Star Dust

National Capital Astronomers, Inc. Washington, DC (301) 320-3621

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President's Welcome

Wayne H. Warren, Jr.

The summer has slipped by quickly and the 1994-5 season of NCA meetings and other activities is now upon us. As the new NCA President, I would like to take this opportunity to welcome everyone to the new semester. I hope that we can continue in the tradition of enthusiasm and active pursuit of our astronomical endeavors. The NCA programs are set up to benefit all members and we hope to see active participation by as many persons as possible, both members and guests, who are always welcome at our meetings.

We had an exciting year in 1993-4, with NCA members turning out in large numbers for our monthly meetings and preceding dinners. Supported by members, we began to change restaurants on a monthly basis to vary our cuisine and to give each speaker the opportunity to choose his or her favorite food. As this procedure has worked well, we will continue to move around this coming year.

The impending possibilities of dense Perseid meteor showers for the next several years, the excitement of the Comet Shoemaker-Levy 9 impacts in the Jovian atmosphere, several eclipses, and a number of reasonably bright grazing occultations gave our observationally-oriented members plenty to do, and we hope to continue these activities in the future.

Although not predictable at the time of this writing, it is possible that by the time you read this, NCA members and many thousands of other astronomers will have observed a spectacular storm of Perseids on August 12-13. We can also look forward to increasing counts of Leonid meteors over the next several years as we approach the 33-year possible repeat of the great Leonid storm of 1966. Many of our members will definitely travel to South America to view the total solar eclipse of November 3,1994, some with the Eclipse Edge Expedition '94 being led by NCA member Tom Van Flandern.

As stated by John Graham in his welcome message of 1992 *Star Dust*, Vol. 51, No. 1, ". . . the objective of the NCA is to promote astronomy and related sciences at all levels. This means that we must have active participation by all members, particularly in programs that will entice more young people into becoming involved in our discipline."

Although astronomy can be enjoyed anywhere with modest equipment, our facilities at Hopewell Observatory, our telescope making and nature programs, and our monthly meetings and lectures provide excellent opportunities for people of all ages to learn more about our universe and to actively engage in observational programs that will enrich their lives and the lives of those about them. The key to increasing this participation is to convince more people to come out and become involved. Only we who are already lovers of astronomy can do this and I hope to see increasing NCA membership throughout the year.

As also stated by John Graham, our monthly publication *Star Dust* is an essential vehicle to keep our members abreast of new and continuing developments and to alert them to upcoming activities. As part of our endeavor to improve and expand the role of *Star Dust*,we are pleased to announce and welcome our new editors, Gary and Alisa Joaquin, who are members of NCA having a mutual interest in astronomy.

We envisage that their interest in the scientific and technical content of

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September Calendar

The Public is Welcome!

Tuesdays, September 6, 13, 20, and 27, 7:30 PM - Telescope making classes at Chevy Chase Community Center, Connecticut Avenue and McKinley Street, NW. Information: Jerry Schnall, 202/362-8872.

Fridays, September 2, 9, 16, 23, and 30, at 7:30 PM - Telescope making classes at American University, McKinley Hall Basement. Information: Jerry Schnall, 202/362-8872.

Fridays, September 9, 16, 23, and 30, 8:30 PM - Open nights with NCA's Celestron-14 telescope with Bob Bolster, 6007 Ridgeview Drive, south of Alexandria off Franconia Road between Telegraph Road and Rose Hill Drive. Call Bob for details 703/960-9126.

Saturday, September 10, 1994, 5:30 PM - Dinner with the speaker at Jade Palace Restaurant (7708 Woodmont, Bethesda) before the monthly meeting. Reservations are for 5:30PM sharp.

Saturday, September 24, 1994 9:00 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

Friday, October 7, 1994 - Open House at Hopewell Observatory. Call Bob Bolster for directions at 703/960-9126

Saturday, October 1, 1994 - The next speaker will be George Wetherill of the Department of Terrestrial Magnetism of the Carnegie Institute of Washington. He will speak on "The Peakskill Meteorite, October 9, 1992, Video Observations: An Orbit Determination."

Thursday, September 15, 1994 - Next deadline for all submissions to October *Star Dust*. Send 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.

