Star Dust

Newsletter of National Capital Astronomers, Inc.
capitalastronomers.org

February 2015 ***Volume 73, Issue 6***

Next Meeting

When: Sat. Feb.14th, 2015

Time: 7:30 pm

Where: UMD Observatory

Speaker: John Keller

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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 Metzerott 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.

The Lunar Reconnaissance Orbiter and Our New View of the Moon

John W. Keller, NASA's Goddard Space Flight Center

Abstract: The Lunar Reconnaissance Orbiter (LRO) has been in orbit about the Moon for over five years. During that time, a remarkable transformation of our understanding of Earth's nearest neighbor has taken place. Prior to LRO and other recent missions, both from NASA and other space-faring nations, the Moon was thought to be inactive, with changes taking place over long time scales as a result of the solar wind and meteoric impacts. We now know that the Moon is still geologically active; that it contains sufficient water to be used as a resource for future explorers; that areas of the poles are sufficiently cold to trap volatiles over geological timescales; the trapped volatiles may provide a record of volatile delivery to the Earth. Likewise, the Moon retains the impact history of the Earth-Moon system, and provides clues to formation of the Earth and the evolution of the Solar System.

Courtesy John Keller
Lunar Reconnaissance Orbiter (LRO)

Planning for LRO began in 2004 as part of the President's Vision for Space Exploration: to extend human presence across the Solar System, starting with a human return to the Moon. This is in preparation for

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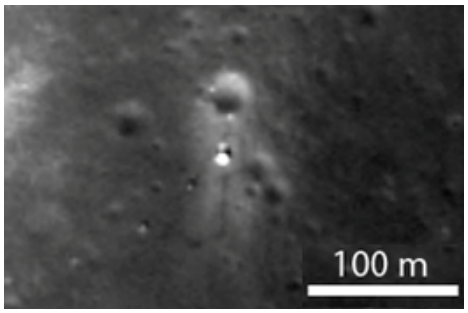
Reminder

After the meeting, everyone is invited to join us at Plato's Diner in College Park. Plato's is located at 7150 Baltimore Ave. (US Rt. 1 at Calvert Rd.), just south of the university's campus. What if it's clear and you want to stick around and observe? No problem -- just come over when you're through. This is very informal, and we fully expect people to wander in and out.

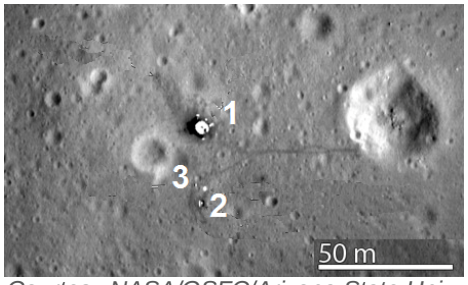
LROC's Views of the Moon

The Lunar Reconnaissance Orbiter Camera (LROC) system takes high-resolution photos of the Moon's surface. LROC captured images of Chang'e & Yutu (China) at different Sun angles from February – May 2014 in Mare Imbrium. Yutu's shadow and tracks from Chang'e are evident in following image.



Courtesy NASA/GSFC/Arizona State Univ.
Chang'e Spacecraft (center) and Yutu "the Rabbit" Rover (17 m southwest of Chang'e)

An image of the Lunar Module of Apollo 11 (US) in Mare Tranquilitatis was also captured. There's a trail (the dark line) that leads 50 meters to the east of the module where Neil Armstrong ran over to get an impromptu look inside a crater.



Courtesy NASA/GSFC/Arizona State Univ.
Some of the visible Apollo 11 gear: (1) Lunar Module, (2) Passive Seismic Experiment Package [PSEP], (3) Laser Ranging Retro-Reflector [LRRR]

LRO – continued from page 1

human exploration of Mars and other destinations. The mission was part of NASA's Exploration Systems Mission Directorate (ESMD). The ESMD goals were to produce accurate maps and high-resolution images of future landing sites, assess potential lunar resources, and characterize the radiation environment. The mission was completed after one year. Since then, LRO has transitioned from being a reconnaissance to being a science mission, under NASA's Science Mission Directorate.

