

Star Dust

Newsletter of National Capital Astronomers, Inc.

capitalastronomers.org

Oct. 2019

Volume 78, Issue 2

**Celebrating 82 Years
of Astronomy**

Next Meeting

When: Sat. Oct. 12th, 2019
Time: 7:30 pm
Where: UMD Observatory
Speaker: Dr. Duilia F. de Mello

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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 Metzertott Rd about halfway between Adelphi Rd and University Blvd.

Observing after the Meeting

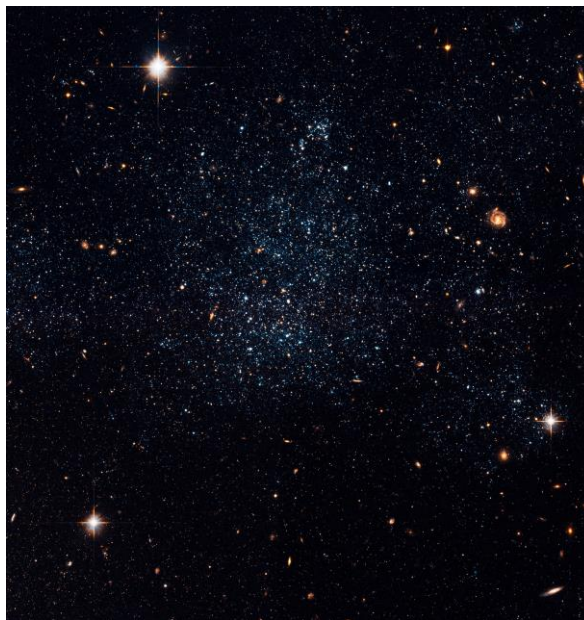
Following the meeting, members and guests are welcome to tour through the Observatory. Weather-permitting, several of the telescopes will also be set up for viewing.

Interacting Galaxies and Blue Blobs

Dr. Duilia F. de Mello

Catholic University of America

Abstract: I will present the latest results on the studies of a class of small objects (blue blobs), which we detected, in ultraviolet light, in the intergalactic medium (IGM) in the vicinity of interacting galaxies. The blobs resulted from tidal interaction between the interacting galaxies, and they have already started forming stars. The blobs are within tidal debris, inside clouds of neutral atomic hydrogen, but they are far from their "parent galaxies".



Dwarf Galaxy Holmberg IX, a dwarf irregular galaxy that lies about 12 million light years from Earth. Image Credit: NASA, ESA and the Hubble Heritage Team (STScI/AURA) The image was created as the result of a proposal by D. de Mello (GSFC/Catholic University of America, Washington/JHU), L. Smith (STScI/ESA/University College London), E. Sabbi (STScI), J. Gallagher (University of Wisconsin, Madison), M. Mountain (STScI), and D. Harbeck (University of Wisconsin, Madison). For incredible high-resolution copies of the image, go to hubblesite.org/image/2236/gallery

These blue blobs were selected from a sample of interacting galaxies having tails of neutral atomic hydrogen. They were observed in the Ultraviolet with the Galaxy Evolution Explorer spacecraft (GALEX). Our data at optical and infrared wavelengths, taken with the Hubble Space Telescope and with the huge telescopes at the Gemini Observatory, show

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Recent Astronomy Highlights

First Observation of a Supermassive Black Hole Destroying a Star

On January 29th, 2019, the ASAS-SN (All-Sky Automated Survey for Supernovae) telescope network captured light from a galaxy that lies 375 million light years away. The origin of that light was the tidal disruption of a star by the galaxy's supermassive black hole, estimated to be six million times the mass of our Sun. The tidal forces ripped the star, which might have been around the size of our Sun, into a cloud of hot gas, some of which will end up in that supermassive black hole. As it turned out TESS (Transiting Exoplanet Survey Satellite) had actually recorded the event even earlier; however, the data had to be downloaded and processed. More information is at www.nasa.gov/feature/goddard/2019/nasa-s-tess-mission-spots-its-1st-star-shredding-black-hole and the recently published paper by the ASAS-SN team is available at arxiv.org/pdf/1904.09293.pdf

