

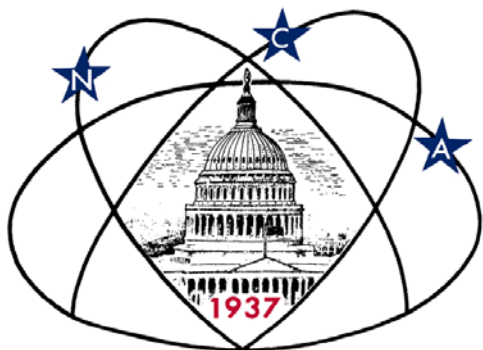
Star Dust

Newsletter of National Capital Astronomers, Inc.

capitlastronomers.org

May 2014

Volume 72, Issue 9



Next Meeting

When: Sat. May. 10th, 2014

Time: 7:30 pm

Where: UMD Observatory

Speaker: Craig Markwardt

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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

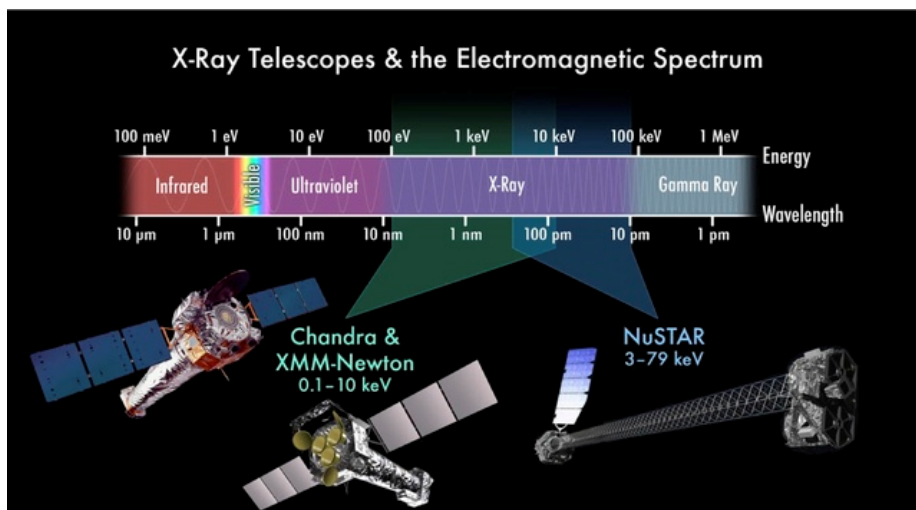
Following the meeting, members and guests are welcome to tour through the Observatory. Weather-permitting, several of the telescopes will also be set up for viewing.

Multi-layered Metallic Sandwiches and Nuclear Titanium:

How the NuSTAR X-ray Observatory is Peering Deeper into the X-ray Sky

Craig B. Markwardt, NASA's Goddard Space Flight Center

Abstract: The X-ray sky reveals nature's energetic processes, including the accretion of matter onto super-dense black holes & neutron stars as well as the emissions from plasmas at temperatures in excess of one million degrees Celsius. If we had X-ray eyes, the sky would be radically different from the one with which we are familiar! The Nuclear Spectroscopic Telescope Array (NuSTAR) X-ray observatory, led by the California Institute of Technology, but with input from scientists around the world, is the first to focus astrophysical X-rays above 10 kiloelectron volts (keV).



Courtesy NASA/JPL-Caltech

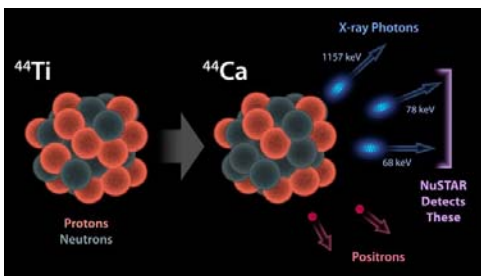
NuSTAR's innovative multilayer optics allow astronomers to take a picture of the "hard" X-ray sky with unprecedented detail. Thanks to NuSTAR, we now know precisely how heavy elements like Titanium,

continued on page 2

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.

