Star Dust

Newsletter of National Capital Astronomers, Inc.
capitalastronomers.org

April 2016 ***Volume 74, Issue 8***

Next Meeting

When: Sat. Apr 9th, 2016
Time: 7:30 pm
Where: UMD Observatory
Speakers: Richard Walker

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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 Origin of the Moon: New Insights Accompany New Controversies

Richard J. Walker,
University of Maryland – College Park

Abstract: The origin of the Moon and how its formation relates to the accretionary history of the Earth remains a highly debated topic. Controversy continues to swirl around two major questions:

How did the Moon form? When did the Moon form?

The creation of the Moon as a result of a giant impact between the proto-Earth and a large body remains the current and favored paradigm. Yet the Earth and Moon appear to be genetically identical, evidenced by isotopic similarities in elements such as oxygen and tungsten. This is troubling for most giant impact models because they predict the Earth and Moon should be made of genetically distinct materials. The age of the Moon is similarly problematic. Most evidence points to its formation more than 50 million years into Solar System history. Recent, highly precise age determinations of the Moon's crust, however, suggest either that the Moon may have formed much later, in conflict with dynamical models of the early Solar System, or question that the crust formed by plagioclase flotation in a magma ocean.

Courtesy NASA/JPL-Caltech
Visualization of Earth-Planetesimal collision in Giant Impact Theory of Moon Formation

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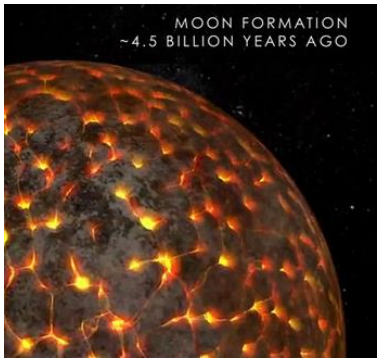
Reminder

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.

Moon Formation Theories

Fission Theory
Fission was proposed by Astronomer George (son of Charles) Darwin in *The Tides and Kindred Phenomena in the Solar System* (1898 CE). The theory hypothesizes that the Moon was part of the Earth during the Solar System's early days, but the young planet's fast spin cast off some of its mantle (from what is currently the location of the Pacific Ocean) and hurled it into space, just not far enough to escape Earth's gravitational field. Lunar rocks retrieved by astronauts and the physics of such a cleaving do not support Darwin's theory.

Capture Theory
The Moon's origin was from some other part of the Milky Way; but, it wandered past Earth and was captured by the gravitational field. Current prevailing views contradicting this theory, however, are that a Moon-sized object would have been torn apart by or broken free of Earth's gravitational field. Also, the Earth & Moon isotope compositions do not support a different origin location.



Courtesy NASA
The Moon's early, molten stage

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Moon Origin – continued from page 1

Biographical Sketch:
Richard J. Walker is a professor and current Chair of the Department of Geology at the University of Maryland. He utilizes radiogenic isotopes and trace elements to conduct research in several areas of geo- and cosmo-chemistry, including the chemical evolution of Earth's mantle, the formation and crystallization histories of early Solar System planetesimals, and the accretional & differentiation histories of Earth, Moon and Mars. The research his group conducts mainly utilizes concentration and high-precision isotopic measurements of siderophile (iron-loving) elements. These elements are of special interest in studies of planetary accretion because they are concentrated by planetary core formation.

Professor Walker received a B.S. in geology from the College of William and Mary. He received his M.S. and Ph.D. degrees in geology from the State University of New York at Stony Brook in 1981 and 1984, respectively. Dr. Walker also did postdoctoral work at the U.S. National Bureau of Standards, the Carnegie Institution of Washington's Department of Terrestrial Magnetism, and the U. S. Geological Survey. He became a member of the faculty of the University of Maryland in 1990. In addition, Dr. Walker was the 1990 recipient of the Clarke Medal of the Geochemical Society and is currently a fellow of the American Geophysical Union, the European Association for Geochemistry and the Geochemical Society.

