Star Dust

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Elizabeth M. Warner to speak about Deep Impact

submitted by Gary Joaquin

Elizabeth M. Warner will present the featured talk, "The Deep Impact Mission", for the April 7 meeting of National Capital Astronomers, The meeting will be held in the Lipsett Amphitheater in Building 10 (Clinical Center) of the National Institutes of Health in Bethesda at 7:30 P.M. The synopsis is an excerpt from the Deep Impact Mission web site at http://deepimpact.jpl.nasa.gov/.

Synopsis

Peering inside a comet could give us clues to the early formation of the Solar System, the Earth and human life. Comets are composed of ice and dust from the solar nebula, out of which the Solar System formed. This primitive debris holds clues to conditions of the Solar System's earliest and coldest period, making it similar to a 4.5 billion-year-old time capsule. Deep Impact is the first mission to open one of these time capsules to explore its treasures.

Deep Impact's spectacular July 4, 2005 impact on Comet Tempel 1 by a 350-kg (770 lbs.) impactor is expected to produce a football field-sized crater seven stories deep. It is the first attempt to expose fresh material from the inside of a comet. Material inside the comet's body will give scientists a clearer picture of the composition and structure of these ancient travelers in space. The public can share in this experience and view the impact with smaller telescopes from Earth. In addition, dramatic images from cameras on the impactor and the spacecraft will be sent back to Earth in near real-time.

Biography

Elizabeth M. Warner is an astronomer and Faculty Research Associate at the University of Maryland in College Park. Ms. Warner earned her B.S. and M.S. in Physics at the University of South Carolina where she also taught astronomy at the Melton Memorial Observatory. She is a member of National Capital Astronomers, a member and former president of the Midlands Astronomy Club, and a member of the Astronomical Society of the Pacific, the South Carolina Academy of Sciences, and the American Association of Physics Teachers.

Review of a Talk by Dr. Pamela Clark about the NEAR Mission

by Dr. Andrew W. Seacord, II

The 2001 March NCA meeting featured Dr. Pamela Clark, who presented the lecture "Motivation and Scope of the NEAR Mission". The Near Earth Asteroid Rendezvous (NEAR) mission was the first mission of the NASA Discovery program. Dr. Clark is a member of the NEAR X-ray/Gamma-ray (XGRS) team.

One of the scientific objectives of the NEAR mission was to relate what the spacecraft finds to the study of the solar system's early history. It is thought that asteroids are parent bodies of meteorites.

Dr. Clark described the NEAR spacecraft and displayed a model of it. The spacecraft, renamed NEAR Shoemaker after Eugene Shoemaker, is now sitting on the surface of its target, the asteroid 433 Eros.

The launch

The NEAR spacecraft was launched on 1996 February 17 by a Delta II launch vehicle. Dr. Clark showed a video clip of the launch (which was flawless) starting at launch minus one minute. The trajectory, which took NEAR to Eros, encountered the asteroid 253 Mathilde with a flyby on 1997 June 27, made an Earth flyby on 1998 January, and encountered Eros for the first time in late 1998. Due to conservative limits imposed on the guidance system, the maneuver to place NEAR in orbit around Eros terminated early, so the encounter became a flyby in 1999. On Valentine's Day the following year, 2000 February 14, the spacecraft executed a successful maneuver and became a satellite of Eros.

The initial orbit was elliptical with a semi-major axis of 1,000 km. This orbit provided the opportunity to look for a companion or debris associated with Eros. Over time, the orbit was reduced in size to 50 km and later, to 35 km to facilitate mapping.

Mission objectives

The spacecraft carried six instrument packages, the Multispectral Imager, Near IR spectrometer, Magnetometer, X-ray Solar Monitor, Laser Altimeter, and the X-ray/Gamma-ray Spectrometer (XGRS).

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NCA Events This Month

The Public is Welcome!

NCA Home Page: http://capitalastronomers.org

Fridays, April 6, 13, 20, and 27, from 7:00 to 10:00 P.M. Telescope-making and mirror-grinding, -polishing, -figuring and -testing classes at American University, McKinley Hall, Basement (Room 9), Nebraska and Massachusetts Avenues, NW. Classes are very informal, and you can start or finish a mirror at any time. We can also aluminize the finished product. (If there is enough interest for a midweek session, we may start having occasional sessions again in the wood shop at the Chevy Chase Community Center.) Call or email Guy Brandenburg for details and prices for materials: 202-635-1860 or gfbranden@earthlink.net.

Fridays, April 13, 20, 27, 8:30 p.m. Open night with NCA's 14-inch telescope at Ridgeview Observatory near Alexandria, Virginia; 6007 Ridge View Drive (off Franconia Road between Telegraph Road and Rose Hill Drive). Call Bob Bolster, (703) 960-9126 before 6:00 p.m.

Saturday, April 21 and May 12, beginning 6:00 p.m. - Open House at Hopewell Observatory. See directions at right.

