

# T A R

National Capital Astronomers, Inc.



# D U S T

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## Goodman Detects Strange High - Energy Particles from Herc X-1



DR. GOODMAN

**D**r. Jordan A. Goodman, Associate Professor, Department of Physics and Astronomy, University of Maryland, will address the October 7 National

Capital Astronomers colloquium in the National Air and Space Museum.

Goodman and his associates have discovered sporadic emissions of strange, ultrahigh-energy particles from the X-ray source X-1<sub>H</sub> Herculis, having energies as high as  $10^{15}$  electron Volts.

The air showers, consisting chiefly of electrons and positrons generated by the interaction of these particles with the atmosphere, are also accompanied by many more muons than would be expected from such events.

Jordan Goodman received his Ph.D. from the University of Maryland in 1978 where, in the Department of Physics and Astronomy, he participated in the origination of the Project Cygnus Experiment, examining celestial X-ray sources beginning with X-3 Cygni. The survey has not been confined to the constellation Cygnus, however; the source of present interest is in Hercules. Dr. Goodman is also an experimenter at the Fermi Collider Laboratory.

### OCTOBER CALENDAR — *The public is welcome.*

Tuesday, October 3, 10, 17, 24, 31, 7:30 pm — Telescope-making classes at Chevy Chase Community Center, Connecticut Avenue and McKinley Street, NW. Information: Jerry Schnall, 362-8872.

Friday, October 6, 13, 20, 27, 7:30 pm — Telescope-making classes at American University, McKinley Hall basement. Information: Jerry Schnall, 362-8872.

Friday, October 6, 13, 20, 8:00 pm — NCA 14-inch 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 960-9126.

Saturday, October 7, 5:45 pm — Dinner with the speaker at the Smithson Restaurant, 6th and C Streets, SW., inside the Holiday Inn. Reservations unnecessary. Use the 7th Street and Maryland Avenue exit of the U/Enfant Plaza Metrorail station.

Saturday, October 7 7:30 pm — NCA monthly colloquium in the Einstein Planetarium of the National Air and Space Museum, Seventh Street and Independence Avenue, SW. Enter Independence Avenue side. Dr. Goodman will speak.

Saturday, October 14, 7:30 pm — *Exploring the Sky*, presented jointly for the public by NCA and the National Park Service, on Glover Road south of Military Road, NW, near Rock Creek Nature Center. Planetarium if cloudy. See page 86. Information: John Lohman, 820,4194, or NCA, 320-3621.

Saturday, October 14, 4:00 pm until .... — National Capital Astronomers invited to visit Hopewell Observatory. See page 83.

The November NCA colloquium will be held on November 4.

For other organizations' events of interest see elsewhere in this issue.

## SEPTEMBER COLLOQUIUM

Dr. Rudolph A. Hanel, a Principal Investigator on the Voyager team in the Laboratory for Extraterrestrial Physics, NASA Goddard Space Flight Center, presented the early results of the Voyager-Neptune flyby at the September NCA colloquium in the National Air and Space Museum. Dr. Hanel has been our "tour guide" on the Grand Tour of the Planets, having addressed NCA on the occasion of each planet encounter during the past 12 years of the Voyager's journey.

In 1977, two spacecraft, Voyagers 1 and 2, were launched from Cape Canaveral, Florida, to explore the planets. Both flew by Jupiter and Saturn, the originally funded goal of the mission. At Saturn, both craft were in good condition, which made it possible to extend the trip to Uranus and Neptune, as originally hoped.

The decision was made to steer Voyager 1 to fly near Saturn and its largest satellite, Titan, a trajectory which would then swing the craft sharply northward of the ecliptic. Voyager 2 was programmed to continue after Saturn, to fly to Uranus and Neptune.

