Star Dust

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December Speaker: Dr. H. John Wood, "Fifteen Years of Astounding Images from HST"

Submitted by Wayne H. Warren Jr.

H. John Wood, Science Liaison, Instrument Synthesis & Analysis Laboratory NASA's Goddard Space Flight Center, will speak to the National Capital Astronomers on Saturday, December 10 at the University of Maryland Observatory lecture hall. Dr. Wood has provided the following summary of his talk.

Abstract

Orbiting high above the turbulence of Earth's atmosphere, the Hubble Space Telescope (HST) is providing breathtaking views of astronomical objects never before seen in such detail. The steady images allow this medium-size telescope to reach the faintest galaxies ever seen by mankind. Some of these galaxies are seen as early as 2 billion years after the Big Bang in a 13.7-billion-year-old Universe. HST has allowed dramatic advances in all fields of astronomy and astrophysics since its launch in April 1990. Servicing by the Space Shuttle has allowed correction of the

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Correction: Last month's article "November Speaker: Lucy-Ann McFadden, First Results from the Deep Impact Mission" should have had the byline "Submitted by Wayne H. Warren Jr."

Review of Talk by Dr. Lucy-Ann A. McFadden: "First Results from the Deep Impact Mission"

by Dr. Wayne H. Warren Jr.

The monthly NCA meeting of November 12, 2005 was highlighted by a lecture on space probes and comets given by Dr. Lucy McFadden of the Department of Astronomy, University of Maryland in College Park. Dr. McFadden is a co-investigator on NASA's Deep Impact Discovery mission and has been associated with the project since its beginning. This very successful mission flew an impactor that crashed into Comet Tempel 1 on Independence Day of this year, thus providing appropriate fireworks for the celebration of our nation's 229th birthday.

Dr. McFadden began by asking the audience how many of us stayed up well into the night on July 4 of this year to watch the Deep Impact probe crash into the comet. A few people had actually done that and found it exciting. We then saw how our ideas about comets have changed in recent years from a long-range view of a spherical object displaying a coma illuminated by sunlight and a short or long tail of great beauty to an object that looks very much like an asteroid except for its surface activity as it approaches the Sun. Our first close-up view of a comet nucleus was obtained in 1986 by the Giotto mission, which gathered spectacular views of the most famous comet of all time, Comet Halley. We saw the comet as a single body with bright areas of active outgassing on its surface. Then in 2001 the Deep Space 1 mission flew past Comet Borrelly at a distance of 2200 km, measuring its size, shape, and albedo. Comet Wild 2 was the destination of the Star Dust mission operated by NASA's Jet Propulsion Laboratory. That spacecraft flew past the comet at 6.1 km s^{-1} at 238 km distance and collected samples with its tennis-racket shaped collector. The samples will be returned to Earth on January 15, 2006 for analysis in ground-based laboratories. As a sample-return mission, the imaging of Comet Wild 2 was not even in the mission objectives, so the very nice images obtained are icing on the cake for what has, so far, been a very successful undertaking.

Although all these previous comet missions have provided some very useful information, we really want to learn more about the internal structure of comets and how they evolve. Specifically, does a comet simply exhaust all its gases and become a dead object like the proverbial black dwarf, or does the surface seal in the gases and dust under a hardened crust? We also wanted to determine the basic properties of the nucleus, such as the strength of the material (bulk modulus), the density, structure, and composition. Does the interior differ from the outer crust in its physi-

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NCA Events This Month

The Public is Welcome!

NCA Home Page: http://capitalastronomers.org

NCA Mirror- and Telescope-making Classes: Fridays, Dec. 2, 9, 16, 23 and 30, 6:30 to 9:30 P.M. at the Chevy Chase Community Center, at the northeast corner of the intersection of McKinley Street and Connecticut Avenue, N.W. Contact instructor Guy Brandenburg at 202-635-1860 or email him at gfbrandenburg @yahoo.com.

Observing with NCA's 14-inch telescope: See schedule and information at right.

