Star Dust

Newsletter of National Capital Astronomers, Inc.

capitalastronomers.org

March 2015 ***Volume 73, Issue 7***

Next Meeting

When: Sat. Mar.14th, 2015

Time: 7:30 pm

Where: UMD Observatory

Speaker: Laura Blecha

Table of Contents

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.

Waking the Giants:
Signatures of Supermassive Black Holes in Merging Galaxies

Laura E. Blecha, University of Maryland – College Park

Abstract: Mergers between galaxies are key components of galaxy evolution via hierarchical growth. Merger events can also trigger bursts of activity in galactic nuclei, fueling rapid accretion onto the galaxies' central supermassive black holes and producing luminous active galactic nuclei (AGN). If both black holes light up simultaneously, they may be detectable as an AGN pair, signaling the formation process of a supermassive black hole binary. These orbiting black holes can eventually merge, releasing a phenomenal amount of energy in the form of gravitational waves -- ripples in the fabric of spacetime. Such events may be directly detectable in the future with pulsar timing arrays or a space-based interferometer. In addition, any asymmetry in the

Courtesy NASA/JPL-Caltech

Arp 299: Two Colliding Galaxies w/ Supermassive Black Holes

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.

Who's Hungry?

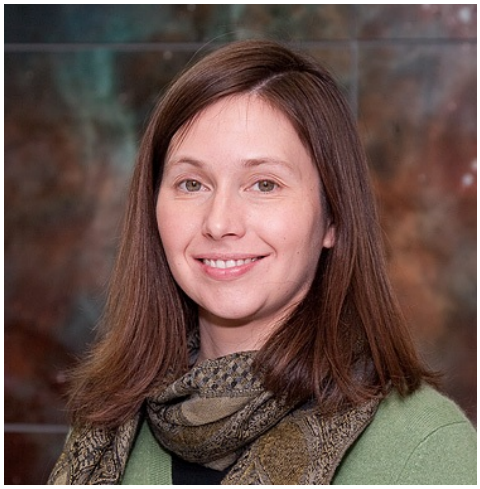
Regarding the merged galaxies of Arp 299, scientists were unsure if one or both of the supermassive black holes in question were actively pulling in matter. Thanks to NuSTAR's X-ray imaging, scientists can now see that Arp 299's galaxy on the right (below) is more active, emitting X-rays as part of the "wind" produced during accretion.

Courtesy NASA/JPL-Caltech
NuSTAR's superimposed X-ray data (top) onto the Hubble Telescope's visible light image (bottom). The X-ray energy is color-coded red (4-6 keV), green (6-12 keV) and blue (12-25 keV).

Waking the Giants – continued from page 1

gravitational wave emission causes the merged black hole to "recoil" in the opposite direction at the time of merger. In some cases, this recoil kick may eject the black hole from the galaxy altogether. If the black hole is actively accreting at the time of the kick, it may be observable as an offset AGN. This month's talk includes a review of the remarkable progress of the last few years in identifying candidate AGN pairs and offset AGN, and how simulations are being used to model the signatures of these exotic AGN. Prospects for future observations and what can hopefully be learned about both galaxy evolution and gravitational physics from studying AGN in merging galaxies will also be discussed.

Biographical Sketch:



Dr. Laura Blecha is an Einstein & Joint Science Institute (UMd and Goddard Space Flight Center) Postdoctoral Fellow in the Astronomy Department at the University of Maryland. Her research focuses on the supermassive black holes that live at the centers of galaxies. Using primarily computer simulations, she studies some of the many unanswered questions about these massive black holes, such as how they form and grow, how they influence their host galaxies, and what happens to them when galaxies collide. Dr. Blecha completed her graduate studies at Harvard University prior to moving to Maryland.

Centenary: Relativity Theory

The Hubble Telescope captured an image of CID-42 (in Constellation Sextans) which is believed to be a remnant of merged, supermassive black holes. Its radio emissions also suggest evidence of recoil. According to scientists at the Harvard-Smithsonian Center for Astrophysics, behaviors of CID-42 support Albert Einstein's *General Theory of Relativity*, whose 100th anniversary is being celebrated worldwide. Einstein's theory predicts that binary, supermassive black holes will generate gravitational waves and that newly-merged, supermassive black holes will recoil, carrying local star material with them.

The centenary celebration is being spearheaded by the United Nations Educational, Scientific & Cultural Organization (UNESCO). Each year, UNESCO hosts an international theme and 2015 is the *International Year of Light and Light-based Technologies*. Another major sub-theme of 2015, along with the General Theory of Relativity, is *Cosmic Light*, which encourages education and activities that address our ability to see, enjoy and understand the cosmos.

"Can You See the Stars?"