Courtesy NASA/Johnson Space Center

KREEP rocks are hypothesized to have formed during the Moon's early, molten stage. The KREEP-rich lunar sample (above) retrieved by Apollo 12 is about 5 cm long and weighs 82 grams. "*KREEP*" rocks acquired their name because they are rich in potassium (atomic symbol = **K**), rare Earth elements ("**REE**") and phosphorus (atomic symbol = **P**). During the investigation of the Giant Impact Theory, the Moon's tungsten (atomic symbol = W) isotope composition was investigated. Therefore, KREEP rocks (from Apollo 16) were studied because of their high levels of tungsten.

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Moon Formation – continued from page 2

Condensation (Co-accretion) Theory
In this theory, the Moon and Earth were created simultaneously via the nebula from which the Solar System formed. However, as evidenced by the Moon's lighter density, it does not have an iron core like Earth does (and one would expect this similarity if the 2 bodies were created at the same time and in the same space).

Giant Impact (Ejected Ring) Theory
The currently accepted theory hypothesizes that a nearby *planetesimal* (small Mars-size planet) collided with Earth 4.5 billion years ago, ejecting super-heated rock debris from the surface of both bodies into Earth's orbit, which eventually formed the Moon. According to scientists at NASA's Astrophysics Science Division, the impact of the 2 bodies released energy that was 100 million times greater than the energy released by the impact thought to have wiped out the dinosaurs; so, the planetesimal (which some refer to as *Theia*) was utterly destroyed. This theory could also explain the Moon's super-heated rock composition as compared to Earth's.

The Great North American Eclipse

Aug 21st 2017

www.greatamericaneclipse.com/

Sky Watchers

Spring Schedule

April

18	1:00 am – **Planets**, N. Hemisphere. Jupiter 2º north of Moon.
22 (peak)	Overnight – **Meteors**, N. Hemisphere. *Lyrids*.
29-30	Evening – **Globe at Night**, Global. Features: *Constellations Leo* (N. Hemisphere) and *Crux* (S. Hemisphere).

Times EDT

May

1-8	Evening – **Globe at Night**, Global. Features: *Constellations Leo* (N. Hemisphere) and *Crux* (S. Hemisphere).
7	9:00 pm – **Exploring the Sky**, Features: *Mars, Saturn, Antares & the Big Dipper.*
8	7 am – **Planets**, N. Hemisphere. Venus 5º north of Moon.

Times EDT

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!

2016 Observation Dates for Spring and Summer

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

Hosted by: National Capital Astronomers, Inc and Rock Creek Park

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CubeSats

Courtesy NASA

CubeSats are playing an increasingly larger role in exploration, technology demonstrations, scientific research and educational investigations at NASA. They are a class of research spacecraft called nanosatellites. The cube-shaped satellites measure about four inches on each side, have a volume of about one quart and weigh less than three pounds each. These miniature satellites provide a low-cost platform for NASA missions, including planetary space exploration; Earth observation; fundamental Earth and space science; and technology demonstrations such as cutting-edge laser communications, energy storage, in-space propulsion and autonomous movement capabilities. They also allow educators an inexpensive means to engage students in all phases of satellite development, operation and exploitation through real-world, hands-on research and development experience on NASA-funded, ride-share launch opportunities.

The CubeSat Launch Initiative (CSLI) enables the launch of CubeSat projects designed, built and operated by students, teachers and faculty. CSLI provides access to space for CubeSats developed by the NASA centers and programs, educational institutions and nonprofit organizations, enabling all these CubeSat developers access to a low-cost pathway to conduct research in the areas of science, exploration, technology development, education or operations. ELaNa Missions, managed by the Launch Services Program at NASA's Kennedy Space in Florida, provide a deployment opportunity or ride-share launch to space for the CubeSats selected through CSLI. ELaNa Mission managers and their teams reach students at schools and colleges across the United States, providing spaceflight education through the preparation of payloads – licensing, integration and testing – that are flown in space. Since its inception in 2010, the initiative has selected more than 100 CubeSats and launched 43 CubeSats from primarily educational and government institutions around the United States. These miniature satellites were chosen from a prioritized queue established through a short-listing process from responses to public announcements on NASA's CubeSat Launch Initiative.