Saturday, April 7, 5:30 P.M.
Dinner with the speaker and NCA members at the
Athenian Plaka Restaurant,
7833 Woodmont Ave.
Bethesda MD
phone: 301/986-1337
See the map and directions on Page 8.

Saturday, April 7, 7:30 P.M. - NCA meeting, at the Lipsett Auditorium in Building 10 at NIH, will feature Elizabeth M. Warner talking to NCA about the Deep Impact project. See Page 6 for more National Capital area astronomical doings. To join NCA, use the membership application on Page 9.

Pamela Clark

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This complement of instruments was chosen to satisfy mission objectives, one of which was to determine the properties of Eros, its size, shape, mass, density, gravity, presence of a magnetic field, and the surface structure and composition (abundance of chemical elements and mineralogy).

The emphasis of Dr. Clark's lecture was on the use of XGRS to determine physical and geological properties, including mineralogy, of Eros. Another mission objective is to determine the relation between meteorites and their asteroid parent bodies and their relation to the formation and early history of the solar system.

A primer on meteorites

Meteorites are thought to originate from a pristine, primitive, surface which has had no geological activity. The origin of meteorites can be deduced from their trajectories through the Earth's atmosphere. If the atmosphere portion of the trajectory can be determined with sufficient accuracy, it can be extrapolated backwards to obtain the object's heliocentric orbit. The orbits of several meteorites have been determined by this process. The aphelia for these are in the main asteroid belt. Therefore, it is reasonable to conclude that some meteorites originated in the asteroid belt.

Dr. Clark presented other evidence relating meteorites to asteroids. The spectra of visible and infrared (IR) radiation reflected from both meteorites and asteroids are used to classify them. Eros had already been classified as an S-type asteroid, because it has a reflection spectrum like that of stony meteorites such as ordinary chondrites and stony-iron meteorites. Dr. Clark displayed a typical spectrum obtained by the NEAR near-infrared spectrometer. Two major features of iron-bearing minerals, pyroxine and olivine, were evident. For comparison, consider the Moon. Reflection spectra from the lunar surface indicate that its main constituent is pyroxine with little olivine present. The lunar surface is known to be 3.5 to 4 billion years old, although some rocks are only about 1

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Open House at Hopewell Observatory

by Bob Bolster

NCA members, families, and guests are invited to enjoy the spring sky at Hopewell Observatory on Saturday evenings April 21 and May 12. View deep-sky objects as well as the planets Saturn and Jupiter (April) and Mars. On April 21 sunset will be at 7:54 p.m. and astronomical twilight ends at 9:31. On May 12 sunset will be at 8:14, astronomical twilight ends at 10:00, and the Moon rises at 1:08 a.m. If you wish, come any time after 6:00 p.m. and bring your prepared picnic dinner. Coffee, tea, and cocoa will be provided by the Hopewell Corporation.

Directions: (1) From the Beltway (I-495) go west on I-66 25 miles to Exit 40 at Haymarket onto U.S. 15.
(2) Turn left on U.S. 15 at the end of the exit ramp. (3) Go 0.3 miles to traffic light, turn right onto Va. 55. (4) Go 0.8 miles to Antioch Road (Rt. 681) and turn right. (5) Go 3.2 miles to the end of Antioch Rd. and turn left onto Waterfall Road (601). (6) Go one mile and bear right onto Bull Run Mountain Rd. (Rt. 629). (7) Go 0.9 miles on 629 to narrow paved road at right with an orange pipe gate (Directly across from an entrance gate with stone facing). (8) Turn right through pipe gates, go 0.3 miles to top of ridge, and around the concrete building and towers. (9) Continue on dirt road through the white gate and woods a few hundred feet to the observatory. Park along the road short of the buildings.

If it is raining or hopelessly cloudy, the events will be canceled.

For further information call (703) 960-9126.
Observatory phone: (703) 754-2317.

Deadline for May *Star Dust*: April 15

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Please send submissions to Elliott Fein at elliott.fein@erols.com.
Text must be in ASCII, MS Word, or WordPerfect. Graphics in BMP are best.
Thanks.

Pamela Clark

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billion years old. The Moon is not geologically active, whereas the Earth is. The Earth's surface is new; 99% of it is less than 2 million years old.

In placing the study of asteroids in the context of early solar system history, Dr. Clark described the nebula of gas and dust from which the sun and planetary system were formed. Interstellar refractory mineral grains, containing magnesium silicate, mixed and clumped together, forming the most primitive objects in the solar system, carbonaceous chondrites. Other clumps developed with a matrix in which are embedded small drops of glass, called chondrules. These undifferentiated clumps are ordinary chondrites. If there is local heating of these clumps, separation of material can occur, leaving differentiated areas of metal (usually nickel and iron), metal-silicate mixtures, and silicates. The question now is: Is Eros a chondrite or is it a differentiated asteroid?