Smithsonian Sky Watchers' Report	**Sky & Telescope's "Skyline"**
Non-technical information recording on astronomical events, objects, and phenomena in the Washington, D.C. region's sky. Updated weekly. 202/357-2000	Moderately technical information recording on latest in space technology, astronomy, and related sciences. Updated weekly, or sooner if necessary. 617/497-4168

***WELCOME*, from Page 1**

Star Dust will manifest itself in an improved publication that will be prepared and distributed in a more timely manner. Our new editors can receive contributions by electronic mail as well as by other traditional methods, plus we expect that they will be present at most of our monthly meetings. With this increased convenience for submitting materials to be published, we encourage the preparation and publications of articles by more members. If you have any material of interest to other NCA members and are willing to prepare an article for *Star Dust*, please contact our editors or me.

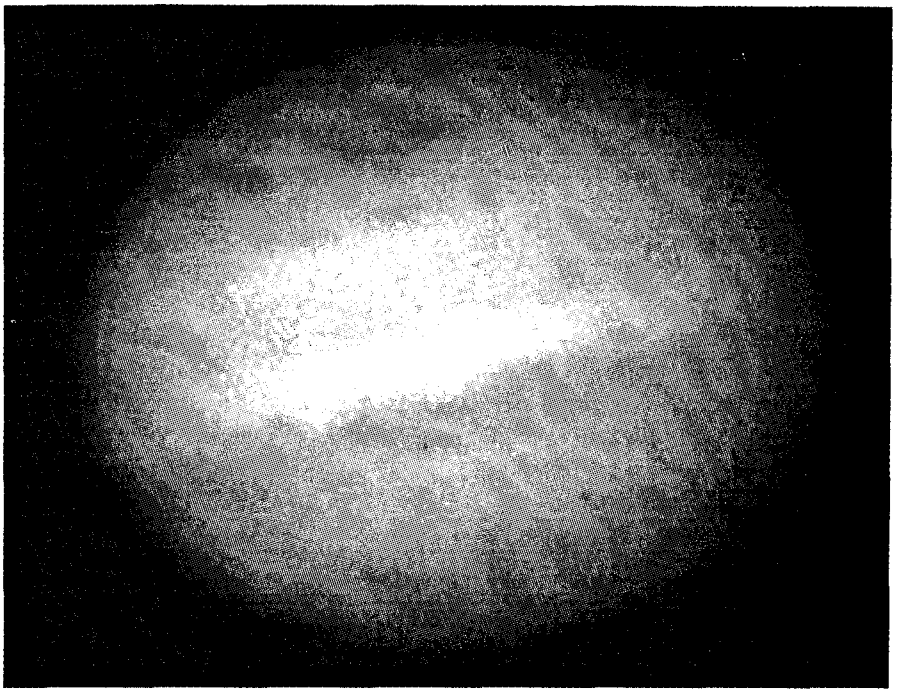
I would also like to welcome our new Vice President, Harold Alden Williams, who will be arranging for speakers at our monthly meetings. As a professional astronomer and teacher at Montgomery College, Harold is well connected to the local scientific and educational establishment for purposes of inviting interesting speakers. I look forward to working with him to provide quality programs that will maintain high meeting attendance and generate increased participation in NCA activities.

As with 1993, since Labor Day falls on the first weekend of September, our inaugural meeting of the new season will not occur until September 10. As announced in this issue, we look forward to an exciting presentation by Dr. Rob Landis (Space Telescope Science Institute), who will tell us about the collision of Comet Shoemaker-Levy 9 with Jupiter. Having seen many of the HST images of those events, as most of us have, I look forward to hearing about this extremely rare event from someone who was as close to the action as anyone.

Finally, I would like to join with other NCA members to congratulate our past President, John A. Graham, on the successful completion of his tenure and to thank him very much for his capable and consistent leadership. I'm sure that all will agree that John is a great person with whom to work and we really appreciate what he has done for the NCA. We look forward to seeing John relaxing comfortably at future meetings while others try to follow in his capable footsteps.

Rob Landis to Speak on "The Comet Shoemaker—Levy 9 Strikes Jupiter"

The next meeting of the National Capital Astronomers will be held on Saturday September 10 at 7:30 P.M., in the Lippsett Amphitheater, Room 1C114, of the Clinical Center (Building 10) at the National Institutes of Health. Rob Landis of the Space Telescope Science Institute will speak on "The Comet Shoemaker-Levy 9 Striking Jupiter." This comet was photographically discovered on 24 March 1993 by the team of Carolyn and Gene Shoemaker and David Levy with the 0.46 meter Schmidt telescope at Mt. Polomar. On the original image it appeared 'squashed'. Subsequent confirmation photographs at a larger scale taken by Jim Scotti with the Spacewatch telescope on Kitt Peak showed that the comet was split into many separate fragments.