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Thank you!

ALCon 2016 Washington DC

August 10 – 13, 2016

The Annual Astronomical League Convention includes space exploration & astronomy talks, special tours, an awards banquet, "Star-B-Que" and more!

Hosted by NOVAC and the Astronomical League

Alcon2016.astroleague.org

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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 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

2016

Date	Day	EDT	Star	Mag	Asteroid	dmag	dur. s	Ap. "	Location, Notes
Apr 8	Fri	23:58	4U489053472	14.9	Pasiphae*	5.1	5	12	neNC,sSC,sWV
Apr 27	Wed	3:03	4U427055675	13.0	Dufour	2.8	4	10	NJ,PA,nOH;MD?
Apr 29	Fri	1:06	4U474050012	12.7	Nerthus	2.1	6	10	neNC,VA,WV,OH
Apr 30	Sat	20:45	SAO 116557	8.9	Alauda	4.4	13	3	eSC,sNC,Sun -9

* *Distant 8th satellite of Jupiter (retrograde orbit)*

Lunar Grazing Occultations

2016

Date	Day	EDT	Star	Mag	% alt	CA	Location & Remarks
Apr 10	Sun	19:22	Aldebaran	0.9	16+ 29	-1N	#Good Enough BigPond,Labrador
Apr 14	Thu	20:51	SAO 97835	8.5	59+ 64	4N	Woodbine,ElicottC,sArbutus,MD
May 9	Mon	21:30	SAO 95469	8.0	14+ 19	0N	nConowingoDam & North East,MD
May 12	Thu	21:45	SAO 98343*	7.4	43+ 43	4N	Hyattstown, Olney, sLaurel,MD