Meteorites can be summarized as follows. The oldest, unaltered type is the carbonaceous chondrite. Ordinary chondrites show minor alterations producing the discrete chondrules. A primitive achondrite is another type of chondrite which has no chondrules and in which there is some transformation into layers. Finally, there are the differentiated types such as achondrites (which resemble the Earth's mantle), stony-irons, and irons.

Dr. Clark showed several meteorite samples. Ordinary chondrites can be distinguished from Earth surface rocks by their fusion crust that the meteorite acquires from frictional heating while passing through the Earth's atmosphere. The meteorite surface is melted to a depth of a millimeter or so. After landing, the surface cools rapidly, forming a glassy (fusion) crust. A cross-section of an ordinary chondrite shows magnesium-rich chondrules embedded in a silicate matrix. Dr. Clark showed us the cross-sections of two other meteorites. One was a carbonaceous chondrite and the other was a stony-iron meteorite in which the nickel-iron metal areas are surrounded by silicates.

EROS — Gross Information
With this background on meteorites, Dr. Clark turned our attention to the near Earth asteroid, Eros. It is a long and irregular asteroid with dimensions of 33x13x13 km (about 20x8x8 miles). It is shaped like a skinny potato (or foot, or cell phone, or ...) with large holes or indentations. It rotates end-over-end with a period of 5.7 hours. Its orbit has a perihelion distance of 1.13 au and an aphelion distance of 1.78 au.

Images of Eros show that on one side of it there is a large crater (named Psyche), and on the opposite side there is a saddle-shaped feature. One view of the saddle region shows multiple horizons. On this and other images, we see large-scale features like ridges, pit chains, and flat-floored troughs. These features indicate a surface that has evolved by impact. On a small scale we also see evidence of a history of bombardment resulting in the rocks, boulders, and stones seen lying on the surface. The surface itself appears to be covered with a soil-like material, or regolith, also the result of bombardment occurring over millions of years. The regolith is at least a few meters deep.

Inside the Psyche crater, different colors corresponding to different strata can be seen. Rocks, which appear to be broken-up parts of the surface can be seen on the floor of the crater. This morphology is similar to that of Meteor Crater in Arizona.

Determination of elemental components
NEAR's x-ray spectrometer consists of three separate detectors and a proportional counter placed behind a collimator which restricts the field of view to five degrees. The gamma-ray spectrometer has two scintillation detectors. The inner detector, a sodium iodide scintillation counter, is surrounded by a shield that tunes the detectors.

The reaction of solar x-rays with the asteroid surface produces fluorescent x-rays which have characteristic energies (spectral lines). By observing these energies, we can determine what elements are there and their line intensities tells us the element abundance.

The gamma-ray spectrometer detects radiation that results from the interaction of the cosmic ray flux with the surface. Neutrons are produced which, in turn, interact with the surface material to produce the characteristic gamma-ray spectrum. Also present in the observed spectrum are spectral features from the radioactive decay of potassium and thorium.

The observability of x-ray spectral lines depends on the solar radiation flux, particularly on the high energies produced in solar flares. Therefore, in order to reduce XGRS data, interactive software was developed to determine times when solar flares occurred.

The spectral lines of interest from the asteroid surface include the low-energy lines of magnesium, aluminum, and silicon. Sulfur is another element, but it is difficult to detect because the abundance of sulfur is small. Calcium and iron are also very important lines. The objective here is to determine the bulk abundance of these major elements for a portion of the asteroid and, from that, determine the closest meteorite analog of the asteroid. That would be some kind of S-type meteorite.

Because detection of these x-ray spectral energies depends on the solar flux, another tool, the NEAR XGRS visualization system, was developed to indicate where the Sun, asteroid, and XGRS are in relation to each other. The solar angle is very important. Also, it is best, or necessary, to observe the asteroid surface when the Sun is particularly active. The spectra observed during a flare contain spectral features that indicate the presence of magnesium, silicon, iron, and a modest amount of calcium. Detection of these features is complicated by the presence of the very large cosmic ray-induced background.

The XGRS data are being interpreted with the use of an interactive meteorite database that contains corresponding laboratory spectra of all meteorite classes and subclasses, each of which has a distinguishing spectrum. The chemical abundances of constituent elements can be determined by comparing the strengths of various features. This analysis can reveal the difference between an ordinary chondrite and, say, an achondrite, an igneous meteorite having a mineralogy similar to that of terrestrial basalts.

Effect of Solar Flares
Comparing Eros XGRS spectra observed with a quiet sun (no flares) with that observed with flare excitation reveals the

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effect that solar flare high-energy x-rays have on surface spectra. Two large flares were used in the present analysis. One flare occurred on 2000 May 4 and the other on 2000 July 17. After removing the background, features of magnesium, silicon, calcium, and iron are evident. Differential filters were used to resolve the spectral lines, the objective being to determine the concentration ratios, or photon ratios, for pairs of elements, such as Mg/Si or Fe/Si. These ratios depend on the solar flux. Once the concentration ratios have been determined, the interactive meteorite data base is used to determine the best meteorite analog by matching the database ratios with those observed. The actual results, however, represent a range in chondritic composition. For Eros, this range includes the possibility of a primitive achondrite. These results imply that, in Eros, there is a minimum amount of differentiation present. This is consistent with a primitive achondrite. Comparing the Mg/Si and Al/Si ratios during the two solar flare events also suggests a primitive achondrite with a minimum amount of differentiation.