The image was taken by Bob Bolster at 01:09 UT, July 25, 1994, using a SBIG ST-6 CCD camera on the NCA 14-inch Celestron telescope. Eyepiece projection to f/72 was used. Jupiter's South pole is at the top. Several dark spots resulting from the impact of the nuclei of Comet Shoemaker-Levy 9 are seen.

The discovery of this comet was a serendipitous product of the Shoemakers' long term search for Apollo objects, near Earth objects. Fortunately for us this object is not an Apollo object for in late May 1993 it was apparent that this object was going to hit a planet, Jupiter, not us. In fact, orbital solutions back in time indicted that this comet was tidal disrupted by Jupiter's gravity on July 8, 1992 when it passed well within Jupiter's Roche limit and only 21,000 kilometers from Jupiter's surface, less than a third of a Jovian radius. It is thought that this comet had probably orbited Jupiter for a few decades having been captured at some point in the past. Its very eccentric orbit took it one third of an astronomical unit away from Jupiter and sunward every orbit which was approximately every two years.

The fragments which were spread out in a rough line three Earth Moon

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Larry White Dies

Alexander L. White ("Larry"), 73 and a long-time member of NCA, died suddenly on June 28, 1994 of heart ailments at his home in Annandale, Virginia. Larry was born in South Carolina and graduated from Wofford College in Spartanburg, S.C. After service in World War II, he came to Washington, D.C. and was first employed in the U. S. Geological Survey and later in the U. S. Department of the Army at Ft Belvoir as a research chemist. He retired from federal service about 1982.

Larry was active in the NCA for many years and served as Chairman of the Observing Committee and maintained the Alvan Clark five-inch refracting telescope at the U. S. Naval Observatory. His early amateur activities were with the NASA Moonwatch program making satellite observations. In Annandale he built his own observatory housing a 4-inch refractor and a 10-inch reflector.

Larry was an ardent hobbyist. He had an enviable rock collection, and also collected stamps, coins, and shells, and both collected and built Kaleidoscopes as well. He had an inquiring mind and studied Egyptian and Mayan hieroglyphics. In recent years he was especially interested in archaeo-astronomy and ancient astronomical systems, especially Ptolomy's *Almagest.* Larry followed his hobby to viewing sites in southern Florida and at the Texas Star Party, and to many eclipses, occultation grazes and planet transits. Larry is survived by his wife, Virginia; two sons, Robert and Arthur; a daughter, Catherine; and three grandchildren, Michael, Eric and Sarah.

MICA and the Art of Astronomical Computing

Reviewed by Wayne H. Warren Jr.

The final meeting of the 1993-4 season of the National Capital Astronomers was held on June 4, 1994 at the National Institutes of Health. At that meeting, members and guests first heard short presentations from the winners of the 1994 NCA Science Fair Awards following their receipt of certificates from President John Graham.

Talks were given by Caleb Fassett of Washington Grove, MD (The Hubble Constant, Distance Relation), Lascalles Linton of Wheaton, MD (Gravitational Lenses), Sandra Martinka of Springfield, VA (An Accurate Scale Value for the Naval Observatory's 26-inch Refracting Telescope),and Justin Sands of Vienna, VA (The Dynamics of Chaos in Interacting Binary Galaxies). Dr. LeRoy Doggett of the Nautical Almanac Office at the U. S. Naval Observatory then gave a fascinating talk on astronomical computing in general and the recently developed *Multiyear Interactive Computer Almanac* (MICA) in particular.

MICA is the most recent of a series of software packages designed to allow users of personal computers to interactively calculate much of the data published annually in the U. S. Naval Observatory's (USNO) *Astronomical Almanac* (AA). The package is available in both MS-DOS and Macintosh versions; it is being officially distributed for USNO by the National Technical Information Service (NTIS) and can be ordered from the U. S. Department of Commerce, NTIS, 5285 Port Royal Road, Springfield, VA 22161; telephone (703)487-4650, FAX (703)321-8547. Call to confirm availability and current price.

