

# Star Dust

Newsletter of National Capital Astronomers, Inc.

[capitalastronomers.org](http://capitalastronomers.org)

November 2019

Volume 78, Issue 3

**Celebrating 82 Years  
of Astronomy**

## Next Meeting

**When:** Sat. Nov. 9th, 2019  
**Time:** 7:30 pm  
**Where:** UMD Observatory  
**Speaker:** Dr. Antonio Paris

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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 Metzert 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.

## Lava Tubes on Mars: Leveraging Volcanic Features to Reduce Exposure to Radiation

*Antonio Paris*

*Center for Planetary Science*

**Abstract:** Mars is currently at the center of intense scientific study aimed at potential human colonization. Consequently, there has been increased curiosity in the identification and study of lava tubes for information on the paleohydrological, geomorphological, geological, and potential biological history of Mars, including the prospect of present microbial life on the planet. Lava tubes, furthermore, could serve as in-situ habitats for upcoming crewed missions to Mars by providing protection from solar energetic particles, unpredictable high-energy cosmic radiation (i.e., gamma-ray bursts), bombardment of micrometeorites, exposure to dangerous perchlorates due to long-term dust storms, and extreme temperature fluctuations.

This lecture provides insight into a recent investigation of prospective lava tubes at Hellas Planitia, a plain located inside the large impact basin Hellas in the southern hemisphere of Mars, through the use of Earth

*continued on page 2*



*Thurston Lava Tube at Hawaii Volcanoes National Park, Big Island Hawaii – Image Credit: Frank Schulenberg. Larger resolution images and licensing are at [commons.wikimedia.org/wiki/File:Thurston\\_Lava\\_Tube,\\_Big\\_Island.jpg](https://commons.wikimedia.org/wiki/File:Thurston_Lava_Tube,_Big_Island.jpg). No changes were made to the image.*

## Recent Astronomy Highlights

### Spin of Super Spiral Galaxies

Super Spiral Galaxies, like the name suggests, are spiral galaxies, but as much as twenty times bigger and more massive than typical spiral galaxies like the Milky Way or Andromeda. Only about a hundred of these galaxies have been discovered so far. A recent study has also shown that the stars in the outer arms of these galaxies orbit much faster than expected, even faster than their inner arms. This is unlike in most typical spiral galaxies where the inner-arm and outer-arm orbital speeds are similar. This seems to indicate that such super spirals are embedded in massive dark matter haloes up to 40 trillion times the mass of our Sun. More information is at [hubblesite.org/contents/news-releases/2019/news-2019-54?news=true](http://hubblesite.org/contents/news-releases/2019/news-2019-54?news=true)

### New Evidence that Rocky Planets May Be Common

In a recently published study, evidence for the possibility that rocky planets like Earth are common comes from a most unexpected place – white dwarfs. Scientists studying the light coming from such white dwarfs have found higher than expected concentrations of metals. (Astronomers consider any element besides hydrogen and helium to be a metal.) Such concentrations of metals, the scientists surmise, come from the planets and other bodies that once orbited the white dwarf. The scientists have even detected the presence of iron oxide, which is plentiful in the rocky planets of our Solar System. More information is available at [newsroom.ucla.edu/releases/stars-planets-earth-geochemistry](http://newsroom.ucla.edu/releases/stars-planets-earth-geochemistry)

### Salt Lakes on Mars

Using data from the NASA Curiosity rover's exploration of Gale Crater, scientists have found that billions of years ago the crater was the site of salt lakes similar to those on Earth. The evidence also points to episodes of drying and expanding of the lake or lakes. More information is at [www.sciencedaily.com/releases/2019/10/191018181051.htm](http://www.sciencedaily.com/releases/2019/10/191018181051.htm)

