Star Dust

National Capital Astronomers, Inc.

Volume 59, Number 7 March 2001 ISSN 0898-7548

Pamela Clark: Motivation and Scope of the NEAR Mission

submitted by Gary Joaquin

Dr. Pamela Clark will present the featured talk, "Motivation and Scope of The Near Earth Asteroid Rendezvous (NEAR) Mission", for the March 3 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. Both the synopsis and biography that follow are provided by Dr. Clark. For the latest news about NEAR and its landing on Eros, see http://near.jhuapl.edu/.

Synopsis

433 Eros is a Rosetta stone that can put us in touch with our cosmological roots. The NEAR X-ray/Gamma-Ray Spectrometer (XGRS) and other instruments are allowing translation of its language, and thus furthering understanding of the early history of the inner solar system. I will discuss the motivation and scope of the Near Earth Asteroid Rendezvous mission, as well as the nature and potential significance of asteroids and their relationship to meteorites, particularly for our target asteroid. Eros is a relatively large asteroid from the largest observational class of asteroids in the inner solar system (Class S). Before our rendezvous, no clear consensus as to the closest analogue to Class S asteroids had been achieved. Compositional (elemental and mineralogical abundance) measurements taken during the course of the mission are still being interpreted and include the range of chondritic meteorite classes, from undifferentiated (ordinary chondrites) to partially differentiated (primitive achondrites). I will present the current findings, as well as uncertainties, challenges, and new questions, raised by the NEAR measurements of Eros. I hope

(Continued on page 2)

A Stratospheric View of The Sun by David Rust

by Nancy Grace Roman

Dr. David Rust, the principal investigator of the Flare Genesis Experiment team spoke to NCA on February 3. He spoke about solar astronomy from twenty-five miles above Antarctica. He started off by introducing us to solar physics.

An Introduction to Solar Physics

In 1962, work began on the Flare Genesis Project, to fly a large telescope (80-cm) in Antarctica at solar maximum. The object of the project was to understand how the magnetic phenomena that bubble up and lead to sun spots also affect the solar wind and the earth's magnetosphere. On July 14, 2000, there was an enormous flare and magnetic storm from a large sunspot. Dr. Rust illustrated this sunspot whose umbra was about 1 1/2 times the diameter of the earth. This Bastille Day flare disrupted about 1/4 of the corona. Large solar eruptions are enormous coronal mass ejections, which disrupt space activities, of not only spacecraft but also communication systems. The ASCA (Japanese X-ray) satellite was lost as a result of this mass ejection and such activity can be dangerous for astronauts.

Dr. Rust showed a sequence of chronograph pictures of the development of a mass ejection. When the mass hit the earth, the detector was bombarded with solar high-energy protons causing "snow" on the images. The number of particles increased quickly by about six orders of magnitude from the background, reaching maximum about ten minutes after the light maximum, and then decreased somewhat more slowly.

On the ground, resolution is limited to about one arcsecond. Much better resolution will be possible with active optics that are just being developed. The ESA/NASA spacecraft, SOHO, has photographed solar mass ejections in helium. They are perhaps 50 times the diameter of the earth. X-rays show that 10^6 degrees K gas covers the entire solar disk and the larger corona. They think that the slow solar wind comes from the bright regions over sunspots; the fast solar wind comes from the coronal holes.

We may be past solar maximum at present. If so, this solar maximum has not been as large as recent ones. He showed a series of X-ray images, taken by the YOKO spacecraft, throughout a solar cycle showing the great increase with activity as solar maximum was approached.

Most X-ray brightenings are loops but a few show a sigmoid (lazy S) shape. This is the signature of an eruption precursor. The sigmoid brightening is the sign of a magnetic kink. This same sigmoid structure

(Continued on page 2)

NCA Events This Month

The Public is Welcome!

NCA Home Page: http://capitalastronomers.org

Fridays, March 2, 9, 16, 23, & 30 7:00 - 10:00 P.M. - Telescope-making and mirror-grinding classes at American University, McKinley Hall, Basement (Room 9), Nebraska and Massachusetts Avenues, NW. Connecticut Avenue, NW. Call or email Guy Brandenburg to confirm: 202-635-1860 or gfbranden@earthlink.net.

Fridays, March 2, 16, 23, & 30 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, March 3, 5:30 P.M. Dinner with the speaker and NCA members at

Frascati Ristorante Italiano
4806 Rugby Ave
Bethesda, MD
301-652-9514

See the map and directions on Page 8.

Saturday, March 3, 7:30 P.M. - NCA meeting, at the Lipsett Auditorium in Building 10 at NIH, will feature Dr. Pamela Clark talking to NCA about "Motivation and Scope of the Near Earth Asteroid Rendezvous Mission"

See Page 6 for more National Capital area astronomical doings. To join NCA, use the membership application on Page 9.