Conclusions

The conclusion based on this early analysis is that, in the case of Eros, we are looking at very primitive material with a minimum amount of differentiation and with some partial melt residue. Eros has experienced little or no differentiation since it was formed. Geological activity has consisted primarily of micrometeorite bombardment which could result in deposition of impact ejecta. However, no differentiation or measurable change in surface composition has occurred.

Following the discussion of XGRS results, Dr. Clark showed three video clips made from NEAR images of Eros. The first video was made from the late 1998 flyby. The second video was made from the 2000 flyby prior to orbital insertion around the asteroid. The image sequence began over the saddle and continued as the spacecraft flew over the tips and around the asteroid. The third video was made from images recorded during the descent toward the landing, starting about 1 km above the surface. The spacecraft actually recorded 59 images during the 30-minute descent.

Fortuitously, the spacecraft had landed with the gamma-ray spectrometer pointed directly at the surface. During its post-landing operation, it identified iron, silicon, and oxygen. During the orbital part of the mission, Eros did not fill the gamma-ray spectrometer field of view; consequently, the signal strength was low. The on-surface data is valuable because it provides a better measurement of iron and oxygen abundances.

NEAR accomplishments

Dr. Clark concluded her lecture by summarizing NEAR accomplishments, specifically the "firsts". The NEAR mission was the first mission to fly by and image a C-class asteroid, 253 Mathilde. The NEAR spacecraft was the first to orbit a small body, the first to land on one, and the first to obtain in situ measurements of an asteroid's surface, a real first for the gamma-ray spectrometer. It was also the first spacecraft to rely on solar cells at a distance greater than 2 au from the sun. And, finally, it was the first mission of NASA's Discovery Program.

More information about the NEAR mission and its results can be obtained from the web site: http://near.jhuapl.edu

Question and answer session

During the question and answer session that followed the formal lecture, some interesting information was brought out. Without radiation from solar flares, the higher energy iron lines would have not been detectable because of the strong background radiation. Iron is observed because the solar flare x-rays excite an inner shell electron. The following decay produces the observed K-alpha fluorescent line.

Another interesting fact brought out during the discussion is that, in the main asteroid belt, there are ten parent bodies from which chondrite meteors are thought to originate. This is known from meteorite isotope ratios. Originally, Eros was probably a part of one of these parent bodies.

Also, it was mentioned that no magnetic field associated with Eros has been detected by the NEAR magnetometer.

NCA was fortunate to have Dr. Clark present these results from the NEAR mission. We thank her for her excellent and informative presentation.

Star Dust Is Now Available Electronically

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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 ngroman@erols.com, or via telephone at 301-656-6092 (home)

From Russia with Love!

Saturday, March 10, 2001 09:34

From Russia with love!

Dear friends,

I'm Albert Garnelis from Moscow (Russia), 31 years old. I run the teenage Astronomy club in Moscow.(Sok2). There are fifteen teenage members in this club and other young people. I helped each one of the teenagers build a 6.25-8 inch Dobsonian. The club has also built a 10-inch Newtonian, a 6-inch refractor and is in the process of making a 20-inch Newtonian.(Tel4)

I have very few books and atlases and other astronomy equipment, and sometimes work with hand-drawn reproductions of atlas pages. We only have 50 to 60 cloudless nights per year and some of these are with a moon. We drive 100 miles east of Moscow for the dark skies, where we can see with the naked eye down to 6.5 magnitude stars.(Tower).

I need help for our amateur club and would appreciate contacts and donations of books, atlases, etc. We are also willing to make and sell mirrors from 6 to 14 inches. If you are interested, please inform me e-mail Nat@goryacho.com or post:

Albert Garnelis
Vostrakovsky Proezd
House #7, Court #2 ,Apt 430
Moscow 113546
Russia

P.S. We are looking forward to other possibilities of cooperation with your astronomy club. I will be waiting for your letter.
Best wishes 

ALBERT GARNELIS

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http://goryacho.com—Russian-American Search Engine

Come See the Stars!

by Joe Morris

Exploring the Sky 2001 Schedule

Date	Time	Notes
4/21	8:30 P.M. (EDT)	Lyrid meteors 4/22; Astronomy Day 4/28
5/19	9:00 P.M. (EDT)	Mercury visible at sunset
6/23	9:00 P.M. (EDT)	Longest day 6/21; latest sunset 6/27
7/21	9:00 P.M. (EDT)	Thin crescent Moon visible
8/18	8:30 P.M. (EDT)	Perseid meteors 8/12
9/22	8:00 P.M. (EDT)	Fall equinox
10/13	7:30 P.M. (EDT)	Mars bright in the constellation Sagittarius
11/10	7:00 P.M. (EST)	Leonids peak 11/18

Exploring the Sky is an informal program that for nearly fifty 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.