Coming in April…

*"**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!

http://astronomerswithoutborders.org/

Sky Watchers

Spring Schedule

March

11-20	Evening – **Globe at Night**, Global. Features: *Orion*
18	10:00 pm **– Planets**, N. Hemisphere. Neptune 4º south of Moon
20	6:45 pm – **Vernal Equinox**, N. Hemisphere
22	8:00 pm **– Planets**, N. Hemisphere. Venus 3º north of Moon
30	6:00 am **– Planets**, N. Hemisphere. Jupiter 6º north of Moon

April

4	6:17 – 6:47 am – **Partial Lunar Eclipse**, Washington DC area. (Find high ground and look west near horizon; maximum visible eclipse at 6:47 am) 8:05 am – **Full Moon**, Global. Other Moon Names: *Full Pink Moon (for spring phlox flowers), Full Sprouting Grass Moon, Full Egg Moon*

Times EDT

Space Chocolate

On Earth, February and March contain sweets-laden celebrations. Astronauts in space also share their home planet's love of sweets. In fact, astronauts' favorite choice for their nutritional "bonus" containers happens to be chocolate. The manager of the Space Foods Systems Laboratory at NASA-JSC, Vickie Kloeris, stated that astronauts request chocolate for practically every mission.

Chocolate's adventure into space began with Yuri Gagarin. In 1961, when Yuri became the first person to orbit Earth, he had a squeezable tube of "pureed meat" as well as a tube containing "chocolate sauce."

The Apollo missions continued the

Courtesy NASM, Smithsonian/Eric Long
Chocolate Space Pudding

continued on page 4

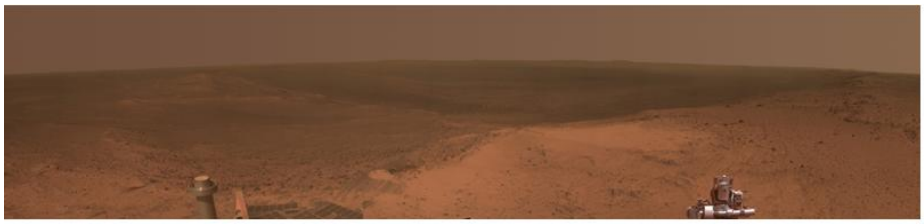
Space Chocolate – continued from page 3

practice of space-bound chocolate. It was carried as hot chocolate drinks, dehydrated chocolate pudding (reconstituted with water) and vacuum-sealed chocolate brownies. By the space shuttle years, there were chocolate candies, chocolate mints and chocolate-covered cookies.

How long does space food last? There are currently some space brownies in the Smithsonian National Air & Space museum that the space shuttle curator says still look "fudgy."

Planetary Destinations

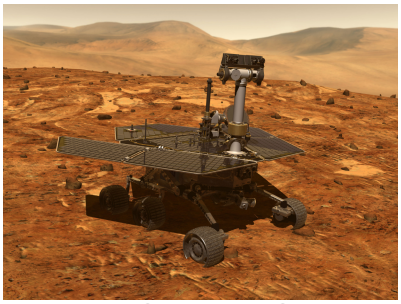
Sightseeing and the Mars Marathon



Courtesy NASA/JPL-Caltech/Arizona State University
Opportunity's Panoramic Camera (PANCAM) gets a stereoscopic view of Mars from the top of Cape Tribulation on the Endeavour Crater rim

Rover Opportunity landed on Mars on January 25, 2004 UT with a 3-month mission. Almost 11 years later, Opportunity reached the summit of Cape Tribulation on sol 3,894 (January 6, 2015). The cape is part of the Endeavour Crater rim. The crater is approximately 14 miles in diameter and Opportunity traveled 440 feet in elevation from a lower part of the rim to reach the summit (about 80% of the height of the Washington Monument). By the time she reached the summit, Opportunity had roamed approximately 25 miles on Mars, more than any other human-made vehicle has traveled on any other planet. The rover left the summit on January 17, 2015 to continue on to Marathon Valley; but, captured the above panoramic image of the landscape over the crater's interior and rim before departing.

An Olympic marathon is just shy of 27 miles. Reaching Marathon Valley is the equivalent of Opportunity's Olympic race on her amazing Martian journey. On the way there, the rover will first investigate the Spirit of Saint Louis Crater. Since the onset of memory storage problems, Opportunity's daily data are stored in volatile memory and



Courtesy NASA
Rover Opportunity

continued on page 6

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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
- Harold Williams

PDF Distributor: Jay Miller

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Thank you!