Open house talks and observing at the University of Maryland Observatory in College Park on the 5th and 20th of every month at 9 P.M. The talks are non-technical. There is telescope viewing afterward if the sky is clear.

Dinner with NCA members and speaker: Saturday, December 10 at 5:30 P.M., preceding the meeting, at the Garden Restaurant in the University of Maryland University College Inn and Conference Center. See map and directions on Page 6.

If you are planning to come to the dinner before the meeting, please tell Benson J. Simon, telephone: 301-776-6721, e-mail st88@ioip.com, so that we can make reservations for the right number of people.

Upcoming NCA Meetings
December 10: John Wood: Fifteen Years of Astounding Images from HST
January 14: TBA
February 11: Vera Rubin, Carnegie Institution: Polar-Ring Galaxies
March 11: Michael A'Hearn, Astronomy Department, University of Maryland: Deep Impact
April 8: Alan Bunner, NASA HQ (retired): The Anthropic Principle
May 13: Robert W. Farquhar, The Johns Hopkins University, Applied Physics Laboratory, Space Department: The Lagrange Points
June 10: TBA.

Observing with the NCA C-14

Mike McNeal

Schedule is open, generally, Saturdays at 7:30 P.M. Call to set up a time.

In Mike McNeal's backyard, 5410 Grove St, Chevy Chase, MD, (Friendship Heights Metro).

Please make reservations by 10 p.m. the Friday before.

Call Mike at 301-907-9449 or email him at mcnealmi@verizon.net.

The deadline for the January Star Dust is December 28. Please send your material to Elliott Fein by that date to ensure inclusion. Send submissions to Elliott Fein at elliott.fein@verizon.net.

Articles submitted may be edited to fit the space available.

December Speaker: Dr. H. John Wood

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optics and installation of new state-of-the-art instruments over the 15 years the telescope has been in orbit.

Sixty years ago Joe Woods in Baltimore began observing with his new 12-inch Cassegrain telescope. The brass clock drive kept the telescope tracking at the sidereal rate. The rotating dome was a curiosity for the mail man because the slit was in a different position every morning. Joe invited a neighbor, 7-year-old Johnny Wood, to come look at the Moon, Mars, and nebulae. Need I say that I was enthralled by the beauty of the objects we could see? So enthralled was I that I made a life commitment to study the stars.

Now, after 15 years of successful operations in space, the HST has provided me with another epiphany: a sudden manifestation of the essence or meaning of objects in the sky. A selection of some of the most beautiful images will demonstrate the power and utility of the HST.

Biography

Dr. H. John Wood is an astronomer and serves as an optical engineer for the Optics Branch at NASA's Goddard Space Flight Center. Since June 1990, he has been Optics Lead Engineer on the Hubble Space Telescope (HST) Project. He led the team that successfully determined the optical prescription of HST while on orbit. He then led NASA's effort to develop and test the corrective optics for HST. In addition to his work on Hubble, he currently serves as Science Liaison in the Instrument Synthesis & Analysis Laboratory for new Earth Science and Space Science instrument engineering design at Goddard.

A graduate of Swarthmore College, Dr. Wood earned the M.A. and Ph.D. in Astronomy from Indiana University. He has been at Goddard Space Flight Center for over 20 years. In addition to the Hubble Project, he has been Lead Optical Engineer on other Goddard projects: the Mars Observer Laser Altimeter and the Diffuse Infrared Background Experiment aboard the Cosmic Background Explorer (COBE). Earlier, he served as assistant to the director at Cerro Tololo Inter- American Observatory (Chile) for two years. He held a Fulbright Research Fellowship for two years at the University Observatory in Vienna, Austria. He also served five years as a staff astronomer at the European Southern Observatory in Chile. His career began with six years on the astronomy faculty of the University of Virginia at Charlottesville.

Winner of the 1992 NASA Exceptional Service Medal and the 1994 NASA Exceptional Achievement Medal for his work on COBE and HST, he is the author of 50 research papers in astronomy and space optics. He was invited by the Optical Society of America to edit special editions of *Applied Optics* and *Optics and Photonics News* on the HST first servicing mission. He was co-chair of the HST Independent Optical Review Panel that was charged with the determination of the optical parameters for the HST while on orbit.