Stellar Titanium & X-Rays



Courtesy NASA/JPL-Caltech

Radioactive titanium-44 is created when a star goes supernova. As the unstable titanium decays into another material, calcium-44, it ejects positrons and X-ray photons, the latter of which can be detected by NuSTAR (thereby documenting supernova remnant radioactivity).

NuSTAR Mast Deployment



Courtesy NASA/JPL-Caltech
http://youtu.be/NxweW3mt_mc

Deployed in orbit, the mast is 10 meters long and located between NuSTAR's dual optical system (foreground) and the craft & detectors (background w/ solar panel)

• *Metallic Sandwiches and Nuclear Titanium – continued from page 1*

• which is produced in the core of an exploding star, are dispersed throughout the Galaxy. NuSTAR was also fortunate enough to capture a spinning pulsar in orbit around the black hole at the center of the Milky Way. Dr. Markwardt will discuss the previously-mentioned science topics and some of the engineering challenges that NuSTAR overcame in order to become a successful orbiting observatory.

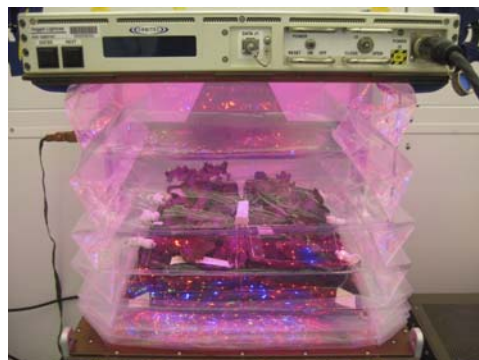
Biographical Sketch:

• Dr. Craig Markwardt has been a research scientist at NASA's Goddard Space Flight Center since 1997 and NuSTAR's mission scientist since 2013. Dr. Markwardt studies X-ray emissions from galactic black holes and neutron stars, and also performs an all-sky survey of active galactic nuclei (AGN) in the nearby Universe. Additionally, Dr. Markwardt is a member of instrument teams for several observatories, including the RXTE Proportional Counter Array and the Swift Burst Alert Telescope. He was also a developer on the GEMS X-ray polarimetry project.



“Veg-01” and the “Veggie”

• On April 20th, NASA dispatched a mini-farm experiment (Veg-01) to the International Space Station (ISS). It was delivered to the ISS by the Space X Dragon cargo craft on its 3rd commercial resupply mission, which also included the component in which the experiment will be conducted: an expandable plant facility also called the “Veggie.”



Courtesy NASA/Bryan Onate
The “Veggie”

The Veggie is 11.5 x 14.5 inches, the largest facility for plant growth in space, yet still expandable 18 more inches. It is equipped with blue, red & green, flat-panel LEDs (the plants like red & blue light for photosynthesis). The research plan is to observe how the Veggie performs as well as how the plants of Veg-01 grow. The plant chosen for this study was *Latuca sativa*

continued on page 3

Exploring the Sky!

“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!

For more information, check:

National Capital Astronomers, Inc:
<http://capitlastronomers.org/>

Rock Creek Park:
<http://www.nps.gov/rocr/planyourvisit/expsky.htm>

The Story of Lettuce in Space (in 4 minutes)




Courtesy NASA ScienceCasts

<http://youtu.be/YFdwv9yrxD0>

Sky Watchers

Spring Schedule

May

3	9:00 pm - Exploring the Sky , Local. Features: <i>Saturn Rising</i>
10	 Astronomy Day! Local & National. 2:00 pm – Planet , N. Hemisphere. Saturn in Opposition to Sun (rings at 22° tilt, great viewing all night!)
14	3:16 pm – Full Moon , Global. Other Moon Names: <i>Full Flower Moon (for the abundant seasonal flowers), Full Corn-Planting Moon, Milk Moon</i> 8:00 am – Planets , N. Hemisphere. Saturn 6° north of Moon
15	9:00 am – Planets , N. Hemisphere. Uranus 1.3° north of Venus
24	3 – 4:00 am – New Meteor Shower , N. Hemisphere. Debris from Comet 209P/Linear (Constellation Camelopardalis – near the nose of Ursa Major)
25	Dawn - Planets , N. Hemisphere. Moonrise above Venus Dusk (sunset + 30 min) – Planet , N. Hemisphere. Mercury (W. Sky: Procyon & Jupiter on the left & Capella on the right)

