A Supernovae, gives a current H_o value of 73.5 km/s/Mpc for the Hubble Constant. This means that on average an object one megaparsec away (a megaparsec being approximately 3.3 million light years) should be receding from us 73.5 kilometers per second. An object twice as far away should be receding twice as fast and so on. Meanwhile researchers using data from the Planck satellite, which measures the fluctuations in the Cosmic Microwave Background, have come up with an expected current H_o value of 66.9 km/s/Mpc. There are uncertainties in these measurements. For SHOES it is plus or minus 1.7 km/s/Mpc and for the Planck team it is plus or minus 0.6 km/s/Mpc. So, the possible ranges of each result don't overlap. A few km/s/Mpc might not seem significant, but such a difference has vast implications for the history of the Universe and for its future expansion. Perhaps the discrepancy points to new physics involving the mysterious dark energy, which is causing the expansion of the Universe.

Both teams continue their work, but independent methods will probably be necessary in order to end the conundrum. Gravitational lensing of distant objects and gravitational waves have been proposed as methods of achieving this goal. And measuring the ratio of ultraviolet radiation versus x-rays coming from quasars, supermassive black holes feeding on large amounts of gas, has recently been proposed as a means of measuring the expansion history of the early Universe, helping to figure out H_o. What will be the results of these methods? Stay tuned.

Exploring the Sky

*"**Exploring the Sky**"* is an informal program that, for 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

2018 Exploring the Sky Sessions

4 May	9:00 p.m. – Moon, Mars, Beehive Cluster
1 June	9:00 p.m. – Mars, M13
6 July	9:00 p.m. – Moon, Jupiter, M13
10 Aug.	8:30 p.m. – Moon, Jupiter, Saturn, M13
7 Sep.	8:00 p.m. – Moon, Jupiter, Saturn
5 Oct.	7:30 p.m. – Moon, Saturn
2 Nov.	7:00 p.m. – Moon, Saturn, Uranus

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 submission deadline for May's Star Dust, is April 21st.

Clear Skies!

Chang'e-4 (or The Moon Goddess, the Jade Rabbit, and the Magpie Bridge)

On February 1, the Lunar Reconnaissance Orbiter (LRO) passed over the landing site of Chang'e-4, the Chinese mission to the Moon, capturing the image just below.