*continued on page 4*

• *Abstract – continued from page 1*

• analogue structures. The search for lava tubes at Hellas Planitia is primarily due to the low radiation environment at this particular location. • Several studies by NASA spacecraft have measured radiation levels in this region at  $\sim 342 \mu\text{Sv/day}^1$ , which is considerably less than other regions on the surface of Mars ( $\sim 547 \mu\text{Sv/day}$ ). By analyzing orbital imagery from two cameras onboard NASA's Mars Reconnaissance Orbiter (MRO) – the High-Resolution Imaging Science Experiment (HiRISE) and the Context Camera (CTX) – the search for lava tubes was refined by identifying pit crater chains in the vicinity of Hadriacus Mons, an ancient low-relief volcanic mountain along the northeastern edge of Hellas Planitia. After surveying 1,500 images from MRO, this investigation has identified several candidate lava tubes in the vicinity of Hadriacus Mons as prospective sites for manned exploration. To complement this investigation, moreover, 30 in-situ radiation monitoring experiments have been conducted at analog lava tubes located at Mojave, CA, El Malpais, NM, and Flagstaff, AZ. The investigation concluded that terrestrial lava tubes can be leveraged for radiation shielding and, accordingly, that the candidate lava tubes on Mars can serve as natural radiation shelters and habitats for a prospective crewed mission to the planet.

• <sup>1</sup>  $\mu\text{Sv}$  - a micro-Sievert, a dosage of ionizing radiation



• **Biography:** Antonio Paris, PhD is the Chief Scientist at the Center for Planetary Science, a former Professor of Astrophysics at St. Petersburg College, FL and a graduate of the NASA Mars Education Program at the Mars Space Flight Center, Arizona State University. He is the author of ***Mars: Your Personal 3D Journey to the Red Planet***. His latest peer-reviewed publications include:

- ***El Bahr: A Prospective Impact Crater in Egypt*** - a preliminary investigation addressing the discovery of an unidentified crater located south of the Sahara Desert between Qaret Had El Bahr and Qaret El Allafa, Egypt.
- ***The Physiological & Psychological Aspects of Sending Humans to Mars*** - an extensive research centered on the implications of prolonged spaceflight, which include radiation, the cardiovascular system in space and long-term nutritional concerns in a microgravity environment.

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## 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](#)

With the winter months, the Exploring the Sky program will take a hiatus until April of 2019. More information can be found at NCA's web site, [www.capitalastronomers.org](http://www.capitalastronomers.org) or the Rock Creek Park web site, [www.nps.gov/rocr/planyourvisit/expsky.htm](http://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](http://www.astronomyindc.org)

From the October Exploring the Sky session, Jay Miller reported, "I started to set up, but the clouds started to thicken from the west and I put everything away. Todd Supple and Guy Brandenburg showed up as well as two Park Service Rangers so we would have had great telescopes. About a half dozen cars did stop by and we were able to give them information so it wasn't a total loss."

**The submission deadline for December's Star Dust, is November 21st.**

**Clear Skies!**

• *Biography – Continued from page 2*

• **Hydrogen Clouds from Comets 266/P Christensen and P/2008 Y2 (Gibbs) are Candidates for the Source of the 1977 "Wow" Signal** - a hypothesis proposing the alleged extraterrestrial "Wow" signal was a result of a neutral hydrogen envelope from a planetary body.

Prof. Paris, moreover, has served as a Planetary Science Consultant for several NASA projects, is a professional member of the Washington Academy of Science and the American Astronomical Society, and has appeared on the Science Channel, the Discovery Channel and the National Geographic Channel.