Second Interplanetary Visitor Discovered

Two years after Oumuamau, a second interstellar object has now been observed making a brief visit to our Solar System. 2I/Borisov, as it has been designated is named after its discoverer, the amateur astronomer Gennady Borisov. The 'I' in the designation stands for Interstellar, and the 2 indicates it is the second such object detected. Fortunately, unlike Oumuamau, which was only discovered when it was headed back out of the Solar System, 2I/Borisov is still coming in, allowing for more extensive study. Its closest approach to the Sun, 2 AU away from both the Earth and the Sun, will be on December 7th, 2019. Observations show that the object is probably a few kilometers in diameter. It is already showing signs of a coma and tail. Assuming it flares up more, it could be viewable in the southern sky in December and January. More information can be found at www.iau.org/news/pressreleases/detail/iau1910/

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• *Abstract – Continued from page 1*

• that the blobs are not well-organized structures. They resemble objects in the process of assembly, or isolated stellar clusters/associations.

• Their fate is not clear. They can either (1) grow to become independent entities by accreting more gas and forming more stars, or (2) make star clusters or even become intergalactic objects, or (3) dissolve and not remain gravitationally bound, yielding only very sparse star streams. Therefore, they are good laboratories for studying star formation in the IGM and may answer important questions regarding the enrichment of the IGM by elements that were synthesized well after the Big Bang.



• **Biography:** Dr. de Mello is a Full Professor in Physics at Catholic University of America, and has just been promoted to Vice Provost for Global Engagement. She obtained her PhD in 1995 from the University of Sao Paulo, Brazil. She was Assistant Professor at Chalmers University of Technology in Sweden. She was a Postdoctoral fellow at the Hubble Space Telescope Science Institute, at the Cerro Tololo Inter-American Observatory in Chile and at the National Observatory in Rio de Janeiro, Brazil.

• She joined the Catholic University of America (CUA) in 2003 as a Research Associate at the Institute for Astrophysics and Computational Sciences based at NASA's Goddard Space Flight Center. In 2008 she joined the Physics Department at the Catholic University of America (CUA) in Washington DC, as Associate Professor.

• Her area of expertise is Extragalactic Astronomy, and she uses the Hubble Space Telescope, along with giant telescopes like those in the Gemini Observatory, to study the evolution of galaxies. As part of the Hubble UV UDF and CANDELS teams, she uses Hubble to investigate how galactic disks are assembled. She studies colliding galaxies and their impact in the intergalactic medium. Her latest discoveries include dozens of blue blobs outside colliding galaxies.

• She is deeply committed to communicating and popularizing science and to inspiring young women to consider careers in STEM fields.

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](#)

Final 2018 Exploring the Sky Session
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

From the September 10th Exploring the Sky session, Jay Miller reports, “Exploring the Sky was a great success. We had about eight telescopes. Rocco, Todd and the Simpsons, plus some of the public, brought telescopes. We had around 100-120 members of the public and the weather was great. It didn’t start clouding up until we were getting ready to leave and then it was coming from the north and the moon and planets were in the south. Some people did go to other objects such as M57.”

The submission deadline for November’s Star Dust, is October 21st.

First Known Film of a Solar Eclipse

These days anybody can record an eclipse on their smartphone, as many did during the Great American Solar Eclipse of 2017. But 119 years ago, when the motion picture industry was in its infancy, it wasn’t so easy. Recently the first known recording of a total solar eclipse, held in the archives of Britain’s Royal Astronomical Society, was painstakingly restored by the British Film Institute and released to the public.

Almost exactly 19 years before the solar eclipse that made Albert Einstein famous (see Page 4), Nevil Maskelyne, a famous magician in his day, as well as an astronomy enthusiast, went on an expedition with the British Astronomical Society to North Carolina where he filmed the eclipse that took place on May 28th, 1900. (According to the article at the link below, Maskelyne actually attempted to film the 1898 solar eclipse, but afterward the film was stolen.) More information, as well as the actual restored film, can be found at www.theverge.com/2019/6/2/18647420/solar-eclipse-bfi-restore-footage

Sky Watchers

October/November

Mercury goes from Greatest Eastern Elongation to a conjunction with Venus to a transit of the Sun. Venus will be low in the early-evening sky. Jupiter and Saturn will be the only planets visible in the later evening sky, with Jupiter setting around 9:00 p.m. and Saturn setting a couple hours later.