Review of Talk by Dr. Lucy-Ann A. McFadden

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cal properties and what is the nature of the primordial ices that are preserved in the comet's interior?

Dr. McFadden then digressed a bit to describe the physical nature of the spacecraft, which was built by Ball Aerospace and Technologies in Boulder, Colorado. The craft consisted of a flyby module and an impactor craft that flew to the comet while firmly attached to each other until 24 hours before the rendezvous. The flyby platform contains two telescopes, an imaging camera, and an infrared spectrometer sensitive in the region 1 – 4.8 μm. The high-resolution telescope is a 30-cm, f/35 instrument with a focal length of 10.5 meters, while the medium-resolution telescope has an aperture of 30.5 cm and a speed of f/17.5. The latter telescope and the imaging camera are outfitted with nine filters for isolating features in different wavelength regions. The impactor module was an independent spacecraft having only a single instrument, a medium resolution imager with no filters. The projectile was a 100-kg copper mass designed to create the largest crater possible and to impart the maximum energy transfer possible.

The spacecraft was launched from Cape Canaveral on January 12, 2005 and followed a 6-month trajectory so as to arrive at Comet Tempel 1 in early July. Shortly after launch the instruments were tested on the Moon and Jupiter and the main instrument was found to be out of focus. When this situation remained after a planned 40-day bake out procedure, a serious problem was suspected, an engineering red team was convened at Ball to diagnose the problem and a workshop was convened to consider various deconvolution techniques similar to what were used for the Hubble Space Telescope problem. Although a technique was developed and used to improve the images, it is only needed in selected cases because there was usually plenty of light during the critical data gathering phases of the mission.

The target was found at the end of April, after which time a series of observations showed natural outbursts of the comet that at first seemed to be periodic, but upon closer examination are not. The light variations are caused by the comet's rotation and the non periodic nature of the light curve by the fact that the axis of rotation was not aligned with the spacecraft's trajectory. As the comet rotated, certain surface areas experienced outbursts when they came into sunlight and were heated by the Sun's rays.

On July 3, just about 24 hours out from the comet, the impactor module dutifully separated from the flyby craft and the impactor's camera took images all the way in. Meanwhile, the flyby changed its trajectory to move it away from the comet's orbit so that it would not be subjected to the hazards of particle impacts. The impactor's trajectory was corrected using an autonavigation system that processed images taken by the onboard camera and calculated corrections to the comet's orbit on the fly. The impactor's trajectory was corrected at 88 minutes, 48 minutes, and finally, only 15 minutes before impact.

We then viewed a series of images of the comet as the impactor approached its surface. The series was cut off when a dust particle hit the camera and apparently defocused it.

Dr. McFadden showed a composite image of the nucleus that had been put together by processing individual images with IDL (Interactive Data Language) and combining them. A surface was revealed that reminded one very much of other bodies in the Solar System, even our own Moon. There were craters, smooth areas reminiscent of the Moon's maria, and rough areas that look like the lunar highlands. In general, the surface resembles other bodies that have a history of impacts. The surface seems to be in three distinct layers, which in itself is not surprising; however, some of the middle layer appears to be the youngest, which is quite a surprise.

The spectrum in the region 309 – 950 nm, as measured by a series of narrow-band filters, is devoid of any strong emission and absorption features and just shows the characteristic slope of a red spectrum typical of comets. The albedo of the comet is 4 percent. There is no apparent water on the surface, as indicated by the lack of water sublimation. A spectral series of the evolution of the ejecta from the impact is still being analyzed and is likely to take some time because each spectrum must be analyzed individually.

The observation time of the flyby was chosen to be 800 seconds, which was a factor of four greater than the time originally estimated to be needed. However, after 800 seconds the debris had not cleared, so the crater was never observed directly. This fact will make it harder to determine the size of the crater. The estimated limits on the size at this point lie anywhere from 100 m to 300 m.