Times EDT

Veg-01 and the Veggie – continued from page 2

(Outredgeous red romaine lettuce), a hearty variety that can be eaten as baby greens or grown into a full head of romaine. Rooting or space “pillows” (filled with dirt & slow-release fertilizer) are being used to grow the plants in orbit.

Another result sought by Veg-01 is the effect of space on the microbe composition present on the plants and in the Veggie. Empirical analyses will take place on Earth after plant harvesting is performed in space and the lettuce is frozen to -80°C or less for shipment. Swabs from the Veggie as well as rooting pillows and water samples will also be sent back to Earth for analyses.



Courtesy NASA/Gioia Massa

Outredgeous Red Romaine Lettuce (on a space pillow)

continued on page 4

Veg-01 and the Veggie – continued from page 3

Other hopeful results from the mini-farm experiment? Fresh food for space-bound researchers & astronauts, psychological mood enhancement; and, maybe, food production modifications on Earth.



Courtesy NASA/Gioia Massa

Lettuce (in their favorite light wavelengths for feeding) with the bellows lowered

Veg-01 is scheduled to last until September 2014 (Harvest time); but, the first lettuce samples should be ready in late May. However, since the ISS team can't eat these early clippings (since safety will not have been established yet), you'll have to pick up the 'lettuce slack' for humanity! Romaine lettuce is actually 17% protein and 1 head has calcium (21% RDA), omega-3 fatty acids (the good fats, 44% RDA), vitamin C (167% RDA), B-vitamin complex ("B is for Brain," 38%-213% RDA), vitamins A & K (antioxidant & anti-cancer, 1800% & 535% RDA, respectively) and 16% of your daily water needs.

Here's a list of ingredients for an easy spring recipe:

- Romaine lettuce
- Corn
- Peas
- Cranberries
- Chickpeas
- Bell peppers
- Feta cheese (or avocado)
- Light vinaigrette (or high quality olive oil & lemon juice)

Mix and enjoy!



Chef Erik Anderson's Romaine Salad

<http://youtu.be/HWRC5OWiyBg>

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• Editor: CA Brooks

• Editorial Advisors:

- Michael Chesnes
- John D. Gaffey, Jr.
- Alex Klein
- Jeffrey Norman
- Elizabeth Warner
- Wayne Warren
- Marjorie Weissberg
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Thank you!

***From Grasshopper to Falcon:
 Falcon 9 Reusable Rocket (F9R)
 Test Launch***



*Courtesy Space X
 (a 250-meter hover)*

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

2014						dur.		Ap.	
Date	Day	EDT	Star	mag.	Asteroid	dmag	s	"	Location
Jun 7	Sat	0: 53	2UC23499435	11.7	Armi da	2.2	12	7	DE, MD, DC, nVA
Jun 8	Sun	23: 55	TYC73790071	11.7	Josephi na	1.9	8	7	NC, sVA, WV; cVA?

Lunar Grazing Occultations

2014									
Date	Day	EDT	Star	Mag	% alt	CA	Location	&	Remarks
May 6	Tue	0: 34	ZC 1256	7.3	41+	8	3N	*	sCl pepr, sFrdrksbg, &PtRoyl, VA
May 31	Sat	20: 48	SAO 96566	7.8	10+	20	OS	*	sEaston, MD; Seaford, DE; Sun -5

Interactive detailed maps at <http://www.timerson.net/IOTA/>
*, no expedition planned from DC area