Dr. Doggett began his presentation by relating the tale of a telephone call received some years ago requesting the "formula" for what was then called *The American Ephemeris and Nautical Almanac*. In those days (about 20 years ago) there were no such contraptions as personal computers and hand/desktop calculators were just beginning to have the capability to make complex calculations. This person had recently purchased such a calculator and naively presumed that he could get a single formula for computing the positions of the Moon and planets. Of course, no such simple formula could be provided for the wide variety of rather complicated calculations, but that experience demonstrated the eventual need for an almanac that could be used by individuals wanting to make such calculations on their own machines. The first product of this work was the *Almanac for Computers*, which was published as a book and contained short mathematical series used to represent positions of the Sun, Moon, and planets for efficient evaluation with small computers and programmable calculators.

The development and evolution of personal computers over the next decade rendered the *Almanac for Computers* obsolete and a more advanced package was needed. The next product to emerge was *The Floppy Almanac*, which was a software package written in Basic and specifically designed to run under MS-DOS. This package was updated each year for several years until it became clear that something was needed to cover a longer time span. The *Interactive Computer Ephemeris* (ICE) was then developed in both mainframe IBM and PC versions, but this quickly evolved and has been replaced by MICA, which is specifically tailored for MS-DOS and Macintosh computers.

Rather than detailing the history of astronomical computing, Dr. Doggett chose to illustrate some of the problems encountered when attempting to perform highly accurate astronomical calculations, particularly of planetary motions. In 1898 the great celestial machanician Simon Newcomb, who was then Director of the Nautical Almanac Office at USNO,gave a formula for the length of the tropical year, which, to first order, is equal to the orbital period of the Earth. The formula is:

$$P = 365.242198979 - 0.00000614T,$$

where T is measured in centuries from 1900. One can clearly see from the negative sign that P decreases with time. In fact, P vanishes when T = 59485700.129. Now we know from Kepler's Third Law of motion that the cube of the semimajor axis of an elliptical orbit is proportional to the square of the period (a^3 = constant * P^2). Thus, as P goes to zero, "a" vanishes and the Earth falls into the Sun in the year 5948571912 AD.

The fallacy here is that the equation is faulty, but it is a likely equation to be picked up from a book on astronomical computing by an unwary programmer who is developing software such as one often sees advertised in the astronomy magazines. As another example, consider the equation for the longitude of a planet:

$$\lambda = a_0 + a_1 t + a_2 t^2 + \ldots + b_1 \cos f(t) + b_2 \cos 2f(t) + b_3 \cos 3f(t) + \ldots,$$

where the "a"s and "b"s are constants. This is an infinite series for which the accuracy of the result appears to depend on where one cuts off the calculation. The constants

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were thought by astronomers of the eighteenth and most of the nineteenth centuries to be well-behaved, until the distinguished French mathematician Henri Poincaré showed that some of the higher-order terms could become very large and the series would not converge. However, he also showed that if the series is cut off at some point before divergence, then the result is a very good approximation to the true longitude. Thus, part of the art of celestial machanics is to determine where to cut off the series to obtain the best results before the equation blows up.

The development of advanced personal computers and powerful graphics applications in recent years has resulted in a number of currently available packages to make astronomical calculations and to produce graphical displays of the results. While these programs are quite impressive and fun to use, astronomers at USNO decided to produce a software package that would give the most accurate results possible to display in numerical form only, similar to what one finds in the AA. As mentioned earlier, these efforts resulted in the *Almanac for Computers* (1977-1991), *The Floppy Almanac* (1986-1996), the *Interactive Computer Ephemeris* (1988-1993) covering the period 1800-2050, and MICA (1993) covering the years 1990-1999. These products have been produced by what is now known as the Astronomical Applications Department (AAD) at USNO, which includes the Nautical Almanac Office (NAO). The original NAO was founded in Cambridge, Massachusetts in 1849 and subsequently moved to USNO. It was reduced in size about 3.5 years ago and became part of the AAD.

Dr. Doggett then described MICA in more detail, explaining that it is based on a software kernal coded in ANSI Fortran 77, over which sit machine-dependent interfaces for the PC and Macintosh systems. Calculations can be done for any geographic location and the program is menu-driven. Many of the data given in the AA can be calculated with MICA, including positions; nutation; sidereal time; rise, set, and transit times for astronomical objects; and daily configurations and physical ephemerides for solar system bodies. Ephemerides are based on the currently most accurate Development Ephemeris (DE-200)/Lunar Ephemeris (LE-200) from the Jet Propulsion Laboratory. MICA also includes various catalogs such as the FK5 astrometric catalog, the BSC5 *Bright Star Catalogue, 5th edition*, the Messier Catalog, and a list of astrometric radio sources. A user can generate his/her own catalog of objects if desired. MICA comes with a detailed User's Guide that not only describes the use of the package, but also introduces the user to the basic concepts of astronomical calculations.