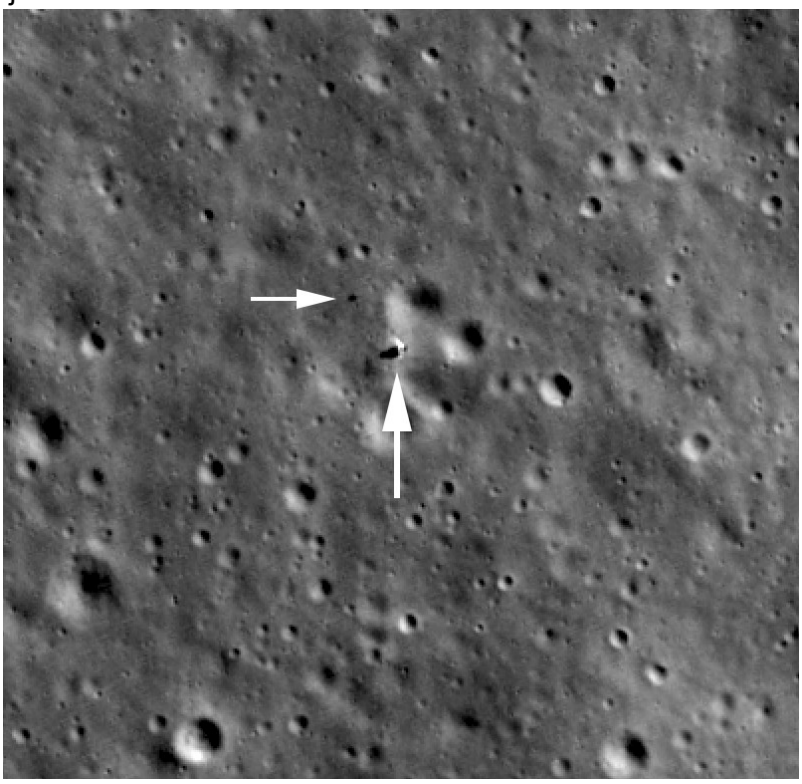

Image Credit: NASA/GSFC/Arizona State University

With a pixel scale of 0.85 meters, Chang'e-4 (Chang'e being the Moon Goddess in Chinese mythology) indicated by the larger arrow, and the rover, Yutu-2 (Yutu being the Jade Rabbit who lives on the Moon), are just visible.

Chang'e-4 is the first probe to land on the far side of Moon, doing so in January. Being on the far side, it would have been impossible for Chang'e to communicate images and scientific results back to Earth directly. To allow for communications, the Chinese National Space Administration put a communications satellite, Queqioa (Chinese for Magpie Bridge) in a Halo orbit around the L-2 point, allowing it a continuous view of Earth and the Moon's far side. Why call the satellite Magpie Bridge? The name comes from the ancient Chinese folk tale, *The Cowherd and the Weaver Girl*. In the tale, Zhi Nu, the weaver girl, daughter of the Jade Emperor and the Mother Queen of Heaven, falls in love with the Cow Herd, Niu Lang. Of course, Zhi Nu's parents do not approve and call their daughter back to Heaven. Niu Lang follows Zhi Nu into the heavens where they can be seen as the stars Vega and Altair. Furious, the Mother Queen of Heaven created a river (the Milky Way)

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Sky Watchers

April/May

Mercury, Venus, Jupiter and Saturn are up in the morning sky while Mars remains viewable after sunset.	
4/19	Full Moon at 7:12 a.m.
4/22-23	The Lyrids Meteor Shower peaks with approximately 20 meteors per hour. Unfortunately, a waning gibbous Moon will make it difficult to see some of the fainter meteors.
5/6-7	The Eta Aquarids Meteor Shower peaks with approximately 30 meteors per hour. With the crescent Moon setting early that night, viewing conditions should be ideal in the early-morning hours.
5/8	4:12 a.m. – Mercury will be 1° 23' south of Uranus.

Times in EDT

Introducing Raphael Chesnes

Michael Chesnes

My wife Jane and I would like to announce the birth of our son, Raphael Hugo, on January 29, 2019. We gave him the nickname "Flare Star" because of his kicking patterns while in utero, and his nickname has stuck. Thank you to my fellow members of Hopewell Observatory who sent Raphael a very warm personalized blanket that appears in the photo with him. While our family has not observed, made telescopes, or attended an NCA meeting since Raphael's birth, Jane and I plan on introducing Raphael to all three activities. We expect more of you to meet him in the coming months.

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Thank you!

Recent Astronomy Highlights – continued from page 2

New Solar System Formation

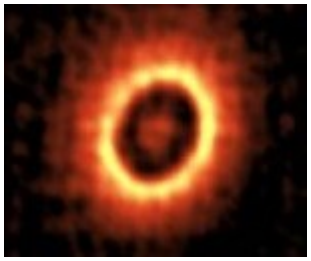

Image Credit: *ALMA (ESO/NAOJ/NRAO), Kudo et al.*

Scientists using ALMA (Atacama Large Millimeter/submillimeter Array) have discovered two concentric rings of dust around the young star DM Tau. The rings are believed to be possible precursors to the formation of planets. More information can be found at: www.sciencedaily.com/releases/2019/03/190313114726.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