Total Lunar Occultations

2014												
Date	Day	EDT	Ph Star	Mag	% alt	CA	Sp.	Notes				
May 9	Fri	20: 00	D ZC 1649	6.1	77+	47	68N	K3	Sun alt.	0		
May 10	Sat	0: 33	D SAO 138220	7.1	78+	31	20S	A0				
May 10	Sat	0: 54	D SAO 138233	7.0	78+	28	75S	K4				
May 12	Mon	1: 44	D ZC 1886	5.6	92+	28	82N	K3	close double??			
May 15	Thu	22: 12	R ZC 2408	6.6	98-	8	43N	K5	Az. 123,	AA 307 deg.		
May 16	Fri	4: 48	R ZC 2436	6.6	97-	23	69N	B7	AA 282,	mg2 8, 4", PA232		
May 17	Sat	0: 52	R ZC 2571	6.8	92-	22	44N	A9				
May 17	Sat	1: 58	R SAO 160891	7.2	92-	28	57S	G8				
May 18	Sun	1: 03	R ZC 2745	6.8	85-	17	85N	K1				
May 18	Sun	2: 38	R ZC 2755	6.6	84-	28	67S	G8				
May 18	Sun	4: 34	R ZC 2764	6.4	84-	33	73S	G5	close double??			
May 19	Mon	3: 35	R SAO 163146	7.7	75-	30	28N	A2				
May 19	Mon	5: 08	R SAO 163173	7.2	74-	35	50N	F5	Sun altitude -8 deg.			
May 20	Tue	1: 42	R ZC 3051	6.9	64-	9	85S	K4	Azimuth 115 degrees			
May 21	Wed	2: 49	R ZC 3199	6.5	53-	14	62N	K0	Azimuth 114 deg.			
May 22	Thu	4: 24	R SAO 146314	7.6	41-	25	33N	G5	close double??			
May 22	Thu	4: 24	R ZC 3344	7.3	41-	25	33N	G5	mg2 8 2.4" PA 149 deg.			
May 22	Thu	4: 37	R ZC 3348	8.2	40-	27	54S	K0	mg2 11 sp .4", PA 1 deg.			
May 30	Fri	21: 05	D SAO 95554	7.6	5+	9	68N	G7	Sun -7, Az. 286 deg.			
May 30	Fri	21: 39	D ZC 970	6.3	5+	3	51S	G9	Azimuth 290 deg.			
May 31	Sat	20: 48	G SAO 96566	7.8	10+	20	OS	F8	Sun alt. -5 deg.			
Jun 2	Mon	20: 14	D 50 Cancri	5.9	24+	41	82S	A1	Sun alt. +1 dg, ZC 1318			
Jun 2	Mon	23: 11	D SAO 98178	7.8	25+	8	37N	K0	Az. 279, close double??			
Jun 7	Sat	0: 57	D ZC 1731	7.5	63+	11	73S	M*	Azimuth 256 deg.			
Jun 9	Mon	20: 53	D SAO 158546	7.3	88+	33	74S	K0	Sun altitude -4 deg.			
Jun 11	Wed	2: 15	D GZ Librae	6.7	95+	20	85S	A*	ZC 2211, close double?			
Jun 14	Sat	2: 02	R U Sgr	6.6	98-	32	44N	G1	AA301, ZC2687, TmD16", db?			
Jun 14	Sat	3: 59	R ZC 2699	6.8	98-	27	76S	M3	AA 241 deg.			
Jun 14	Sat	4: 52	R SAO 161665	7.0	98-	21	70S	G8	Sun -9, AA 235			
Jun 15	Sun	4: 45	R ZC 2870	7.4	93-	30	41N	F2	Sun -10, AA311, mg2 7 10"			
Jun 15	Sun	4: 45	R ZC 2871	7.3	93-	30	41N	A7	compan., R= ZC2870 +14s			

Explanations & more information is at <http://iota.jhuapl.edu/exped.htm>.
David Dunham, dunham@starpower.net, phone 301-526-5590

Russian Rockets & Space X

- Space X successfully stopped the purchase of rocket engines by the US Air Force from United Launch Alliance via a federally-issued injunction on April 30th. United Launch reportedly acquires its RD-180 engines from NPO Energomash (near Moscow). One of the arguments posed by Space X was that the head of the Russian space program, Deputy Prime Minister Dmitry Rogozin, is on a list of sanction-targeted officials due to the events in the Ukraine. Since Russia's Soyuz crafts currently carry astronauts to & from the ISS, DPM Rogozin reportedly (via NBC News) suggested via his twitter account that the USA could "bring their astronauts to the ISS using a trampoline."