Spectra in the range 2.0 – 4.5 μm taken a few seconds before and after impact show a marked change — the post impact spectrum shows strong features due to CO_2 gas and water vapor at a rotational temperature of about 1500 Kelvin. Features due to hot organics are also seen. Spectra taken after impact at two times show enhanced features of hot organics and decreased water vapor as they cooled down. Close examination of the plume shows that it did not detach from the comet, which indicates that the comet's strength is dominated by gravitational forces. Measurement of the extent of the base of the plume plotted against time gives a slope that constrains the value of the gravitational constant, g, for the comet. The value of g is found to be about 5×10^{-4} m s^{-2}. This value can be compared to 9.8 m s^{-2} for the Earth. Using the shape of the comet (assumed to be approximately spherical), an estimated mass can be derived, from which a density of ≤ 600 kg m^{-3} is found (ice is 917 kg m^{-3}).

Ground-based observers had been monitoring the comet through several apparitions and some minor brightening had been seen about 300 days prior to perihelion. Ground-based observers at Calar Alto noted a short-lived outburst on June 14. Although a large increase in brightness occurred after impact, the comet faded again, thus showing that the impact did not create a new active site on the comet's surface as some people predicted that it might.

Dr. McFadden summed up as follows:

1. Multiple natural outbursts were observed prior to impact.
2. A nucleus with varied topography was seen with some cratered, some smooth, and some layered terrain. Some of the lower terrain appeared to be younger than higher elevations, and some very rough highlands exist.
3. The surface is near thermal equilibrium with low thermal inertia.
4. An albedo of 0.04 (ranging to perhaps 0.06) was measured.

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Other National Capital Area Meetings

Northern Virginia Astronomy Club
General membership meetings are open to the public, and are held at Enterprise Hall, room 80, on the campus of George Mason University in Fairfax, Virginia. The meeting hall is in the basement floor of the building. It is best to park in parking lot B and walk up the hill to the rear of Enterprise Hall.

Meetings start at 7:00 P.M., on the second Sunday of every month. If you come earlier you can do a little socializing. The first part of the meeting is club business, during which the officers make reports about their activities and areas of responsibility. The next part of the meeting usually includes:

- Show and Tell, where members share gadgets, books, techniques, etc.
- The Observing Report, describing the astronomical events for the next month.
- Q&A, where beginning astronomers are encouraged to ask questions to be answered by more experienced members.
- The Sky Tour, describing what's where in the sky for the next month.

The final part of the meeting is a program, usually by one of the members, but sometimes by "outside experts." We've had presenters from all aspects of Astronomy.

There's a good deal of socializing before and after meetings, allowing members to put faces with the voices they've heard in the dark.

Please note: GMU has two parking lots designated as B. One of them has closed temporarily. Please continue further around Patriot Circle to the 2nd lot B or park in the Patriot center lot and walk to Enterprise Hall. Handicapped parking remains the same.

For more information: see http://www.novac.com

Planetarium at Montgomery College at Takoma Park, Maryland, USA Planetarium College-wide located at the Takoma Park/Silver Spring Campus Maryland, United States of America, Planet Earth around star named Sol, in the Milky Way Galaxy an out lying member of the Virgo Super Cluster around 13.7 billon years after creation

The planetarium shows 1,834 naked-eye stars, the Milky Way (the diffuse band of light caused by the disk of our own galaxy), and the five naked eye planets (Mercury, Venus, Mars, Jupiter, and Saturn) under a twenty-four-foot dome with forty-two comfortable chairs. The planetarium is located on Fenton Street on the Takoma Park/Silver Spring campus of Montgomery College. It is attached to the Science South building on the ground level and has a conspicuous silver colored domed roof. The stars are the province of all of mankind. An astrophysicist will answer questions about the universe. There is no admission charge for these public planetarium programs.

Directions to the planetarium. Astronomy is the oldest science and one of the few sciences that welcomes amateurs. Everyone who looks up at the stars with wonder is an astronomer. The planetarium is open from the last week in August until the Friday before Memorial day in May. This is an academic institution so there are a few holidays like Thanksgiving and around Christmas and New Year's Day when the entire institution is closed.