David Rust

(Continued from page 1)

can appear in hurricanes. Thus, it may arise from Coriolis force. The sigmoids are reversed in the two hemispheres on both the earth and the sun. The eruptions are bright, braided, twisted structures. Perhaps the twist is in the lower levels of the corona. It is apparently stored somehow in the corona until the eruption occurs. The eruption can be a solar radius or more in length. Eruptions occur about once a day at solar minimum and three times a day at solar maximum. About one per month hits the earth about three days later. It distorts the magnetosphere, condensing it on the sunward side and stretching it significantly on the antisun side. This distortion of the earth's magnetic field causes auroras.

The APL Flare Genesis Project

After this introduction to solar physics, Dr. Rust switched to a discussion of the APL Flare Genesis Project. The telescope was intended originally for the Star Wars Program. After several redesigns, each of which proved too expensive, Dr. Rust asked for the telescope. The Air Force was happy to get rid of it. The telescope has an f/3.5 low-expansion mirror and a graphite epoxy structure. APL built the gondola and yoke and the various focal-plane instruments. The telescope weighs about 300 pounds; the entire balloon-borne system weighs about 3000 pounds. APL flew this in Antarctica twice.

Why Antarctica?

There are a number of advantages to Antarctica. There are no military operations there, but about fifteen countries have some sort of claim there. There are 24 hours of daylight, flights of 10-20 days duration, predictable stratospheric winds that let you bring the payload down near to the launch site, and strong support form the National Scientific Ballooning Facility (NSBF). The NASA NSBF has been flying balloons in Antarctica for about 20 years. They usually can fly two each year. Typically these flights are to study cosmic rays; the APL payload was the first large solar telescope to fly. Precursors to the HESSI mission to study hard X-rays from the sun were also flown in Antarctica.

Working conditions are difficult. Dr. Rust showed pictures of McMurdo base. It is unattractive, with large stockpiles of lumber and oil, etc. All waste is now carted away. The remains, called "nukey-poo", from the nuclear power plant that had been there, have also been removed. The sum-

(Continued on page 3)

Pamela Clark

(Continued from page 1)

to deepen your sense of wonder about what we do and don't know about our Eros, and by implication, other solar system bodies.

Biography

I am a NEAR XGRS team member involved in the development and design of the X-ray spectrometers, theoretical modeling, analysis and interpretation of geochemical measurements from the NEAR mission. At the start of my career, I completed doctoral work at the University of Maryland while working at NASA/GSFC. I then did a National Academy of Sciences post-doctoral appointment at NASA/JPL.

I am currently a member of the research faculty in physics at Catholic University of America working at NASA/GSFC. I have also held positions at NASA/JPL and the US Geological Survey in Flagstaff, Arizona, as well as faculty positions at two academic institutions: in chemistry at Albright College, and in geosciences at Murray State University. I have been extensively involved in educational outreach activities throughout my career. The space program has always been an important part of my life.

NASA projects I have been involved with include the Near Earth Asteroid Rendezvous, Pioneer Venus, Mars Observer, and Magellan, and Mercury Messenger missions, a number of studies and proposals for Mercury missions, the Goldstone Solar System Radar, Planetary Data System, and Planetary Instrument Definition and Development programs, as well as a number of planetary data analysis programs. Generally, my work has involved the development of theoretical models, measurement and correlation of geochemical and other remote sensing measurements with sample and in-situ observations to determine the composition and origin of solar system objects. Most notably, this work has included the determination/ interpretation of definitive lunar elemental abundance and distribution maps; analysis of orbital Gamma-ray and X-ray Fluorescence (XRF), derived elemental concentration maps on scales ranging from local to global to determine origin of major terranes and of ground-based radar-derived roughness parameters at different size scales to determine origin of major tectonic features.

David Rust

(Continued from page 2)

mer population is about 1200 with an active air force with helicopters and air freighters. An ocean freighter calls once each year. There are only a few penguins near McMurdo. These cannot be disturbed. Project scientists must keep their coats on because they must keep the door open to watch the telescope as it reacts to various commands. Most activity between December 1 and launch on January 10 was devoted to perfecting the pointing control system to keep the telescope accurately pointed as the balloon swings slightly. The sun went from about 32 degrees above the horizon at noon to about 11 degrees above the horizon at midnight on the flight date.

The Equipment

Large solar panels generate about 1300 watts. The NSBF equipment was mounted under the telescope; the APL equipment was above it. Storms occur in Antarctica but usually pass quickly. The launch vehicle that took the payload to the launch site was the type used frequently on the Canadian tundra. The balloon and parachute were not laid out until the team was sure that the wind was be low enough to allow the launch. Only then was the balloon inflated with helium.