Major accomplishments from the LRO mission include:

- Discovery that the Moon is shrinking, based on the analysis of small widely distributed tectonic features.
- Discovery of geologically recent volcanism on the Moon, as recent as 50 million years ago instead of over 1 billion years ago as previously thought.
- Determination of the shape and topography of the Moon more accurately than any planet (including the Earth), and use of these measurements to characterize, globally, the Moon's tidal motions.
- Discovery of numerous impacts on the Moon occurring during the LRO mission.
- Characterization of lunar pits, which are thought to be collapsed volcanic vent tubes (these are places with relatively benign environments, where outposts may be constructed in the future).
- Accurate determination of areas at the lunar poles that are in permanent shadow and relevant temperatures. These areas were found to be colder than any previously measured place in the Solar System. They can be as cold as 25 K.
- Mapping the distribution of hydrogen, thought to be in the form of water, at the lunar poles. Some of the water, but not all, is concentrated in the permanently shadowed areas.

The LRO mission has been extended for an additional two years. During the extended mission, the orbiter will continue to explore the Moon, building on prior observations from LRO and other missions. The five themes of focus will be: 1) Transport of Volatiles, 2) Contemporary Surface Change, 3) Regolith Evolution, 4) Probing the Interior from Observations of the Surface, and 5) Interactions with the Space Environment.

Biographical Sketch:

John Keller is the project scientist for the Lunar Reconnaissance Orbiter Mission. Prior to LRO he worked on instrument development on numerous missions, including WIND, POLAR, and DSCOVR. His training is in physical chemistry, with a Ph.D. from the University of Maryland. He maintains an active laboratory research effort in which he simulates the interaction of the solar wind with planetary surfaces.

"Can You See the Stars?"

February & March Viewing Campaign:

Orion

Madrid Codex

On the celestial equator, Orion can be seen by people in both the northern & southern hemispheres. Many cultures refer to Orion as "the Hunter." The Mayans, however, historically referred to Orion as *Ak'-Ek'* ("Turtle Star"); and, the glyph for this constellation is a turtle (symbolizing Earth). It's hanging from the "sky band," representing the ecliptic or path of the Sun across the sky and is carrying 3 stones on its back ("The 3 Stones of the Hearth" or *Oxib X'kub*: Rigel, Saiph & Alnitak). The hearth is the birthplace of creation (and central to a Mayan home) and the glyph indicates that Earth & sky have not been separated yet (it is a moment before creation). Inside of the hearth is the fire

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Sky Watchers

Late Winter Schedule

February

9-18	Evening – **Globe at Night**, Global. Features: *Orion*
15-6	Overnight **– Asteroids**, N. & S. Hemispheres. *Flora* (in opposition to Sun) in the Constellation Leo. *Best Washington DC viewing time is 12:30 am*
18-9	Overnight – **Deep Sky**, N. Hemisphere. *Bode's Galaxy* (M81, NGC 3031) in the Constellation Ursa Major. *Best Washington DC viewing time is midnight*
19	2:28 am – **Planets**, N. & S. Hemispheres. Moon (at perigee, only 221,826 miles from Earth)
20	8:00 pm **– Planets**, N. Hemisphere. Venus 2º south of Moon
26-7	9:17 pm-3:02 am **– Occultation/Eclipse Combo**, N. Hemisphere. Features: *Io, Ganymede & Callisto*

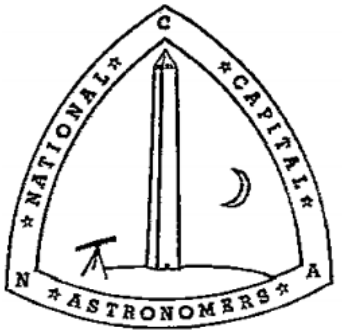
March

5	1:06 pm – **Full Moon**, Global. Other Moon Names: *Full Crow Moon*, *Full Sap Moon, Full Worm Moon (worms reappear for spring birds)*

Times EST

The NCA Star Dust Scanning Project: a 15-Year Effort

Wayne H. Warren, Jr.