10/13	Full Moon at 5:09 p.m.
10/20	Mercury at Greatest Eastern Elongation. At 26° from the Sun, the planet will be viewable after sunset low in the western sky.
10/21, 22	The Orionids Meteor Shower peaks with approximately 20 meteors per hour. A second-quarter Moon may interfere with seeing some of the fainter ones.
10/30	Conjunction of Mercury and Venus. The planets will be 2° 43’ apart at their closest at 4:29 a.m.
11/5, 6	The Taurids Meteor Shower peaks with approximately 10 meteors per hour. The Moon sets around midnight, allowing for ideal early-morning viewing.
11/11	Mercury Transits the Sun. (While this will take place after the November issue of Star Dust is published, it seemed worthy of an early heads-up. See Page 4 for details.)

Times in EDT

Upcoming Transit of Mercury

On the morning of November 11th, 2019 (Veterans' Day), a somewhat rare celestial event will take place when Mercury transits the Sun over a period of 5 hours and 29 minutes. Assuming clouds don't interfere, not the best of assumptions for this area and time of year, the entire transit will be visible in DC-area skies. The transit will begin when Mercury makes first contact with the Sun at 7:35 a.m. EST (12:35 UT), a little less than an hour after sunrise. The transit will end at 1:04 p.m. EST (18:04 UT). High-power binoculars with a pair of solar filters or a telescope also with a solar filter will be necessary to see the event.



Solar Dynamics Observatory Image of the May 9, 2016 Transit of Mercury across the Sun. Image Credit: NASA and SDO

Transits of Mercury take place around 13 or 14 times in a century. The last took place in 2016. Because of how the orbit of Mercury is at an angle to the ecliptic, the plane of the Earth's orbit around the Sun, such transits can only take place when Mercury passes through the plane of the ecliptic around May 8th or November 10th. The transits in May are when Mercury is in descending mode, passing downward through the ecliptic, while the ones in November are when Mercury is in ascending mode, passing upward through the ecliptic. More information can be found at eclipsewise.com/oh/tm2019.html.

Centennial of the "Einstein Eclipse" Announcement

"LIGHTS ALL ASKEW IN THE HEAVENS" and "EINSTEIN THEORY TRIUMPHS", were the headlines in the November 10th issue of the New York Times. Those headlines helped make Albert Einstein an internationally known figure of science. They came as a result of the study of photographs taken during the May 29, 1919 total solar eclipse in the southern hemisphere. The results of those studies were announced by British astronomer Arthur Eddington at a joint meeting

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Thank you!

• *Recent Astronomy Highlights – continued from page 2*

• **Sagittarius A* Suddenly Brightens**

• The brightness of the region around the supermassive black hole at the center of the Milky Way Galaxy, known as Sagittarius A*, varies a little, but on May 13th it flared at least 75 times brighter in the near-infrared. Black holes, even supermassive ones, don't radiate light, but matter around them, in being drawn in by that black hole's gravitational field, can do so. (See first Recent Astronomy Highlight on Page 2.) The brightening might have been due to gas from an object named G2, thought to be a gas cloud, which passed close to Sagittarius A*. Another possibility is that S0-2, a star orbiting Sag A* may have stirred up gas in its accretion disk. More info is at www.sciencealert.com/our-galaxy-s-supermassive-black-hole-just-mysteriously-got-really-really-bright