The telescope is a Ritchey-Chretien Cassagrain telescope. The resolution is about 0.2 arcseconds, corresponding to about 150 km on the sun. The secondary mirror is silver-coated silicon. Most of the heat is reflected back to the sun by a tertiary mirror. Only about 1% goes on to the remainder of the system. The light goes through two crystal modulating polarizers and a linear polarizer to an image stabilization mirror. In the focal plane, a portion of the light goes to a TV camera; most goes through a lens and a narrow-band Fabry-Perot filter to a 1300X1000 pixel CCD.

The Launch

Dr. Rust showed a movie of the launch, which was flown into fog. The first twenty hours were used for adjustments. After that, communications were very poor, with only a few hundred bits per day. At first it appeared that a key solder joint had broken, but they rebooted the computer system and then things worked well. At altitude (about 45 miles) the balloon was about half the height of the Eiffel Tower with a width of four times the length of a Boeing 747. The balloon carried about 400 pounds of ballast to be dropped to compensate for a slight leak. The balloon was sealed, except for a valve from which helium could be vented. This valve could also be used if the cut-down mechanism did not work.

The Flight

The flight path was nearly circular with slight wiggles. Near the end of the flight, the balloon tended to head south and pull away from McMurdo. They landed it about 340 kilometers from McMurdo after a 17-day flight. Dr. Rust showed a series of pictures of the landing. The payload landed upright, almost totally undamaged. The balloon was not recovered. It was too late in the season to recover the payload in 2000, but the team was able to get the data tapes. The solar panels were removed so they would not be whipped too badly in the wind and things were still in good condition when the payload was recovered a year later. (It may have received some damage in transport after that.)

On the flight they obtained vector magnetograms that gave them much information on the solar magnetic fields. These observations were complemented by simultaneous observations from a comprehensive worldwide network. They were successful in targeting. The highlights were observations of a major flare on January 22 and of an emerging flux region on January 25 that grew unexpectedly while observations were being made of a nearby region. The resolution in the resulting pictures and magnetograms was about 0.5 arcseconds. In this region they observed an area in which the direction of the magnetic field changed completely in a small distance, giving the first observation of a twisted flux rope. Dr. Rust showed a speeded-up movie of the region showing the growth of the sunspots. The movie also showed a braided flux rope feeding into one of the spots.

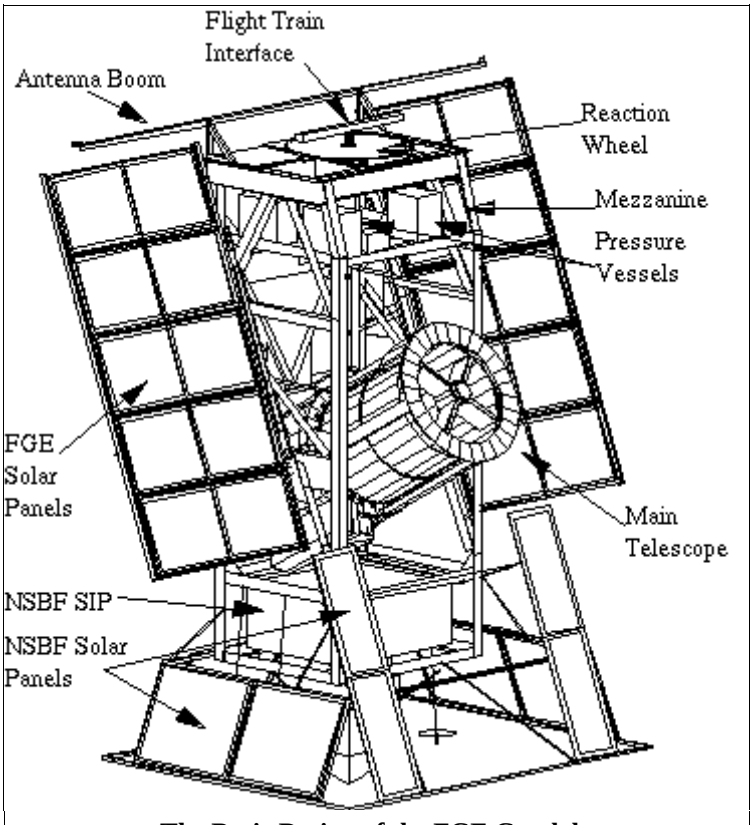
In Conclusion

Dr. Rust summarized the observations:

- The flux in the developing region emerged primarily at three distinct centers.
- Threads like those in the penumbra appear in the photosphere where the flux emerges.
- The fields in the threads are horizontal along the thread in contrast to most of the fields, which are vertical.
- The mission provided the clearest observations of flux ropes ever obtained.

Answers from the Q&A Period

- The balloon took 15 - 20 minutes to descend.
- The telescope was flown out in a DC3.
- It is possible to command the telescope to point to particular coordinates on the sun, but once pointed, holding that pointing is autonomous. The rotation is taken up with a wheel; when the wheel spins too fast, the momentum is autonomously dumped into the balloon.