## Sky Watchers

November/December

	Jupiter and Saturn continue to be visible in the evening sky, with Venus moving between and meeting up with them (see below). Mercury transits to the morning sky on 11/11, actually doing so by passing across the Sun (also see below). Mars is in the early morning sky, rising just a couple hours before dawn.
11/11	Mercury Transits the Sun - From 7:35 a.m. to 1:04 p.m. EST, Mercury will appear to cross the Sun. Only visible through a telescope or binoculars with proper solar filters.
11/12	Full Moon at 8:36 a.m.
11/17, 18	Peak of Leonids Meteor Shower. Approximately 15 meteors/hour. A quarter Moon may keep some of the dimmer meteors from being visible.
11/24	Conjunction of Venus and Jupiter. Venus appear closest to Jupiter, 1° 24' south of the gas giant, at 11:00 a.m.
11/28	Mercury at Greatest Western Elongation – Our innermost planet will be 20° away from the Sun and its highest in the predawn sky.
12/10	Conjunction of Venus and Saturn. Venus will be 1° 49' south of Saturn at 11:42 p.m.
12/12	Full Moon at 12:14 a.m.
12/14	Peak of Geminids Meteor Shower – 120 meteors/hour at the peak. The near full Moon will interfere with viewing dimmer meteors, but there still should be plenty of brighter ones to see.

*Times in EST*



## NCA 2019-2020 Schedule of Speakers

*John Hornstein*

**Sep 14** Carrie Anderson (GSFC) **NASA Cassini's 13-year Journey in the Saturn System**

**Oct 12** Duilia Demello (CUA) **Interacting Galaxies, and Star Formation Outside Galaxies**

**Nov 09** Antonio Paris (Center for Planetary Science) **Lava Tubes on Mars: Leveraging Volcanic Features to Reduce Exposure to Radiation**

**Dec 14** Larry Nittler, (Carnegie) **A Fossil Comet Found Inside a Meteorite**

**Jan 11** Amy Simon (GSFC) **Uranus and Neptune: The Ice Giants**

**Feb 08** Tim Livengood (GSFC) **The Depletion of Mars' Atmosphere**

**Mar 14** Anat Shahar (Carnegie DTM) **A Geochemist's Perspective on Planetary Differentiation**

**Apr 11** Bethany Cobb Kung (GWU) **Shedding Light on Gravitational Waves**

**May 09** Joe Helmboldt (MRL) **Radio Astronomy Observes the Earth's Ionosphere**

**Jun 13** **Science Fair Winners, Election, Astrophoto Show & Tell**

## Index for NCA Meetings, Talks and Star Dust Issues

*Wayne H. Warren Jr., NCA*

### Abstract

An index for NCA meetings going back to the first published issue of *Star Dust* in 1943 and continuing to the end of 2019 is presented. The index contains, in addition to a log of all NCA meetings, other information such as speaker presentations, affiliations, and titles of talks. A remarks column contains miscellaneous information such as meeting locations, certain activities, and other useful comments. The index will be placed on the NCA website and updated periodically.

### Procedure and Contents

Prior to the initiation of the project to scan all issues of *Star Dust* (see *Star Dust*, 2015 February, p. 3) I completed a preliminary version of the index. Following the completion of scanning the older issues of *Star Dust* (issues after 2000 were retained in machine-readable form), an extensive review of the complete index was undertaken. Miscellaneous notes inserted during the compilation were checked and questions were resolved where possible. Comments about membership, special meeting locations and activities, and other useful information were added.

The contents of the index are grouped by year rather than by volume. An error in the assignment of volume numbers resulted in volume 47 being assigned to only one issue (Summer 1989). The index is stored on the NCA website in the form of a text file, so it can be accessed and searched with any text editor. It is hoped that the index will be updated on an annual basis. The index can be accessed at [capitalastronomers.org/StarDust\\_Archive.html](http://capitalastronomers.org/StarDust_Archive.html).

If anyone finds errors in the index, please inform the editor of *Star Dust* so that they can be corrected.