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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/ EST	Star	Mag.	Asteroid	dmag	dur. s	Ap. " Location
Oct 12	Sat	2:19	TYC32931959	11.3	Phaethon*	5.5	0.2	6 seMD,c-swVA,eTN
Oct 15	Tue	2:30	TYC18961786	10.9	Vibilia	1.7	11	6 nVA,DC,MD,ePA,NJ
Oct 15	Tue	23:01	4UC59907871	14.2	Salonta	1.4	6	11 ePA,WMD,nwVA;DC?
Oct 17	Thu	6:13	TYC00431148	9.5	Kacivelia	4.6	2	3 nNJ,sPA,COH,CAZ
Oct 19	Sat	6:32	4UC57045189	10.8	Emita	3.2	4	4 SKY,swV,sVA,sMD
Oct 22	Tue	5:08	4UC57304433	11.7	Fredegundis	0.5	6	6 sVA,SKY,nAZ,LAX
Oct 23	Wed	20:44	SAO 39578	7.9	Hirose	3.2	2	2 CPA,WMD,eWV,swNC
Oct 24	Thu	21:45	PPM 143176	9.6	1941 UN	5.3	5	3 DE,MD,DC,nVA,SOH
Oct 25	Fri	3:11	4UC45043525	13.1	Gallia	0.5	5	9 sPA,sNJ;MD,DC?
Oct 26	Sat	21:24	4UC46698467	14.2	Palisana	0.3	3	11 PA,NJ;nVA,DC,MD?
Oct 31	Thu	3:13	4UC53516432	13.7	Burgundia	0.7	8	10 NJ,e&sMD,eVA;DC?
Oct 31	Thu	22:54	4UC58412645	13.6	Fraternitas	1.5	5	11 seMD,e&scVA,wNC
Nov 4	Mon	3:09	4UC58212471	14.0	Erida	1.5	6	11 DE,MD,DC,OH;nVA?
Nov 5	Tue	2:18	4UC50931703	11.8	Hesperia	0.6	22	6 w&sPA,MD,DC,nVA
Nov 8	Fri	4:56	4UC62219481	11.4	Fukui	5.8	3	6 sMD,nVA,SOH;DC?
Nov 10	Sun	1:12	SAO 56540	7.7	Kachuevskaya	8.2	1.1	2 LI?,CNJ,sPA,COH
Nov 10	Sun	22:50	4UC60109279	13.4	Gantrisch	2.7	3	10 NJ,nMD;DC,nVA?

*** Dates and times above are EDT, those below are EST ***
 *parent of Geminids, see iota.jhuapl.edu/2019Phaethon.htm
 Most event details at www.asteroidoccultation.com/

Lunar Grazing Occultations

2019	Day	EDT	Star	Mag	% alt	CA	Location, Notes
Oct 1	Tue	19:48	30 Librae	6.5	14+ 13	5N	Warfld,StonyCrk,LangleyAFB,VA
Oct 20	Sun	5:48	SAO 78851	8.8	62- 74	6N	Frdksbg,VA;nCalif.,OceanC.,MD
Oct 20	Sun	6:54	X 95442	9.6	62- 71	3N	Good,VA; Columbia,Hanover,MD
Oct 21	Mon	4:13	SAO 79744	8.2	52- 51	10N	Keene,sPortRoyal,VA;Calif.,MD
Oct 31	Thu	19:41	SAO 185799	7.8	18+ 11	1S	nLeesbg,VA;Damscs,sEldrsbg,MD