Following Dr. Doggett's excellent description of MICA's capabilities, we saw a live demonstration of how the program works and the results that it generates. By using a projection plate connected to a 486 Notebook computer, everyone was able to see the computer screen very clearly. The NCA expresses its appreciation to Dr. Doggett for giving us this very interesting talk and valuable demonstration. We are also indebted to NCA member Jay Miller for allowing us to use his personal Notebook computer and to the NIH for providing the facilities and audio/visual assistance for the meeting.

Montgomery College's Public Planetarium Programs for 1994-1995 academic year

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.

Friday, September 23, 1994	—	"When the Sky Falls."
Saturday, October 22, 1994	—	"Splendors of Star Formation."
Saturday, November 19, 1994	—	"Eclipse of the Sun."
Thursday, December 22, 1994	—	"The Day of the Sun's Return: The Winter Solstice."
Saturday, January, 28, 1995	—	"Astrolabes."
Saturday, February 25, 1995	—	"Aftrican Skies."
Monday, MArch 20, 1995	—	"The Rites of Spring: The Vernal Equinox."
Saturday, April 29, 1995	—	"Discovery of Extra-Solar Planets."
Saturday, May 13, 1995	—	"The Search for Extra-Terrestrial Intelligence."

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.

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distances would strike the back side, the side not facing the sun and the Earth, at the same approximate latitude on Jupiter from July 16 until July 22. Until the impacts started there was major uncertainty as to whether any visible marks would be made in the cloud tops of Jupiter. The uncertainty was caused by the fact that even the Hubble Space Telescope could not resolve the solid nuclei of the comet but could only see the diffuse debris trail, coma, around the nuclei. The uncertainty in size was at least a factor of one hundred. Further uncertainties of another factor of around 5 were caused by not knowing the comets density or real composition. As most of us now know the comet turned out to be on the upper end of everybody's expectations; and it put on a proper show to commemorate the twenty fifth anniversary of the Apollo landing on the moon by human kind.

HST has recently concluded the intensive study of Comet P/Shoemaker-Levy's crash into Jupiter. Rob Landis, a former member of the Moving Targets Group at STScI, holds degrees in physics and astrophysics from Michigan State University. Upon first arriving at the Science Institute, Landis' primary responsibility in the Science Planning Branch was the near-term planning scheduling of HST Observations. Following the highly successful servicing mission, he transferred to the Moving Targets (planets, asteroids, comets, satellites of planets) Group in time to prepare for the HST Jupiter campaign. Author of several award-winning articles on astronomy and space science, Landis was recently transferred into the newly created Public Outreach Office at STScI.

NCA TREASURER'S REPORT

July 1, 1993 to June 30, 1994

by Jeffrey B. Norman

INCOME	
Dues	$6,616.00
Gifts	46.00
Interest	208.48
Miscellaneous	9.95
Sale of *Observer's Handbooks*	360.00
Sale of Alvan Clark Telescope	3,500.00[1]
Telescope-making classes	445.70
Total Income	$ 11,186.13
EXPENSES	
Int'l. Dark-Sky Association dues	100.00
Miscellaneous	90.06
Purchase of *Observer's Handbooks*	315.00
Sky & Telescope subscriptions	2,620.00
Secretary	383.60
Speaker's Dinners	182.41
Star Dust	4,352.17
Telephone	186.57
Total Expenses	$ 8,229.81
Balance on July 1, 1993	7,591.86
Excess Income over Expenses	2,956.32
Balance on June 30, 1994	$10,548.18 [2]
Total number of members joining or renewing from 7/1/92 to 6/30/93	184
Total number of members joining or renewing from 7/1/93 to 6/30/94 (not counting science fair winners)	163
Drop in membership	21 (11.4%)

[1]The sale of our telescope is a one-time occurrence, not an annual event. If the proceeds from this sale were subtracted from Income, there would be a deficit of $543.68.

[2]The Balance includes $2,226.66 from the NCA Travel account.

National Capital Astronomers, Inc.

is a non-profit, public-service corporation for advancement of the astronomical sciences and is the astronomy affiliate of the Washington Academy of Sciences. For information, call NCA: (301) 320-3621.

SERVICES AND ACTIVITIES:

A Forum for dissemination of the status and results of current work by scientists at the horizons of their fields is provided through the monthly NCA Meeting. (See monthly *Stardust* for time and location.) All interested persons are welcome; there is no charge.