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### Please Get Star Dust Electronically

• NCA members able to receive Star Dust,  
 • the newsletter of the NCA, via e-mail as a  
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 • amount of money on the printing and  
 • postage in the production of Star Dust (the  
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 • Henry Bofinger, the NCA Secretary-  
 • Treasurer, at [hbofinger@earthlink.net](mailto:hbofinger@earthlink.net)

• **Thank you!**

• [Recent Astronomy Highlights – continued from page 2](#)

### Image of the Cosmic Web

• Although there has been indirect proof for  
 • decades of the Cosmic Web, long filaments  
 • of gas connecting the galaxies and clusters  
 • of galaxies throughout the Universe, until  
 • recently there have not been any large-scale  
 • images of the structure. But finally,  
 • astronomers using the European Space  
 • Observatory's Very Large Telescope have  
 • imaged some of the tenuous clouds of gas in  
 • between the galaxies in an area three million  
 • light years across. The galaxies and the  
 • filaments of gas between them lie about  
 • twelve billion light years away. Those  
 • filaments were lit faintly by light from the  
 • galaxies. As theory predicted, the gas from  
 • filaments is feeding into the galaxies,  
 • providing fresh material from which new  
 • stars can form. For the groundbreaking  
 • image, as well as more information, go to  
 • [www.livescience.com/cosmic-web-hydrogen-filament-photo.html](http://www.livescience.com/cosmic-web-hydrogen-filament-photo.html)

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# Occultation Notes

- D following the time denotes a disappearance, while R indicates that the event is a reappearance.
- When a power (x; actually, zoom factor) is given in the notes, the event can probably be recorded directly with a camcorder of that power with no telescope needed.
- The times are for Greenbelt, MD, and will be good to within +/-1 min. for other locations in the Washington-Baltimore metropolitan areas unless the cusp angle (CA) is less than 30 deg., in which case, it might be as much as 5 minutes different for other locations across the region.
- Some stars in Flamsteed's catalog are in the wrong constellation, according to the official IAU constellation boundaries that were established well after Flamsteed's catalog was published. In these cases, Flamsteed's constellation is in parentheses and the actual constellation is given in the notes following a /.
- Mag is the star's magnitude.
- % is the percent of the Moon's visible disk that is sunlit, followed by a + indicating that the Moon is waxing and - showing that it is waning. So 0 is new moon, 50+ is first quarter, 100+ or - is full moon, and 50- is last quarter. The Moon is crescent if % is less than 50 and is gibbous if it is more than 50.
- Cusp Angle is described more fully at the main IOTA Web site.
- Sp. is the star's spectral type (color), O,B,blue; A,F,white; G,yellow; K,orange; M,N,S,C red.
- Also in the notes, information about double stars is often given. "Close double" with no other information usually means nearly equal components with a separation less than 0.2". "mg2" or "m2" means the magnitude of the secondary component, followed by its separation in arc seconds ("), and sometimes its PA from the primary. If there is a 3rd component (for a triple star), it might be indicated with "mg3" or "m3". Double is sometime abbreviated "dbl".
- Sometimes the Axis angle (AA) is given. It is the angle measured around the Moon's disk, from the Moon's axis of rotation. It can be used with a lunar map to tell where a star will reappear relative to lunar features.