The Basic Design of the FGE Gondola

from the Flare Genesis Experiment web site, http://sd-www.jhuapl.edu/FlareGenesis, via Gary Joaquin

(Continued on page 4)

Science Fair Judges Needed

As one of its functions in encouraging an interest in astronomy in our children, NCA has attended science fairs in the metropolitan area over the years and presented a year's membership in NCA and a subscription to Sky and Telescope magazine to winners of astronomically related projects. The students present their projects at our June meeting. This year's fairs are coming up in March and April and we need judges. The fairs I know about are: Montgomery County's on 31 March at NIST and the District of Columbia (Howard University gymnasium) and Fairfax County fairs which are on 17 March. There will also be a fair in Prince George's County around this time. If you can assist in judging any of these fairs please contact Wayne Warren (301-474-0814) for P.G. County, Bob Bolster (703-960-9126) for Virginia or Jay Miller (301-530-7942) for the Montgomery County or D.C. fairs. Since you will be judging with others, don't be afraid if you don't have an extensive knowledge of astronomy.

RASC Observer's Handbooks and Calendars

Anyone who ordered RASC Observer's Handbooks or Calendars and has not gotten them, please pick up your copies at the March 3rd meeting. If you are unable to do so, please email me at nancy@pangean.com or telephone 703-978-3440; otherwise, I will assume you don't want them and will sell them off.
Thanks,
Nancy Byrd

David Rust

(Continued from page 3)

- Weather forecasts are not much good. You hope that the forecast is correct and then monitor the weather with small balloons.
- The temperature was about 25° at midnight and reached as high as 40° one day.
- The autofocus failed to work much of the time. Thus, many pictures were out of focus. Otherwise, all systems worked pretty well. More communication would have helped; this is now available with TDRS.
- The telescope will reach APL in April of this year and it will take at least two years to refurbish it. They would not be able to fly it again before 2003. However, it will be solar minimum by then, and Dr. Rust is not interested in flying it at that time.
- Nothing is biodegradable in Antarctica. There are no bacteria, etc.
- The magnetic field is measured by Zeeman splitting. The linear polarization gives the strength of the horizontal component; the circular polarization gives the strength of the vertical component.
- The filter has a 0.1 Å width. The CaI line at 6122 Å that they use is rather broad, which makes it easier to use.
- Dr. Rust does not think that NASA would certify a payload that wintered over in Antarctica. The temperature in the balloon barn where it would have to be stored has no temperature control so it would get very cold.
- The Antarctica Program pays for all expenses Baltimore to Baltimore. So it is cheaper for APL to bring it home for refurbishment than to refurbish it in New Zealand.

Meteor Showers

Full Moon: March 9

Major Activity: None

Minor Activity

Radiant	Duration	Maximum
Eta Draconids	March 22-April 8	Mar. 29-31
Beta Leonids	February 14-April 25	Mar. 19-21
Rho Leonids	February 13-March 13	Mar. 1-4
Leonids-Ursids	March 18-April 7	Mar. 10/11
Delta Mensids	March 14-21	Mar. 18/19
Gamma Normids (GNO)	March 11-21	Mar. 16/17
Eta Virginids	February 24-March 27	Mar. 18/19
Pi Virginids	February 13-April 8	Mar. 3-9
Theta Virginids	March 10-April 21	Mar. 20/21

Daylight Activity

Radiant	Duration	Maximum
March Aquarids	February ??-April ??	Mar. 15-18

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

Mid-Atlantic Occultations and Expeditions

by David Dunham

Asteroidal Occultations

DATE	Day	EST	Star	Mag	Asteroid	dmag	Dur s	Ap. in.	Location
Mar 4	Sun	1:28	TYC19581580	10.8	Mombasa	4.9	5	7	Virginia
Mar 6	Tue	2:08	SAO 138387	9.5	Hypatia	3.2	11	5	Georgia
Mar 26	Mon	20:57	TYC19422449	10.8	Academia	4.5	9	8	New York
Mar 27	Tue	0:57	HIP 70660	10.4	Jarnefelt	5.0	6	7	Georgia

Lunar Grazing Occultations and a Grazing Annular Solar Eclipse

DATE	Day	EST	Star	Mag	%	alt	CA	Location
Feb 27	Tue	19:52	ZC 0306	6.8	19+	26	7S	Emmitsburg & MD Line(I83), MD
Mar 3	Sat	18:05	zeta Tauri	3.0	59+	71	10S	Back Bay, VA, Sun -2 *
Mar 3	Sat	21:50	SAO 077460	8.4	60+	52	0N	Nags Head, NC
Mar 3	Sat	23:35	SAO 077553	8.1	61+	32	3N	Nags Head, NC & Roanoke, VA
Mar 14	Wed	0:28	ZC 2210	6.8	75-	15	15S	Chester, VA
Mar 27	Tue	19:57	85 Ceti	6.3	8+	13	6S	Charlotte, NC (Star ZC 401)
Apr 1	Sun	20:57	SAO 079409	7.9	56+	58	2N	York, PA & Wilmington, DE
Dec 14	Fri	17:30	The Sun	-27	0	13	N	Liberia, Costa Rica **

* Zeta Tau is the brightest star grazed in the region this year. The other two give a chance to see 3 grazes in one night.