Links for interactive maps are at iota.jhuapl.edu/exped.htm

Lunar Total Occultations

2019	Day	EDT/ EST	Ph star	Mag	% alt	CA	Sp.	Notes
Oct 11	Fri	20:25	D 30 Piscium	4.4	97+ 25	50S	M3	ZC3536, close double?
Oct 11	Fri	20:25	D 30 Piscium	4.4	97+ 25	50S	M3	ZC 3536, close double?
Oct 15	Tue	6:47	R ZC 368	6.2	98- 21	24S	K2	Sun-6,AA219,dbl,TmDst7"
Oct 16	Wed	2:13	R ZC 464	6.1	94- 64	22S	K0	AA 210,closeDb1?,TmD16"
Oct 17	Thu	4:48	R ZC 600	6.6	89- 63	44N	K2	close db1?, PA graze
Oct 17	Thu	6:49	R ZC 610	6.1	88- 43	36S	K5	Sun -6,close double?
Oct 20	Sun	6:52	R SAO 78861	7.7	62- 71	54S	A2	Sun altitude -6 deg.
Oct 22	Tue	2:37	R ZC 1313*	7.6	41- 21	85S	F8	
Oct 22	Tue	3:22	R SAO 80426	7.7	41- 29	71S	K0	Only 12s before next
Oct 22	Tue	3:22	R SAO 98124	9.3	41- 29	43S	F5	close double?
Oct 22	Tue	5:45	R SAO 98179	8.3	40- 55	78S	K0	
Oct 22	Tue	6:29	R ZC 1329*	6.8	40- 63	43N	F8	Sun -11, close double
Oct 23	Wed	6:00	R ZC 1450	8.0	29- 46	69S	K0	
Oct 24	Thu	7:20	R ZC 1578	6.9	18- 47	71S	K0	Sun -2, close double??
Oct 25	Fri	5:23	D nu Vir =	4.0	10- 12	-75N	M0	Azimuth 92 degrees
Oct 25	Fri	6:22	R ZC 1702	4.0	10- 24	89N	M0	
Oct 26	Sat	6:49	R ZC 1823	8.1	4- 15	51S	F2	Sun -8, Azimuth 102 dg.
Oct 31	Thu	18:36	D SAO 185780	7.9	17+ 20	60S	F0	Sun altitude -6 deg.
Oct 31	Thu	20:12	D ZC 2567	7.2	18+ 8	46N	G3	Azimuth 232 degrees
Nov 2	Sat	20:41	D SAO 188511	7.4	36+ 18	78S	K4	
Nov 4	Mon	19:39	D ZC 3140	7.8	55+ 32	81N	K1	
Nov 5	Tue	19:01	D ZC 3265*	6.6	64+ 32	80N	K0	Sun altitude -12 deg.
Nov 5	Tue	19:20	D SAO164952*	7.9	64+ 34	56N	K5	
Nov 9	Sat	20:28	D SAO 109783	7.3	94+ 38	87S	G5	mg2 10 sep. 39", PA 104
Nov 10	Sun	2:58	D SAO 109873	7.4	94+ 29	77N	A0	
Nov 10	Sun	3:10	D ZC 210	6.6	95+ 16	88N	B9	mag2 10 sep. 6", PA 330
Nov 10	Sun	21:44	D ZC 306	6.8	98+ 55	43S	F0	

*** Dates and times above are EDT, those below are EST ***
 *in Kepler2 program so occultation light curves are sought.

More, esp. total lunar occultations, at iota.jhuapl.edu/exped.htm
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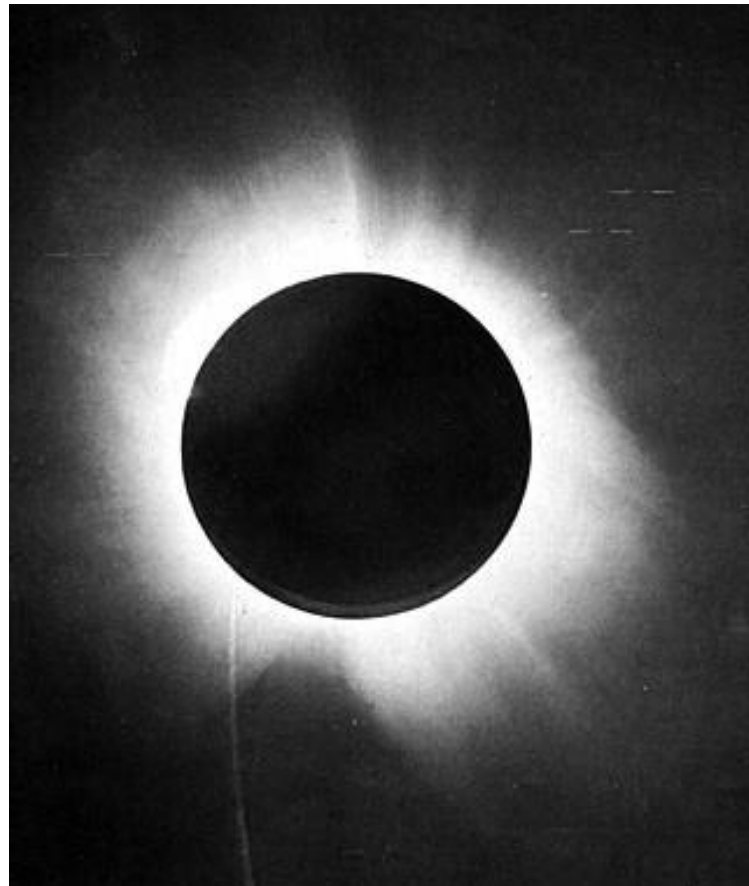
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• Centennial of the “Einstein Eclipse” Announcement – Continued from page 4
 • of the Royal Society and the Royal Astronomical Society in London on
 • November 6th.



