

Star Dust

National Capital Astronomers, Inc.

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Superconducting Robotic Telescopes on the Moon

by Harold Williams

The next meeting of the National Capital Astronomers will be held Saturday, April 6, at 7:30 P.M. in the Lipsett Auditorium of the Clinical Center (Building 10) at the National Institutes of Health (NIH). Peter Chen who is employed by the Computer Science Corporation (CSC) in the Laboratory for Astronomy and Solar Physics at the Goddard Space Flight Center (GSFC) and combines astronomical research with instrument design, will speak about "Superconducting Robotic Telescopes on the Moon." He was originally scheduled to speak to us on February 3, but a

snow storm intervened. The title of his talk has changed slightly since February 3 in that the word superconducting has been added. He got his Ph.D. from the University of Texas at Austin, where he started doing occultation timings. Peter recommends this as an exciting and fun thing to do with small portable telescopes used in a time-critical way.

As one of many speakers on our Charge Coupled Devices (CCD's) program, he spoke to us in September 1995 on Charge Injection Devices (CIDs) and demonstrated a CID camera in operation. He mentioned the projected use of

CID chips as image detectors for the lunar telescopes in that meeting, and it was decided to ask him to speak about robotic telescopes on the Moon in greater detail at a future meeting. The radiation resistance of CID chips compared with that of CCD chips is their main recommendation as image detectors for lunar environments, since the Moon has no atmosphere or appreciable magnetic field to protect it from the energetic charged particles in the solar wind. I am sure Peter will explain what advantage making the telescope superconducting will confer.

Searching for the Cosmic Infrared Background

by Harold Williams

On Saturday March 2, 1996 at the National Institutes of Health (NIH) in the Lipsett Auditorium, Eli Dwek, an astrophysicist in the Infrared Astrophysics Branch of the Laboratory of Astronomy and Solar Physics (LASP) at the NASA/GSFC (National Aeronautics and Space Administration/Goddard Space Flight Center), spoke to us on "Searching for the Cosmic Infrared Background."

The COBE, Cosmic Background Explorer, launched in November 18, 1989, had three instruments of which the Diffuse Infrared Background Experiment (DIRBE) was one. The primary purpose of the DIRBE was to measure "the cosmic background," (CIB) where it was suspected that because of the cosmic redshift caused by

the expanding Universe, the short-wavelength radiation (short relative to infrared) would contain much of the total radiant energy of stars and galaxies at a time before $Z > 1$. Z is the redshift, the change in wavelength divided by the wavelength at rest. For velocities much less than the speed of light Z as measured by the change in the wavelength divided by the wavelength is the velocity divided by the speed of light in a vacuum, according to the standard Doppler shift equation. For $Z > 1$ obviously this approximation is not valid and special relativistic expressions must be used to express Z in terms of the velocity and the speed of light. $Z > 1$ is a long time ago and very far away. The radiant energy emitted at that time would be

shifted into the infrared and reprocessed by the dust in the Universe. The light from the so called Population III stars, the first stars formed, but never seen directly would be in the infrared now and reprocessed by the dust. The total energy in the CIB is comparable to the microwave background that was formed at an earlier epoch when the Universe was just created and after a few hundred thousand years had become photons. The CIB time would be the first star and galaxy formation epoch.

The only problem is the zodiacal dust within the disk of our own Solar System also emits in these frequencies in the infrared. Fortunately the sources

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Calendar of Monthly Events

The Public is Welcome!

Daily, 3:00 PM—The Smithsonian Institution, National Air and Space Museum (NASM) planetarium lecture on current night sky: “The Stars Tonight.” Einstein Planetarium uses one of the finest planetarium projectors in the Eastern U.S. Recorded information (call anytime): 202/357-1550, or 202/357-1686.

Mondays, April 1, 8, 15, 22, and 29, 8:30 PM—Public nights at the U.S. Naval Observatory (USNO), in Northwest Washington, D.C. (off Massachusetts Avenue). Includes orientation on USNO’s mission, viewing of operating atomic clocks, and glimpses through the finest optical telescopes in the National Capital region. Information: USNO Public Affairs Office, 202/653-1541.

Tuesdays, April 2, 9, 16, 23, and 30, 7:00-9:30 PM—Mirror-making classes with Jerry Schnall at the Chevy Chase Community Center at Connecticut Avenue and McKinley Street, NW in Washington. Information: 202/362-8872.

Wednesday, April 3—April “Sky Watch” column appears in *The Washington Post* “Style” section. It lists many events for that month.

Wednesday, April 3, Dusk—Total Lunar Eclipse. Opportunity to view Comet Hyakutake without Full Moon interfering. Look between roughly nautical twilight’s end (around 7:23 PM EST) and around 8:15 to 8:30 PM. Moon clear of umbra shadow by 8:58 PM. Recorded information (call anytime): 202/357-2000.

Saturday, April 6, 9:30 AM—NASM Monthly sky lecture: Andy Johnston (Center for Earth and Planetary Studies, NASM), “Your Neighborhood from Space.” Einstein Planetarium. Recorded information (call anytime): 202/357-1550.