All evening planetarium programs include a star party after the show, if it is clear. Star party means we look at the sky with telescopes. We have a 10 inch (2540mm) Meade LX200-GPS-SMT, a 3½ inch (88.9mm) Questar, and a 4 1/8 inch (105mm) Edmund Astroscan telescopes that we bring outside the planetarium when clear. Bring your telescope to the star party, and we can have even more fun sharing, the more the merrier.

Free Public Shows
Saturday, 28 January 2006 at 7 P.M. *How are Stars Born?* not the celebrities, but the gravitational controlled thermonuclear fusion reactors that are real stars.
Saturday, 18 February 2006 at 7 P.M. *African Skies* hear creation myths and how at least 40,000 people got their freedom using the Drinking Gourd, the Big Dipper.
Tuesday, 21 February 2006, St. Valentines Day, at 6:30 P.M. Tentative: A Montgomery College Community Colloquium: *Faith in Science?* not in the planetarium, but in the Health Science Building Room 122 at 7977 Georgia Avenue, Silver Spring, MD 20910
Tuesday, 11 April 2006 at 6:30 P.M. Tentative: A Montgomery College Community Colloquium: Navigating Uncertainties not in the planetarium, but in the Health Science Building Room 122 at 7977 Georgia Avenue, Silver Spring, MD 20910
Saturday, 15 April 2006 at 7 P.M. *Spacetime Invariance and Quantum Gravity* discover the smallest distances and times measurable and how the universe is pixelated.

Do You Want to Get *Star Dust* Electronically?

Any member wishing to receive *Star Dust,* the newsletter of the National Capital Astronomers, via e-mail as a PDF file attachment, instead of hardcopy via U.S. Mail, should contact Nancy Grace Roman, the NCA Secretary, at nancy.roman6@verizon.net or 301-656-6092 (home).

Review of Talk by Dr. Lucy-Ann A. McFadden

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5. Spectroscopy indicated hot water vapor, carbon dioxide (CO_2), and CH emission bands, 1000 – 2000 K rotational temperatures, and icy grains.
6. The crater was obscured by dust during the observation period.
7. The first observations of the inner corona are now being analyzed.

The NCA thanks Dr. McFadden for presenting an interesting and exciting talk about preliminary Deep Impact results. We look forward to learning more about Comet Tempel 1 following further analysis of the data.

The reviewer thanks Lucy-Ann McFadden for reviewing this review of her talk and for her comments

Mid-Atlantic Occultations and Expeditions

by David Dunham

Asteroidal Occultations

Date	Day	EST	Star	Mag	Asteroid	dmag	dur. s	Ap. in.	Location
Dec 1	Thu	5:15	SAO 58354	8.9	Dike	5.2	5	2	MD,DC,nVA,wPA
Dec 1	Thu	19:14	TYC18610376	12.4	Eva	0.4	9	10	NJ,MD,DC,nVA
Dec 2	Fri	19:20	TYC57651274	11.5	Chimaera	4.6	1	8	nVA,MD,DC,sNJ
Dec 9	Fri	0:03	TYC48281297	12.4	Gallia	0.4	13	9	DE,MD,DC,nVA
Dec 15	Thu	0:02	TYC52810228	11.4	Nipponia	2.2	4	7	eNC,seVA,NJ?
Dec 16	Fri	22:39	2UC34801128	11.5	Ucclia	3.1	2	8	neNC,swVA,eKY
Dec 17	Sat	22:13	2UC32529230	11.2	Olga	3.1	7	7	sVirginia,sKY
Dec 19	Mon	4:33	TYC18850823	11.0	Andromache	2.1	7	7	s&wNY,CT,nePA
Dec 20	Tue	3:01	TYC13391108	11.0	Amalthea	1.2	4	7	neNC,sVA,sWV
Dec 30	Fri	21:18	SAO 128805	8.2	Lilaea	5.8	4	2	WV,wMD,sePA,NJ