Courtesy NCA

The *Star Dust* publication of the National Capital Astronomers (NCA) is quite different from most other publications in that there is only one copy of the complete run in the world. This collection is housed in the library of the U.S. Naval Observatory in Washington, DC (USNO). No private collection that even approaches completeness exists. In 1998 while looking through some old issues of *Star Dust* at the USNO, I thought about the fact that if anything happened to the USNO collection, our publication would be lost forever. Therefore, I decided to compile an index of all issues as a starter

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Star Dust Scanning Project – continued from page 3

to ensure that at least a record of all meetings and guest speakers would be preserved, with the idea that a project to scan the actual paper copies would eventually be undertaken. At the time, such a project seemed a daunting task. However, the indexing was begun and worked on over the next several years whenever I was at USNO for some other purpose such as colloquia, library usage, to visit other astronomers, etc. Through the kindness of librarians Brenda Corbin and Sally Bosken, I was able to take my laptop computer to the USNO library and work in the room that houses the *Star Dust* collection. After I had compiled most of the index, I discussed the scanning of *Star Dust* with Sally Bosken. It was clear that I couldn't very well remove the collection from the library, so the scanning would need to be done there. Sally informed me that she sometimes had students working in the library on a temporary basis and that we could discuss the project the next time that a student was available.

During the holiday season of 2007-8, Sally Bosken informed me that a student was working at the USNO library and could spend some time on the scanning project. The library has a photocopying machine that can scan and produce PDF images only. The machine can't do the *Optical Character Recognition* (OCR) work that I wanted; however, once the images are available, OCR is a fairly simple procedure. The student, Nick Kutchak, was assigned the task of scanning the early issues and was able to complete the work up through 1969. Since issues of *Star Dust* for 2000 and newer were being produced in PDF format, we needed to scan and OCR all issues between 1970 and 1999, including certain other issues that had not turned out properly during their initial scans. An announcement was made at an NCA meeting asking for volunteers to help with the work and a computer file was designed to keep track of the assignments and dates of dispersal and return. Although I had a collection of *Star Dust* issues going back to the early 1990s, I did not have issues back to 1970. Collections of issues from Leith Holloway, Bob McCracken, Jay Miller, Jerry Schnall, and Morton Schiff were donated and used to complete the hardcopy inventory destined to be scanned by the volunteers. Issues were dispensed by whole years and the resulting scans were checked and OCRed if necessary. The table on page 6 contains information about the completed scanning assignments.

The issues scanned at the USNO were not OCRed initially and that job had to be done by me. It was important to produce a finished product that can be searched by users. Automated searches work for the most part, but certain text such as handwritten material can't be found by machine. Following the scanning, checking, and any other work needed, the issues were sent to Elizabeth Warner for transfer to the NCA website, where they are available to anyone who wants them. The final set of issues will be committed to archival-quality CDs and the NCA meeting/lecture index will be transferred to the website so that it will be available to everyone.

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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 PDF file attachment, instead of hardcopy via U.S. Mail, can save NCA a considerable amount of money on the printing and postage in the production of Star Dust (the NCA's single largest expense), save some trees and have one-click access to all the embedded links in the document. If you can switch from paper to digital, please contact Henry Bofinger, the NCA Secretary-Treasurer, at hbofinger@earthlink.net

Thank you!