Sessions are held in Rock Creek Park once each month on a Saturday night from April through November, in the field south of the intersection of Military and Glover Roads, near the Nature Center.

Beginners (including children) and experienced stargazers are all welcome - and it's free!

Questions? Call the Nature Center at (202) 426-6829 or check the Internet sites: http://www.nps.gov/rocr/planetarium or http://www.capitalastronomers.org

Meteor Showers
April Radiants

Full Moon: April 8

Major Activity

Radiant	Duration	Maximum
Lyrids (LYR)	April 16-25	Apr. 22, 04:26 UT

Minor Activity

Radiant	Duration	Maximum
Tau Draconids	March 13-April 17	Mar. 31-Apr. 2
Librids	March 11-May 5	Apr. 17/18
Delta Pavonids	March 21-April 8	Apr. 5/6
Pi Puppids (PPU)	April 18-25	Apr. 23/24
April Ursids	March 18-May 9	Apr. 19/20
Alpha Virginids	March 10-May 6	Apr. 7-18
April Virginids	April 1-16	Apr. 7/8
Gamma Virginids	April 5-21	Apr. 14/15

Daylight Activity

Radiant	Duration	Maximum
April Piscids	April 8-29	Apr. 20/21

Source:http://comets.amsmeteors.org/meteors

Other National Capital Area Meetings, etc.

Goddard Scientific Colloquium — Construction in Building 3 has been postponed. The Scientific Colloquium will be held at 3:30 p.m. on Fridays in the Building 3 auditorium until the work is re-scheduled.
April 13 Terrie Williams, University of California, "Santa Cruz Seals in Space: Marine Mammal Strategies for Cost Efficient Locomotion in 3 Dimensions"
April 20 William Hartmann, Planetary Science Institute, "Recent Geological Activity on Mars"
If you plan to attend and do not have a NASA badge, please contact Carol Krueger, at (301) 286-6878, at least 24 hours beforehand. Source: lheawww.gsfc.nasa.gov/users/djt/colloq/

Montgomery College's Planetarium
Fenton St. in Takoma Park, MD.
Saturday, April 21 at 7:00 P.M.
"Black Holes, Gravity to the Max".
Gravity bends light. If gravity is too strong, it bends light completely. Gravity bends (distorts) not only space, but space-time. This planetarium show is a friendly introduction to the General Theory of Relativity suitable for general audiences. You do not have to know what the local metricization of Riemanian manifolds is to appreciate the basis and the results of the General Theory of Relativity. Black Holes are the most extreme results of this theory. They are literally Gravity to the Max. By looking at something in its most extreme case facets that are not revealed in mundane application like normal falling motion on the earth are shown.
The infinite time dilation (time asymmetry) between an outside the hole observer and an observer who decides to visit the hole are explained. Some of the other weird properties of Black Holes including recent observation of the vicinity of black holes will be shared with the audience. Anyone with an inquiring mind and imagination of a typical third grader can enjoy this planetarium show. Those few people who do not want to flex (distort) or exercise (move) their mind are advised to stay home and watch mindless television situation comedies, which are doubtless on at the same time on Saturday evening.
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 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. e-mail: hwilliam@mc.cc.md.us phone 301-650-1463
Source: http://www.mc.cc.md.us/Departments/planet/

Northern Virginia Astronomy Club (NOVAC) meets 6:00 p.m. at Lecture Hall 1 on the Fairfax campus of George Mason University. 703 803-3153.
April 8 TBD
Source: http://novac.com

University of Maryland at College Park Astronomy Colloquia
All Astronomy Colloquia are held in Room CSS 2400 on Wednesdays at 4:00-5:00 p.m. unless otherwise noted.
April 4 Dr. Caryl Gronwall, JHU, "The KPNO International Spectroscopic Survey for Nearby Emission-Line Galaxies"
April 11 Dr. Matt Holman, CfA/SAO, TBA
April 18 Dr. Jane Charlton (PSU), (tentative) "Star Forming Pockets Outside of Galaxies"
April 25 Dr. Steinn Sigurdsson, PSU, TBA
Special accommodations for individuals with disabilities can be made by calling (301) 405-3001. It would be appreciated if we are notified at least one week in advance. Parking: Most parking meters in Parking Garage 2 have been removed. Parking for visitors is available in the Cashier-Attended Parking Lot at the intersection of Paint Branch & Technology Drive. It is a 5-10 minute walk from the parking lot to the Computer & Space Sciences building. Source:http://www.astro.umd.edu/colloquia/colloquium.html

