

**Celebrating 80 Years
of Astronomy
1937-2017**

Star Dust

Newsletter of National Capital Astronomers, Inc.

capitalastronomers.org

April 2017

Volume 75, Issue 8

Next Meeting

When: Sat. Apr. 8th, 2017

Time: 7:30 pm

Where: UMD Observatory

Speakers: Karen Yang

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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 "The Common," the restaurant in the UMD University College building located at 3501 University Blvd.

The meeting is held at the UMD Astronomy Observatory on Metzert Rd about halfway between Adelphi Rd and University Blvd.

Need a Ride?

Please contact Jay Miller, 240-401-8693, if you need a ride from the metro to dinner or to the meeting @ observatory. Please try to let him know in advance by e-mail at rigel1@starpower.net.

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.

What is the Origin of Fermi Bubbles?

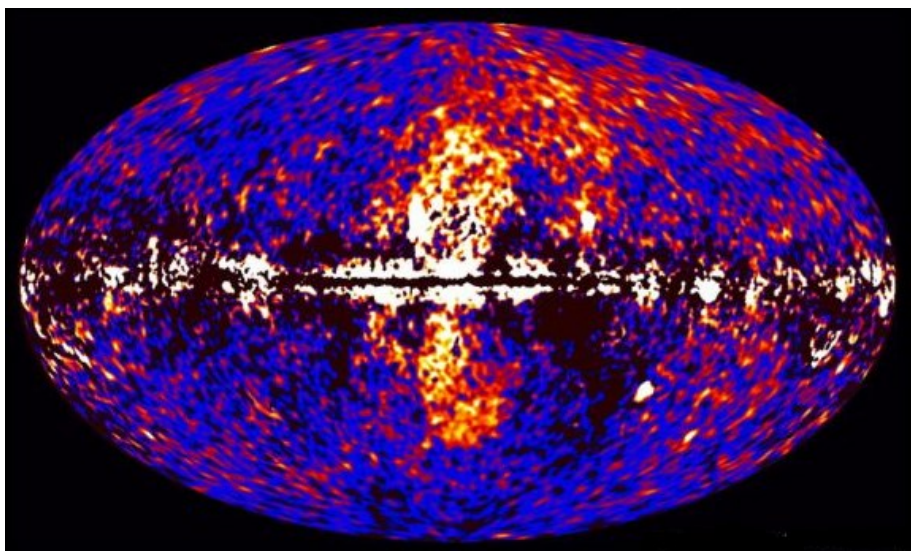
Hsiang-Yi Karen Yang

University of Maryland and NASA's Goddard Space Flight Center

Abstract: The Fermi bubbles, two giant bubbles above and below the Galactic center, are among the most important findings of the Fermi Gamma-ray Space Telescope. Because of their proximity, we can study them with unprecedented detail in multiple parts of the spectrum in order to learn about physical processes within our Milky Way Galaxy and in other galaxies.

Despite their importance, we are still uncertain about what causes the Fermi bubbles. In this talk, the unique features of the observed bubbles will be summarized as well as the spatially-resolved, multi-wavelength observed data's effect on the constraints of competing theoretical models.

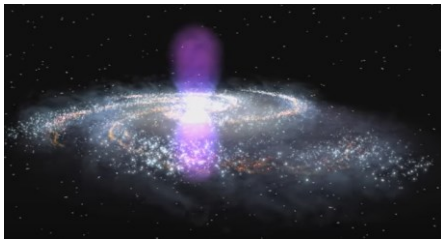
The effect of advanced numerical simulations, which have helped to unveil some of the mysteries about how the bubbles form, will also be addressed. Finally, future multi-messenger observations that will provide critical information about the physical origin of the Fermi bubbles will be discussed.



*Courtesy NASA/DOE/Fermi LAT/D. Finkbeiner et al.
Fermi data's revelation of giant gamma-ray bubbles on the sky map.*

continued on page 2

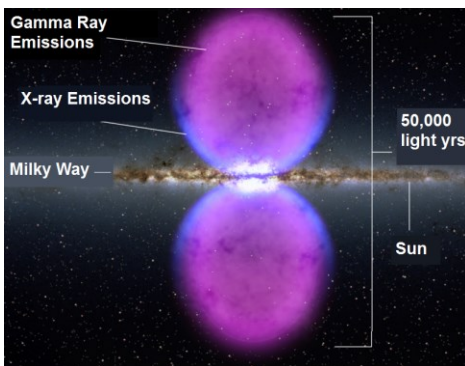
A Mystery



Courtesy NASA

NASA gives a 1 minute background of the Fermi telescope's discovery of the Milky Way "bubbles."

youtu.be/COqvzwg6Q68



Courtesy NASA/GSFC

The gamma-ray bubbles are each about 25,000 light-years (together making them roughly half of the Milky Way's diameter). They are expanding at approximately 2 million mph at the center of the Galaxy.