No expedition from DC area planned

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

Total Lunar Occultations

2016

Date	Day	EDT	Ph	Star	Mag	%	alt	CA	Sp.	Notes
Apr 9	Sat	21:04	D	SAO 93544*	9.6	9+	15	79S		Az. 277
Apr 10	Sun	14:36	D	theta1 Tau	3.8	16+	58	43S	G7	Sun +54,mg2 8 ".1,PA212
Apr 10	Sun	15:19	R	= ZC 669	3.8	16+	64	-23S	G7	Sun +48, AA 209
Apr 10	Sun	18:43	D	Aldebaran=	0.9	17+	53	84N	K5	Sun +10, ZC 692 Lab.
Apr 10	Sun	19:55	R	alpha Tau	0.9	17+	39	-86N	K5	Sun -4,AA 279 graze
Apr 11	Mon	21:40	D	ZC 858	7.0	27+	31	51S	M*	
Apr 12	Tue	0:13	D	130 Tauri	5.5	28+	3	60N	F0	Az.290,ZC878,close dbl?
Apr 12	Tue	22:02	D	SAO 95985	7.9	38+	38	86S	F8	Triple, mg2 10, mg3 11
Apr 12	Tue	22:57	D	26 Gem	5.2	38+	28	78N	A2	ZC1029, spec. binary
Apr 12	Tue	23:49	D	SAO 96054	8.2	39+	18	80N	K0	
Apr 13	Wed	20:55	D	SAO 97030	7.8	48+	59	30N	G5	PA graze
Apr 14	Thu	20:44	D	SAO 97835*	8.5	59+	64	15N	A2	Sun -12 deg.; MD graze
Apr 14	Thu	22:38	D	SAO 97867*	8.5	59+	48	47S	M2	
Apr 15	Fri	21:44	D	SAO 98515	8.0	69+	61	63S	F0	
Apr 15	Fri	21:53	D	SAO 98519	8.2	69+	60	44N	MB	Close double?
Apr 23	Sat	22:09	R	gamma Lib	3.9	97-	8	15N	K0	Az117,AA334,ZC2223,dbl
Apr 24	Sun	4:51	R	eta Librae	5.4	96-	28	74N	A6	AxisAngle 277, ZCd2247
Apr 25	Mon	2:03	R	ZC 2375*	8.0	91-	33	53S	B9	
Apr 27	Wed	3:02	R	X 43594	7.8	77-	26	28N	K5	
Apr 27	Wed	3:07	R	SAO 161217	7.1	77-	26	50N	B0	
Apr 27	Wed	4:10	R	SAO 161255	7.4	77-	31	37N	B2	Maybe close double?
Apr 27	Wed	4:24	R	WZ Sgr	7.7	77-	31	66N	F7	SAO 161257; spec. bin.
Apr 28	Thu	2:20	R	ZC 2787*	6.3	69-	15	65S	B8	Az.129,mg2 9 .7" PA 104
Apr 28	Thu	3:30	R	SAO 162239	7.0	68-	24	79S	F2	
Apr 29	Fri	3:27	R	SAO 163210	7.6	58-	18	44S	K1	
Apr 29	Fri	6:03	R	ZC 2933	7.9	58-	33	48S	F3	Sun altitude -2 degrees
Apr 30	Sat	4:25	R	DV Aquarii	6.0	48-	21	24N	A9	ZC3066; close double??
May 3	Tue	5:16	R	ZC 3496	7.3	16-	12	76S	F8	Sun alt.-10, Azimuth104
May 9	Mon	20:15	D	ZC 944	5.9	14+	33	82S	A6	Sun -2,eq.dbl .5" PA141
May 9	Mon	21:23	D	SAO 95469	8.0	14+	20	16N	A0	
May 12	Thu	21:45	G	SAO 98343*	7.4	43+	43	4N	G8	Mont.&PG CountyMD graze
May 13	Fri	21:10	D	SAO 98845	8.2	53+	54	75N	G5	Sun-11,mg2 11 19" PA228
May 14	Sat	22:58	D	37 Sex	6.4	64+	42	70N	K1	ZC 1567;actually in Leo
May 14	Sat	23:54	D	38 Sex/Leo	7.1	64+	32	40N	A2	ZC 1573, spec. binary

* *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

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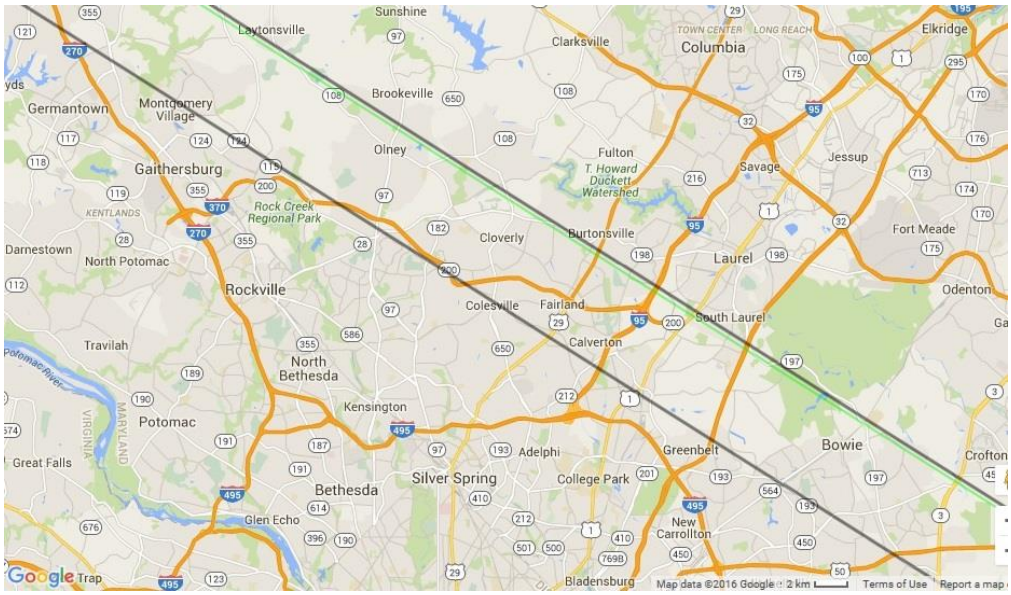
SAO 98343