2019	Day	EDT	Star	Mag.	Asteroid	dmag	dur. s	Ap. "	Location
Apr 20	Sat	4:54	4UC41257041	13.6	Herluga	2.4	2	11	se&nVA,MD;DC?
Apr 20	Sat	5:12	4U460126775	12.9	Zappala	4.6	1	9	WV,wMD;DC,nVA?
Apr 21	Sun	22:24	4UC45750912	12.1	Mechthild	2.7	4	7	se&cVA,cWV,s&wOH
Apr 29	Mon	1:41	4UC43460358	11.8	Brixia	1.8	7	7	neNC,se&cVA,sWV
Apr 30	Tue	23:46	4UC50752412	9.8	1998 BU48	12.8	10	6	TNO; USA?
May 9	Thu	1:17	4UC42462271	12.9	Dudu	0.8	5	9	sNJ,DE,MD,DC,nVA

Most event details at http://www.asteroidoccultation.com/

Lunar Grazing Occultations

2019	Day	EDT	Star	Mag	% alt	CA	Location, Notes
May 10	Fri	23:16	ZC 1298	6.4	39+ 27	4N	Faber,Templetn,VA;Coinjock,NC
May 10	Fri	23:27	ZC 1303	6.8	39+ 25	3N	Emmaus,Newtown, PA; FtDix, NJ
May 12	Sun	21:02	ZC 1545	8.0	61+ 61	5N	NwFreedm,PA;BlAir,MD;Camdn,DE

Interactive and static maps are at http://iota.jhuapl.edu/exped.htm

Lunar Total Occultations

2019	Day	EDT	Ph	Star	Mag	% alt	CA	Sp.	Notes
Apr 13	Sat	20:36	D	ZC 1322*	6.4	64+ 70	68S	A2	Sun altitude -11 deg.
Apr 14	Sun	0:43	D	ZC 1340*	6.6	65+ 34	90S	A0	
Apr 14	Sun	1:13	D	FZ Cancri	6.3	66+ 28	69S	M4	ZC 1343
Apr 15	Mon	0:37	D	ZC 1459	7.4	76+ 43	53S	G5	
Apr 16	Tue	2:55	D	SAO118593*	7.6	86+ 24	41S	K2	
Apr 16	Tue	3:11	D	ZC 1596*	7.2	86+ 22	59N	A2	
Apr 17	Wed	0:04	D	ZC 1709	6.6	93+ 55	29S	K0	
Apr 19	Fri	21:37	R	ZC 2072	6.6	99- 15	57N	K0	Az 116,AA 278,TermDst9"
Apr 23	Tue	1:34	R	xi Oph	4.4	83- 18	37N	F2	ZC2498,mg2 9,sep4",PA25
Apr 23	Tue	4:06	R	ZC 2509	5.8	83- 30	58N	K0	
Apr 23	Tue	5:18	R	SAO 185402	7.2	82- 29	41N	K4	Sun-12,mg2 9, .1",PA350
Apr 24	Wed	5:38	R	ZC 2661	7.3	74- 28	70S	B8	Sun altitude -8 degrees
Apr 25	Thu	3:27	R	SAO187846*	7.9	65- 18	10N	B9	
Apr 25	Thu	4:04	R	SAO 187851	8.0	65- 22	71S	K3	
Apr 28	Sun	4:39	R	SAO 164653	7.7	36- 12	35S	B9	Az 124,Mg2 11, 4",PA207
Apr 30	Tue	5:31	R	ZC 3438*	7.7	19- 11	56S	B3	Sun -8, Azimuth 112 dg.
May 7	Tue	20:59	D	SAO 77323	7.7	10+ 21	83S	G4	Sun altitude -10 deg.
May 8	Wed	21:36	D	SAO 78560	8.1	18+ 25	86S	G5	
May 8	Wed	21:58	D	SAO 78574	7.6	18+ 21	58N	K5	
May 9	Thu	21:19	D	SAO 79556	8.2	28+ 39	89S	F5	
May 9	Thu	23:39	D	SAO 79623	7.9	29+ 13	60S	K1	Az. 287, close double??
May 10	Fri	20:26	D	SAO 97941	7.5	38+ 58	85N	A*	Sun altitude -4 deg.
May 10	Fri	20:27	D	35 Cancri	6.6	38+ 58	50S	G0	Sun -4,ZC1282, Praesepe
May 10	Fri	21:29	D	SAO 97973	7.7	38+ 47	61N	A0	All this pm, Praesepe
May 10	Fri	22:19	D	SAO 97999*	7.4	39+ 38	45N	F0	
May 10	Fri	22:37	D	ZC 1293*	6.8	39+ 34	65N	K0	Mg2 10, sep .5", PA 248
May 10	Fri	22:40	D	ZC 1294*	7.3	39+ 34	60N	A0	Mg2 12, sep .8", PA 290
May 10	Fri	22:41	D	SAO 98014*	7.5	39+ 34	62N	A0	close double??
May 10	Fri	22:44	D	BU Cancri*	7.6	39+ 33	58S	A7	SAO 98009
May 10	Fri	22:51	D	SAO 98018*	7.5	39+ 32	58N	A0	
May 10	Fri	22:53	D	ZC 1297*	6.8	39+ 31	83S	A9	Maybe close double?
May 10	Fri	22:57	D	epsilonCnc*	6.3	39+ 31	52N	A*	ZC 1299, spec. binary
May 10	Fri	23:08	D	BN Cancri*	7.8	39+ 28	63S	A8	SAO 98027
May 10	Fri	23:18	D	EP Cancri*	6.8	39+ 27	27N	A6	ZC 1303; nNJ graze
May 10	Fri	23:21	D	HI Cancri*	8.0	39+ 26	81S	A3	X13184, Mg2 10,2",PA164
May 10	Fri	23:42	D	BX Cancri*	7.9	39+ 22	54N	A7	SAO 98053
May 11	Sat	1:16	D	ZC 1312*	6.8	40+ 5	48S	F2	Azimuth 290 degrees
May 11	Sat	21:55	D	8 Leonis	5.7	50+ 51	77S	K1	ZC1418, close double??
May 11	Sat	22:23	D	SAO 98674	7.8	50+ 45	29S	F8	=dbl,sep. .3", PA 253
May 12	Sun	0:44	D	ZC 1430	8.0	51+ 19	27S	K0	
May 12	Sun	20:52	D	ZC 1545	8.0	61+ 63	22N	F2	Sun alt. -8, neMD graze
May 12	Sun	21:56	D	SAO 99185*	7.9	62+ 56	83S	A3	close double?
May 13	Mon	22:02	D	ZC 1669*	6.7	73+ 57	74N	F5	

