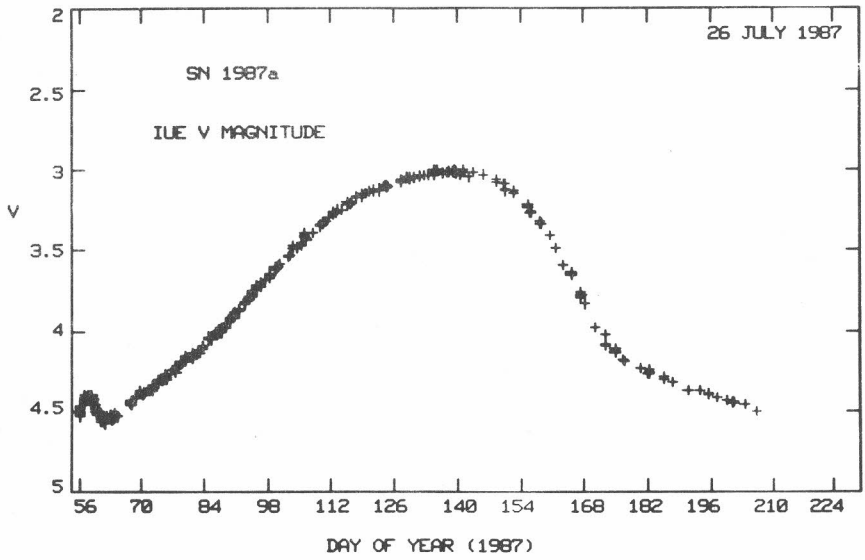
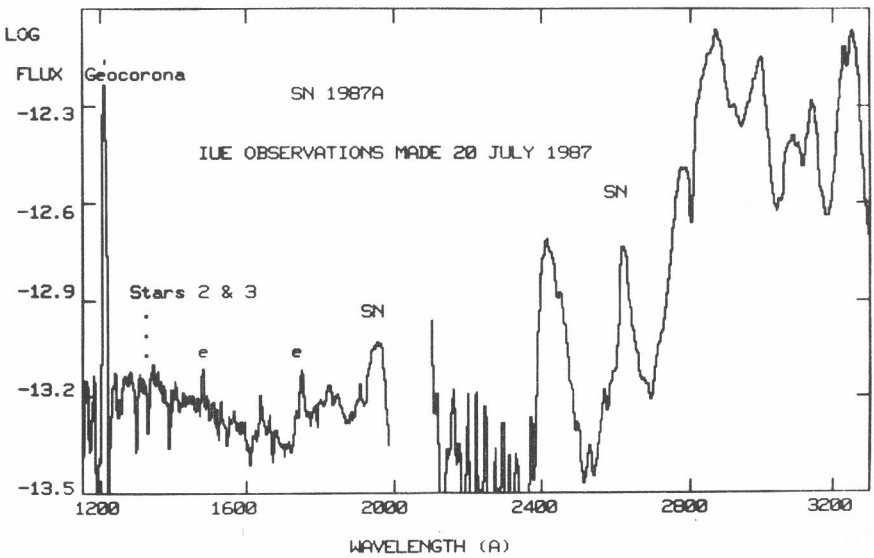
★ STAR DUST

Volume XLIII Summer 1987 Number 11

Again this year, there is no question as to our annual astronomical feature item! It's . . .

The Year of the Supernova – 1987A





COVER FEATURE: THE YEAR OF THE SUPERNOVA

Supernova 1987A, the brightest and closest for hundreds of years, has shown probably the strangest behavior of any supernova ever observed.

Our cover feature, late July observations by the International Ultraviolet Explorer (IUE), were provided by Dr. George Sonneborn and Dr. Robert P. Kirshner. Dr. Sonneborn, of NASA Goddard Space Flight Center and Computer Sciences Corporation, is the IUE Telescope Operations Manager. Dr. Kirshner, Harvard-Smithsonian Center for Astrophysics, is the Principal Investigator for the NASA IUE Supernova Observing Program. Dr. Sonneborn delivered the May 1987 National Capital Astronomers colloquium on the supernova at the National Air and Space Museum.