2013-2014 Officers

President:

Alexander Klein
alexander_klein@virtualhomespaces.com
 301-233-8406 (c)

Vice-President:

John Hornstein
jshgwave@yahoo.com
 301-593-1095 (h)

Secretary-Treasurer:

Henry Bofinger
hbofinger@earthlink.net
 202-675-1075

Asst. Secretary-Treasurer:

Jeffrey B. Norman
jeffreynorman@comcast.net

Trustees:

- Andrew Seacord (2014)
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Appointed Officers and Committee Heads:

Exploring the Sky
 Joseph C. Morris
j.c.morris@verizon.net

Telescope Making

Guy Brandenburg
gfbandenburg@yahoo.com
 202-635-1860

NCA Webmaster

Harold Williams
Harold.Williams@montgomerycollege.edu
 240-567-1463 (w)
 301-565-3709 (h)

Meeting Facilities

Jay H. Miller
rigel1@starpower.net
 240-401-8693

Star Dust Editor

CA Brooks
NCAStardust@gmail.com
 301-860-3266

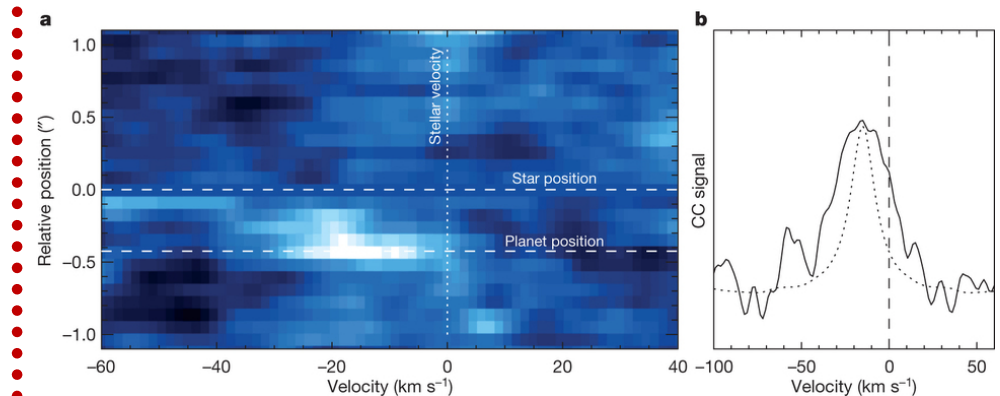
Fast Spin



Beta Pictoris b

Beta Pictoris b is a giant, gas exoplanet orbiting the star, Beta Pictoris, in the southern constellation Pictor. Seven times the mass of Jupiter, the planet was discovered in 2008 and is 63 light years away. Whereas the Earth's age is over 4 billion years, this planet is projected to be only 20 million years old. Its distance from its sun is about 8 times the distance of Earth to her Sun and its solar year is projected to be between 17 and 21 Earth years.

The Very Large Array in Chile made it possible to calculate the planet's speed & velocity from differential spectrum shifts on the surface of the planet. Through differences in carbon monoxide absorption, scientists have been able to conclude that the planet has a circular orbit and has varying velocities indicative of high axial rotation. One of the researchers, Dr. Snellen, stated that wavelength emissions from the planet were precisely measured to "1 part in 100,000."



a CO + H₂O cross-correlation signal (linear color scale) as function of the position along the slit (orientated 30° east of north), after the stellar contribution was removed. The x-axis shows the radial velocity with respect to the system velocity ($+20 \pm 0.7 \text{ km s}^{-1}$) of the star. The y-axis denotes the relative position with respect to the star β Pictoris with the planet located 0.4" below, both indicated by horizontal dashed lines. A broad signal, at a signal-to-noise ratio of 6.4 is visible, blue-shifted by $15.4 \pm 1.7 \text{ km s}^{-1}$ (1σ) with respect to the parent star. **b** Cross-correlation (CC) signal at the planet position. The dotted curve shows the arbitrarily scaled auto-correlation function of the $\lambda/\Delta\lambda = 100,000$ (resolving power) model template, indicating the CC signal expected from a non-rotating planet.