The radio signals sent back to Earth from Voyager 2 take 4 hours 6 minutes to traverse the 3 billion miles from Neptune. At that distance, the solar illumination is only about 0.001 of that at the Earth. The low light level and 40 K temperature (about -440° F) posed a challenge for the photography and infrared spectrometry teams. To photograph with the necessary long exposures from a vehicle moving at more than 60,000 km per hour required motion-compensation techniques, some of which were developed during the last three years of the flight. Roll, pitch, or yaw of the craft to keep the cameras on target, used on the Uranus encounter, cause the craft's highly directional antennas to lose contact with the Earth until rolled back. This limited the usable exposure times. Instead, at Neptune, where even longer exposures are necessary, the scan platform bearing the cameras was programmed to rotate without rotating the craft. The resulting improvements were striking.

Neptune was discovered independently by Adams and Leverrier in 1846 as a result of perturbations in the orbit of Uranus. Herschel discovered Uranus in 1781. Until 1822, Uranus accelerated, then decelerated. From this, the presence of Neptune was postulated and its approximate position calculated, which led to a successful search.

Neptune has long been regarded as an approximate twin of Uranus. Both show tiny, light blue-green disks with little detail on Earth-based photographs. Neptune, however, has an appreciable

internal heat source, while Uranus has not. As a result, Neptune has a far more dynamic atmosphere, showing white clouds, dark bands, a dark area now known as the Great Dark Spot, somewhat similar to the Great Red Spot of Jupiter, and a second, smaller dark spot with a white cloud in its center. Changes in these features are seen during the 18-hour rotation of the planet.

A strange similarity between Neptune and Uranus is that on both planets the polar and equatorial temperatures are higher than those at mid latitudes.

Two marked differences between Neptune and Uranus make the latter similarity seem even stranger: 1. Neptune has the previously mentioned internal heat source, which Uranus lacks. 2. Neptune's polar axis is tilted about 29° and its rotation is direct, while Uranus' polar axis is tilted 98°, so that its rotation is actually retrograde, with one pole now approximately facing the Sun for many years at a time.

By using various combinations of the wide- and narrow-angle cameras with orange, green, blue, and ultraviolet filtration to yield differential atmospheric penetration, by correlation with the infrared and other spectroscopic data, and by measurement of cloud shadows, the depths of many of the recorded features on the planet have been approximately determined. The white clouds, apparently methane, seem to be very high above the lower cloud deck, as high as 50 to 75 km. The Great Dark Spot seems to be very deep. The infrared spectrum shows a temperature of 62 K (-412° F) at 200 wavenumbers, somewhat higher than that of Uranus. (Ed. note for others than spectroscopists - Number of wavelengths in one centimeter, hence, a measure of frequency. 200 wavenumbers corresponds to a frequency of 600 GHz, or a wavelength of 50 micrometers, about 100 times the wavelength of visible light.)

The Neptunian atmosphere is mainly hydrogen with a considerable amount of helium, and traces of methane and other gases. Later reductions of the infrared and radio data will disclose the helium abundance. Some spectroscopic temperature-pressure-altitude profiles have shown lower-stratosphere temperatures of just below 62 K at 100 millibars. The infrared data also yield vertical wind-shear measurements.

The previously detected ring arcs, discovered by stellar occultations, were found to be continuous, but subtly thin in places.

In a spectacular example of NASA's precision long-distance trajectory control, Voyager 2 was sent over the north pole of Neptune, within 3000 km of the planet.

then southward toward Triton, Neptune's largest satellite, about the size of the Moon.

Whether the surface of Triton would be visible or enshrouded in clouds was not previously known. The surface is quite visible, and is covered with a surprising, fascinating, and puzzling variety of terrain. Some areas resemble the skin of a cantelope. Smooth basins apparently are caldera of frozen nitrogen magma, the ejecta of cold volcanoes! There are stepped features, indicating repeated eruptions. Below the surface, the temperature may be high enough for liquid nitrogen to exist. Subsurface pressure may burst through surface stresses to result in volcanic eruptions at temperatures hundreds of degrees below zero. Exposed to the external surface, the liquid nitrogen may freeze to form solid nitrogen rocks, or the smooth, frozen caldera.