** For more, see http://iota.jhuapl.edu

Total Lunar Occultations

DATE	Day	EST		Star	Mag	%	alt	CA	Notes
Mar 3	Sat	17:44	D	zeta Tauri	3.0	60+	66	43S	Sp. B4; Sun alt. +3 deg.
Mar 3	Sat	18:28	R	zeta Tauri	3.0	60+	71	-22S	ZC 847; WA 201; Sun -6 deg.
Mar 4	Sun	22:21	D	SAO 078742	7.0	72+	56	38S	Sp. K0
Mar 4	Sun	23:09	D	SAO 078774	7.3	72+	47	68S	Sp. B9
Mar 9	Fri	19:15	R	nu Vir	4.0	100-	10	30N	Sp. M0, R at Mare Crisium
Mar 12	Mon	4:05	R	ZC 1978	6.6	90-	40	78S	Sp. K0, probable close double
Mar 14	Wed	0:43	R	ZC 2210	6.8	75-	17	40S	Sp. K0; graze s. of Richmond
Mar 17	Sat	4:35	R	AP Sgr	7.1	45-	21	33N	Sp. F7; prob. dbl.; SAO 186478
Mar 27	Tue	19:34	D	85 Ceti	6.3	9+	17	48S	Prob. dbl.; graze in sw N.Car.
Mar 28	Wed	21:32	D	ZC 0523	6.4	16+	7	80N	Sp. A5; poss. close double
Mar 31	Sat	13:59	D	eta Gem	3.3	43+	49	38N	Sp. M3; Sun alt. 48 deg.
Mar 31	Sat	14:54	R	eta Gem	3.3	43+	50	-65N	ZC 946; Sun alt. 40 deg.
Mar 31	Sat	18:19	D	mu Gem	2.9	45+	73	80S	Sp. M3; Sun alt. 1 deg.
Mar 31	Sat	19:39	R	mu Gem	2.9	45+	62	-73S	ZC 976
Mar 31	Sat	19:54	D	SAO 078352	7.2	45+	60	66S	Close double, 2nd mag. 9.5
Mar 31	Sat	22:18	D	ZC 0997	7.0	46+	33	77N	Sp. A0
Mar 31	Sat	23:22	D	ZC 1001	7.3	46+	21	20S	Sp. A0
Apr 1	Sun	0:18	D	SAO 078508	7.2	47+	11	12S	Sp. A3; wide (54") double
Apr 1	Sun	20:45	D	SAO 079409	7.9	57+	61	20N	Sp. K0 and NEXT
Apr 1	Sun	20:45	D	ZC 1128	6.8	57+	61	14S	Sp. K5
Apr 2	Mon	22:08	D	eta Cancri	5.3	69+	56	71S	Sp. K3
Apr 2	Mon	23:52	D	SAO 080278	7.5	69+	37	72N	Sp. A
Apr 3	Tue	1:01	D	CY Cancri	8.1	70+	23	74S	Sp. A5; SAO 080309
Apr 3	Tue	1:34	D	ZC 1295	6.4	70+	17	80N	Sp. K0; Start of Praesepe
Apr 3	Tue	1:36	D	ZC 1296	6.6	70+	17	86N	Sp. A1 Passage
Apr 3	Tue	1:39	D	BT Cancri	6.7	70+	16	43S	Sp. F0; ZC 1292
Apr 3	Tue	2:02	D	ZC 1302	6.8	70+	12	47S	Sp. A9; prob. close double
Apr 3	Tue	2:05	D	ZC 1298	6.4	70+	11	21S	Sp. K0
Apr 3	Tue	2:16	D	ZC 1305	6.9	70+	10	82N	Sp. K0
Apr 5	Thu	23:08	D	ZC 1669	6.7	95+	58	51S	Sp. F5

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 site at http://www.lunar-occultations.com/iota

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

Other National Capital Area Meetings, etc.