*in Kepler2 program so occultation light curves are sought.

More, esp. total lunar occultations, at http://iota.jhuapl.edu/exped.htm
David Dunham, dunham@starpower.net

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Occultations – Continued from page 5

The evening of May 10, the 39% sunlit crescent Moon will pass over the Praesepe cluster, giving quite a spectacular show for observers throughout the eastern USA. The predictions in the list are complete to mag. 8.0; in addition, with medium and larger telescopes, several more occultations can be observed.

Just after the May NCA meeting, at 9:55pm, Sat. May 11, there will be a really good occultation of 5.7-mag. 8 Leonis by the first quarter Moon.

Chang'e-4 (or The Moon Goddess, the Jade Rabbit and the Bridge of Mapgies) – continued from page 3

between her rebellious daughter and the cowherd so that they can never be together. But later a flock of magpies took pity on the lovers, and once a year creates a bridge across the river with their bodies so that the lovers can see each other for a brief time.

While the satellite Queqioa will not be used to give lovers a chance to see each other, it will transmit data back from the Moon and allow instructions to be sent to Chang'e 4 and Yutu-2. Pictures of the landing site have already been published and are available at such sites as www.planetary.org/explore/space-topics/space-missions/change-4.html, and data will no doubt be coming from the lander and rover throughout the duration of the mission – expected to be one year for the lander and three months for the rover.

The lander and rover will study the lunar surface and subsurface as well as the solar wind and cosmic rays. The lander has a low frequency spectrometer for studying solar radio bursts.