Subtle color differences are apparent in Triton's in surface. The reddish hue is believed to be due to hydrocarbons generated in the extremely tenuous atmosphere. The ultraviolet experiment indicates a surface pressure of only about 10 microbars — about one hundred-thousandth of the surface pressure of the Earth's atmosphere. The pressure of the predominantly nitrogen atmosphere is in equilibrium with the vapor pressure of the

frozen nitrogen surface. Under ultraviolet irradiation, traces (about 0.0001) of methane in the atmosphere react with the nitrogen to form a variety of compounds.

There are dark and light areas, some apparently shaded, others illuminated by the Sun. Measurements of these areas can yield a relief map of the surface. Such vertical measurements have shown some features as high as 2 km. The overall albedo of Triton is quite high; it appears bright and white.

Voyager 2 has now left the ecliptic, having been swung sharply southward around Triton. Voyager 1 departed northward from Saturn in 1980.

The Voyager mission is a long-term program; only five of the 11 original principal investigators are still active. One has died, others have retired and have been replaced. Although the Voyagers have now left the realm of the planets, the mission is expected to continue well into the next century, measuring radiation and particles out to the fringes of the heliosphere.

The cameras will be turned off — they can be turned on if needed — to conserve the nuclear power supply (the only practical source; solar power is useless at such distances — ed.) to extend the high-energy particle experiments, field measurements, and radio telemetry as long as possible.

Robert H. McCracken

#### NCA AGAIN INVITED TO HOPEWELL CORPORATION OBSERVATORY

NCA members, families, and guests are again invited to explore the autumn night sky at Hopewell Observatory on Saturday evening, October 28. If you wish, come early (any time after 4:00 pm) and bring your prepared picnic dinner (...and stay as long as you like, of course!) Coffee, tea, cocoa, and soft drinks will be provided by the Hopewell Corporation. The nights will be chilly so dress warmly; the observatory is not heated (the operations building is, however).

From the Beltway, go west on I-66, 25 miles to the Haymarket exit at U.S. 15.

#### DR. JAMES Q. GANT, PAST NCA VICE PRESIDENT, PHYSICIAN, ASTRONOMER

With deep regret we note the passing of Dr. James Quincy Gant on September 2 from a heart attack. He was 83.

Dr. Gant has been an NCA member since its early days. He was a past Vice President of National Capital Astronomers, an organizer and former President of the Association of Lunar and Planetary Observers, an eminent physician, and a leading member of several medical societies.

In 1954, in recognition of his contributions to selenography, the lunar crater Archimedes-A, a crater near the

Left on 15, 0.25 mile to traffic light, right on Route 55, 0.75 mile to County Road 681. Right on 681, 3.2 miles to end, left on County Road 601 (gravel) 1.2 miles to County Road 629, Right on 629, 0.9 mile to narrow paved road on right (Directly across from easier-to-see entrance gate with stone facing on left). Turn right, go 0.3 mile to top of ridge, go around microwave station and continue on dirt road through woods a few hundred feet to the observatory.

Carpooling is recommended. Further information? Call NCA: 320-3621.

large crater Archimedes, was designated by the Lunar Section of the British Astronomical Society to be named for him upon his demise (Lunar craters are not named for living persons). He owned an observatory near Boyds, Maryland, in upper Montgomery County, where in past years he was an active selenographer.

Dr. Gant will be sorely missed by all those who knew him in both medical and astronomical circles. We members of National Capital Astronomers extend our sincere sympathy to his family.

## OCCULTATION EXPEDITIONS PLANNED

Dr. David Dunham is organizing observers for the following occultations. For further information

call the NCA-IOTA Information Line: (301) 474-4945 (Greenbelt, MD).

Date	Time	Place	Vis Mag	Pent Sunlit	Cusp Angle	Min Aper
Grazing Lunar:						
10-17-89	01:14	Windsor Hill, CT	4.4	91	9S	5 cm
10-17-89	01:32	Largo, MD; Vienna, VA	5.8	90	9S	10 cm
10-21-89	20:50	Chappaquiddick Is., MA	6.7	43	2N	10 cm
10-22-89	23:37	Nantucket, MA.	7.6	32	4S	8 cm cm
Asteroidal Appulse*:						
10-15-89	01:33	s. Canada	9.4	5.0	(617) Patroclus	10 cm
10-22-89	18:31	MA, CT, s.NY	7.4	3.0	(521) Brbia	5 cm

\*Appulses to be observed for possible satellites UNr path shifts.