The planet's equator spins at 56,000 mph (vs. Earth at 1,040 mph or Jupiter at 29,000 mph). A day on Beta Pictoris b is 8 Earth hours long as the planet spins 50 times faster than Earth. Scientists believe that the planet may cool and reduce in size as it ages over a million-year process. These findings may support the hypothesis that larger planets spin faster than smaller ones.

Source:

Ignas A. G. Snellen, Bernhard R. Brandl, Remco J. de Kok, Matteo Brogi, Jayne Birkby & Henriette Schwarz. [Fast spin of the young extrasolar planet \$\beta\$ Pictoris b.](#) *Nature* **509**, 63–65 (01 May 2014) doi:10.1038/nature13253

Best Selfie



Courtesy Rick Mastracchio/NASA/AFP-Getty Images

NASA's Rick Mastracchio strikes a pose while installing a backup computer on the ISS (June 3, 1965 was the 1st US spacewalk by Ed White, Gemini 4)

The submission deadline for the last issue in this volume of Star Dust is June 1st – be a part of NCA history!

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).
- Owens Science Center Planetarium: "Night of the Fireflies," Fri. May 9, at 7:30 pm; \$5/adult; \$3/students/senior/teachers/military; children under 3 free. Doors open 7:15 for pre-show activities. www1.pgcps.org/howardbowens
- Exploring Space Lectures: "How Skylab Changed Solar Astronomy into Heliophysics," with Richard Fisher (Scientist Emeritus, NASA/GSFC), Tues. May 13, 8 - 9 pm at Lockheed Martin IMAX Theater at the National Air & Space Museum (live webcast will be available)
- Mid-Atlantic Senior Physicists Group: "Helioseismology and Asteroseismology: Oscillations from Space" with W. Dean Pesnell (NASA/GSFC), Wed. May 28, at 1 pm at the American Center for Physics (1st floor conference room). <http://www.aps.org/units/maspg/>
- Upcoming NCA Meetings at the University of Maryland Observatory:
 - 10 May: Craig Markwardt (GSFC), *What NuSTAR Has Found So Far*
 - 14 June: Election; Science Fair Winners

Clear Skies!

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.?

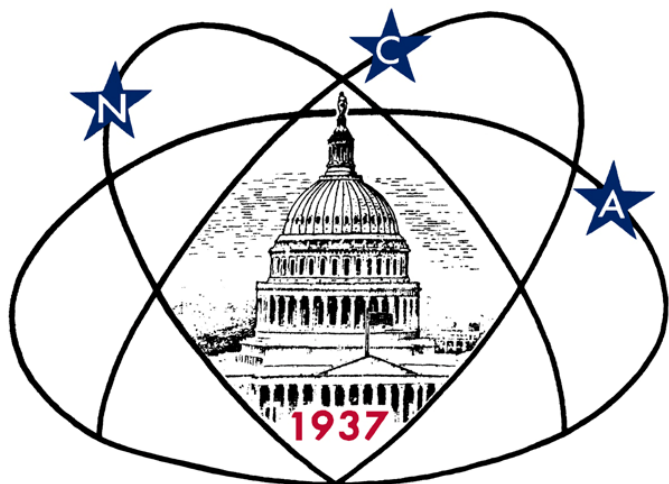
Are you interested in volunteering for: Telescope making, Exploring the Sky, Star Dust, NCA Officer, etc.?

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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Next NCA Meeting:

2014 May 10th

7:30 pm

@ UMD Observatory

Dr. Craig B.

Markwardt

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