INTERNATIONAL YEAR OF LIGHT 2015

COSMIC LIGHT IAU

*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 Date	Day	EDT	Star	Mag	Asteroid	dmag	dur. s	Ap. "	Location, Notes
Mar 14	Sat	21:14	TYC01060733	11.8	Gallia	1.2	3	7	w&nVA,DC,MD,NJ
Mar 17	Tue	4:55	2UC24630871	11.7	Tercidina	2.0	8	7	WV,nVA,MD,DC,DE
Mar 23	Mon	23:27	2UC36776784	12.4	Melitta	3.1	4	8	OH,sPA,MD,nVA,DC
Mar 24	Tue	2:37	SAO 184110	9.6	Repsolda	4.8	15	4	cPA,MD,DC;n&eVA?
Mar 31	Tue	21:19	TYC08030156	11.4	Juno	0.2	30	7	wNC,VA,DC,MD,DE
Apr 2	Thu	0:52	TYC02830694	10.7	Antiope	2.7	9	6	cFL,LA,nTX,nNM

Lunar Grazing Occultations

2015 Date	Day	EDT	Star	Mag	% alt	CA	Location & Remarks
Mar 26	Thu	23:58	ZC 944	5.9	48+ 24	8N	Oxford,Whitakers,Hatteras,NC
Apr 11	Sat	4:56	SAO 161825	8.3	58- 28	3S	*nHarisonbrg,sFrederickbrg,VA

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

Total Lunar Occultations

2015 Date	Day	EDT	Ph	Star	Mag	%	alt	CA	Sp.	Notes
Mar 22	Sun	20:34	D	SAO 92929	7.9	9+	18	89S	K5	maybe close double??
Mar 24	Tue	21:04	D	55 Tauri	7.0	27+	36	76S	F7	ZC 636, close double
Mar 24	Tue	22:40	D	SAO 93895	7.9	27+	18	43N	G4	
Mar 24	Tue	22:48	D	SAO 93901	8.1	27+	17	86N	A0	maybe close double?
Mar 24	Tue	22:56	D	63 Tauri	5.6	27+	15	49N	A1	ZC650,Az.279,spec.bin.
Mar 24	Tue	23:18	D	SAO 93909	8.2	27+	11	32S	G0	Az.282,mg2 11 2",PA257
Mar 26	Thu	20:24	D	SAO 95299	8.4	47+	62	85N	F7	
Mar 26	Thu	20:53	D	SAO 95316	8.4	47+	58	73S	A0	
Mar 26	Thu	21:09	D	SAO 95328	8.2	47+	55	71S	K0	
Mar 26	Thu	22:01	D	SAO 95360	8.2	47+	46	83N	B9	
Mar 26	Thu	22:06	D	SAO 95366	8.4	47+	45	84N	K2	
Mar 27	Fri	0:02	D	SAO 95448	8.4	48+	23	54N	M2	
Mar 27	Fri	1:42	D	ZC 961	6.3	49+	5	55S	B9	Azimuth 289 degrees
Mar 27	Fri	23:23	D	SAO 96496	7.9	58+	40	70S	G5	Maybe close double
Mar 28	Sat	0:35	D	SAO 96546	7.9	58+	26	54S	A0	
Mar 28	Sat	0:48	D	SAO 96566	7.8	58+	23	75S	F8	
Mar 28	Sat	20:03	D	SAO 97330	8.0	66+	65	84S	A2	Sun altitude -8 degrees
Mar 28	Sat	21:19	D	SAO 97356	8.2	67+	65	58N	G5	Maybe close double?
Mar 30	Mon	0:46	D	FX Cancri	6.7	76+	39	87N	M3	Zodiacal Catalog # 1320
Mar 30	Mon	0:49	D	SAO 98144	7.9	76+	38	74N	G5	
Mar 30	Mon	1:55	D	SAO 98146	7.7	77+	26	16S	F5	Maybe close double?
Mar 31	Tue	23:21	D	SAO 118241	7.4	90+	57	68S	F5	Close double
Apr 2	Thu	2:00	D	SAO 118693*	7.7	95+	41	78S	G5	
Apr 2	Thu	20:50	D	ZC 1708	6.2	98+	29	65N	F7	
Apr 6	Mon	1:14	R	ZC 2036	7.0	97-	37	54S	G5	Axis Angle 228 degrees
Apr 8	Wed	0:26	R	theta Lib	4.1	87-	16	90N	K0	ZC 2271, close double?
Apr 10	Fri	6:35	R	ZC 2573	7.2	68-	31	73S	A0	Sun altitude -2 degrees
Apr 11	Sat	4:32	R	SAO 161801	7.4	58-	26	53N	A	
Apr 11	Sat	5:21	R	SAO 161834	7.5	58-	30	5N	B2	mg2 8.7 sep .4",PA 154
Apr 11	Sat	6:00	R	SAO 161837	8.1	58-	32	74N	A5	Sun alt. -8 deg.
Apr 11	Sat	6:18	R	SAO 161850	7.2	58-	32	55S	A2	Sun alt. -4 deg.
Apr 11	Sat	6:20	R	ZC 2731	6.6	58-	32	63S	A1	Sun -4, close double
Apr 12	Sun	6:31	R	ZC 2889	6.9	47-	32	18S	M2	Sun alt. -2 deg.
Apr 13	Mon	4:52	R	SAO 163793	7.8	36-	17	64S	F0	mg2 11 sep 3",PA 227deg