## NCA WELCOMES NEW MEMBERS

Christopher A. Adler  
7131 Gordons Road  
Falls Church, VA 22043

Joseph H. Kitrosser  
5726 Larpin Lane  
Alexandria, VA 22310

Gabriele Hills  
14502 MacBeth Drive  
Silver Spring, MD 20906

Robert Thompson  
1406 Cool Spring Drive  
Alexandria, VA 22308

Nancy Hueper-Hoke  
11308 Hawhill End  
Potomac, MD 20854

## U.S. NAVAL OBSERVATORY COLLOQUIUM SCHEDULED

On Tuesday October 24, at 3:00 pm, the U.S. Naval Observatory Colloquium will hear "The History of the Astronomer's Clock," by Dr. Beresford Hutchinson, Curator of Horology, National Maritime Museum at the old Greenwich Observatory, Greenwich, England. The colloquia are held in Building 52, Room 300.

Parking is available behind the building.

NCA members are welcome. Enter the main gate at Massachusetts Avenue and 34th Street, NW, where the guard will require some form of identification and provide directions. For further information call the Scientific Director's Office: 653-1513.

## U.S. NAVAL OBSERVATORY TOURS IN OCTOBER

The next Monday night public tours of the Naval Observatory are scheduled to begin at 8:30 pm EDT on October 2, 9, 16, and 23, and at 7:30 pm EST on October 30.

Passes will be issued to the first 100 persons in line at the gate across from the British Embassy, at Massachusetts Avenue and the southeast side of Observatory Circle, at the end of the circular road. Some form of photoidentification will be required. Parking for the tours is not allowed on the grounds except for the

handicapped; ample parking is available near the gate.

Visitors will see various observatory facilities and, weather permitting, appropriately selected celestial objects, with the historic 26-inch Clark refractor with which the satellites of Mars were discovered more than a century ago.

For details, call the taped Observatory message: (202) 653-1543. Have a pad and pencil ready; there is much information.

## AIR AND SPACE MUSEUM OFFERS PROGRAMS IN OCTOBER

The following public programs will be offered during October in the Albert Einstein Planetarium of the National Air and Space Museum:

Saturday, October 7, 9:30 am - Free Monthly Sky Lecture: "The Paw of the Polar Bear." Tom Callen of the planetarium staff, will present his original research on the constellations of the

Chuckchee and Koryak Siberian Eskimos. Safe telescopic viewing of Sunspots will follow, weather permitting.

Wednesday, October 18, 7:30 pm - Free Celestial Seasons Lecture: the first of a series: "Under the Harvest Moon." Ellen Sprouls of the planetarium staff, will discuss the constellations seen at this season.

## ASTRONOMY AND PERSONAL COMPUTERS      Joan B. Dunham

**Precession and Mean Place** — The reference frames we use to define coordinate systems for celestial objects are based on the Earth's orbit about the Sun and the Earth's equator. These two planes, the ecliptic plane and the equatorial plane, are not fixed, but move as the Earth's orbit and pole of rotation are moved by gravitational perturbations from the Sun, Moon, and planets. As a result, star positions measured in a reference plane determined by the ecliptic and the equator appear to move. These motions are not large, but they can be observed in measurements repeated over many years. This phenomenon of precession was discovered by Hipparchus over 2000 years ago. The standard practice to accommodate this motion has been to define certain dates as the dates of mean epochs, to prepare star catalogs with positions as they would be on those dates, and with very long-term observing programs, to determine formulae to compute the precession so that observations or predicted positions of celestial objects may be placed in the reference frames of those star catalogs.

When we recompute star catalogs, and move their epochs from time A to time B, we include the effects of the motions of the stars from time A to time B (their proper motion, or space motion). This is necessary to give us a representation of the sky at time B, our new mean epoch. This is different from how we use mean positions for asteroids, comets, planets, or artificial satellites. When we have an asteroid position given in mean of 1950 coordinates, we have its position as of today (or whenever we are observing) in the reference frame defined by the star catalog of 1950. That is, the mean position of the asteroid can be plotted on the star catalog of 1950 and show us the position of the stars. We very specifically do not want to move the asteroid to where it will be on the epoch date of 1950. We can also compute the asteroid's mean position in the new reference frame of

2000. It is still the same asteroid, and it's "real" position measured in some absolute reference frame has not changed. We have just redefined its position in a reference frame defined by the stars in 2000.

The current systems and catalogs are in a state of flux. The "old" system is being replaced with a "new" one. The epochs of the old system are 1950 or, sometimes, 1900; the new is 2000. It is possible to define mean epochs of whatever time we wish. To distinguish the old and new systems, epochs of the old are prefaced with a B, to give us B1900, B1950, B1975, and the new with a J, as in J2000. The B refers to the Besselian year used as a unit of time, while the J refers to a Julian year. The day and time of B1950 is December 31, 1949 at 22:09.8 UT, that of J2000 is January 1, 2000 at 12 noon. The current state of affairs can leave us with the problem of converting mean of 1950 elements (from an IAU circular, for example) to J2000 to use with a star catalog in J2000 (Uranometria 2000 is one).

If we are using orbital elements, the precession affects only the angles that orient the orbit within the reference frame, the inclination ( $i$ ), longitude of ascending node (capital  $\omega$ ), and argument of perigee (small  $\omega$ ). The eccentricity, semimajor axis, and position on the orbit are unchanged. Equations are given in the *Astronomical Ephemeris* (p. B19 in the 1989 version) for the precession to/from the J2000 epoch of these orbital elements, valid for elements given in either the ecliptic or the equatorial frames. Equations are also given on the same page for precession of right ascension ( $\alpha$ ) and declination ( $\delta$ ), or latitude ( $\beta$ ) and longitude ( $\lambda$ ).

The page before gives the equations for more precise computations. However, most cometary and asteroidal elements are not terribly accurate themselves, and the simpler equations may be sufficient. We do not need high precision for simply locating objects.

### UNIVERSITY OF MARYLAND OPEN HOUSE SCHEDULED

The Astronomy Program, University of Maryland, holds open house on the 5th and 20th of each month at the University's observatory on Metzert Road in College Park. Talks and slide shows are presented at 9:00 pm, followed by telescopic sky viewing, weather permitting. The public is invited; there is no charge.

Thursday, October 5, — "The Origin of the Solar System," Dr. T.A. Matthews.

Friday, October 20, — "Chasing Occultations," Dr. M.F. A'Hearn.

No reservations are necessary for individuals. Groups larger than ten should call (301) 454-3001 at least 5 days prior to the program.

**EXCERPTS FROM THE IAU CIRCULARS Robert N. Bolster**

1. August 17 - W. Liller, Vina del Mar, Chile, discovered a nova of 9th magnitude in Scorpius on patrol photographs taken during the lunar eclipse.

2. August 24-26 - K.Okazaki, Kahokumachi, Japan; D.Levy, Tucson, Arizona; and M.Rudenko, Ashfield, Mass.; independently discovered a comet (1989r) of 11th magnitude in Bootes. Okazaki's discovery was made with a 25-cm Schmidt camera using T-Max 400 film, those by Levy and Rudenko visually with a 40-cm reflector and a 15-cm refractor, respectively. The orbital elements by D.W.E. Green indicate

that perihelion will be reached on November 11.

3. August 29 - Radio observations with a 13-m antenna at Jodrel Bank by Lynn and Pritchard, University of Manchester, detected a discontinuity in the rotation rate of the Crab Nebula pulsar.

4. September 5 - E.F. Helin and B.P. Roman discovered a comet (1989s) of 14th magnitude in Ophiuchus with the 46-cm Palomar Schmidt.

5. September - Anderson, Kulkarni, Prince, and Wolszczan discovered a 33-ms pulsar in the globular cluster M53.

**COMET OKAZAKI-LEVY-RUDENKO BRIGHTENING**

The comet will be visible in the evening sky through mid-October, and is expected to brighten to 6th magnitude. It

will be visible in the morning sky during November, expected to reach 4th magnitude by about Thanksgiving.

**NASA GODDARD SEMINAR SCHEDULED**

During the academic year, Goddard Space Flight Center at Greenbelt, Maryland, holds weekly colloquia on Fridays, biweekly seminars on alternate Tuesdays, on a wide variety of scientific subjects, frequently astronomy-related.

The following seminar will be held at 15:30 at the Center. Coffee and tea will be served from 3:00. Enter the main gate

and obtain a visitor's pass from the guard. Call Tracy Parlate, 286-8543, for further information.

**Laboratory for Atmospheres Seminar Series in Building 21, Conference Room 183:**  
Tuesday, October 24 - "Mars' Upper Atmosphere," Larry Brace, NASA Goddard Space Flight Center.

**UNUSUAL EXPLORING THE SKY PROGRAM TO FEATURE FULL MOON**

These joint National Capital Astronomers - National Park Service programs for the public ordinarily avoid nights of the full Moon, but will feature it on October 14. Although the rough, mountainous terrain is not nearly as obvious when the Moon is full, proper filtration will show certain details best seen at that time.

All ages are welcome; there is no charge. Make it a family night and share telescopic views.

Members planning to participate should equip oculars with amber filters.

For further information, call Dr. John Lohman: (703) 820-4194 (Arlington, VA), or NCA: (301) 320-3621 (Bethesda, MD).

**UNIVERSITY OF MARYLAND ASTRONOMY PROGRAM COLLOQUIUM SCHEDULED**

The University of Maryland Astronomy Program Colloquia are held each Wednesday at 4:30 pm at the UMD Computer and Space Sciences Building (CSS), Room 1113. For more information, call Dr. Roger Bell, (301) 454-3005.

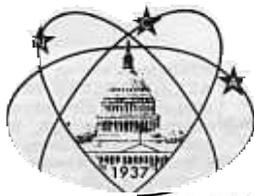
4 October - "X-ray Observations of Clusters of Galaxies," Dr Keith Arnaud, University of Maryland.

11 October - "Large Scale Correlations in the Distributions of Galaxies," Dr. A. Szalay, Johns Hopkins University.

18 October - "Sun, Supernovae, and the Neutrinos," Dr. Rabindra Mohapatra, University of Maryland.

25 October - "How Novae Make Stardust," Dr. Robert Gehrz, University of Minnesota.

The colloquia are preceded by tea at 15:30 in CCS 0254, and followed by refreshments. Park at meters in the garage at the corner of Regents Drive and Stadium Drive, across the street from the Ccs Building.



# National Capital Astronomers, Inc.

is a non-profit, public-service corporation for advancement of the astronomical sciences. NCA 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 colloquia held at the National Air and Space Museum of the Smithsonian Institution. 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 *Sky & Telescope* magazine and the NCA newsletter, *Star Dust*.

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.

The Telescope Selection, Use, and Care Seminar, 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 lead 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 and other astronomical items.

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 (\$32 per year) Each regular member receives *Sky & Telescope* and *Star Dust*.

Junior (Only open to those under age 18.) Date of birth \_\_\_\_\_

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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 mail label, or indicate expiration date: \_\_\_\_\_. A prorata adjustment will be made.

Make check payable to National Capital Astronomers, Inc., and send with this form to: Patricia B. Trueblood, Secretary, 10912 Broad Green Terrace, Potomac, MD 20854.

The following information is optional. If you would like to participate actively in NCA affairs, please indicate briefly any special interest, skills, vocation, education, experience, or other qualifications which you might contribute. Thank you, and welcome!



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