NASA/GSFC LEP Seminar Laboratory for Extraterrestrial Physics Brown Bag Seminar. Fridays at noon in Room 8 in Building 2 at Goddard.
April 6 Ron Lepping, Diana Taggart, and Michael Collier, NASA/GSFC, "The Laboratory for Extraterrestrial Physics Education/Outreach Web site "
April 13 Nikolai Tsyganenko, Raytheon ITSS at NASA/GSFC, "Data-based Modeling of the Geomagnetosphere: Lessons, Challenges, Promises"
April 27 Antti Pulkkinen, FMI, TBA
Source: http://lepjas.gsfc.nasa.gov/~seminar/lep_seminar.html

Goddard Engineering Colloquia
All colloquia are held at 3:30 p.m. on Mondays in the Building 3 Auditorium, unless otherwise indicated below.
April 2 Richard Gran, Mathematical Analysis Co., "Fly Me to the Moon"
April 9 Michael Wagner, Carnegie Mellon University, "The Robotic Search for Antarctic Meteorites"
April 16 Michael E. Levi, Lawrence Berkeley National Laboratory, "SNAP - Super Nova/Acceleration Probe"
April 23 Mitty Plummer, University of North Texas, "Liquid Nitrogen Powered Car"
April 30 Meyya Meyyappan, NASA Ames Research Center, "Nanotechnology for NASA Missions"
Note: Individuals not badged for entry into Goddard should obtain the current procedure by contacting Main Gate security at 301-286-7211. Source:http://ecolloq.gsfc.nasa.gov/sched.html

Laboratory for Astronomy and Solar Physics (LASP) — Seminars are on Thursday at 3:30 P.M. in GSFC Bldg. 21, Room 183.
April 5 Art Poland GSFC, "Living With a Star"
April 12 Harley Thronson, NASA HQ, "Long-Range Planning for NASA"
April 19 Robert O'Connell, University of Virginia, "Elliptical Galaxies in the Ultraviolet"
April 26 Carol Grady, GSFC/NOAO, "New Views of Proto-Planetary Disks"
Coffee, Tea, and Cookies served before the seminar. For additional information, contact Eli Dwek at 301-286-6209 (edwek@stars.gsfc.nasa.gov) or Jon Gardner at 301-286-3938 (gardner@harmony.gsfc.nasa.gov).
Source: http://stars.gsfc.nasa.gov/www/lasp_colloq

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Mid-Atlantic Occultations and Expeditions for April

by David Dunham

Asteroidal Occultations

DATE	Day	EST	Star	Mag	Asteroid	dmag	Dur s	Ap. in.	Location
Apr 8	Sun	23:07	TYC23901625	11.7	Bamberga	0.9	7	10	Carolinas
Apr 14	Sat	4:59	TYC72810298	10.8	Massinga	1.3	8	10	DC, alt. 6 deg.
Apr 20	Fri	23:50	TYC50120469	10.9	Croatia	3.1	7	7	New Jersey
Apr 29	Sun	23:26	TYC54331392	11.4	Antilochus	5.0	6	8	Manitoba

Lunar Grazing Occultations and a Grazing Annular Solar Eclipse

DATE	Day	EST	Star	Mag	%	alt	CA	Location
Apr 26	Thu	21:08	SAO 077012	7.8	12+	23	1S	Sunbury & Kutztown, PA
Apr 30	Mon	0:49	ZC 1250	5.8	43+	14	-2S	Fredericksburg & Elkwood, VA
Dec 14	Fri	17:30	The Sun	-27	0	13	N	Liberia, Costa Rica *

* Time CST; for more, see http://iota.jhuapl.edu

Total Lunar Occultations

DATE	Day	EST	Star	Mag	%	alt	CA	Notes
Apr 11	Wed	5:52 R	ZC 2301	6.7	87-	26	70N	Sp. F5; Sun alt. -9 deg.
Apr 14	Sat	2:36 R	26 Sgr	6.2	63-	8	84S	Sp. A3; ZC 2714
Apr 15	Sun	5:54 R	53 Sgr	6.3	52-	25	76N	mags 6.9 & 7.1, sep. 0.2"
Apr 15	Sun	6:07 R	ZC 2875	6.0	52-	26	77N	Sp. K0; Sun alt. -5 deg.
Apr 18	Wed	5:06 R	ZC 3243	7.3	25-	7	59S	Sp. G8
Apr 27	Fri	22:37 D	Propus	3.3	22+	18	82N	Sp. M3; eta Gem = ZC 0946
Apr 27	Fri	23:31 R	Propus	3.3	22+	8	-78N	
Apr 29	Sun	22:36 D	SAO 080063	7.6	43+	39	79S	Sp. G5
Apr 29	Sun	23:49 D	SAO 080094	8.0	43+	25	55N	Sp. K2
Apr 30	Mon	0:05 D	SAO 080099	8.1	43+	22	57S	Sp. B9
Apr 30	Mon	0:41 D	ZC 1250	5.8	44+	15	13S	Sp. K1; graze Fredericksburg
Apr 30	Mon	22:36 D	ZC 1377	7.0	54+	48	34N	Sp. A3
May 4	Fri	22:27 D	ZC 1856	6.6	92+	49	54N	Dbl.,mgs.7.2&7.6,sep.1",PA104
May 5	Sat	22:11 D	ZC 1976	7.0	97+	38	49S	Sp. A3
May 5	Sat	22:46 D	ZC 1978	6.6	97+	41	52S	Dbl., mags. 7.4&7.4, sep.0.1"