# Mid-Atlantic Occultations

David Dunham

## Asteroidal Occultations

2019	Day	EST	Star	Mag.	Asteroid	dmag	dur. s	Ap. " Location
Nov 10	Sun	0:12	SAO 56540	7.7	Kachuevskaya	8.2	1.1 2	LI?, CNJ, SPA, CAZ
Nov 10	Sun	22:50	4UC60109279	13.4	Gantrisch	2.7	3 10	NJ, NMD; DC, nVA?
Nov 12	Tue	0:01	TYC17581901	12.0	Nanjingdaxue	5.3	1 7	DE, CMD, DC, nVA
Nov 18	Mon	4:27	4UC51552017	12.8	Amherstia	1.1	3 7	WV, CMD; SMD, DC?
Nov 20	wed	0:47	4UC63837075	12.7	Hippodamia	1.3	4 7	eMD, sc-nwPA; DC?
Nov 26	Tue	4:01	4UC42908566	12.9	Geranda	2.7	4 8	sePA, NMD; DC, nVA?
Nov 26	Tue	19:31	4UC68927732	12.3	Patricia	2.4	4 6	sePA, CMD, DC, nVA
Nov 28	Thu	19:15	4U409135445	13.6	Tercidina	0.9	4 10	VA, SMD, sDE; DC?
Nov 29	Fri	0:57	TYC13330245	11.9	Burnhamia	3.4	5 5	SNJ, SPA, NMD; nVA?
Nov 29	Fri	18:18	HIP 113020	10.4	Eurybates	7.0	6 4	seVA, SMD, SNJ; DC?
Nov 29	Fri	21:04	4UC54030865	14.1	Burnhamia	1.5	5 12	sePA, WMD; DC, nVA?
Nov 30	Sat	23:07	4UC56420386	12.9	Coelestina	1.0	4 8	SNJ, NMD, SOH; nVA?
Dec 3	Tue	1:53	ZC 1054	6.7	Kugultinov	9.4	3 2	ec-nwNC, nTN, nAZ
Dec 12	Thu	2:34	TYC24110362	11.7	Leukothea	1.8	8 6	DE, MD, DC, nVA, COH
Dec 13	Fri	1:03	TYC23791843	11.3	Farinella	4.3	3 5	SDE, SMD, DC, nVA
Dec 13	Fri	21:15	PPM 71765	9.7	Wrubel	5.2	3 3	NJ, SPA, nWMD; nVA?
Dec 13	Fri	23:48	SAO 78022	8.4	Steinmetz	5.6	2 2	SVA, SWV, nKY, nMO

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

## Lunar Grazing Occultation

2019	Day	EST	Star	Mag	% alt	CA	Location, Notes
Dec 4	wed	20:22	SAO 146764	8.0	57+ 37	10S	FrtRoyal, VA; Frdrk, MD; sYork, PA