Saturday, April 6, 5:30 PM—Dinner with our speaker will take place at Sunrise Kabob Restaurant, 4910A St. Elmo Avenue, Bethesda, MD., before the monthly meeting. We will start ordering at 5:30 PM. See the map on the back page for directions.

Saturday, April 6, 7:30 PM—The April NCA meeting will feature Peter Chen speaking on “Superconducting Robotic Telescopes on the Moon.” More information will follow on the new Comet Hyakutake.

Sunday, April 7, 2:00 AM—Change clocks forward one hour, from Eastern Standard Time (EST) to Eastern Daylight Time (EDT).

Monday, April 8, 7:00 PM—Arlington Planetarium lecture on current night sky: “Stars Tonight for April.” Outside observing follows, weather permitting. Details, 703/358-6070.

Wednesday April 10, 8:00 PM—NASM 1996 Wernher von Braun Memorial Lecture: James Lovell, Jr. (Commander, Apollo 13), “*Apollo 13: A Successful Failure.*” Langley Theater. Recorded information (call anytime): 202/357-1686.

Fridays, April 12, 19, and 26, 9:00 PM—NCA’s Celestron-14 telescope open nights with Bob Bolster, 6007 Ridgeview Drive, south of Alexandria off Franconia Road between Telegraph Road and Rose Hill Drive. Call Bob at 703/960-9126.

Saturday, April 13, Night—Waning crescent Moon provides this month’s *longest* Saturday night “deep night” period, with Moon free skies almost all night long, including between dusk and Midnight EDT. See explanation below.

Wednesday, April 17, 7:30 PM—NASM Exploring Space Lecture: Robert Kirshner (Harvard-Smithsonian Center for Astrophysics), “Lighthouses in the Sky: Extragalactic Supernovae.” Einstein Planetarium. Recorded information (call anytime): 202/357-1550.

Friday through Sunday, April 19 through 21, At Dusk—Young crescent Moon, with Earthshine, situated for observation and enjoyment. Easily visible with unaided eye from both near and away from city lights. Particularly impressive with the monuments from the Mall. Recorded information (call anytime): 202/357-2000.

Saturday, April 20—Astronomy Day, celebrating the theme of “Taking Astronomy to the People.” Now cosponsored by a dozen astronomical and education organizations, including NCA.

Saturday, April 20, 5:00 AM—NCA and Patuxent Park present “Breakfast With The Stars.” Bring binoculars and telescopes, although telescopes will be available (thanks to NCA). Continental breakfast accompanies program. Reservations required. Infor-

mation, reservations, and directions: 301/627-6074; more information: Bob Bolster (NCA), 703/960-9126.

Saturday, April 20, Dusk—(Civil twilight ends around 8:20 PM). Geoff Chester (NASM) presents sky watching at Sky Meadow State Park, near Paris, VA. Information and Directions: Sky Meadow State Park, 703/592-3556; Geoff Chester, 202/357-1529.

Saturday, April 20, 8:30 PM—*Exploring the Sky* held in Rock Creek Park near the Nature Center, south of the intersection of Military and Glover Roads, NW. Additional information, call the Nature Center, 202/426-6829, Joe Morris (NCA), 703/620-0996. See this issue, page 8 for complete schedule.

Saturday, April 20, Night—Waxing crescent Moon provides this month's *second longest* Saturday night "deep night" period, although Moon free skies don't begin until after Moonset around 10:40 PM EDT. See explanation below.

Sunday, April 21, 1:00-4:30 PM—"The Scale of the Universe 1996 Debate" featuring Gustav A. Tammann and Sidney van den Bergh. Natural History Museum, Washington, DC. See ad on page 8 for more information about program and tickets.

Sunday through Saturday, April 21 through 27—National Science and Technology Week. Information: National Science Foundation, 703/306-1070, or via Internet: nstw@nsf.gov. This week is also Sky Awareness Week which fosters awareness of the sky, including the night sky. For details, call 301/762-SNOW (301/762-7669).

Monday, April 22—Earth Day.

Saturday, April 27, 7:00 PM—Montgomery College's Planetarium on Fenton Street in Takoma Park will present "Black Hole, Gravity to the Max." That evening it is permissible to park in the faculty/staff-only parking lot adjacent to the planetarium and Funton Street.

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of non-cosmological emission are not the same at all infrared frequencies and they are not so uniformly distributed like it is assumed that the CIB would be. In fact, the zodiacal dust, is obviously contained in the zodiac or it would not be so named. This emission though is around 1,000 greater than the CIB. Then there is interstellar dust within our Milky Way Galaxy that does the same thing, but it is around 10 times greater than the CIB. Then there are reasonably nearby galaxies resolvable in the all sky

map doing the same thing that our Galaxy does with its interstellar gas.

The game plan is to remove the foreground Solar System disk, our own Galaxy, and any resolvable galaxies. Test the residuals, which must be statistically positive and supposedly isotropic like our naive big bang models of an expanding Universe. Trailing dust blobs behind and in front of Earth's orbit around the sun were also found by this study. These interesting objects themselves must be removed, too, to get at the

Wednesday, May 1—May "Sky Watch" column appears in The Washington Post "Style section. It lists many events for that month.

Saturday, May 4, 7:30 PM—The May NCA meeting will feature Casey Lisse speaking on "Comets."

The Calendar's Saturday "Deep Night" Periods—Astronomy is quite unique among the sciences in that the original specimen of study, the Universe itself, is accessible to each of us possessing the gift of sight. We need only look up at the sky with wonder. And there is no better place to experience that original specimen than at a dark-sky site during "deep night" periods. For many, Saturday nights represent the most convenient times to do that.

Saturday deep night periods listed in this issue's "Calendar of Monthly Events" occur on two to three Saturday nights each month. They are continuous time intervals, of two or more hours duration, starting either Saturday night or Sunday morning, when neither daylight, twilight, nor Moonlight interfere with experiencing the dark sky. However, artificial light, i.e., light pollution, can interfere. To avoid this problem, several relatively dark-sky sites are available for NCA members' use in Maryland, Virginia, and West Virginia. Information: Daniel Costanzo, 703/841-4765.

This deep night listing was prepared by Daniel Costanzo from data generated by Jay Miller using MICA, the Multi-year Interactive Computer Almanac software package, created by the U.S. Naval Observatory. MICA is publicly available in both PC and Macintosh versions. Several NCA members can assist those interested in learning to use MICA.

Other events too numerous to mention here are listed in the publications *Sky & Telescope*, the *Astronomical Calendar 1996*, the *Observer's Handbook 1996*, and in numerous software packages. NCA members can purchase all these at a discount. To join NCA, use membership application on page 9.

CIB. This is not an easy task, but the removal task also reveals dust structures around our planet, dust structures within the Solar System, and dust structures within our Galaxy. The maps made of the dust structure within our Galaxy actually enables us to see our Galaxy in the dust as if we were viewing it from the outside if projected properly. This has, in fact, become a pretty picture with a significance that has gained a certain

See INFRARED on page 6

Comet Hyakutake: NCA's Up-To-Date Viewing Primer

Part 2

by Daniel Costanzo

Well, The comet has come at last. The Solar System's two decade long "drought" of very bright comets dramatically ended last month when Comet Hyakutake whisked past Earth at a scant forty times the Earth-Moon distance. It became the brightest comet since Comet West exactly twenty years earlier. Many now appropriately label Hyakutake "The Great Comet of 1996."

But the comet show is not yet over! Contrary to some confusing media reports, Comet Hyakutake will continue gracing Northern Hemisphere, mid-latitude skies in April. Below is an up-to-date April viewing primer, customized for the National Capital area. Like the March issue's primer (part 1), it is based on over a quarter century of personal experience finding and observing comets from both suburban and dark-sky locations. Like part 1, it is kept as nontechnical as possible. Please refer to last month's more extensive primer for viewing basics, the March events, plus further advice and assistance. More information is also given in this month's "Calendar of Monthly Events" (page 2).

April Viewing

In early April, Comet Hyakutake should still be visible to the unaided eye in the northwest after evening twilight ends, and despite interfering Moonlight. If it hopefully continues performing as predicted, the comet will put on a very nice visual show to both unaided eye and binocular views until late April.

To understand the comet's behavior in April, keep in mind that besides the three motions mentioned in March's viewing primer (Part 1), three major factors are acting on Hyakutake's April viewing prospects. First, it is moving away from Earth. Because of that, the comet is expected to dim during the first week of April. Second, the tail will rapidly foreshorten as the comet recedes from Earth. This means that throughout April, each night the tail will get shorter and shorter. But at the same time it is receding from Earth, the comet is getting closer to the Sun, both in actual distance, and in angular distance in the

sky. Because of this, after the first week in April it will brighten, again. But as Hyakutake gets brighter from evening to evening, it will be hanging lower and lower in the northwestern sky as it slowly moves across the constellation Perseus. However, throughout most of April, Hyakutake should still be easily visible (at least in binoculars) until getting lost in the evening twilight glow in late April.

April begins with the Moon interfering by trying to drown out the comet with Moonlight. (But the comet should be bright enough to see even in Moonlight.) However, Full Moon on the evening of April 3 provides a singularly brief opportunity to view Hyakutake during a total Lunar eclipse. Look for the comet between roughly nautical twilight's end (around 7:23 PM EST) and around 8:15 to 8:30 PM. This brief respite from strong Moonlight ends when the Moon clears the darkest (umbral) part of Earth's shadow by 8:58 PM. (See the "Calendar of Monthly Events" on page 2 for other particulars.) After that, the Moon will slowly get out of the way for a while. April 5 is around the first evening without any Moon interfering at the end of nautical twilight. At that time, the comet should still be bright (magnitude 2.4) and relatively high up (33 degrees). While it will now be getting slightly fainter from night to night, the comet will still be nice and high at the end of nautical twilight, and could be easily visible to the unaided eye and in binoculars from a relatively dark-sky site.

From April 5 through 19, the comet will be visible in Moon free skies at the end of nautical twilight as a 2nd magnitude object that after fading slightly eventually starts slowly brightening from night to night (from April 17 on). But at the same time, it will appear lower in the sky at the end of nautical twilight on each successive evening. After April 19, the waxing Moon begins to interfere, again. But by then, the comet will have dipped into the evening twilight so much as to make the twilight a major viewing hinderance.

Increasing twilight interference means having to wait longer and longer each evening to get a good view of the comet without objectionable twilight. But that means that each evening the comet will also have to be viewed lower and lower towards the horizon. The comet will eventually get lost in twilight's glare. The end of Comet Hyakutake's visibility for us in the Northern Hemisphere is about April 24. On the evening of April 24 at the end of nautical twilight (8:57 PM EDT), the comet will be at an altitude of only 5 degrees (and azimuth 305 degrees), and shine at magnitude 0.6, while the waxing crescent Moon approaching First Quarter, hangs 53 degrees up. At magnitude 0.6, with very clear skies, and a nice clear horizon, the comet may be something nice to see, with a tail sticking up from the horizon. It might even be visible at the end of civil twilight, when the Sun is 6 degrees below the horizon, and the comet is higher in the sky. The only way to find out is to go outside and look, particularly with the aid of binoculars.

After April 24, the comet could be tough to spot, requiring looking in the increasingly bright evening twilight

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Newsletter Deadline for May *Star Dust* APRIL 15, 1996

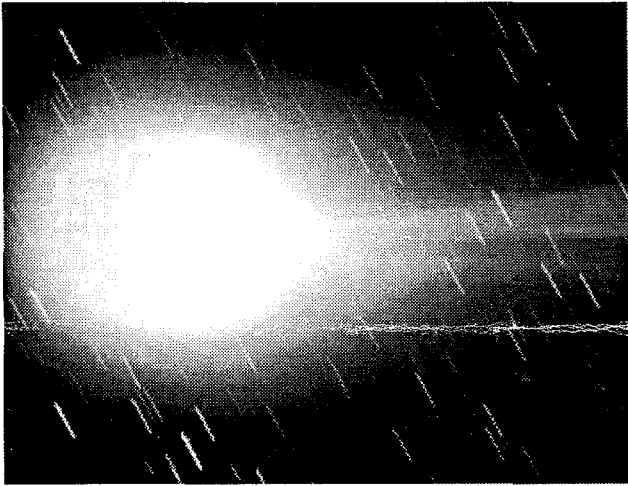
*** DO NOT BE LATE!!! ***

We need everyone to work together. Please send your submissions in on time so that all NCA members will receive newsletters on time. Send your submissions to Gary & Alisa Joaquin, at 7821 Winona Ct., Annandale, VA, 22003. Leave a message on voice mail 703/750-1636 or send an ASCII file via e-mail at 71561.1747@compuserve.com or AGJOAQ@ix.netcom.com or fax to 703/658-2233. Submissions must be on time or they may not get in.

Comet C/1996 B2 (Hyakutake)

photos by Robert N. Bolster

Comet Hyakutake photographed from Hopewell Observatory. Hypersensitized Technical Pan film was used for all photos. (1) Taken with the 31 cm Wright telescope, f/4.1, Friday evening (UT March 23, 04:37 to 04:53), a 16 minute exposure, showing the coma and the beginning of the bifurcated tail. (2) With a 35mm camera and an 85mm lens at f/2.8, this photo of the tail was taken the same night (UT March 23, 05:55 to 06:11), a 16 minute exposure. The bright star is Arcturus. (3) Taken with a 35mm lens at f/2, this photo shows the tail extending 40 degrees (UT March 25, 05:43 to 05:55, a 12 minute exposure). The three bright stars above the tail make up part of Ursa Major. Arcturus is over to the far right. (4) This photo taken with a 135mm lens at f/2.8 shows a tail disconnection caused by a fluctuation in the solar wind. (UT March 25, 05:19 to 05:35, a 16 minute exposure).



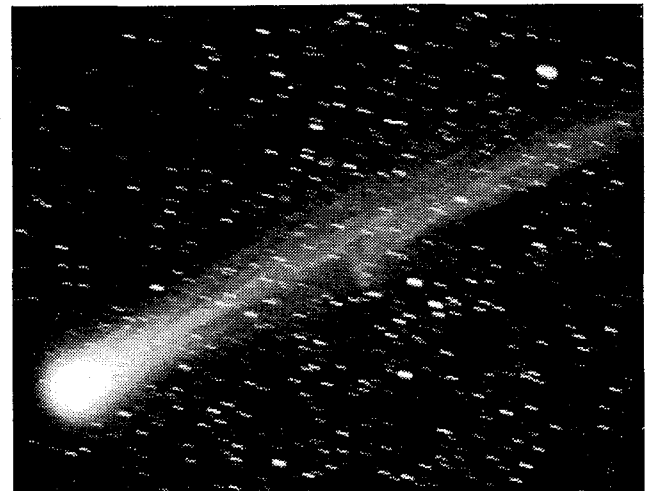
1



2



3



4

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glow. But it is worth the attempt with binoculars on clear evenings. It can even be searched for from areas plagued by artificial light pollution, as twilight will be the greatest obstacle.

As mentioned in Part 1, Hyakutake will reach perihelion, the point of closest approach to the Sun (and maximum cooking by the Sun), on May 1, at a distance from the Sun of 0.23 Astronomical Unit. (1 AU is Earth's mean orbital distance from the Sun, or 149,597,870 kilometers.) Around this date, it may be visible in broad daylight under certain extremely favorable viewing conditions, and if it gets particularly bright. But generally speaking, perihelion passage will occur with the comet lost in the Solar glare.

Some Parting Thoughts

You can't directly experience a magnificent comet like this from a textbook, a television program, or a computer

screen. You must experience it directly, on its terms, with those precious senses you possess. Watching it satisfies the basic human need to experience the original specimen of creation, directly. It's what means to be alive. So please go outside and observe this rare and hopefully wonderful sky spectacle. That is the most important thing you can do.

Once this comet is done, you'll have had a good practice run for observing Comet Hale-Bopp in 1997. Good Comet Viewing!

Information and data for this primer was obtained and generated by NCA members Bob Bolster, Walter Nissen, and Harold Williams, with other information coming from the "Skyline" for March 22, 1996. As noted in Part 1, best views of the comet will generally be from relatively dark-sky sites away from artificial light pollution, except when the comet is always stuck in twilight (as discussed above).

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currency within astronomy texts and artistic illustrations of our Galaxy. (Just as the Differential Microwave Radiometer (DMR), another COBE instrument, has produced the significant picture of large scale fluctuations in creation, the DMR fluctuations with everything subtracted away are even more awesome when you realize that they are on large enough scales, because of limitation in instrumentation resolutions, to represent structures that are so large as to have not yet collapsed to form any structure yet.—Editorial aside.)

To calibrate the whole thing, Markarian 421, a very blue galaxy discovered by Markarian, which is a source of TeV gamma rays, is being used to derive limits on the CIB intensity, since gamma rays of this energy will interact with a certain fraction of the infrared spectrum; sort of a gamma ray absorption line because of the presence of infrared photons that allow the TeV gamma rays to scatter off the infrared photons in some frequencies and produce electron position pairs. This latter work is on going.

What can we say about CIB? Well, it appears to be such as to eliminate some of the primordial cosmic strings that some cosmologists seem to have initially predicted. Of course, Eli Dwek, and the reviewer suspect that such overly clever cosmologists can twiddle an undetermined constant in their model to possibly slip out of this; just as the proton decay people did when they initially predicted proton decay, because of the unification of the strong, weak, and electromagnetic forces, but found no proton decay at the currently observed large underground proton detector experiments. My conclusion is that the CIB warrants further data analysis, and eventually further experimental measurement, at higher angular resolution, once the current data is exhaustively analyzed. Of course, what astronomer doesn't want to eventually increase their angular resolution?

Currently theoretical efforts are underway for modeling the infrared emission from evolving galaxies to estimate their contribution to the CIB.

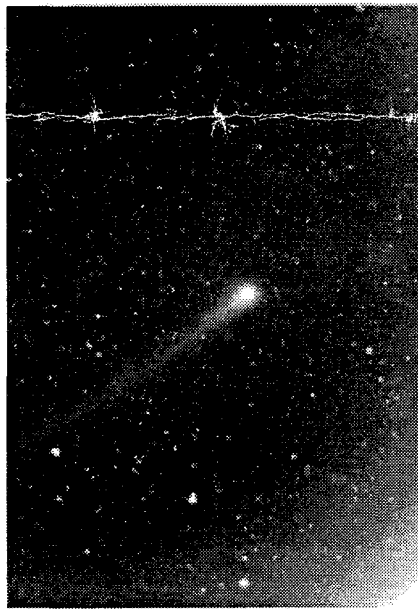
As usual, we are indebted to NIH and NCA member Jay Miller for arranging to meet at NIH, where he works.

More Comet Images

photos by
Harold Williams and
Sean Taylor

(1) This picture was taken with a 35mm Single Lens Reflex PENTAX camera attached to a 3 1/2 inch Questar telescope, tracking the sky around 2 AM, Monday, March 25, 1996, Eastern Standard Time, from near the Comus Inn in a farmer's field. The Comus Inn is on Old One Hundred road, state route 109, west and south of the Interstate 270 exit in Montgomery county, Maryland. The picture shows fairly faithfully what could be seen with the unaided eye.

(2) This image was taken at the same place a little later without using the telescope to track with the stars; the camera pointed up, attached to a tripod. The comet is the brightest trail, brighter than any of the star trails in the big dipper, Ursa Major. Besides the star trail and the comet trail, light pollution can be clearly seen as the horizon is approached. The Milky Way was not visible even though it was up.



1



2

NEAR Watch

by Daniel Costanzo

On February 17, at 3:43 p.m. EST, the National Aeronautics and Space Administration (NASA) successfully launched NEAR, the Near-Earth Asteroid Rendezvous mission, on the first attempt ever to study an asteroid close-up for an extended period.

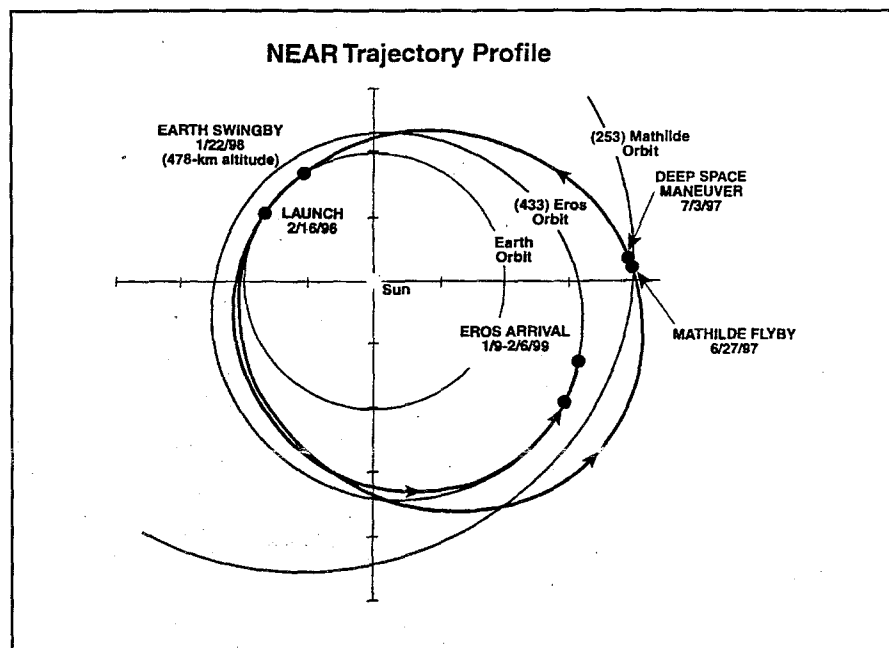
Swiftly rising from Cape Canaveral into Florida's sunny February skies, the highly reliable Delta launch vehicle lived up to its reputation and safely boosted this 805 kg (1710 lb), golf-cart sized "astrobot" (my term, not NASA's) on a tricky looping, three-year long, 2.1 billion km (1.3 billion mi) trajectory to the 36 km (22 mi) long potato-shaped near-Earth asteroid (NEA) 433 Eros. (NEAR's launch was the Delta's first use for boosting a planetary mission.) Immediately after launch, NEAR successfully passed through the entire mission's dirtiest portion, avoiding damaging dirt and debris from the Delta launcher's shroud and other expended booster parts. Once free of the booster, the craft successfully deployed its Solar panels, permanently locked them into place, and began generating electrical power. The panel's deployment was the first and only movement of any spacecraft parts on the entire mission. From now on, no parts on NEAR will move, as intended under NASA's emphasis on design economy, simplicity, and reliability.

Besides being the first spacecraft to visit an NEA, as an added bonus, NEAR's successful launch, well within the first eleven days of the restricted sixteen day launch window, allows it to fly by the main-belt asteroid, 253 Mathilde, while on the way to Eros. This flyby will be the first visit to a C-class (carbon-rich) Solar System body. Mathilde is even a more mysterious object than Eros. Even its diameter isn't known with certainty, but at roughly 61 km (38 mi) in diameter, Mathilde will be the largest asteroid ever visited. NEAR is now outward bound from Earth, sailing towards the Asteroid Belt for its June 1997 Mathilde flyby. After an Earth swingby in January 1998, NEAR will reach Eros' vicinity in January 1999.

NEAR's successful launch also launched NASA's Discovery Program of robotic missions extolling the new-found virtues of a "faster, cheaper, better" approach to Solar System exploration. Proponents of NEAR's \$210 million total cost heralds this new era, and its importance to providing insights on Earth's origin and evolution.

NEAR also is the first U.S. planetary mission managed by a non-NASA facility: The Johns Hopkins University's Applied Physics Laboratory. By being built at, and run from, APL's facility in Laurel, Maryland, NEAR is a "home town" spacecraft for

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February 1998 Eclipse Trip

National Capital Astronomers, Inc. and Greenbelt Travel are planning a 5 day, 4 night trip to Curacao for the February 1998 eclipse. The projected price of about \$1000 per person, double occupancy, will include airfare from BWI, hotel room, airport transfers, and transportation to and from the viewing site. (Prices may vary since airfare cannot be locked in this far in advance.)

Curacao, a dutch island located just off the cost of South America, has a desert climate (rainfall is 20 inches per year). Tourist attractions include beaches, coral reefs for scuba and snorkeling, a famed shopping district, historical buildings, and restaurants for every taste and budget.

To be added to the mailing list, send a note to:

ATS — EC98
P.O. Box 2509
Laurel, MD 20709

Editor's Note: Alisa Joaquin and Sue Bassett along with a travel agent will be traveling to Curocao to scout out the best viewing areas to see the eclipse as well as exploring what the island has to offer. That trip will be happening very soon. An article will be published later.

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NCA, if one can consider the Washington-Baltimore megalopolis a "home town." So NEAR's mission is a particularly appropriate one for NCA to keep its members updated on. NEAR is all the more important to NCA because long-time NCA member David Dunham is a key person on APL's NEAR Mission Design Team. Thanks Dave.

Information for this article was gleaned from David Dunham's presentation on NEAR at NCA's monthly meeting on October 7, 1995, articles on NEAR's launch in the *Washington Post* on February 17 and 18, 1996, plus reports on NEAR's launch on National

Public Radio (WAMU-FM and WETA-FM) on February 17 and 18, 1996, and on the "Ten O'clock News" (WTTG-TV) on February 17, 1996

Remember

Don't throw this newsletter away. If you are finished with it, pass it on to someone else to read. If not, then recycle it. It's right for the environment.



Dates for *Exploring the Sky* in 1996

Note: each date is a Saturday. Bring binoculars and telescopes, although telescopes will be available (thanks to NCA).

Times are EDT except EST in November. "Sunset" times listed here (from the *1996 Observer's Handbook*) correspond to the upper limb of the Sun crossing the horizon.

Date	Time	Sunset	Moon Phase	Moon Set	Notes
4/20	8:30 PM	7:51	New+3d	10:35	Lyrids peak 4/21; Astronomy Day
5/18	9:00 PM	8:17	New+1d	9:19	
6/22	9:00 PM	8:38	New+6d	0:24	Solstice 6/21
7/13	9:00 PM	8:34	New-2d	6:49	Jupiter at opposition on 7/4
8/10	9:00 PM	8:10	New+3d	5:32	Perseids peak 8/12
9/14	8:00 PM	7:17	New+2d	8:07	Lunar eclipse 9/27
10/12	7:30 PM	6:33	New		6:39
11/9	7:00 PM	4:59	New-2d	4:12	

Exploring the Sky is held in Rock Creek Park near the Nature Center, in the fields just south of the intersection of Military and Glover Roads NW. For additional information, call the Nature Center at (202) 426-6829.

NCA Telephone Changes

The official NCA telephone, located in Bethesda, 301/320-3521, has recently undergone a change in status and members should be aware of this when they wish to get information, refer others to the line, or talk with member Bob McCracken, who has been the keeper of the line for many years. The line has been converted to a message-only status. That is, the caller is transferred immediately to an answering machine where a message can be left. The machine is monitored by one or more NCA members so that calls can be returned quickly or an appropriate NCA member can be asked to return the call. Members will be selected according to the nature of the call and what information or services are being requested. We hope to be able to count on people to help with this task from time to time. Anyone wishing to personally contact Bob McCracken should use his private home telephone number rather than the NCA line.

In April 1920, Harlow Shapley and Heber D. Curtis debated "The Scale of the Universe" at the Smithsonian's Natural History Building in Washington, DC. Once again, in April 1996,

Gustav A. Tammann

and

Sidney van den Bergh

will debate

"The Scale of the Universe"

John Bahcall, Moderator

Introductory Lectures by
Owen Gingerich & Virginia Trimble

Date: April 21, 1996, 1:00-4:30 pm. Tickets are free but should be requested in writing. **Location:** Natural History Museum, Washington, DC (same auditorium as 1920 Great Debate). **Sponsoring Institutions:** Smithsonian, NASA, and George Mason University.

Tickets requests write: The Scale of the Universe 1996 Debate, Laboratory for Astrophysics, MRC 321, National Air and Space Museum, Washington, DC 20560. **For more information on WWW:** http://antwrp.gsfc.nasa.gov/diamond_jubilee/debate.html.

NCA Meeting Hotline

The recent great blizzard of 1996, which started during the January NCA meeting, caused us some anxious moments and reawakened an idea briefly discussed last year but never implemented. NCA member David Dunham has agreed to announce meeting status at times of questionable weather situations. Thus, when future weather conditions threaten cancellation of an NCA meeting, members should call the IOTA hotline at 301/474-4945 (location Greenbelt). The absence of a cancellation notice on the hotline will indicate that we intend to go ahead with a meeting. Wayne Warren, President.

National Capital Astronomers, Inc.

SERVING SCIENCE & SOCIETY SINCE 1937

NCA is a non-profit, membership supported, volunteer run, public-service corporation dedicated to advancing space technology, astronomy, 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. For information: 301/320-3621 or 703/841-4765.

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 as skilled observers frequently deploying to many parts of the National Capital region, and beyond, on campaigns and expeditions collecting vital scientific data for astronomy and related sciences. They also serve locally by assisting with scientific conferences, judge science fairs, and interpreting astronomy and related subjects during public programs.

Discussion Groups exchange information, ideas, and questions on preselected topics, moderated by an NCA member or guest expert.

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

NCA Information Service answers a wide variety of inquiries about space technology, astronomy, and related subjects from the public, the media, and other organizations.

Consumer Programs on selection, use, and care of binoculars and telescopes, provide myth-breaking information, guidance, and demonstrations for those contemplating acquiring their first astronomical instrument.

Dark-Sky Protection Efforts educate society at large about the serious environmental threat of light pollution, plus seek ways and means of light pollution avoidance and abatement. NCA is an organizational member of the International Dark-Sky Association (IDA), and the National Capital region's IDA representative.

Classes teach about subjects ranging from basic astronomy to hand-making a fine astronomical telescope. NCA's instructors also train educators in how to better teach about space technology, astronomy, and related sciences.

Tours travel to dark-sky sites, observatories, laboratories, museums, and other points of interest around the National Capital region, the Nation, and the World.

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, the Smithsonian Institution, the U.S. Naval Observatory, and others.