David Dunham

A good grazing occultation of 7.4-magnitude SAO 98343 will be visible on the evening of May 12th from the zone between the two dark gray lines on the map of central Maryland (below). A short total occultation will be visible from locations south of the zone, while the star will not be occulted for locations north of it. Video recordings of the event will be valuable to check for stellar duplicity since the star is in the Kepler 2 exoplanet search program.



CubeSats – continued from page 4

The CubeSats are housed in the NRCSD, a stackable, modular, ground loaded dispenser built by NanoRacks, LLC in Webster, Texas. Each deployer accommodates up to 6.5U of CubeSat volume. Astronauts on the space station stack the NRCSDs into an eight-dispenser configuration, which is mounted on the Japanese Experiment Module airlock slide table and moved outside of the station. The Kibo arm captures the table and positions the entire facility toward Earth. Upon the approval to proceed from NASA and JAXA (Japan Aerospace Exploration Agency), the NRCSDs are commanded, one by one, to allow the dispenser doors to open and a large internal spring is released, deploying the CubeSats into an orbital altitude similar to that of the ISS (about 400 km above Earth). After 30 minutes in orbit, the internal timers on the CubeSats allow their onboard computers to boot up and begin transmitting. The CubeSat teams utilize their ground stations to listen for their beacons to determine the small satellites' functionality and operational status. CubeSat mission durations and orbital lives vary, but are anticipated to last at least 120 days. Upon mission completion, the CubeSats fall toward Earth, burning up in the atmosphere.

NASA will announce another call for CubeSat proposals in **mid-August 2016.**

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April 2016

Global Astronomy Month

astronomerswithoutborders.org/global-astronomy-month-2016.html

The submission deadline for the May issue of Star Dust is April 29th.

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

Mid-Atlantic Senior Physicists Group: "Earth's Changing Sea Ice Coverage and Its Connections with Broader Climate Change and Geo-engineering" with Claire Parkinson (GSFC) Wed. Apr. 20, at 1 pm at the American Center for Physics (1st floor conference room). www.aps.org/units/maspg/

Owens Science Center Planetarium (Planetarium Patty's Plaza): "Searching for Signs of Life" with Jane Ulrich, Fri. May 6, 7:30 pm; $5/adult; $3/students/senior/teachers/military. www1.pgcps.org/howardbowens

Owens Science Center Planetarium (Family Night): "Astin's Sky Adventure," Fri. May 13, 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:
14 May: Chyssa Kouveliotou (GWU), "Magnetars."
11 June: Science Fair Winners' presentations, Elections, Astro-Photos!

National Capital Astronomers Membership Form

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

Address: _____ **ZIP Code:** _____

Home Phone: ____-____-_____ **E-mail:** _____ **Print / E-mail Star Dust (circle one)**

Membership (circle one): Student….. $ 5; Individual / Family…..$10; Optional Contribution…..$__

Please indicate which activities interest you:

- Attending monthly scientific lectures on some aspect of astronomy ____
- Making scientific astronomical observations ____
- Observing astronomical objects for personal pleasure at relatively dark sites ____
- Attending large regional star parties ____
- Doing outreach events to educate the public, such as Exploring the Sky ____
- Building or modifying telescopes ____
- Participating in travel/expeditions to view eclipses or occultations ____
- Combating light pollution ____

Do you have any special skills, such as videography, graphic arts, science education, electronics, machining, etc.?

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

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

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First Class
Dated Material

Next NCA Meeting:

2016 April 9th

7:30 pm

@ UMD Observatory

Richard J. Walker

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