Department of Terrestrial Magnetism (DTM) Carnegie Institute of Washington Seminars are held on Wednesdays at 11:00 a.m. in the Main Building, 5241 Broad Branch Road, N.W., Washington, D.C. No information available at press time. DTM is located on 32nd Street one block south of its intersection with Military Road. Proceed south on 32nd Street one block to Jocelyn Street, turn left on Jocelyn, and right into the parking lot. Coffee and tea will be served at 10:45 a. m. Please call to confirm that there have been no cancellations. Tel. 202-478-8830. Source: http://www.ciw.edu/DTM-seminars.html

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.
March 2 Todd Tripp, Princeton University, "The Census of the Nearby Universe: The Intergalactic Population"
March 9 E. Sterl Phinney, Cal Tech, "LISA and Gravitational Radiation"
March 16 William Kuperman, Scripps Institution, "Time-Reversed Acoustics"
March 23 Mark Tilden, Los Alamos, "Nervous Networks and the Architecture of 'Living' Machines"
March 30 Shrinivas Kulkarni, California Institute of Technology, "Gamma Ray Bursts: Dying Cries from the Deep Universe"
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. Wednesday, 21 March 2001 at 7:00 P.M. "The Rites of Spring, the Vernal Equinox" The planetarium show will explore the astronomical events associated with the first day of spring and will demonstrate how the position of the equinox has changed over the millennia with respect to the fixed stars. The vernal equinox which is both a time and a direction in space is called the first point of Aries. Come find out why it is in Pisces now and when last it was in Aries. Help us celebrate Noruz the oldest continuously celebrated human holiday. The Vernal equinox was in Taurus when this celebration began 5,000 years ago. Find out when we will really enter the age of Aquarius. 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.
March 11 Sean O'Brien: "Education Under the Dome" What kind of educational activities can be pursued in a planetarium? NOVAC V.P. and Albert Einstein Planetarium program manager Sean O'Brien will show some examples. Of course, the best way to find out about planetarium education is to get "under the dome" yourself! But this will be a great introduction. Source: http://novac.com

University of Maryland Observatory on Metzerott Road. Open house on 5 and 20 of each month includes a 20- to 30-minute slide presentation in the lecture hall, followed by telescope viewing. No information available at press time. Info: (301) 405-3001 Source: http://www.astro.umd.edu/openhouse/

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.
March 7 Dr. Dara Norman, SUNY/SB, "Quasar-Galaxy Correlations and the Detection of Magnification Bias"
March 14 Dr. Lynne Hillenbrand, Caltech, TBA
March 28 Dr. Chuck Steidel, Caltech, 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.
March 2 Akimasa Ieda, NRC at NASA/GSFC, "Auroral Breakups and Magnetotail Plasmoids: Polar/UVI and Geotail Observations"
March 9 Rebecca Bishop, University of Texas at Dallas, "Investigation of Intermediate Layers in the Nighttime Ionosphere"
March 16 Lutz Rastaetter, RITSS at NASA/GSFC, 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.
March 5 Mario Livio, Space Telescope Science Institute, "Beauty in Physics and the Accelerating Universe"
March 12 Dale Schulz, NASA/GSFC, "Earth Observing 1: Validating Affordable New Landsat Technology"
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

Space Telescope Science Institute (STScI) Free public Lectures at the Space Telescope Science Institute. Lectures are at 8 p.m. the first Tuesday of every month in the STScI auditorium, on the campus of Johns Hopkins University. Free parking is available. For directions, call 410-338-4700.
March 6 "The Taranaki Event, July 7th 1999" - Ian Griffin
The Johns Hopkins University's Bloomberg Telescope is open to the public every Friday evening, weather permitting. For more information, contact the observatory at (410)-516-6275 or via email at altan@pha.jhu.edu. Source: http://hubble.stsci.edu/about_us/open-night.shtml

Laboratory for Astronomy and Solar Physics (LASP) — Seminars are on Thursday at 3:30 P.M. in GSFC Bldg. 21, Room 183.
March 1 Bhuvnesh Jain, University of Pennsylvania, "Gravitational Lensing and Cosmology"
March 8 Karl Glazebrook, Johns Hopkins University, "The 2dF Galaxy Red-

Other National Capital Area Meetings, etc.

shift Survey: Well Past Halfway"
March 15 Mario Livio, STScI, "Supernovae Type 1a and the Accelerating Universe"
March 22 David Hogg, New York University, "Are Galaxies Evolving?"
March 29 Neill Reid, STScI, "Brown Dwarfs; Dark Matters"
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

LASP Stellar & Extra-Galactic Astronomy Lunch — Talks are Wednesdays at 12:00 Noon in Room 242 of Building 21, except as noted.
Tuesday, March 13 Chris Fassnacht, TBD
March 21 Tom Pauls, NRL, "Optical Interferometry with the Navy Prototype Optical Interferometer"
March 28 Bill Danchi, GSFC, "Circumstellar Disks with Near- and Mid-IR Interferometry".
Source: http://hires.gsfc.nasa.gov/~gardner/seal/