The bubbles' edges were first observed in X-rays (blue) by the ROSAT (ROentgen SATellite, Germany) X-ray observatory mission from the 1990s. The gamma rays detected by Fermi (purple) extend much farther from the galaxy's plane than the X-rays.

Learn more about the Fermi Telescope:

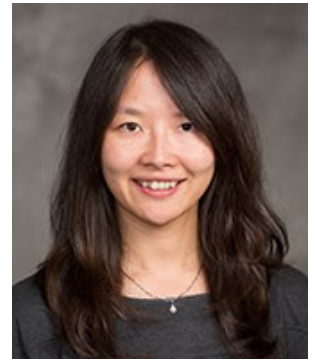


www.nasa.gov/content/fermi-gamma-ray-space-telescope

• *Fermi Bubbles – continued from page 1*

• **Biographical Sketch:**

• Dr. Yang is an Einstein & Joint Space-Science Institute (UMd and Goddard Space Flight Center) Postdoctoral Fellow in the Astronomy Department at the University of Maryland. She obtained her Ph.D. degree from University of Illinois and did postdoctoral research at University of Michigan prior to moving to Maryland.



Courtesy K. Yang

• Her research uses numerical simulations to investigate how the combined effects of shocks, radiative cooling, feedback from active galactic nuclei (AGN), magnetic fields, and cosmic rays (CRs) influence the observable properties of galaxies and galaxy clusters. She has been studying cluster cosmology, AGN accretion and feedback, the role of CRs in galaxies and galaxy clusters, and theoretical modeling of the Fermi bubbles. Her recent works have helped to reveal some of the mysteries about the origin of the Fermi bubbles, CR-driven galactic winds, and the cooling-flow problem in galaxy clusters.

**The Great
North American
Eclipse**



Aug 21st 2017

www.greatamericaneclipse.com/

Exploring the Sky Returns!



“Exploring the Sky” is an informal program that, for over 60 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!

2017 Observation Dates

2 April (8:30 pm) - Winter Constellations & Jupiter

7 May (9:00 pm) - Mars, Saturn, Antares & the Big Dipper

4 June (9:00 pm) - Vega & 3 planets

9 July (9:00 pm) - Summer Triangle, Moon & Jupiter

6 August (8:30 pm) - Andromeda & Mercury

3 September (8:00 pm) - Mars, Saturn, Antares & Vega

1 October (7:30 pm) - Summer Triangle

5 November (7:00 pm) - Pleiades & Winter Constellations

Hosted by: [National Capital Astronomers, Inc](#) and [Rock Creek Park](#)

Sky Watchers

Spring Schedule

April

| | |
|--------------|---|
| 10 | 1:01 am – Planets , N. Hemisphere. Jupiter 2° from Moon (<i>in Constellation Virgo</i>). |
| 11 | 2:08 am – Full Moon , Global. Other Moon Names: <i>Full Pink Moon</i> (for wild phlox flowers), <i>Sprouting Grass Moon</i> , <i>Egg Moon</i> , <i>Fish Moon</i> (shad swim upstream to spawn). |
| 14 | 1:51 am – Dwarf Planet , N. Hemisphere. <i>Haumea</i> in opposition to Sun. |
| 17 | Overnight – Globular Cluster , N. Hemisphere. M3/NGC 5272 (<i>in Canes Venatici Constellation</i>). Use binoculars or small telescope. |
| 18 -27 | Evening – Globe at Night , Global. Features: <i>Constellations Leo</i> (N. Hemisphere) & <i>Crux</i> (S. Hemisphere). |
| 22-23 (peak) | Overnight – Meteors , N. Hemisphere. <i>Lyrids</i> (radiant point near Vega in the <i>Lyra Constellation</i> , most meteors just before dawn). |
| 29 | International Astronomy Day , Global. |

Times EDT

Where’s Hopkinsville?