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. 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 http://www.lunar-occultations.com/iota. Sp. is spectral type-color, O,B,blue; A,F,white; G,yellow; K,orange; M,N,S,C red

Phone the IOTA occultation line, 301-474-4945, for weather go/cancel decisions, and other updates and details, or check IOTA's Web sites at http://www.lunar-occultations.com/iota or http://iota.jhuapl.edu

David Dunham dunham@erols.com or 301-474-4722; car 301-526-5590.

Other National Capital Area Meetings, etc.

(Continued from page 6)

LASP Stellar & Extra-Galactic Astronomy Lunch — Talks are Wednesdays at 12:00 Noon in Room 242 of Building 21.
April 4 David Leisawitz, GSFC, "Science, Engineering, and Technology Requirements for Next-generation Far-IR Telescopes and Interferometers"
April 11 Gerry Williger, GSFC/NOAO, "A Large Group of Quasars at z=1.2"
Source: http://hires.gsfc.nasa.gov/~gardner/seal/

Maryland Science Center, 601 Light Street, Baltimore, MD
Davis Planetarium
Explore the vastness of the universe. Find constellations, visit other worlds, or travel deep into space in these original productions. Beneath the 50-foot dome, hundreds of images and special effects mix with over 8500 stars to portray the marvels of the cosmos.
Tuesday, April 10, 7:00 P.M. "An Evening with Marcia and Einstein". Marcia Bartusiak will be speaking about her book, *Einstein's Unfinished Symphony*, at the Davis Planetarium. She will tell the story of the exciting 40-year-long quest to capture gravity waves—vibrations in space-time predicted by general relativity—introducing us to the people, the technology, and the science of this fascinating enterprise. She will give us a sneak preview of the first new astronomy of the 21st century. Free admission. For more information, call 410-545-5964.
Source: http://www.mdsci.org/