One of the images taken during the 1919 Solar Eclipse. Public Domain

• Einstein himself had proposed the idea of taking such pictures during an
 • eclipse in order to see how much the positions of background stars
 • appeared to move. This “movement” would take place, according to his
 • theory of General Relativity, because the Sun’s mass would curve
 • spacetime, causing the direction of the light from those stars to be bent
 • slightly. But the change would be extremely small, only about 1.7
 • arcseconds, an arcsecond being 1/3600th of a degree. (For comparison,
 • the Moon is approximately half of a degree or 1800 arcseconds across.)
 • Fortunately, during the eclipse of 1919, the Sun would be in the Hyades
 • Cluster, a cluster full of bright stars, allowing for lots of measurements.

• Eddington went to the island of Principe off the west coast of Africa, while
 • Charles Davidson and Andrew Crommelin went to Sobral in northern
 • Brazil. Most of the photographs taken by both teams turned out to be
 • unusable, but some of them did show the changed positions of the stars,
 • giving enough data to favor General Relativity over Isaac Newton’s
 • equations, which predicted half of the displacement Einstein’s equations
 • did.

• An interesting article addressing controversies over the results as well as
 • the measures taken by the team scientists to assure the validity of their
 • conclusions can be found at:

• w.astro.berkeley.edu/~kalas/labs/documents/kennefick_phystoday_09.pdf

Recent Astronomy Highlights – continued from page 4

A Possible Gateway for Comets

Using computer simulations, scientists have discovered a way for centaurs (small icy bodies orbiting between Jupiter and Neptune) to transition into Jupiter-Family comets, orbiting the Sun within the orbit of Jupiter. The simulation results indicate that an unusual centaur, designated 29P/Schwassmann-Wachmann 1, which is in a nearly circular orbit a bit farther out than Jupiter, may be making the transition from centaur to Jupiter-Family comet, a process that may only take a few thousand years. The discovery of this gateway may bring further advances in our understanding of the ways in which Jupiter-Family comets are formed. More information can be found at phys.org/news/2019-09-comet-gateway-solar-fundamental-evolution.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](tel:202-635-1860) or at gbrandenburg@yahoo.com. Additional information is at [guysmathastro.wordpress.com/](http://guysmathastro.wordpress.com/home.earthlink.net/~gbranden/GFB_Home_Page.html) and home.earthlink.net/~gbranden/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: **9 November** 7:30 p.m., Antonio Paris (Center for Planetary Science), *Lava Tubes on Mars: Leveraging Volcanic Features to Reduce Exposure to Radiation*
- **The Mid-Atlantic Senior Physicists Group:** “Biophysics of Life in Extreme Environments” by Toshiko Ichiye, Georgetown University, Oct. 16th 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.

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.?

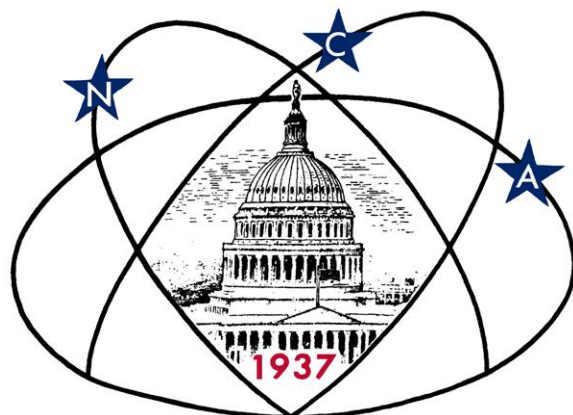
Are you interested in volunteering for: Telescope making, Exploring the Sky, Star Dust, NCA Officer, etc.?

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
Dated Material



Celebrating 82 Years of Astronomy

Next NCA Meeting:

2019 October 12th

7:30 pm

@ UMD Observatory

Dr. Duilia F. de
Mello

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