*UNESCO's 2015 International Year Theme is "**Light and Light-Based Technologies**." A segment of this theme has been allocated to the night sky, including star gazing, dark sky awareness issues, cosmic radiation and the centenary anniversary of the general theory of relativity.*

http://www.light2015.org/Home/CosmicLight.html

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

2015		EST/					dur.	Ap.	
Date	Day	EDT	Star	Mag	Asteroid	dmag	s	"	Location, Notes
Feb 15	Sun	5:01	SAO 160928	9.8	Nora	5.6	1	4	wKY,neTN,N.Car.
Feb 22	Sun	18:47	2UC31273915	12.5	Seeligeria	2.5	5	8	eVA,DC,MD,ePA,NY
Feb 23	Mon	22:44	SAO 79784	7.9	Taurinensis	1.4	3	2	sSC,nGA,nAL,wTN
Mar 2	Mon	4:01	4UC663052116	12.9	Luisa	1.7	8	10	sNJ,DE,PA;MD,DC?
Mar 4	Wed	4:24	2UC29480870	13.1	Olga	1.7	3	10	WV,nVA,MD,DC,NJ
		*** Dates and times above are EST, those below are EDT ***							
Mar 14	Sat	6:09	TYC57061799	11.2	Kartvelia	4.0	3	7	PA,NJ,sNE;MD?
Mar 14	Sat	21:14	TYC01060733	11.8	Gallia	1.2	3	7	w&nVA,DC,MD,NJ

Lunar Grazing Occultations

2015							
Date	Day	EST	Star	Mag	% alt	CA	Location & Remarks
Feb 15	Sun	5:43	U Sgr	6.6	17- 17	1S	Clvrtn,Qntco,VA;Nwbg,Crsfd,MD
Feb 15	Sun	5:53	SAO 161576	7.4	17- 18	1S	*Syria,sFredrksbrg,FtAPHil,VA
Feb 25	Wed	21:04	ZC 705	7.9	53+ 50	6N	Jfrsntn,Triangl,VA;Sprnghl,MD
Feb 26	Thu	19:27	ZC 829	6.8	63+ 71	3N	*Carson, Waverly &Hampton, VA
Feb 28	Sat	0:14	20 Gem	6.9	74+ 33	11N	Damascus, APL, Gambrils, MD
Feb 28	Sat	0:15	21 Gem	6.3	74+ 33	11N	Dulles,Anandal,VA;Brndywin,MD

Interactive detailed maps at http://www.iota.timerson.net/.