Grazing Occultations

DATE	Day	EST	Star	Mag	%	alt	CA	Location
Dec 7	Wed	18:46	SAO 165346	8.8	44+	39	18S	Hughesville,MD;Oliver,VA;++
Dec 13	Tue	1:43	zeta Ari	4.9	93+	40	7S	RockyMt.&SHill,VA;Curituk,NC
Dec 26	Mon	3:46	SAO 158321	8.8	26-	12	16S	n.Harrisburg & W.Chester, PA
Dec 28	Wed	5:53	3 Scorpii	5.9	7-	9	20S	Scranton,PA & Princeton, PA

Total Lunar Occultations

DATE	Day	EST	Ph	Star	Mag	%	alt	CA	Sp.	Notes
Dec 3	Sat	17:31	D	SAO 187432	8.3	7+	8	90N	K5	Az. 223 deg.; Sun -9
Dec 4	Sun	17:40	D	60 Sgr	4.8	14+	16	52N	G8	ZC2914,spec.bin.,Sun-11
Dec 4	Sun	18:30	D	SAO 188817	8.0	14+	10	84S	A9	Azimuth 224 degrees
Dec 5	Mon	19:11	D	SAO 189965	8.3	23+	16	84N	K0	
Dec 7	Wed	20:09	D	SAO 165373	7.7	45+	32	82S	K0	
Dec 8	Thu	22:46	D	20 Piscium	5.5	58+	20	25N	G8	ZC3505;mg2 10 173",285d
Dec 9	Fri	20:46	D	ZC 69	7.5	68+	50	6N	G4	
Dec 10	Sat	19:27	D	ZC 205	7.4	78+	59	74S	F0	Just before NCA meeting
Dec 11	Sun	1:41	D	ZC 222	7.0	79+	14	44N	G5	Azimuth 273 deg.
Dec 11	Sun	19:20	D	19 Arietis	5.7	86+	58	49N	M0	ZC 326; spec. binary
Dec 12	Mon	21:37	D	ZC 459	6.4	93+	72	71N	K2	Maybe close double
Dec 13	Tue	1:22	D	zeta Ari	4.9	93+	42	39S	A1	ZC 472; graze, s. VA
Dec 13	Tue	1:45	D	SAO 75819	7.9	94+	38	58S	F2	
Dec 13	Tue	18:09	D	SAO 76358	7.2	97+	33	42N	B9	
Dec 15	Thu	19:06	R	136 Tauri	4.6	100-	25	55S	A0	ZC890;dbl?;term.dist.4"
Dec 15	Thu	20:11	R	SAO 77724	7.0	100-	37	49S	B1	terminator dist. 4"
Dec 15	Thu	23:15	R	SAO 77818	6.7	100-	71	64N	K5	terminator dist. 7"
Dec 17	Sat	19:17	R	76 Gem	5.3	94-	7	84N	K5	ZC 1169; azimuth 63deg.
Dec 18	Sun	5:37	R	4 Cancri	6.3	93-	47	45N	A1	ZC 1211
Dec 20	Tue	22:46	R	37 Leonis	5.4	73-	13	65S	M1	ZC 1504; azimuth 83deg.
Dec 23	Fri	3:09	R	SAO 119068	7.8	54-	38	40N	F5	
Dec 23	Fri	4:31	R	beta Vir	3.6	54-	49	89S	F8	ZC 1712 = Zavijava
Dec 25	Sun	6:21	R	SAO 139285	8.1	34-	40	64N	K0	Sun alt. -12 deg.
Dec 25	Sun	9:05	D	Spica	1.0	33-	34	-76S	B1	ZC 1925; Sun alt. +15
Dec 25	Sun	10:25	R	Spica	1.0	33-	23	78N	B1	ZC 1925; Sun alt. +23
Dec 26	Mon	3:39	R	ZC 2017	6.4	25-	10	26N	K1	Azimuth 119 deg.
Dec 27	Tue	4:40	R	SAO 183010	8.0	17-	8	70N	K0	Az. 125; maybe double
Dec 27	Tue	5:02	R	SAO 183024	8.2	16-	12	72N	G8	Az. 129 deg.