It’s in Kentucky and near the point of “greatest eclipse” (GE) for the **Great North American Eclipse of 2017**. GE, as defined by NASA, is the “instant when the axis of the Moon’s shadow cone passes closest to Earth’s center. The computation of the duration of the total (or annular) phase at this point is typically done using a smooth edge for the Moon that ignores the effects of mountains and valleys along the lunar limb.”

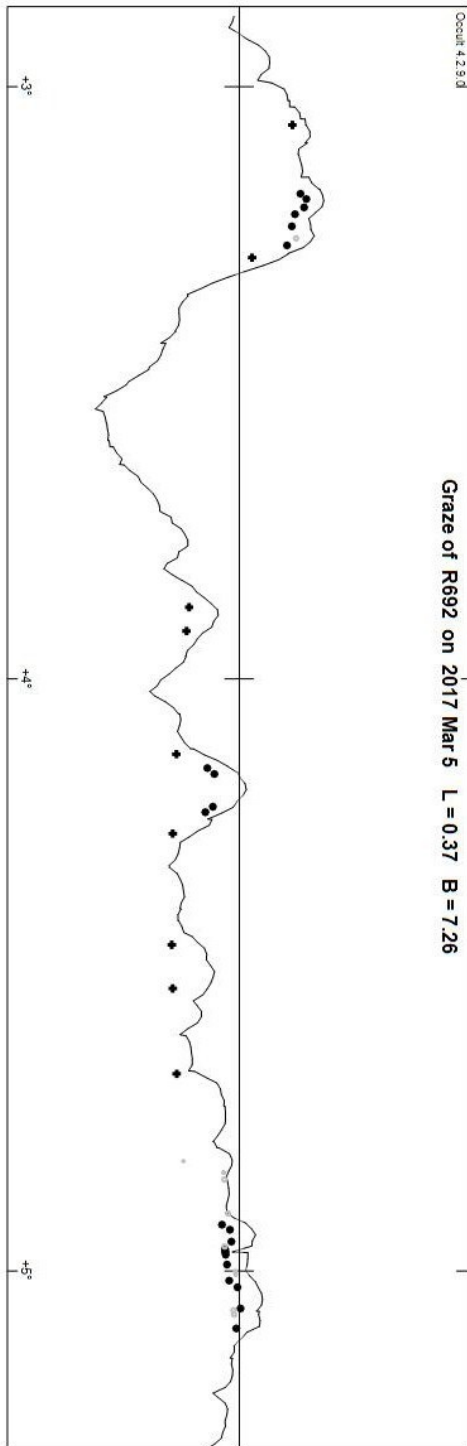
Hopkinsville is charging \$30 for a 10’ x 10’ area at the DeBow Recreation Complex, where one can set up telescopes, chairs, etc., at GPS coordinates (36.86413, -87.5076). There will be food vendors and portable & permanent restroom facilities.

During eclipse week, there will also be an Eclipse Festival and a Kentucky Bourbon *Mashoree*.

www.eclipseville.com/

Spectacular Grazing of Aldebaran

David Dunham



Courtesy David Dunham
Observations plotted with LRO's lunar profile, showing slight error to south.

The March 4th (March 5th UT) grazing occultation of Aldebaran by the 46% sunlit first quarter Moon was the best graze of 2017 for the USA. Aldebaran's large angular diameter causes gradual and partial events that can even be seen with the naked eye. The graze was visible from a narrow strip, only about 200 yards wide, at the northern limit of the region of visibility of the occultation; it extended close to the US-Canadian border from Vancouver Island to North Dakota, then extended southeast, passing over Mississauga, a suburb of Toronto (Ont.), the suburbs of Rochester, NY; Hartford, CT; and Narragansett, RI.

It was clear across the NE USA, but also the coldest night of the year, with a temperature around 12° F in the Hudson Valley (where Joan and I observed, near Saugerties, NY), with some wind. We video-recorded the graze with two 80mm refractor automated stations, while our main telescopes failed to work in the cold. We both observed the graze visually with the finder scopes on the telescopes; and, I was able to time the events by calling them out to a camcorder used for its audio recording capabilities. The results of our efforts are plotted against the Lunar Reconnaissance Orbiter profile (shown in the figure) that is similar to the one published in

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• NCA members able to receive Star Dust,
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Thank you!



continued on page 6

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 Watts angle (WA) is given; it is aligned with the Moon's rotation axis and can be used to estimate where a star will reappear relative to lunar features. The selenographic latitude is WA -270. For example, WA 305 - 310 is near Mare Crisium.