Expeditions frequently go to many parts of the world to acquire observational data from occultations and eclipses which contribute significantly to refinement of orbital parameters, the coordinate system, navigation tables and timekeeping. Other results of this work under continuing study include the discovery of apparent satellites of some asteroids, discovery of apparent small variations in the solar radius, and profiles of asteroids.

Discussion Groups provide opportunities for participants to exchange information, ideas, and questions on preselected topics, moderated by a 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.

The NCA Public Information Service answers many astronomy-related questions, provides predictions of the paths and times of eclipses and occultations, schedules of expeditions and resulting data, assistance in developing programs, and locating references.

Astronomical Telescope & Binocular - Public Seminar, for Selection, Use, and Care, held annually in November, offers the public guidance for those contemplating the acquisition of a first telescope, and dispels the many common misconceptions which often leads to disappointment.

Working Groups support areas such as computer science and software, photographic materials and techniques, instrumentation, and others.

Telescope-Making Classes teach the student to grind and polish, by hand, the precise optical surface that becomes the heart of a fine astronomical telescope.

NCA Travel offers occasional tours, local and world-wide, to observatories, laboratories, and other points of interest. NCA sponsored tours for comet Halley to many parts of the southern hemisphere.

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

Public Programs are offered jointly with the National Park Service, the Smithsonian Institution, the U.S. Naval Observatory, and others.

PLEASE ENROLL ME IN NATIONAL CAPITAL ASTRONOMERS MEMBERSHIP

[ ] Regular
- [ ] *Sky & Telescope* and *Star Dust.* ($46 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.* ($32 per year)
- [ ] Star Dust only ($10 per year)

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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 $22 when it expires.

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

Jeffrey Norman Apt. 717, 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 qualifications which you might contribute to NCA.

Thank you, and welcome!

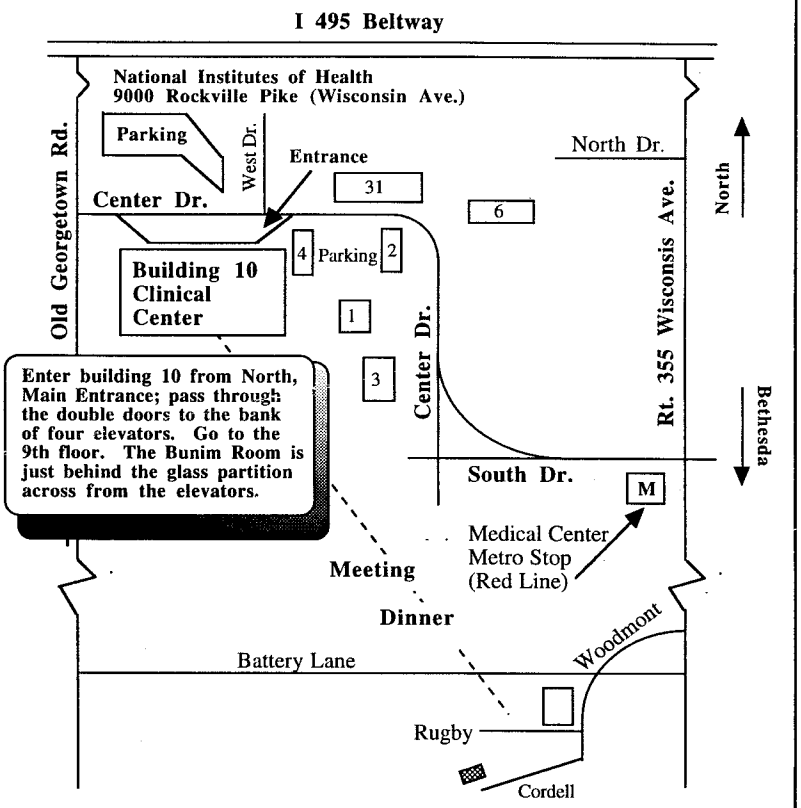
_____

_____

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).

•To Jade Palace: Take Wisconsin Avenue toward Bethesda and bear right onto Woodmont (or take the next right onto Battery Lane). Follow Woodmont to Norfolk (5 blocks south of Battery) and look for the restaurant on your right. Parking may be found on Woodmont, on the side streets, or in the one of several parking lots in the area. Seats are not guaranteed after 5:30.



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National Capital Astronomers, Inc.

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First Moon Landing, 1969

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