David Dunham, e-mail dunham@starpower.net, more info. http://iota.jhuapl.edu
Phone home 301-474-4722; office 240-228-5609; car 301-526-5590

Getting to the NCA Monthly Meeting and the Dinner Before the Meeting

Jeff Guerber

NCA meetings are now held at 7:30 p.m. at the University of Maryland Observatory, in College Park on Metzerott Rd. between University Blvd. (MD-193) and Adelphi Rd. To get there from the Capital Beltway (I-495), either take US Rt. 1 south about a mile, turning right onto MD-193 West, then at the first light turn right onto Metzerott; or, take New Hampshire Ave. (MD-650) south, turn left at the second light onto Adelphi Rd., two more lights, turn left onto Metzerott, and proceed about a mile to the observatory. The observatory is on the south side of Metzerott Rd., directly opposite the UM System Administration building; you can park there if the observatory lot is full, but be careful crossing Metzerott Rd.

At 5:30 p.m., before the meeting, please join us for dinner at the Garden Restaurant in the UMD University College Inn and Conference Center, 3501 University Blvd. East at Adelphi Rd. From the Beltway, either take New Hampshire Ave. south, turn left onto Adelphi, and at the third light (passing Metzerott) turn left onto University then immediately right into the garage; or, take US-1 south, turn right onto University Blvd. west, and take it to the intersection with Adelphi Rd. Park either in the garage (costs), or in Lot 1 nearby (free). To get to the Observatory, exit to the right onto University Blvd. (MD-193) east, and at the second light turn left onto Metzerott Rd.

Getting to the NCA Meeting
Star=Observatory R=Restaurant P=Parking

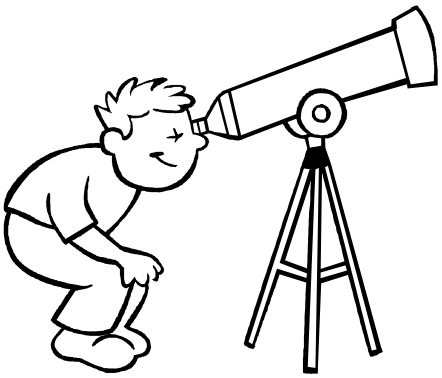
Observing after the Meeting

Elizabeth Warner

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.

Are You Coming to Dinner?

If you are planning to come to the dinner before the meeting, please tell Benson J. Simon, telephone: 301-776-6721, e-mail st88@ioip.com, so that we can make reservations for the right number of people.



Do You Need a Ride?

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

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3225 N. First Avenue Tucson, AZ 85719-2103

www.darksky.org

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Editor: Elliott Fein, Co-editor: Adele Fein, Editorial Advisor: Nancy Byrd. Consultant: Jeffrey Norman

National Capital Astronomers, Inc.

http://capitalastronomers.org

Dr. Harold Williams, NCA President, Harold.Williams@montgomerycollege.edu, 301-650-1463 (planetarium), 301-565-3709 (home).
Dr. Walter L. Faust, NCA Vice-president, wlfaust1370@direcway.com, 301-217-0771.
Dr. Nancy Grace Roman, NCA Secretary, nancy.roman6@verizon.net, 301-656-6092 (home).
Jeffrey Norman, NCA Treasurer, jefffrey.norman@att.net, 5410 Connecticut Avenue, NW, Apt. #717, Washington, DC 20015-2837, 202-966-0739
Trustees: Guy Brandenburg, Gary Joaquin, Benson Simon, Dr. Wayne H. Warren,
NCA Webmaster, Dr. Harold Williams, Harold.Williams@montgomerycollege.edu, 301-650-1463 (planetarium), 301-565-3709 (home).
Elliott Fein, NCA *Star Dust* Editor, elliott.fein@verizon.net, 301-762-6261 (home), 5 Carter Ct. Rockville, MD 20852-1005.
NCA Web Page: http://capitalastronomers.org/.
Appointed Officers and Committee Heads: Exploring the Sky - Joseph C. Morris; Meeting Facilities - Jay H. Miller; Observing - Michael McNeal, mcnealmi@verizon.net; Telescope Making - Guy Brandenburg; *Star Dust* Editor - Elliott Fein