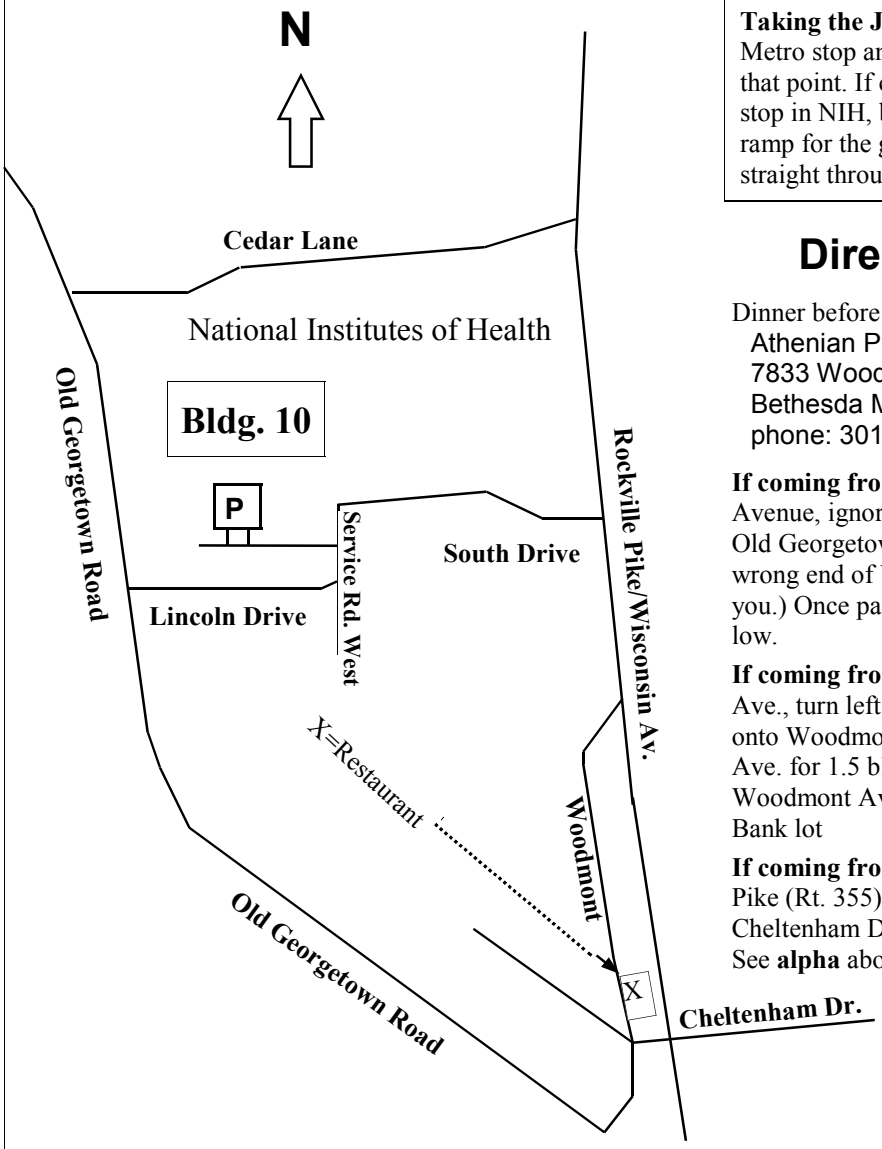
Getting to the NCA Monthly Meeting

Saturday, April 7

5:30 P.M. - Dinner with the speaker and NCA members at the

Athenian Plaka Restaurant,
7833 Woodmont Ave.
Bethesda MD
phone: 301/986-1337

7:30 P.M. - NCA Meeting at Lipsett Auditorium in Building 10 at NIH. Guest speaker: Elizabeth M. Warner will talk about "The Deep Impact Mission".



Directions to the Meeting Place

From Rockville Pike (Wisconsin Ave., Rt. 355), to get to the parking lot at the South entrance (this will be the entrance for the next three years or so until they finish the new wing) from Rockville Pike, enter NIH at the Metro Entrance: South Drive (traffic light). Go straight ahead. At the third stop sign you will be at the parking lot, but you will have to make a left turn then a right to get to the entrance to the lot. Make a right turn into the lot. Building 10 is just north of the parking lot. Enter the building and follow the signs to the Lipsett Auditorium.

From Old Georgetown Rd., enter at Lincoln Drive (traffic light nearest to Suburban Hospital). Go straight ahead. The second stop sign is at a T. Go left and left again, and the lot will be on the right. Make a right turn into the lot.

Metrorail Riders - From Medical Center Metro Station: Walk down the hill, past the bus stops. Continue straight past the anchor. At the second stop sign after the anchor, bear right up the incline into the entrance of Building 10, the tallest building on campus (walking time less than 10 minutes).

Taking the J2 or J3 buses from Silver Spring, get off at the Metro stop and follow the directions given for motorists from that point. If coming from Montgomery Mall, get off at the first stop in NIH, before the Clinical Center. There are signs near the ramp for the garage directing you into the side entrance. Walk straight through the building to the Lipsett amphitheater.

Directions to the Restaurant

Dinner before the meeting will be at 5:30 P.M. at the
Athenian Plaka Restaurant,
7833 Woodmont Ave.
Bethesda MD
phone: 301/986-1337

If coming from the District, when going north on Wisconsin Avenue, ignore all signs for Woodmont Avenue until you pass Old Georgetown Road on your left. (Those signs put you on the wrong end of Woodmont Ave., which becomes one-way against you.) Once past Old Georgetown Rd., follow the directions below.

If coming from south of Bethesda, go north on Wisconsin Ave., turn left at onto Cheltenham Dr.(traffic light). Turn right onto Woodmont Ave. **(alpha)** Continue North on Woodmont Ave. for 1.5 blocks to the restaurant, which is on the right side of Woodmont Ave. Free parking on the upper level of the Suburban Bank lot

If coming from north of Bethesda, go south on the Rockville Pike (Rt. 355) which becomes Wisconsin Ave. Turn right at Cheltenham Dr. (traffic light). Turn right onto Woodmont Ave. See **alpha** above.

After dinner, go north on Woodmont Ave to the traffic light at Rockville Pike (=Wisconsin Avenue) and turn left. Proceed north on the Rockville Pike and follow "directions to the meeting place" at the top of this page.

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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. 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. Most of these NCA members are also members of the International Occultation Timing Association (IOTA).

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). Some NCA members are also individual members of IDA.

Classes: Some NCA members are available for educational programs for schools and other organizations. The instruction settings include star parties, classroom instruction, and schoolteacher 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. Contact: Sue Bassett wb3enm@amsat.org

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 the NATIONAL CAPITAL ASTRONOMERS **Date:**

Name(s): _____
Address: _____
_____
Telephone: _____ E-mail: _____
Other family members who should receive a membership card: _____
Dues:

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___ $27 With *Star Dust* ONLY.
___ $45 Junior membership with *Star Dust* and a discount subscription to *Sky & Telescope*.
___ $15 Junior membership with *Star Dust* ONLY.
___ $100 Contributing member (with *Sky & Telescope*) ($43 tax-deductible).
___ $150 Sustaining member (with *Sky & Telescope*) ($93 tax-deductible).

Junior members only: Date of Birth: _____ Only members under the age of 18 may join as juniors.

Tax deductible contribution: ____ Thank You.
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