Links for interactive maps are at <http://iota.jhuapl.edu/exped.htm>

## Lunar Total Occultations

2019	Day	EST	Ph Star	Mag	% alt	CA	Sp. Notes
Nov 9	Sat	19:28	D SAO 109783	7.3	94+ 38	87S	G5 mg2 10 sep. 39", PA 104
Nov 10	Sun	1:58	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
Nov 15	Fri	2:03	R X 75822	7.5	92- 73	40N	ZC843 comp., 17s before
Nov 15	Fri	2:03	R ZC 843	7.1	92- 73	40N	F8 sep. 4", PA 276 deg.
Nov 15	Fri	4:09	R ZC 851	6.4	92- 60	59S	A1 close double??
Nov 15	Fri	20:25	R mu Gem	2.9	87- 9	67N	M3 Az 68, ZC 976 = Tejat
Nov 15	Fri	21:33	R SAO 78352	7.2	87- 21	75S	A3 mg2 9 sep .6", PA 262
Nov 15	Fri	23:46	R ZC 997	7.0	86- 46	48S	A0
Nov 16	Sat	3:21	R ZC 1014	7.0	85- 74	35N	A0
Nov 16	Sat	4:09	R SAO 78561	7.4	85- 69	50S	K2
Nov 16	Sat	23:14	R SAO 79409	7.9	78- 29	62N	K0
Nov 17	Sun	4:39	R ZC 1152	7.0	76- 72	53S	G5 close double?
Nov 17	Sun	6:51	R SAO 79615	7.6	76- 51	41S	A2 Sun -1, close double?
Nov 17	Sun	23:43	R ZC 1269*	6.9	68- 23	56N	G5
Nov 21	Thu	1:58	R ZC 1647	6.7	33- 11	69N	A2 Azimuth 87 deg.
Nov 21	Thu	4:23	R ZC 1659	6.7	32- 38	82N	K0
Nov 22	Fri	4:11	R 16 Vir	5.0	22- 23	46N	K1 ZC 1773
Nov 23	Sat	4:14	R SAO139227	7.7	13- 10	85S	F8 Az 102, triple:
			mag. 2 10, sep. .4", PA 333;				mag. 3 10 sep. 10", PA 302, time -17s
Nov 23	Sat	4:43	R SW Vir	7.1	13- 15	56S	M7 Az 107, SAO 139236
Nov 29	Fri	18:12	D ZC 2819	7.8	12+ 12	30N	K0 Azimuth 226 degrees
Nov 29	Fri	18:51	D SAO188005*	7.6	12+ 7	69N	K0 Azimuth 232 degrees
Dec 1	Sun	17:55	D ZC 3081	6.5	28+ 28	30N	K3
Dec 1	Sun	19:10	D 26 Cap	6.7	28+ 21	86S	K0 The star is ZC 3090
Dec 4	wed	17:17	D ZC 3458	6.2	56+ 38	33N	K0 Sun altitude -6 deg.
Dec 7	Sat	23:51	D SAO 110166	7.7	83+ 38	51N	K0
Dec 8	Sun	17:21	D SAO 110566	7.0	89+ 27	38S	A5 Sun altitude -7 deg.
Dec 9	Mon	0:32	D ZC 393	6.7	90+ 42	80N	K0 maybe close double??
Dec 9	Mon	2:35	D 85 Ceti	6.3	91+ 19	51S	A2 ZC401, Closedbl, in Aries
Dec 10	Tue	17:02	D ZC 610	6.1	98+ 11	51N	K5 Sun -4, Az. 77, Closedbl?
Dec 13	Fri	1:26	R eta Gem	3.5	99- 73	36S	M3 AA217, ZC946, Trmd 8", dbl
Dec 13	Fri	5:01	D mu Gem =	2.9	98- 37	-55S	M3 AA 126 deg., ZC 976
Dec 13	Fri	5:54	R Tejat	2.9	98- 27	55S	M3 Axis Angle 236 deg.
Dec 14	Sat	21:25	R mu Cancri	5.3	90- 21	53S	G2 ZC 1224

\*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](mailto:dunham@starpower.net)

## 2019-2020 Officers

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## Interstellar Comet 2I/BORISOV Observing Update

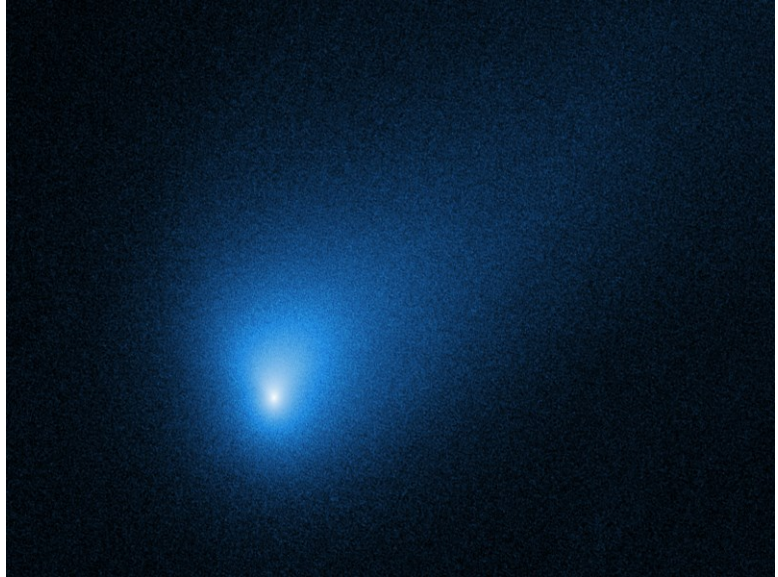


Image of 2I/Borisov, taken by the Hubble Telescope on October 12. Image credit: NASA, ESA, and D. Jewitt (UCLA)

Study continues on the second detected interstellar visitor to our solar system. Spectra of the comet show that it has a composition similar to comets from our Solar System's Oort Cloud. Unfortunately, it may not be observable with anything less than a 10-inch telescope. An animation of 2I/Borisov's trajectory can be found at [www.youtube.com/watch?v=vqMJJo3DHOfg](http://www.youtube.com/watch?v=vqMJJo3DHOfg).