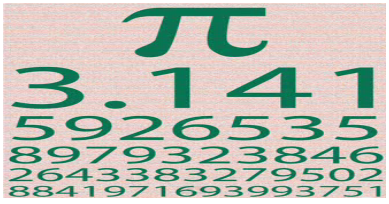
**The star is in the Kepler 2 exoplanet search program so lightcurves of the occultation are desired to check for close stellar duplicity.*

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

PI DAY!

March 14th

http://youtu.be/qsjrjPquqiA



2014-2015 Officers

Planetary Destinations – continued from page 4

Courtesy NASA/JPL-Caltech/Arizona State University
Opportunity's location on February 10, 2015 with about 220 yards to go to finish the official marathon of 26.219 miles!

transmitted to Mars Odyssey or Mars Reconnaissance Orbiter before the rover goes into energy-conservation mode for the Martian night.

As Opportunity finishes her marathon, she will be carrying a US flag. Its image happens to be on the cable guard of the rover's rock abrasion tool (RAT). The cable guard is made of recovered aluminum, retrieved from the site of New York's twin towers soon after September 11, 2001.

Spinning in Backwater Physics

Last month's Academy Awards showcased science as Eddie Redmayne won an Oscar® for the Best Actor category by portraying Stephen Hawking in the movie, *The Theory of Everything;* and, *Interstellar* won the category for Achievement in Visual Effects. Interstellar is being referred to as the first Hollywood film to present the perception of a viewer near a spinning black hole.

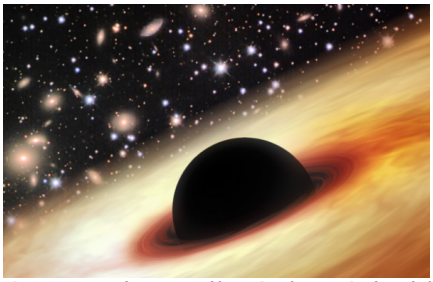
Kip Thorne (physicist at Caltech), consulted on the film and co-authored the paper introducing Double Negative Gravitational Rendering (DNGR), the computer code developed to solve equations for light-beam propagation through curved spacetime around a spinning Kerr black hole. The authors of the paper referred to gravitational lensing (i.e., the bending of light rays) by spinning black holes as a "backwater of physics" (at least, until the late 1970s).

Chris Nolan (director, writer) and Paul Franklin (visual effects) not only wanted to showcase accurate science in creating a black hole and accretion disk, but to create IMAX-quality smoothness of rapidly changing images comprehensible to the audience. For consistency, the artists asked for a glow to be added to the accretion disk image of the black hole generated by DNGR so that it would be seamless with the soft glow, called a veiling or lens flare, which is produced by an IMAX camera lens.

Courtesy DNGR, Ltd & Warner Bros. Entertainment Inc (cc)
DNGR's Black Hole Accretion Disk with Lens Flare

Source: James, O., von Tunzelmann, E. & Thorne, K. (2015). Gravitational lensing by spinning black holes in astrophysics, and in the movie Interstellar. *Classical and Quantum Gravity*, *32*.

SDSS J0100+2802



Courtesy Zhaoyu Li/NASA/JPL-Caltech/ Misti Mountain Observatory

A quasar that is incredibly bright (420 trillion suns), incredibly old (900 million years post Big Bang), & fueled by an *incredibly* supermassive black hole (12 billion solar masses), was recently discovered by an international team of scientists. Their findings were reported in the journal *Nature* in late February.

The submission deadline for the April issue of Star Dust is March 27th .

Clear Skies!

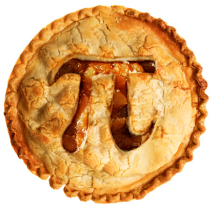
Calendar of Events

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).

Owens Science Center Planetarium: "The Little Star that Could," Fri. Mar. 13, 7:30 pm; $5/adult; $3/students/senior/teachers/military; children under 3 free. www1.pgcps.org/howardbowens



Ultimate Pi Day: Sat. Mar. 14, 9:26:53 am. www.piday.org

Mid-Atlantic Senior Physicists Group: "Brilliant Blunders" with Mario Livio (STSCI), Wed. Mar. 18, 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:
11 Apr: Timothy Stubbs (UMD), "Meteor Showers Affect the Moon's Atmosphere."

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.

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First Class
Dated Material

Next NCA Meeting:

2015 March 14th

7:30 pm

@ UMD Observatory

Dr. Laura Blecha

Inside This Issue