Maryland Science Center, 601 Light Street, Baltimore, MD
Planetarium programs: no information available for March.
Crosby Ramsey Memorial Observatory: Stargazing Thursdays
See the Moon, planets, and stars through our historic, and now computer controlled, Alvan Clark & Sons 8" refracting telescope. The observatory is open to the public every Thursday from 5:30 to 10:00 P.M., weather permitting. Admission is free. Phone 410-545-2999 after 5:00 P.M. on Thursdays to find out if the observatory will be open that night. The observatory is on the roof of the Maryland Science Center. On Thursdays, enter on the southern side of the building — the side that faces Key Highway. (The northern doors, facing the Inner Harbor, will not be open.) The observatory is open to the outdoors, so please dress appropriately.
Sungazing Sundays: Safely look at the Sun and its features — such as sunspots and prominences — through a special set of filters on our telescope. The observatory is open to museum visitors every Sunday from 11:00 A.M. to 4:00 P.M., weather permitting. Admission is included with Science Center admission. Phone 410-545-2999 after 10:30 A.M. on Sundays to find out if the observatory will be open that day. Source: http://www.mdsci.org/.

Laboratory for High Energy Astrophysics (LHEA) Tuesday Seminar Series — NASA GSFC Building 2, Ground Floor Conference Room, 3:30 P.M.
No information available at press time.
Source: http://lheawww.gsfc.nasa.gov/docs/lhea/TuesSeminar/Seminar.html

Baltimore Astronomical Society
Meetings are held the second Tuesday of each month at 7:30 p.m. at the Maryland Science Center, 601 Light Street, Baltimore, MD. For these meetings ***only,*** you may park in the Science Center Lot on Key Highway. No information available at press time. Come in the Members' Entrance, and sign in at the Guard Desk. Hotline: 410-545-5919.
Source: http://www.baltastro.org/

National Air & Space Museum – Free lectures at the Einstein Planetarium and other daily events. 202-357-2700.
2001 EXPLORING SPACE LECTURE SERIES
Is the Universe Fit for Life?
Wednesday, March 7
7:30 p.m., Einstein Planetarium
This year's series examines one of the major themes of science in the 21st century: the search for extraterrestrial life. Steven J. Dick, Historian of Science at the U.S. Naval Observatory in Washington, D.C., opens the series. His lecture, The Biological Universe: Historical Reflections, traces the roots of the debate from Copernicus to the present, and examines the philosophical implications of a universe filled with planetary systems teaming with life.
Home page: http://www.nasm.edu.

Greenbelt Astronomy Club The Greenbelt Astronomy Club meets on the last Thursday of each month (except holidays) at 7:30 p.m. at the Howard B. Owens Science Center, 9601 Greenbelt Road, Lanham, MD 20706. For more information on upcoming events, call (301) 277-4041 or e-mail at grnbltastro@learn.com. (Call the Science Center at 301-918-8750 or (301) 441-4605 to confirm meeting dates). Club meetings are open to the general public. No information available at press time.
Source: lheawww.gsfc.nasa.gov/docs/outreach/gac/GAC.html

U.S. Naval Observatory (USNO)
conducts a free 90-minute tour of its facilities every Monday night at 8:30 p.m., except on Federal holidays. The tour includes presentations about the Master Clock, observations through telescopes (weather permitting), a video presentation on the mission and history of the Observatory, and discussions with staff astronomers. Call the USNO Public Affairs Office, 202/762-1438 before going down.
Source: http://www.usno.navy.mil

Star Dust Is Now Available 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 ngroman@erols.com, or via telephone at 301-656-6092 (home)

Deadline for April *Star Dust*: March 15

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.