## Nancy Grace Roman Article and Interview



Known as the "Mother of the Hubble Telescope", longtime NCA member Nancy Grace Roman had many other discoveries and credits which can be read about in an autobiographical article entitled "Nancy Grace Roman and the Dawn of Space Astronomy" that she wrote shortly before her death in 2018. The article was just recently published and is available at [www.annualreviews.org/doi/pdf/10.1146/annurev-astro-091918-104446](http://www.annualreviews.org/doi/pdf/10.1146/annurev-astro-091918-104446). An interview that took place in August 2018 is also available at [www.annualreviews.org/doi/10.1146/annurev-astro-061819-095801/abs/](http://www.annualreviews.org/doi/10.1146/annurev-astro-061819-095801/abs/).



*Recent Astronomy Highlights – continued from page 4*

**Study Finds Galaxies Flaring Up Quickly**

Low-ionization nuclear-emission line region (LINER) galaxies are galaxies that are brighter than ordinary galaxies, in which most of the light comes from stars, but less bright than active galaxies, in which most of the light is generated by matter feeding into the central supermassive black hole. A recent study by astronomers, using data from the Zwicky Transient Facility at the Palomar Observatory near San Diego, has found evidence of six such LINER galaxies flaring up into quasars within a matter of months. Previously it was thought that it would take thousands of years for such a change to occur. The flaring seems to be due to some new, so far unidentified, method of feeding matter into those galaxies' supermassive black holes. For more information, go to [cmns.umd.edu/news-events/features/4493](http://cmns.umd.edu/news-events/features/4493)

**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 [gfbrandenburg@yahoo.com](mailto:gfbrandenburg@yahoo.com). Additional information is at [guysmathastro.wordpress.com/](http://guysmathastro.wordpress.com/) and [home.earthlink.net/~gfbranden/GFB\\_Home\\_Page.html](http://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](http://www.astro.umd.edu/openhouse)

• **Next NCA Meeting** at the University of Maryland Observatory: **13 December** 7:30 p.m., Larry Nittler, (Carnegie), *A Fossil Comet Found Inside a Meteorite*

• **The APS Mid-Atlantic Senior Physicists Group:** "The Kepler Space Telescope" by Elisa Quintana, NASA Goddard Space Flight Center, Nov. 20th 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.?

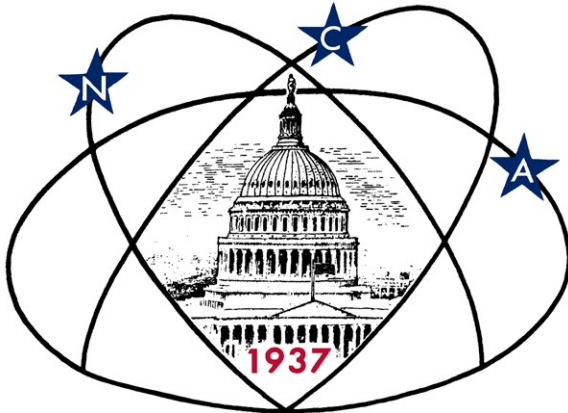
Are you interested in volunteering for: Telescope making, Exploring the Sky, Star Dust, NCA Officer, etc.?

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

National Capital Astronomers, Inc.

If undeliverable, return to  
NCA c/o Elizabeth Warner  
400 Madison St #2208  
Alexandria, VA 22314

First Class  
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*Celebrating 82 Years of Astronomy*

*Next NCA Meeting:*

**2019 November 9<sup>th</sup>**

**7:30 pm**

**@ UMD Observatory**

**Dr. Antonio Paris**

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