Total Lunar Occultations

2015		EST/							
Date	Day	EDT	Ph	Star	Mag	%	alt	CA	Sp. Notes
Feb 15	Sun	5:22	R	ZC 2680	5.6	17- 13		63N	K0 Az.128, close double?
Feb 15	Sun	5:52	R	U Sgr	6.6	17- 17		15S	G1 ZC2687,mg9 stars 66"
Feb 15	Sun	5:54	R	SAO 161570	8.1	17- 18		33S	B9
Feb 15	Sun	6:00	R	ZC 2685	6.8	17- 19		80S	K1 Sun altitude -12 deg.
Feb 15	Sun	6:04	R	SAO 161576	7.4	17- 19		17S	K0 Sun altitude -11 deg.
Feb 15	Sun	6:36	R	SAO 161582	7.0	17- 23		67S	G3 Sun altitude -5 deg.
Feb 21	Sat	17:48	D	Uranus	5.9	12+ 38		76N	Sun altitude 0 degrees
Feb 22	Sun	19:19	D	DD Piscium	8.2	21+ 35		88N	M* ZC 274
Feb 22	Sun	20:48	D	SAO 110215	8.3	22+ 18		80N	A0
Feb 23	Mon	17:45	D	38 Arietis	5.2	31+ 60		48S	A7 Sun+1,UV Ari=ZC404,dbl?
Feb 23	Mon	20:54	D	ZC 417	8.2	32+ 29		14S	F2
Feb 24	Tue	22:25	D	ZC 558	8.2	43+ 24		60S	A0
Feb 25	Wed	19:52	D	SAO 94047	7.9	53+ 61		44N	F0
Feb 26	Thu	19:27	D	SAO 94633	8.0	63+ 69		30S	F0
Feb 27	Fri	18:47	D	SAO 95645*	8.9	73+ 63		86S	F5 Sun -10, close double?
Feb 27	Fri	21:41	D	SAO 95730	7.6	73+ 61		82N	G0
Feb 27	Fri	22:00	D	SAO 95733	7.8	73+ 57		40S	K0
Feb 27	Fri	22:13	D	SAO 95745	7.6	73+ 55		78S	A2
Feb 27	Fri	23:23	D	SAO 95771	7.3	74+ 43		45S	K0 mg2 11,sep. 24", PA 6dg
Feb 27	Fri	23:38	D	SAO 95791	7.9	74+ 40		71N	K0
Feb 28	Sat	0:10	D	20 Gem	6.9	74+ 34		18N	G8 MDgraze;6.3mg 21Gem 20"
Feb 28	Sat	0:19	R	= ZC 1002	6.9	74+ 32		4N	G8 21Gem VA&sMD graze
Feb 28	Sat	1:51	D	SAO 95881	7.5	74+ 15		39S	A0 Azimuth 280 degrees
Feb 28	Sat	19:56	D	lambda Gem	3.6	81+ 65		49S	A3 ZC 1106, close double?
Mar 1	Sun	21:37	D	SAO 97618	7.6	88+ 66		23S	F5 close double?
Mar 1	Sun	21:48	D	ZC 1234	6.2	88+ 66		72S	A1 close double?
Mar 6	Fri	3:19	R	79 Leonis	5.4	100- 37		83S	G8 ZC1652,AA282,TermDist6"
Mar 7	Sat	4:47	R	ZC 1753	6.7	98- 27		67S	K0 Axis Angle 250 degrees
		*** Dates and times above are EST, those below are EDT ***							
Mar 11	Wed	3:02	R	SAO 159188	7.4	74- 33		67N	K0 Close double??
Mar 11	Wed	4:14	R	omicronLib	6.1	73- 34		76S	F2 ZC2193,mg2 10,40",PA349
Mar 14	Sat	5:37	R	ZC 2613	8.0	43- 25		90N	A3 mg2 10,37",PA207,dT-42s

**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
http://iota.jhuapl.edu/exped.htm.
David Dunham, dunham@starpower.net, phone 301-526-5590

2014-2015 Officers

Star Dust Scanning Project – continued from page 4

Acknowledgments

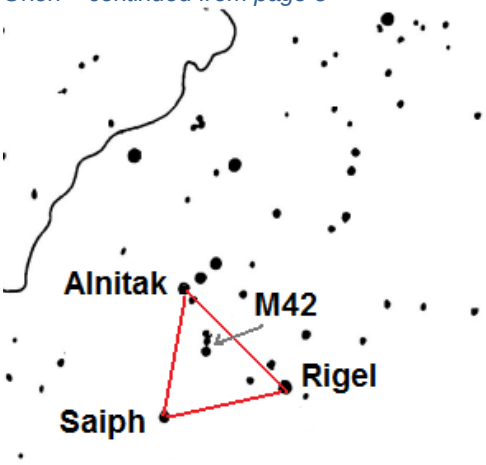
This project could not have been done without the cooperation and help of the USNO librarian, Sally Bosken, who is also an NCA member. The help of Nick Kutchak with the actual scanning work is greatly appreciated. The work of the NCA volunteers listed in the table allowed the completion of the project on a reasonable timescale, as there was far too much scanning to be done by any one person. I am grateful for their work and dedication to the project. I am also indebted to Elizabeth Warner for moving issues to the NCA website and for proofing the early PDF files. Several archival-quality CDs were donated by Alan Bromborsky for transfer of the final set of *Star Dust* issues to permanent media.