Mid-Atlantic Occultations

David Dunham

Asteroidal and Planetary Occultations

| Date | Day | EDT | Star | Mag | Asteroid | dmag | dur. s | Ap. " Location, Notes |
|--------|-----|-------|-------------|------|----------|------|--------|-----------------------|
| Apr 10 | Mon | 5:36 | SAO 184216 | 8.5 | Luisa | 4.7 | 11 | 3 seMD,seVA,eNC |
| Apr 28 | Fri | 0:56 | TYC49520483 | 10.6 | Bohlinia | 3.4 | 4 | 5 nSC,nGA,TN,sMO |
| Apr 28 | Fri | 21:44 | 4UC54523885 | 13.0 | Feronia | 1.6 | 2 | 11 WV,n&eVA;DC,MD? |
| May 3 | Wed | 1:51 | TYC61941638 | 10.7 | Loretta | 4.3 | 3 | 6 NJ,PA,neOH;nMD? |

Lunar Grazing Occultations

| Date | Day | EDT | Star | Mag | % alt | CA | Location & Remarks |
|--------|-----|-------|---------|-----|--------|-----|------------------------------|
| Apr 18 | Tue | 3:46 | ZC 2798 | 6.1 | 60- 22 | 10S | Allison,VA;Nashv,Hatteras,NC |
| May 2 | Tue | 23:17 | ZC 1336 | 5.2 | 50+ 34 | 3N | Fayettev,Burgaw,TopsailBc,NC |

*** Interactive detailed maps at www.iota.timerson.net/ ***

Total Lunar Occultations

| Date | Day | EDT | Ph Star | Mag | % alt | CA | Sp. Notes |
|--------|-----|-------|--------------|-----|---------|---------|------------------------|
| Apr 7 | Fri | 23:34 | D GY Leonis | 7.4 | 91+ 57 | 41N K0 | SAO 118578 |
| Apr 12 | Wed | 23:14 | R 13 Librae | 5.8 | 96- 21 | 42N G7 | AA 307, ZC2128 |
| Apr 14 | Fri | 0:10 | R 2245 | 6.3 | 92- 20 | 75N K0 | |
| Apr 15 | Sat | 6:46 | R 24 Scorpii | 4.9 | 85- 23 | 40N G8 | Sun alt. +2, ZC 2399 |
| Apr 16 | Sun | 5:32 | R TW Oph | 7.5 | 77- 31 | 40S * | Sun alt -11, ZC2522 |
| Apr 17 | Mon | 3:40 | R SAO 161273 | 7.6 | 69- 25 | 50N B1 | Equal dbl sep. 0.5" |
| Apr 17 | Mon | 5:05 | R X 43762 | 8.2 | 69- 31 | 55N K0 | Equal dbl sep. 0.3" |
| Apr 17 | Mon | 5:54 | R X 43805 | 8.1 | 69- 32 | 27N F0 | Sun -7,mg2 9.2 sep. 3" |
| Apr 18 | Tue | 4:05 | R SAO 162253 | 8.2 | 60- 23 | 37N A0 | |
| Apr 18 | Tue | 4:09 | R ZC 2798 * | 6.1 | 60- 23 | 39S K1 | = dbl,sep .1",NC graze |
| Apr 19 | Wed | 5:29 | R ZC 2926 | 7.6 | 50- 27 | 73S G0 | Sun altitude -11 deg. |
| Apr 19 | Wed | 5:33 | R SAO 163211 | 7.9 | 50- 28 | 33N F3 | Sun alt. -10 deg. |
| Apr 20 | Thu | 7:15 | R ZC 3064 | 5.9 | 40- 34 | 16N A2 | Sun alt. +9 deg. |
| Apr 22 | Sat | 5:30 | R SAO165215* | 8.2 | 21- 13 | 79S G0 | Sun -10, Azimuth 115 |
| Apr 22 | Sat | 5:43 | R 64Aquarii* | 6.9 | 21- 16 | 90S G0 | Sun alt. -8, ZC 3324 |
| Apr 28 | Fri | 12:23 | D Aldebaran | 0.9 | 7+ 46 | 72N K5 | Sun alt. +64, ZC 692 |
| Apr 28 | Fri | 13:34 | R =alpha Tau | 0.9 | 8+ 58 | -74S K5 | Sun alt. +65, ZC 692 |
| Apr 28 | Fri | 20:06 | D ZC 729 | 7.1 | 9+ 27 | 59N F8 | Sun alt. -3 |
| Apr 28 | Fri | 21:33 | D SAO 94187 | 7.2 | 9+ 11 | 75S F8 | Az. 283, spec. binary |
| Apr 29 | Sat | 20:49 | D SAO 94978 | 8.2 | 17+ 31 | 87S G5 | Sun -10, close double? |
| Apr 30 | Sun | 20:37 | D SAO 96277 | 7.6 | 27+ 44 | 61S A5 | Sun -8, close double? |
| Apr 30 | Sun | 20:46 | D SAO 96283 | 8.1 | 27+ 43 | 48N B9 | Sun altitude -9 deg. |
| Apr 30 | Sun | 21:02 | D X 95612 * | 9.2 | 27+ 40 | 75S | Sun altitude -12 deg. |
| Apr 30 | Sun | 21:03 | D X 95651 * | 9.7 | 27+ 36 | 78N | |
| Apr 30 | Sun | 21:14 | D SAO 96343* | 8.7 | 28+ 26 | 38N | |
| May 1 | Mon | 23:02 | D 3 Cancri | 5.6 | 39+ 27 | 69N K3 | ZC 1207 very close dbl |
| May 2 | Tue | 0:27 | D SAO 97512 | 7.4 | 39+ 11 | 42S K0 | Azimuth 283 degrees |
| May 2 | Tue | 19:09 | D 54 Cancri | 6.4 | 48+ 66 | 56S G2 | Sun alt. +9, ZC 1323 |
| May 3 | Wed | 22:42 | D 21 Leonis | 6.9 | 60+ 47 | 54S A0 | ZC 1448 |
| May 4 | Thu | 15:58 | D rho Leonis | 3.8 | 69+ 19 | 81S B1 | Sun +46, ZC 1547 |
| May 4 | Thu | 20:20 | D SAO 118418 | 7.6 | 70+ 59 | 67N F5 | Sun -4, close triple? |
| May 4 | Thu | 21:38 | D EU Leonis | 7.7 | 70+ 58 | 83N M* | ZC 1560 |
| May 7 | Sun | 2:39 | D SAO138774* | 7.7 | 88+ 21 | 62N G5 | maybe close double?? |
| May 8 | Mon | 23:54 | D ZC 1994 * | 6.6 | 97+ 43 | 44S F8 | mag2 7.3 sep 4" PA 100 |
| May 9 | Tue | 3:26 | D ZC 2008 * | 6.6 | 97+ 23 | 19N K0 | TermDist 5",spec. bin. |
| May 11 | Thu | 4:49 | R gamma Lib | 3.9 | 100- 18 | 6N K0 | AA 312, ZC 2223 |
| May 14 | Sun | 5:46 | R ZC 2611 | 7.1 | 89- 25 | 30N B9 | Sun altitude -2 deg. |
| May 15 | Mon | 3:10 | R X 44912 * | 8.3 | 83- 28 | 78N B8 | |
| May 15 | Mon | 3:47 | R SAO 161947 | 7.0 | 83- 31 | 26N K2 | |

* The star is in the Kepler 2 exoplanet search program so lightcurves of the occultation are desired to check for close stellar duplicity.

Further explanations & more information is at iota.jhuapl.edu

David Dunham, dunham@starpower.net

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Planetary Destinations

In February, Acting NASA Administrator, Robert Lightfoot, asked Bill Gerstenmaier, NASA's Associate Administrator for Human Exploration & Operations, to investigate the feasibility of adding 2 crewmembers to the currently planned, uncrewed Exploration Mission 1 (EM-1), the first test flight of the Space Launch System (SLS). This was at the request of the Trump administration, which also requested that, if a crew on EM-1 was not feasible, that EM-2, the Orion/SLS crewed mission, be pushed forward. Astronaut safety will be a key issue in the feasibility study, projected to be completed this spring. Currently, the EM-1 launch has moved from 2018 to mid-2019 due to scheduling and Orion craft issues.

In March, Astronaut Buzz Aldrin had a meeting with Vice President Mike Pence regarding the space program under the current administration. Nothing is definite, but if the National Space Council is reinstated (there's been some talk about that), then Pence would oversee it. Space.com whimsically asked its readers to specify on what NASA should focus as it tweaks the space program. You can [vote in the survey](#) as well, but here are the replies to date. Mars wins!

President Donald Trump says his administration will pursue the "mysteries of space" to make America great again. Where should he start?

The Big Bang: How did it all begin? 10% (1107 votes)

Dark Matter: It's invisible. It's out there. Let's find it! 11% (1308 votes)

Extraterrestrials: Are we alone? 23% (2578 votes)

Dark Energy: Not low energy. Dark energy. So mysterious! 17% (1902 votes)

Life on Mars: It's time to go to the Red Planet. 40% (4509 votes)

Total Votes: 11404



Aldebaran - continued from page 4

last month's Stardust for the gamma Librae graze that we recorded from six stations in Pennsylvania. The points are all south of the predicted lunar profile due to a small error in the star's proper motion in declination, amounting to 0.04"; similar shifts were found from two other northern-limit Aldebaran grazes in July and October last year. The results of several others who observed the graze are given at:

www.asteroidoccultation.com/observations/AldebaranGraze_05March2017/

Especially noteworthy are the excellent results obtained by observers from the North York (Ont.) Astronomical Society led by Andreas Gada. They recorded the graze from five locations spread across the narrow graze zone along a golf club road in Mississauga. They were able to synchronize the video and audio of all five recordings to produce a very interesting collage of the graze that you should watch at:

vimeo.com/209854850

Food Staple of the Solar System

The International Potato Center in Peru (CIP) placed a potato in a container the size of a CubeSat, which had internal conditions similar to the Martian environment. The potato sprouted; so, more studies are planned, said Julio Valdivia-Silva, a SETI research associate who works at the University of Engineering & Technology in Lima, Peru.

We've got your 'tater-cam' right here: potatoes.space/mars/

The submission deadline for the May issue of Star Dust is April 28th.

Clear Skies!

Calendar of Events

- **NCA Mirror- or Telescope-making Classes:** Tuesdays and Fridays, from 6:30 to 9:45 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 email him at gbrandenburg@yahoo.com.
- **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
- **Owens Science Center Planetarium:** "April Showers," Fri. Apr. 7, 7:30 pm; \$5/adult; \$3/students/senior/teachers /military; children under 3 free. www1.pgcps.org/howardbowens
- **National Air & Space Museum** in DC: "Yuri's Night," Tues. Apr. 11, 7 pm, \$45 (advanced tickets required). airandspace.si.edu/visit/events
- **Mid-Atlantic Senior Physicists Group:** "The Current Experimental Status of the High Tc Problem" with Rick Greene (UMD/JQI), Wed. Apr. 19, at 1 pm at the American Center for Physics (1st floor conference room). www.aps.org/units/maspg/
- **Owens Science Center Planetarium:** "Time & Space Warp," Fri. May 12, 7:30 pm; \$5/adult; \$3/students/senior/teachers /military; children under 3 free. www1.pgcps.org/howardbowens
- **Upcoming NCA Meetings** at the University of Maryland Observatory:
 - 13 May: Brian Hicks (UMD), The Challenges of Directly Imaging Earth-like Exoplanets Around Nearby Stars

National Capital Astronomers Membership Form

Name: _____ **Date:** ___/___/___

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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.?

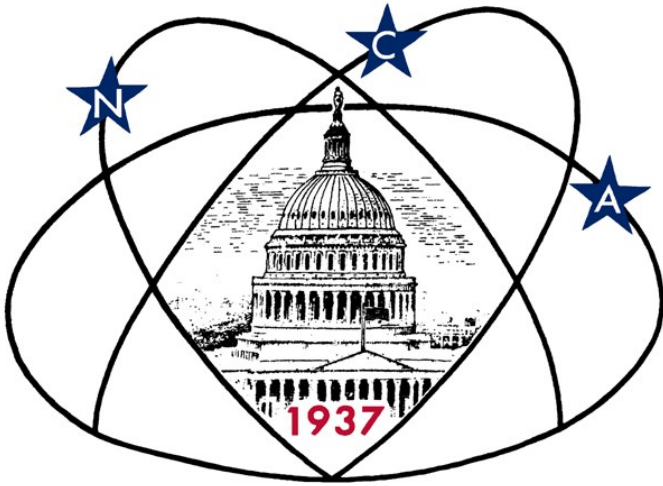
Are you interested in volunteering for: Telescope making, Exploring the Sky, Star Dust, NCA Officer, etc.?

Please mail this form with check payable to **National Capital Astronomers** to:
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First Class
Dated Material



*Celebrating 80 Years of Astronomy
1937-2017*

Next NCA Meeting:

2017 April 8th

7:30 pm

@ UMD Observatory

Dr. H-Y. Karen
Yang

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