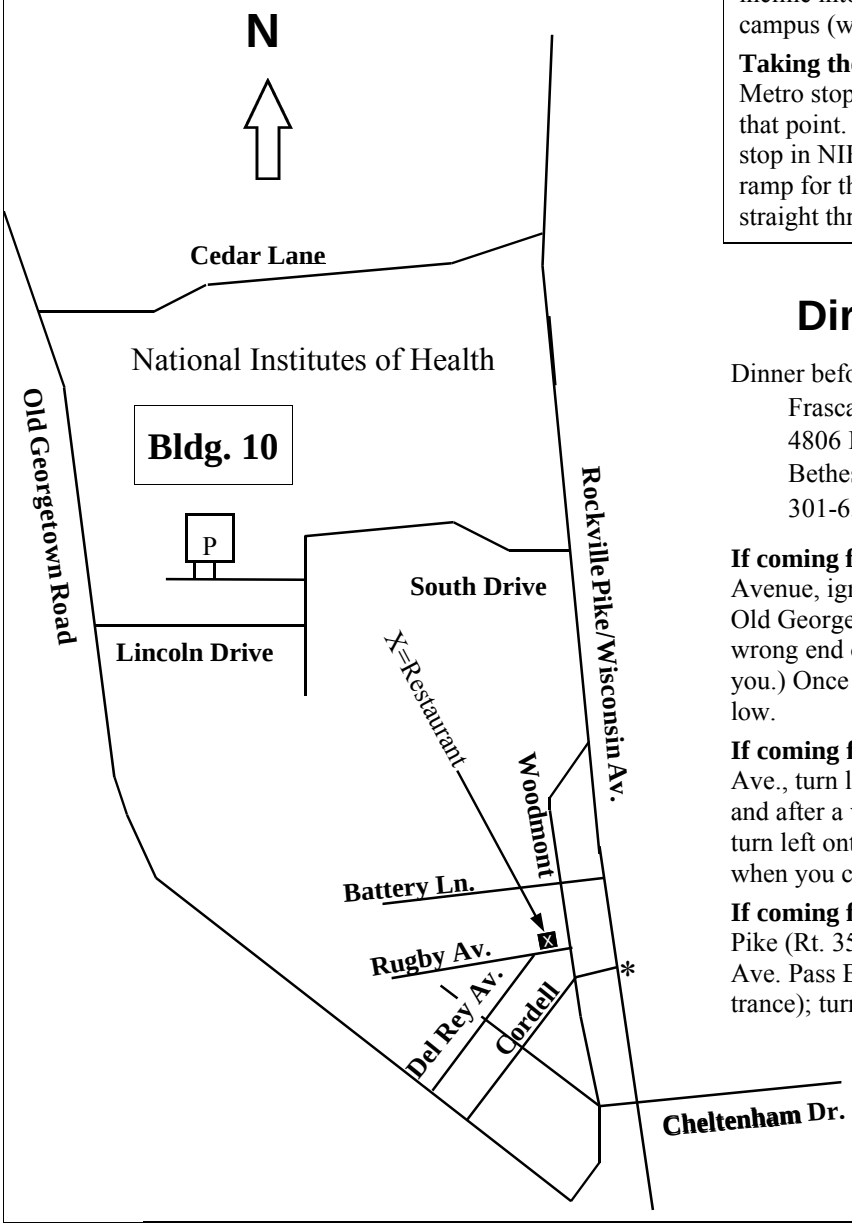
Getting to the NCA Monthly Meeting

Saturday, March 3

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

Frascati Ristorante Italiano
4806 Rugby Ave
Bethesda, MD
301-652-9514

7:30 P.M. - NCA Meeting at Lipsett Auditorium in Building 10 at NIH. Guest speaker: Dr. Pamela Clark talking to NCA about "Motivation and Scope of the Near Earth Asteroid Rendezvous 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. Bear left 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
Frascati Ristorante Italiano
4806 Rugby Ave
Bethesda, MD
301-652-9514

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 onto Cordell (traffic light), right onto Woodmont, and after a very short distance (way before the next traffic light) turn left onto Rugby Ave. The restaurant will be on your left when you complete the turn.

If coming from north of Bethesda, go south on the Rockville Pike (Rt. 355). As you pass NIH, make a right onto Woodmont Ave. Pass Battery Lane, and the next light (next to the garage entrance); turn right onto Rugby Ave. The restaurant is on your left.

After dinner, take Woodmont Ave. north 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.

Star Dust is published ten times yearly, September through June, by the National Capital Astronomers, Inc. (NCA).
Editor: Elliott Fein, Co-editor: Adele Fein, Editorial Advisor: Nancy Byrd.

National Capital Astronomers, Inc.

Nancy Byrd, NCA President, nancy@pangean.com, 703-978-3440 (home).
Gary Joaquin, NCA Vice-president, glj1@erols.com.
Nancy Grace Roman, NCA Secretary, ngroman@erols.com, 301-656-6092 (home).
Jeffrey Norman, NCA Treasurer, jeffrey.norman@ferc.fed.us, 5410 Connecticut Avenue, NW, Apt. #717, Washington, DC 20015-2837.
Harold Williams, NCA Webmaster, hwilliam@mc.cc.md.us, 301-650-1463 planetarium, 301-565-3709 (home).
Leith Holloway, NCA contact for Junior members, jleithh@aol.com, 301-564-6061.
Elliott Fein, NCA *Star Dust* Editor, elliott.fein@erols.com, 301-762-6261 (home), 5 Carter Ct. Rockville, MD 20852-1005.
NCA Web Page: http://capitalastronomers.org/.

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:
___ $57 With *Star Dust* and a discount subscription to *Sky & Telescope*.
___ $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.
_____ I prefer to receive *Star Dust* by e-mail.

Please send this form, with your check payable to National Capital Astronomers, Inc., to:
Mr. Jeffrey Norman, NCA Treasurer, 5410 Connecticut Ave NW #717, Washington DC 20015-2837

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

Inside this issue: