Star Dust

National Capital Astronomers, Inc. Washington, DC

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Carol Ann Grady to Speak on "The β Pictoris Phenomenon in Herbig Ae/Be and A-shell Stars"

by

Harold Williams

The next meeting of the National Capital Astronomers will be held on Saturday, November 5 at 7:30 P.M., in the Bunim room on the ninth floor of the Clinical Center (building 10) at the National Institutes of Health (NIH). Carol Ann Grady of Applied Research Corporation will speak on "The β Pictoris Phenomenon in Herbig Ae/Be and A-shell Stars." The speaker sent the following abstract:

"One of the most important discoveries made by the IRAS satellite was the detection of a large, circumstellar dust disk around the nearby, southern A-shell star β Pictoris. In the intervening decade we have learned a great deal about the nature of the particles in this disk, and have begun to obtain some tantalizing hints of central clearing, which has implications for the probability of extra-Solar planet formation. Until very recently, similar data for other A-shell stars, and the evolutionary precursors of such stars, the Herbig Ae/Be stars was not available. As the result of multi-wavelength observational studies, a number of investigators have begun to identify PMS stars with circumstellar disks which are oriented favorably for the detection of *accreting* (growing) material. UV observations, made with the 18 year old International Ultraviolet Explorer, have played a critical role in our ability to detect the precursors of β Pic, and to identify suitably oriented and comparatively nearby shell stars with accreting material."

IRAS, the Infrared Astronomical Satellite, was launched on January 24, 1983, and was developed and operated by the Netherlands Agency for Aerospace Programs (NIVR), the United State National Aeronautics and Space Administration (NASA), and the United Kingdom Science and Engineering Research Council (SERC). Its data-taking mission lasted for ten months from launch until its dewar, containing 700 liters of liquid helium that kept the telescope and its heat sensitive detectors at a temperature of 2 degrees Kelvin, ran out on November 23, 1983. Even in the cold of space liquid helium slowly boils away and is exhausted. IRAS scanned 96% of the sky twice. Interstellar dust is at a temperature such that most of its thermal radiation is emitted in the infrared. A number of stars were shown to have an infrared excess in their spectra. This infrared excess was caused by the circumstellar dust disk around the star.

β Pictoris is the second brightest star in the southern constellation Pictor. It has a magnitude of 3.85 bright as seen from earth, 16 parsecs or 53 light years away from us. β Pictoris is a spectral class A5 V with a color temperature of 8,400° Kelvin as compared with our sun with a color temperature of around 5,800° Kelvin. The dust disk, which may be forming planets right now, is 10 times larger than the sun-to-Pluto distance and is 400 astronomical units, or 60 billion kilometers, across. PMS stars are premain sequence stars. Those of us interested in star formation certainly feel that PMS stars have an interesting attitude (to indulge in a little anthropomorphism). Our speaker is involved in this research and coordinates ob-

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November Calendar

The Public is Welcome!

Wednesday, November 2, 1994-November "Sky Watch" column by Blaine P. Friedlander, Jr. appears in *The Washington Post* "Style" section. It lists many other events for the month.

Friday, November 4 and 25, 1994, 8:30 PM-NCA's Celestron 14-inch (0.36 meter) telescope open nights with Bob Bolster at Ridgeview Observatory, 6007 Ridgeview Drive (off Franconia Road between Telegraph Road and Rose Hill Drive). Information: Bob Bolster at 703/960-9126.

Saturday, November 5, 1994, 7:30 PM-The November NCA meeting will feature Carol Ann Grady speaking about "The β Pictoris Phenomenon in Herbig Ae/Be and A-shell Stars." Meeting will be held in the Bunim Room. For directions, refer to map and description on back page.

Saturday, November 5, 1994, 5:30 PM-Dinner with the speaker at the La Fosada Restaurant, 8117 Woodmont Ave., Bethesda, MD., before the monthly meeting. Reservations are for 5:30 p.m., sharp.

Saturday November 5, 1994, 9:30 AM-The Smithsonian Institute, National Air and Space Museum (SI-NASM) monthly sky lecture: Geoff Chester (NASM), "Telescopes For Everyone." At NASM Albert Einstein Planetarium. Held in conjunction with "Binoculars! Telescopes! Astronomy!: A Free Consumer Presentation" (*see* below). Information: 202/357-1686

Saturday, November 5, 1994, 11:00 AM to 4:00 PM-NCA and NASM present Binoculars! Telescopes! Astronomy!: A Free Consumer Presentation." NASM, Briefing Room. NCA volunteers still needed!. *See* article in October *Star Dust*, p. 5. Information: Daniel Costanzo (NCA), 703/841-4756; Chery Bauer (NASM), 202/357-1529.

Saturday November 5, 1994, Night (After The Meeting)-November's best Saturday night for dark-sky observing, and "absorbing" (Moon sets by 8:15 p.m., providing nine hours of "Deep Night," weather permitting, until dawn, Sunday morning). Several relatively light-pollution-free sites are available for NCA members's use. Information: Daniel Costanzo, 703/841-4765.

Tuesdays, November 1, 8, 15, 22, and 29, 1994, at 7:30 PM-Telescope making classes at Chevy Chase Community Center, Connecticut Avenue and McKinley Street, NW. Information: Jerry Schnall, 202/362-8872.

Fridays, November 4, 11, 18, and 25, 1994, at 7:30-Telescope making classes at American University, McKinley Hall Basement. Information: Jerry Schnall, 202/362-8872.

Mondays, November 7, 14, 21, and 28, 1994, 8:30 PM-Public nights at U.S. Naval Observatory (USNO), in Northwest Washington, DC (off Massachusetts Avenue). Includes orientation program on USNO's mission, viewing of operating atomic clocks, and glimpse through the finest optical telescopes in the Washington-Baltimore region. Information: USNO Public Affairs Office, 202/653-1541.

Friday, November 11, 1994 8:00 PM-Electronic imaging of Saturn and the Moon with the NCA C-14. See November 4th item for location and phone number.

Saturday, November 19, 1994 7:30 PM-"Exploring the Sky" telescope viewing at the open field in Rock Creek Park nearest to the Nature Center. NCA members please bring telescopes. For more information, call John Lohman, 703/820-4194

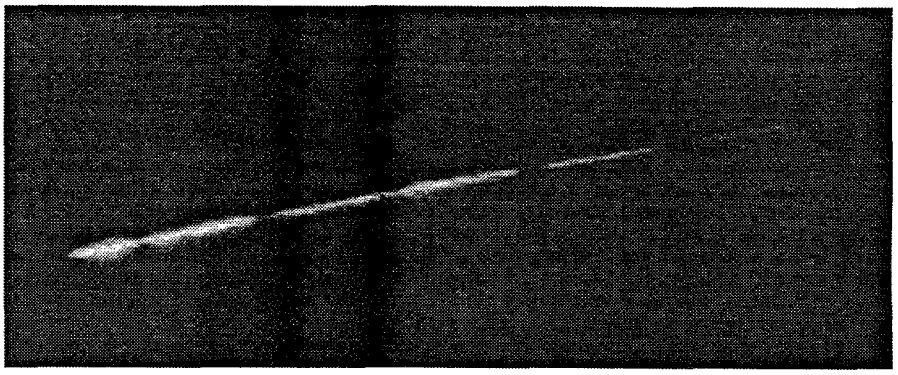
Saturday, November 26, 1994, Night-November's second best night for dark-sky observing and "absorbing" ("Moon-dark" until around Midnight). *See* November 5th listing.

Saturday, December 3, 1994, 7:30 PM-The December NCA meeting will feature Virginia Trimble speaking about "The Universe You Don't See: Existance and Nature of Dark Matter."

The Peekskill Meteorite, October 9, 1992, Video Observations: An Orbit Determination

Reviewed by Harold William

On Saturday, October 1, 1994, at the National Institutes of Health (NIH), George Wetherill of the Department of Terrestrial Magnetism (DTM) of the Carnegie Institution of Washington (CIW) spoke to us on "The Peekskill Meteorite, October 9, 1992, Video Observations: An Orbit Determination." At the time of the meteorite fall, George Wetherill was attending his fiftieth high school reunion in Philadelphia and it was raining. During the 11 o'clock news in the hotel room, George caught the tail end of a meteor fire ball video, but he could not tell much from the small clip that he saw. The next morning there was a small article in the Philadelphia paper that did not reveal much useful information. Because of the rain, there was no observation of the fall near the impact sight. On Monday morning back at DTM, George started calling around to find out what might have happened. The newspaper articles seemed to give quite garbled information.



A -8 mag. fireball close to the northern horizon captured by Jurgen Rendtel on a photograph exposed on January 27-28, 1993, between 17:00:50 UT and 05:53:35 UT from Potsdam, Germany. The fireball appeared at 04:02:22 UT. A fish-eye lens (Kodiak 8 f/3.5), f=30mm was used in combination with ISO 100/21° film.

October 9 corresponds to the Draconid meteor shower, which is caused by the earth passing through the debris trail of the comet Giacobini-Zinner. The Draconid's have been spectacular occasionally; in fact, George witnessed the great shower of 1946 while attending college at the University of Chicago. It was so spectacular, with so many bolide, that it could be seen despite the lights of a major metropolitan area in 1946. If there were a recovered fall and if the radiant had been in Draco, the 1992 meteor would have given us a sample of the comet Giacobini-Zinner without costing taxpayers hundreds of millions of dollars to send a space mission to a comet. As it turned out, there was a recovered fall in Peekskill, New York, caught by Michelle Knapp's 1980 Chevrolet Malibu car. After only a few reports from independent witnesses, it was apparent that the radiant was not Draco, so this fragment, a 12.4-kilogram chondritic rock, was not a sample of comet Giacobini-Zinner. Even though it was not from an identified comet, it is the only event with a moving picture made of a recovered fall. The only other moving picture of a meteor was photographed with a home movie camera in Wyoming on August 10, 1972, as the meteor streaked through the earth's atmosphere above the Teton Mountains in broad daylight, but the meteor went back out into space. The Wyoming movie also did not show the break up of the meteor as the multiple videos from the Peekskill event did. It was also apparent that with a lot of arithmetic an orbital determination of the Peekskill meteorite could be found. For details on this computation, consult *Nature*, volume 367, number 17, February 1994, pages 624 through 626, "The orbit and atmospheric trajectory of the Peekskill meteorite from video records" by P. Brown, Z. Ceplecha, R.L. Hawkees, G. Wetherill, M. Beech, and K. Mossman. (If you desire to see the specific mathematics, see the *Bulletin of the Astronomical Institute of Czecholslovak*, volume 12, pages 21 through 47, published in 1961, "Multiple Fall of Pribram Meteorites Photographed 1. Double-Station Photographs of the Fireball and Their Relations to the Found Meteorites" by Zd. Ceplecha. This last article is published in English with only the abstract in Russian. There is also an English abstract.)

Every astrometric network that has been set up; the Prairie network in the central United States, one in Canada, and one in central Europe (that operated for a few years), has determined one orbit of one recovered fall. This is the fourth such event and the first event from the Friday night football video network. Of the twenty or so videos that show the fireball, all were taken by local television stations or parents of football players. No coaching videos captured anything other than the football game. One video taken by David Kranz and broadcasted on WRC, local Washington Metro channel 4, was a nonfootball video.

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PEEKSKILL, from Page 3

Some very useful potential data were lost because of the uncooperative nature of the Federal Aviation Administration (FAA). Many pilots reported seeing the bolide. This is all logged, at least temporarily, by the FAA. The Department of Defense network that monitors such things was evidently down at the time, or at least they failed to capture this event. Once the event is determined to be nonhostile, the event is often purged from the records.

Peter Brown of the University of Western Ontario and George were the two people that worked the hardest to get the videos that were taken by various people, secure the permission to use them, track down where they took the pictures, and survey the sight where the video was taken so that the direction of landmarks in the video could be used to determine the path through the atmosphere. The trail is extremely shallow at the start of the video records; the height is 46.4 km and makes an angle of 3.4 degrees. The last point measured on the video corresponded to a height of 33.6 km, although this is not the end of the luminous path. In fact, this Earth-grazing fireball would have returned to space were it not for the Earth's atmosphere. If perigee, the closest approach to Earth's center, had been around 40 km higher it would have skipped out of the atmosphere as the Wyoming fireball did. Ceplecha from the Czech Republic, who was the first to calculate a meteorite orbit, the Pribram meteorite, was essential to the effort in correctly calculating the orbit and its interaction with the atmosphere.

George showed us several videos. The WRC video included the news broadcast with correct information and incorrect surmises the night of the event. Some of the less spectacular videos were often the most valuable, since a video that was to be used at all for the orbital determination had to include foreground objects whose location could be determined with a complete triangulation. George mentioned that when you stepped through the video frame by frame you often saw all kinds of details of the break up of the object that no one understands yet. The rich video record should permit a detailed analysis of the fragmentation dynamics and the plasma tail. Eye witnesses seem to agree that the object had a green hue, but the video images do not show this color, owing to the spectral response of the CCD (charge-coupled device) photodetectors. Eye witnesses also reported that the fireball was brighter than the full moon, which was visible that night and at the time of the event was 97% illuminated. The fireball saturated the dynamic response of the camcorders.

George told us several stories of the difficulty of getting specific videos and of the still on-going search for Sara Eyknor (possibly misspelled) from Altoona, PA, a professional photographer who took still images of the fireball with ASA 3,200 film. Sara has evidently married a marine and has traveled across the country toward California and has now been lost, at least temporarily to science. Other stories involving WRC of not revealing their journalistic sources when they had broadcast the name of the person who took the original videos, makes one doubt the sanity and clear thinking of people. Another television station would reveal only what they broadcast and not the full tape of the data sighting vague possible legal precedents. Probably several papers could be written on the sociology of doing science in U.S and Canada today on the data collection effort, both the successes and the failures.

The meteor, after it hit Earth's atmosphere, was luminous and traveled across the country in about 40 seconds before its forward space velocity was stopped. After that, it essentially fell like the rock that it was, achieving terminal velocity much as any 12.4 kilogram rock dropped from an airplane several miles up might do (actually taking longer, several minutes) to fall over Peekskill from an altitude of around 30 km. During this downward fall, it would be nonluminous since it was not traveling very fast compared to its space velocity. The terminal velocity of the rock, though, still had enough velocity to punch through the steel of the car trunk and make a

See METEORITE, on Page 5

Montgomery College's Public Planetarium

Exciting public planetarium programs are offered at Takoma Park's own planetarium. Astronomy is one of the few sciences accessible to any inquiring mind. All programs begin at 7:00 p.m. There is no admission charge.

Saturday, November 19, 1994 — "Eclipse of the Sun."

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.

Newsletter Deadline for December *Star Dust*

Thursday, November 15, 1994

Send submissions to Gary & Alisa Joaquin, Editors at 7821 Winona Ct., Annandale, VA, 22003, or send an ASCII file via E-Mail at 71561.1747 @compuserve.com or fax to 703/658-2233. Submissions must be on time or they may not get in.

METEORITE, from Page 3

small whole in the ground underneath the car.

A 120 gram piece of the meteor was procured by the Canadian government from the meteor dealers that bought the meteor from Michelle Knapp since four of the authors of the *Nature* communication are Canadian's. Only George and Ceplecha are not Canadian. The Canadian government considers this meteor to be a Canadian one and traded a piece of Innisfree with the meteor dealers. Many countries have laws so that all meteorite falls become properties of the state. In such countries, almost no meteorites are ever recovered. In countries where the state makes no automatic claim much more meteoritic material is recovered. George told us that is why he was against passing a law to make meteorite falls federal in the United States.

The entry mass of this meteorite was approximately one ton. The flat trajectory of this meteor makes the fall area around Peekskill for other fragments quite large. There are probably other meteorites buried in the woods within several miles. The orbit of the Peekskill meteorite is qualitatively similar to the previous three meteorites whose orbits have been determined and qualitatively similar to 30 meteors whose orbits have been determined from the Prairie network but whose meteorite was never recovered. These meteors are probably perturbed fragments from the asteroid belt involving known resonances. Magnetic compass determination, even when corrected for magnetic declination, of directions are actually the chief source of error in orbital determinations. When Francois Schweizer and George Wetherill went to Fairfax, Virginia to measure things using Polaris to get north this altered the Fairfax determination by three degrees, but the errors propagate in such a way as to still not make much difference in the orbital elements. In the questions that followed George pointed out that the uncertainty in absolute time that allowed you to go from geocentric to astrometric reference frame was not very sensitive as long as you knew the time within a minute or so. The velocities of course could be measured very accurately from the framing of the film which gave very accurate relative time. How often does a meteorite like this fall? George answered about once a week. Are any of these meteor networks still in operation? Only the Central European one which has always been low key and involves 35 millimeter cameras, but the time is determined by phoning local police stations. There are amateur networks, but they mainly concentrate on showers. George was told by NORAD that they did not see this object, but its space velocity was low for good radar echoes off of the plasma tail. A much smaller high velocity object like a Perseid would produce more radar echo from the plasma. Also, no military satellites observed it. Meteorites that fragment this high have a ram pressure of only 10^7 dynes/cm^2 as opposed to ordinary rocks in the laboratory that will stand up to 10^9 dynes/cm^2. The meteorites that fragment in the atmosphere must be already cracked. The ones that get quite low in the earths atmosphere before braking apart, according to the Prairie network data, break up at 10^{10} dynes/cm^2. Meteors seem to either fragment quite high or quite low.

As usual we are indebted to NIH and NCA member Jay Miller for arranging to meet at NIH, where he works, and doubly indebted before the use of the nice Lippsett Amphitheater room and its good video projection equipment.

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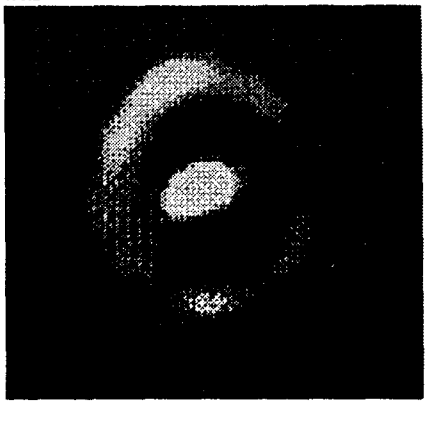
servations with the IUE, the International Ultraviolet Explorer, which was launched in 1978 and is controlled from the Goddard Space Flight Center. This satellite is still going strong and is one of the most successful space-based telescopes of all time. Our speaker is very enthusiastic about her subject, and in keeping with the tradition of telling one short story about how our speaker chose her field of astronomical inquiry, she told me that her father was an archeologist and she went with him on several hot, dusty, bug infested, and dry digs as a child. She loved science but decided to study something that would not get her personally dusty. So she studies cold interstellar dust from a safe distance in front of a computer terminal.



This is a NASA Hubble Space Telescope image of a rapidly ballooning bubble of gas blasted off of a star. The shell surrounds Nova Cygni 1992 which erupted on February 19, 1992. The shell is so young that it still contains a record of the initial conditions of the explosion. The HST was taken with ESA Faint Object Camera on May 31, 1993, 467 days after the explosion.

Credit: Francesco Paresce, ESA/ STScI and NASA

NCA Welcomes These New Members!

Virginia Saegmuller Knull
5525 Yorktown Blvd:
Arlington, VA 22207-1552

Marsha Kostura &
Matthew Schmidt
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Silver Spring, MD 20910-2541

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420 7th St., NW, Apt. 514
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Julian F Saenz
1807 Belmont Rd., NW, Apt. 407
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Thomas N Stepka
1747 Church St., NW, Apt. 6B
Washington, DC 20036-1335

Matthew C Taylor
(Junior member)
18339 Sharon Rd.
Triangle, VA 22172

Important Numbers For Information

Smithsonian Sky Watchers' Report
Non-technical information recording on astronomical events, objects, and phenomena in the Washington, D.C. region's sky. Updated weekly. 202/357-2000

***Sky & Telescope*'s "Skyline"**
Moderately technical information recording on latest in space technology, astronomy, and related sciences. Updated weekly, or sooner if necessary. 617/497-4168

McDonald Observatory's "Star Date"
Non-technical information on space technology, astronomy, and related subjects. Broadcast weeknights, around 8:00 PM, by listener-supported public radio station WAMU FM 88.5

U.S. Naval Observatory's Time Service
Accurate Eastern Time (in 24 hour mode) and Universal Time given every few seconds. Excellent for synchronizing clocks and watches. (Voice Recordings) 202/653-1800, 900/410-TIME, and 303/499-7111; (Modem Time Service) 202/653-0351

NOAA "Space Weather" Indices
Highly technical, but quite useful recording on Solar activity and its effect on Planet Earth. From the National Oceanic and Atmospheric Administration (NOAA). Updated every three hours. 303/497-3235 (anytime) or WWV at 2.5, 5, 10, 15, and 20 MHz (18 minutes after every hour)

Weather, Sunrise/Sunset, & UV Index
Recording of latest weather forecast out to five days, plus Sunrise/Sunset times, and forecasted Solar ultraviolet radiation index. Covers Washington, DC and vicinity. 703/260-0307

NCA Artificial Satellite Prediction Service
Customized prediction of viewing opportunities. These objects are frequently clearly visible with unaided eyes or binoculars, even from light polluted areas. Contact Walter I. Nissen, Jr., (voice phone) 216/243-4980, (modem) dk058@cleveland.freenet.deu

FROM THE SECRETARY

You may have noticed a change in the appearance of your NCA mailing label recently. I had a U.S. Postal Service mailpiece specialist "standardize" the mailing addresses in the entire NCA membership database.

The standard address has all capital letters, contains approved street suffix, town name and secondary unit (e.g., APT) abbreviations and contains no commas nor hyphens except in special places such as in the zip code. In some cases non-standard or misspelled street names have been corrected, and in a few places even the city name was found to be misspelled or unofficial (had wrong PO name).

With standard address format, Star Dust issues are most likely to be read by the Postal Service's Optical Character Readers (OCRs) and bar coded for more rapid delivery to you.

The total capitalization will not appear in the NCA directory, but the standard abbreviations will. If your Star Dust arrived late or you object to any of the changes in your address label, let me know, but be aware that any deviation from standard may delay the delivery of your Star Dusts. Thanks for your cooperation.

Leith Holloway
Telephone: 301/ 564-6061

National Capital Astronomers, Inc.

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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 (WAS). All are welcome to join NCA. For information, call NCA: (301) 320-3621.

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. NCA volunteers serve by assisting with international scientific conferences, judge science fairs, and interpret 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 Presentations 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 astronomy and related subjects.

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 membership rates, mentorship from dedicated members, and NCA's annual Science Fair Awards.

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

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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 $22 when it expires.

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

NCA c/o Jeffrey B. Norman, Suite #717, The Garfield Building, 5410 Connecticut Avenue, NW, Washington, D.C. 20015.

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

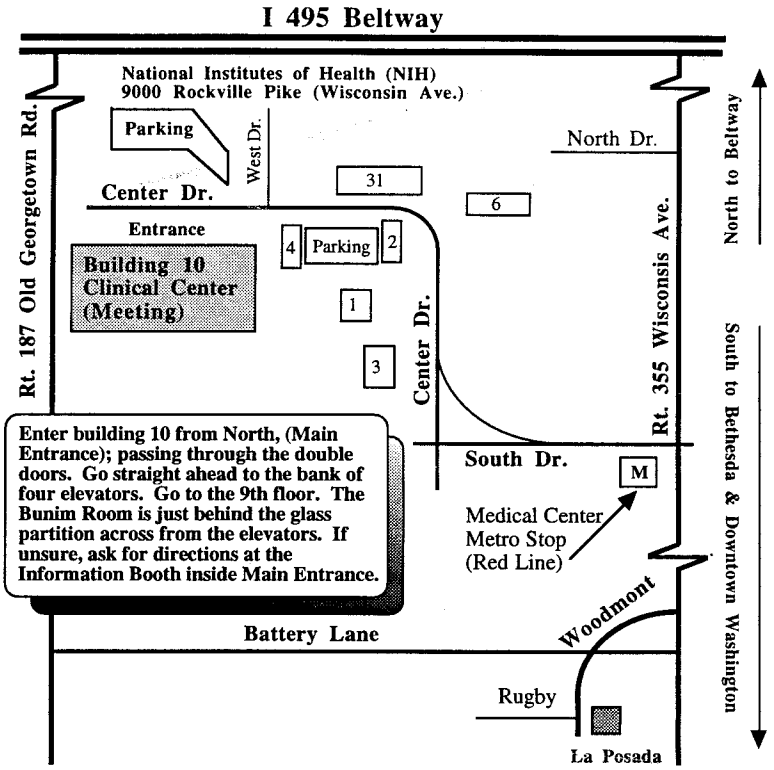
_____

_____

Getting to the NCA Monthly Meeting

Subway 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, the largest 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).

La Posada - Take Wisconsin Avenue toward Bethesda and bear right onto Woodmont (or take the next right onto Battery Lane). Follow Woodmont to Rugby (1 blocks south of Battery) and look for the restaraunt on your left (across from Rugby, 8117 Woodmont). Parking may be found on Woodmont, on Rugby, in a local parking lot one block down on Rugby from Woodmont, and opposite the restaraunt entrance. Seats are not guaranteed after 5:30.



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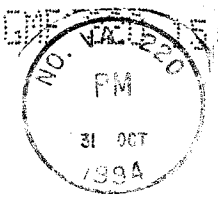

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