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

Fine Quality Telescopes up to 36-cm (14-inch) aperture are available free for member's use. NCA also has access to several relatively dark-sky sites in Maryland, Virginia, and West Virginia.

YES! I'D LIKE TO JOIN THE NATIONAL CAPITAL ASTRONOMERS

Enclosed is my payment for the following membership category:

- Regular
 - Sky & Telescope* and *Star Dust*. (\$48 per year)
 - Star Dust* only (\$24 per year)
- Junior (Only open to those under age 18) Date of birth: _____
 - Junior members pay a reduced rate.
 - Sky & Telescope* and *Star Dust*. (\$34 per year)
 - Star Dust* only (\$10 per year)

First name	Middle	Last name	(____) _____ Telephone
Street or Box	Apartment	City	State Zip

If family membership, list names of additional participating immediate family members in same household, with birthdates of all those under 18 years old: _____

Note: If you already subscribe to *Sky & Telescope*, please attach a recent mailing label. You may renew this subscription through NCA for \$24 when it expires.

Make check payable to: **National Capital Astronomers, Inc.**, and send with this form to:

NCA c/o Jeffrey B. Norman, 5410 Connecticut Avenue, NW, Apt. #717, Washington, D.C. 20015-2837.

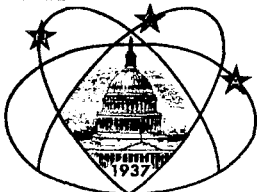
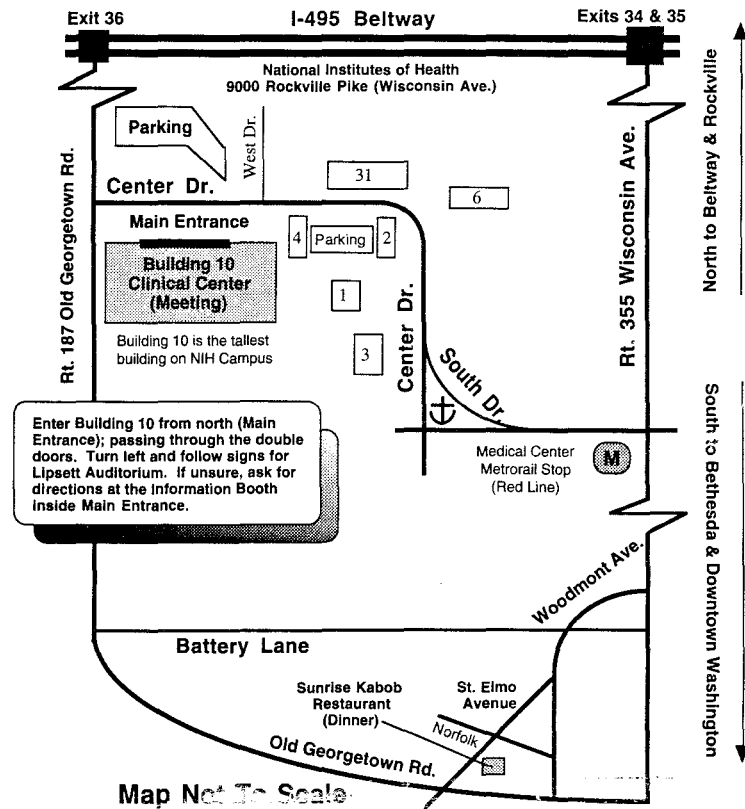
The following information is optional. Please indicate briefly any special interests, skills, education, experience, or other resources which you might contribute to NCA. **Thank you, and welcome to NCA!**

Getting to the NCA Monthly Meeting

Metrorail Riders—From Medical Center Metro Stop: Walk down the hill, pass the bus stops and turn right at the anchor onto Center Drive. Continue uphill to Building 10 (walking time about 10 minutes), the tallest building on campus. Also, the J2 bus line connects the Bethesda (7:16 PM) and NIH (7:23 PM) Metro stops with Building 10 (7:25 PM).

To Sunrise Kabob Restaurant—Take Wisconsin Avenue toward Bethesda and bear right onto Woodmont (or take the next right onto Battery Lane). Follow Woodmont to St Elmo (3 blocks south of Battery) and make a right. Proceed one block and cross Norfolk Avenue. The restaurant will be on the left at 4910A St. Elmo Avenue. There should be plenty of parking in the garage (free on weekends) located just past the restaurant (on the opposite side of street) if you would rather not park on the street. Seats not guaranteed after 5:30.

Star Dust is published ten times yearly (September through June) by the National Capital Astronomers, Inc. (NCA), a non-profit, astronomical organization serving the entire National Capital region, and beyond. NCA is the astronomy affiliate of the Washington Academy of Sciences and the National Capital region's representative of the International Dark-Sky Association. Phone Numbers: 301/320-3621 or 703/841-4765. President, Wayne H. Warren, Jr., 301/474-0814. Deadline for *Star Dust* is the 15th of the preceding month. Editors Alisa & Gary Joaquin, 7821 Winona Ct., Annandale, VA 22003, 703/750-1636, E-mail-see deadline box for new address. Daniel J. Costanzo, Editorial Advisor. *Star Dust* © 1995 may be reproduced with credit to National Capital Astronomers, Inc.



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