SERVING SCIENCE & SOCIETY SINCE 1937

NCA is a nonprofit, membership-supported, volunteer-run, public-service corporation dedicated to advancing astronomy, space technology, and related sciences through information, participation, and inspiration, via research, lectures, presentations, publications, expeditions, tours, public interpretation, and education. NCA is the astronomy affiliate of the Washington Academy of Sciences. NCA is an IRS Section 501(c)(3) tax-deductible organization. All are welcome to join NCA.

SERVICES & ACTIVITIES:

Monthly Meetings feature presentations of current work by researchers at the horizons of their fields. All are welcome; there is no charge. *See* monthly *Star Dust* for time and location.

NCA Volunteers serve in a number of capacities. Many members serve as teachers, clinicians, and science fair judges. Some members observe total or graze occultations of stars occulted by the Moon or asteroids.

Publications received by members include the monthly newsletter of NCA, *Star Dust*, and an optional discount subscription to *Sky & Telescope* magazine.

Consumer Clinics: Some members serve as clinicians and provide advice for the selection, use, and care of binoculars and telescopes and their accessories. One such clinic is the semiannual event held at the Smithsonian Institution National Air and Space Museum.

Fighting Light Pollution: NCA is concerned about light pollution and is interested in the technology for reducing or eliminating it. To that purpose, NCA is an Organization Member of the International Dark Sky Association (IDA).

Classes: Some NCA members are available for educational programs for schools and other organizations. The instruction settings include star parties, classroom instruction, and school-teacher training programs that provide techniques for teaching astronomy. NCA sponsors a telescope-making class, which is described in the *Star Dust* "Calendar of Monthly Events."

Tours: On several occasions, NCA has sponsored tours of astronomical interest, mainly to observatories (such as the National Radio Astronomy Observatory) and to the solar eclipses of 1998 and 1999.

Discounts are available to members on many publications, products, and services, including *Sky & Telescope* magazine.

Public Sky Viewing Programs are offered jointly with the National Park Service, and others. Contact: Joe Morris, joemorris@erols.com or (703) 620-0996.

Members-Only Viewing Programs periodically, at a dark-sky site.

NCA Juniors Program fosters children's and young adults' interest in astronomy, space technology, and related sciences through discounted memberships, mentoring from dedicated members, and NCA's annual Science Fair Awards.

Fine Quality Telescope, 14-inch aperture, see "Calendar of Monthly Events."

Yes, I'd like to join NATIONAL CAPITAL ASTRONOMERS!

Name: _____ Date: ____/____/_____
Street address: _____ ZIP Code:_____
Telephone: ____-____-_____ E-mail: _____
Would you prefer to get *Star Dust* by e-mail? ____
Present or Former Occupation (or, If Student, Field of Study): _____
Academic Degrees: _____ Field(s) of Specialization: _____
Employer or Educational Institution: _____

MEMBERSHIP CATEGORIES AND ANNUAL DUES RATES

All members receive Star Dust*, the monthly newsletter announcing NCA activities. As an added optional benefit to extend your knowledge of astronomy you may also choose* Sky and Telescope *magazine at the discounted rate of $33.*

Student Membership: ……..… $15 ……..with *Sky and Telescope*....$48
Standard Individual or Family Membership: …….. $27 ……...…..with *Sky and Telescope*....$60

You are welcome to make contributions in any amount in addition to the dues shown above.
Contribution amount:_____

Please mail this form with your check payable to National Capital Astronomers, to:
Mr. Jeffrey Norman, NCA Treasurer; 5410 Connecticut Avenue, NW #717; Washington, D.C. 20015

National Capital Astronomers, Inc.
If undeliverable, return to
NCA c/o Nancy Roman
4620 N. Park Ave., #306W
Chevy Chase, MD 20815-4551

FIRST CLASS
DATED MATERIAL

The December NCA Meeting is on the 2nd Saturday of December!

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