Table of Scanning Assignments and Work Completed *

Name	Year(s)	Done	#	Remark(s)
Bromborsky Alan	1992	2010	1	Complete year scanned; OCRed by WHW
Morris Joseph	1982, 1984, 1987, 1990, 1997	2009-11	5	Complete years scanned and OCRed
Peterson Norman	1995	2009	1	Complete year scanned and OCRed
Powell Paul	1972-8, 1981, 1988-90	2011-12	11	Complete years scanned and OCRed
Warner Elizabeth	1943-1955	2009-12	13	USNO PDF files checked and edited
Warren Wayne	1955-56, 1958, 1960-1, 1965	2007-8	--	Certain issues scanned and OCRed
Warren Wayne	1970-1, 1982, 1990, 1992	2008	--	Select issues scanned and OCRed
Warren Wayne	2000, 2004	2007	--	Select issues scanned and OCRed
Warren Wayne	1971, 1993-4, 1996, 1998-9	2007	6	Complete years scanned and OCRed
Weissberg Marjorie	1979-80, 1983, 1986	2010-11	4	Complete years scanned and OCRed
Wing Simon	1985	2010	1	Images only; OCRed by WHW

* Approximately 620 issues of *Star Dust* were scanned, including some issues that did not scan well on the first attempt and had to be redone. All issues were processed by OCR so that the text can be searched for strings of characters. An index of all issues was prepared, containing meeting dates, speaker identifications, topics, affiliations, and miscellaneous information. In fact, the index was started way before any scanning took place. The index will be kept up to date and put onto the NCA website periodically.

Orion – continued from page 3



The Hearth and the Flame

called *K'ak* (M42, the Orion Nebula). Many K'iche' Maya still call these stars "the hearth stones" and refer to M42 as "the smoke from the hearth."

The submission deadline for the March issue of Star Dust is Feb. 22nd.

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 gfbrandenburg@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

Phoebe Waterman Haas Public Observatory at the National Air & Space Museum, Solar viewing, Wed. – Sun., 12 – 3 pm (weather permitting).

Mid-Atlantic Senior Physicists Group: "Quantum Entanglement" with James Franson (Univ. of MD-Baltimore County), Wed. Feb. 18, at 1 pm at the American Center for Physics (1st floor conference room). http://www.aps.org/units/maspg/

Owens Science Center Planetarium: "Skywatchers of Africa," Fri. Feb. 20, 7:30 pm; $5/adult; $3/students/senior/teachers/military; children under 3 free. www1.pgcps.org/howardbowens

Smithsonian's Stars Lectures: "Tracing the Structure of the Universe with Galaxy Surveys" with Cameron McBride (Harvard-Smithsonian Center for Astrophysics), Sat. Feb. 21, 5:15 pm at the Einstein Planetarium, National Air & Space Museum. http://airandspace.si.edu/events/lectures/smithsonian-stars/. Free.

Upcoming NCA Meetings at the University of Maryland Observatory:
14 Mar: Laura Blecha (UMD), "Super Massive Black Holes in Merging Galaxies."

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.?

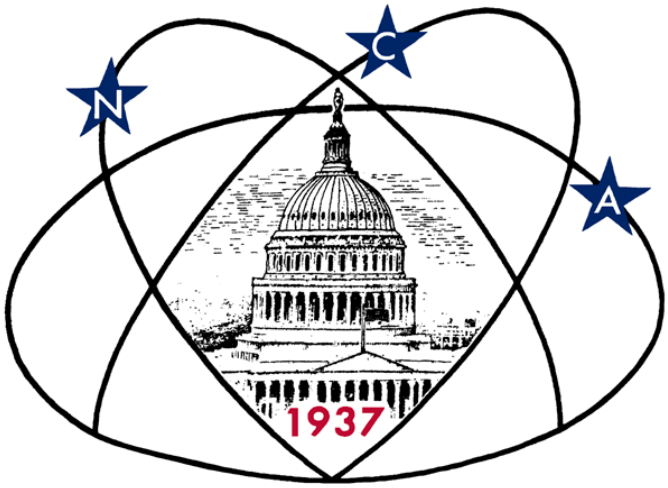
Are you interested in volunteering for: Telescope making, Exploring the Sky, Star Dust, NCA Officer, etc.?

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
Dated Material



Next NCA Meeting:

2015 February 14th
7:30 pm
@ UMD Observatory

Dr. John Keller

Inside This Issue