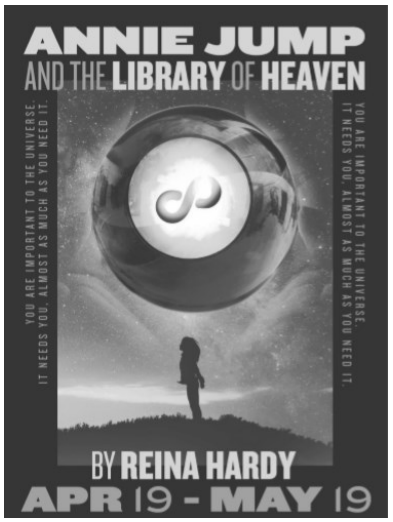
Also, a small temperature-controlled biosphere on the lander contained seeds, yeast and fruit-fly eggs. Cottonseed, rapeseed and potato seeds were reported to have sprouted twelve days after landing. The next day, however, the loss of temperature control caused the premature ending of this experiment.

Annie Jump and the Library of Heaven

The award-winning Rorschach Theatre in DC will present the play "Annie Jump and the Library of Heaven", written by Reina Hardy, at the Atlas Performing Arts Center from April 19th – May 19th, 2019.

Annie Jump, the namesake of Annie Jump Cannon, is a small-town teen and science genius, who comes face to face with her worst nightmare: a popular girl. When she learns that this girl with great hair might be an intergalactic super computer tasked with bringing humanity to the stars, she must decide what is worth sacrificing to fulfill her destiny.

For tickets and information, go to bit.ly/anniejump. Discount tickets for students and seniors are available.



Recent Astronomy Highlights – continued from page 4

Bennu's Rotation Rate is Speeding Up

Bennu, an asteroid which is currently being studied by NASA's OSIRIS-REx mission, is undergoing a speed up in its rate of rotation. Based on archival data that acceleration turns out to be a decrease of one second per century in its current rotation period of 4.3 hours. Scientists are trying to determine the cause of the acceleration. It could be due to some change in the asteroid, such as movement of materials on the surface or within it. Another possible mechanism is the Yarkovsky–O'Keefe–Radzievskii–Paddack (YORP) effect. The YORP effect is caused by sunlight hitting and being reflected off the surface of an asteroid and by thermal emission from the asteroid itself. The effect can cause the rotation rates of asteroids to slow down or to speed up. More information can be found at: www.space.com/asteroid-bennu-spin-mysteriously-speeding-up.html

Calendar of Events

NCA Mirror- or Telescope-making Classes: 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 or at gfbrandenburg@yahoo.com. Additional information 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 on the 5th and 20th of every month at 8:00 pm (Nov.-Apr.) or 9:00 pm (May-Oct.). Details: www.astro.umd.edu/openhouse

Next NCA Meeting at the University of Maryland Observatory: **11 May** 7:30 p.m., Noel Klingler (George Washington U), *Winds from Pulsars*

Montgomery College's Planetarium – "How c, the speed of causality, G, Newtonian gravitational constant, and h, Planck's constant with Quantum Entanglement, make the fabric of the Universe.", April 20th at 7:00 p.m. (Not a show for little kids unless they know algebra and powers of 10.) www.montgomerycollege.edu/academics/stem/science-engineering-technology/planetarium.html

The Mid-Atlantic Senior Physicists Group: "The Revised International System of Units" by Stephan Schlamminger, National Institute of Standards and Technology, April 17th at 1:00 pm at the American Center for Physics (1st floor conference room). 1 Physics Ellipse, College Park MD -- off River Rd. between Kenilworth Ave. and Paint Branch Parkway. www.aps.org/units/maspg/meetings/meeting.cfm?name=SENIOR0419

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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Dated Material

Celebrating 82 Years of Astronomy

Next NCA Meeting:

2019 April 13th

7:30 pm

@ UMD Observatory

Dr. Noam Izenberg

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