The light curve (top) was made in the visual band by the IUE fine error sensor (FES) using an S-20 photocathode. It shows the unusually fast early rise, the first seemingly premature decline, and resumption of a slower, continued rise. The decline has recently (until 26 July 1987) converged to the more usual form characteristic of the classical type II supernova.

Early spectra did not resolve the two fainter stars very close to the supernova. In the UV spectrum (bottom trace) taken by the IUE on 20 July, their contributions (stars 2 and 3, shortward of 170 nm) are shown. Spectral features longward, 170 to 200 nm and 240 to 330 nm, all are those of the supernova. Features marked "e" appear to be narrow emission lines of semi-forbidden transitions of N III and N IV. They are almost certainly *not* originating in the supernova ejecta, but probably in circumstellar matter.

The supernova, which appeared in the large Megellanic cloud in February, is also the first for which the progenitor star has been identified, previously catalogued, and spectrally classified. It is also the first extragalactic source bright enough to permit the absorption spectrum of the galactic gas halo to be observed.

The March (Kurfess), May (Sonneborn), and June (Panagia) 1987 NCA colloquia have followed the peculiar development of the supernova.

Early identification of the progenitor star, Sanduleak -69 202 (star nr. 202 at declination 69 degrees south in the Sanduleak catalogue), was soon confused when an unexpected rapid decrease in the UV radiation exposed the unresolved composite UV spectrum of the other nearby stars. First interpretation was that S -69 202 was still there. Later resolution of the spectra indicated that S -69 202 was missing, hence apparently was the progenitor. It now seems clear that that is indeed the case.

Two separate precurser neutrino bursts have been interpreted as possibly indicating a two-stage collapse: first to a neutron star, then to a black hole. An interesting speculation as to how a blue giant such as S -69 202 could become a supernova was given in the June lecture reviewed in this issue.

As the expanding envelope of supernova ejecta thins out during coming months and years and becomes transparent to other radiations, direct gamma-ray evidence of nucleosynthesis will be sought by the Solar Maximum Mission (SMM) spacecraft. Extended monitoring by the Hubble Space Telescope (HST) and other measurements are expected to yield much new knowledge of the supernova processes.

AUGUST CALENDAR — ***The public is welcome.***

Tuesday August 4, 11, 18, 25, September 1, 7:30 pm — Telescope-making classes at Chevy Chase Community Center, Connecticut Avenue and McKinley Street, NW. Information: Jerry Schnall, 362-8872.

Friday, August 7, 6:00 pm — Joint NASM-NCA Telescope Fair. See page 45.

Friday, August 7 — Special telescope-making class at the National Air and Space Museum in conjunction with joint NASM/NCA program. See page 45.

Friday, August 14, 21, 28, September 4, 7:30 pm — Telescope-making classes at American University, McKinley Hall basement. Information: Jerry Schnall, 362-8872.

Friday, August 14, 21, 28, September 4, 9:00 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, August 15, 9:00 pm — *Exploring the Sky*, presented jointly by NCA and the National Park Service. Glover Road south of Military Road, NW, near Rock Creek Nature Center. Information: 320-3621.

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

JUNE LECTURE

Dr. Nino Panagia, Space Telescope Science Center, delivered the June 6 National Capital Astronomers colloquium at the National Air and Space Museum. He presented some new (since the May lecture) developments in the large Magellanic cloud (LMC) supernova, 1987A, as well as some new ways of examining earlier observations.

Early behavior of the supernova seemed anomolous; photometry by the optical system of the the IUE satellite showed a very rapid rise to about magnitude 4.5, then a plateau or slight dimming. Thus seeming to have reached an early peak, it was at that stage disappointing. Then it unexpectedly brightened to another plateau at about magnitude 3, only to decline again, slowly, in early June. The observed spectrum was a composite of the suspected 12th-magnitude type O supergiant, Sanduleak -69 202 and two very close fainter stars.

This was an example of the interesting but strange early behavior in the optical band. Recently, however, the light curve and resolved spectrum are consistent with those of a classical type II supernova.

The pre-discovery bursts of neutrinos reported in the United states and Japan were later recognized as having signaled the collapse of the stellar core. However, the bursts were several hours apart. Panagia suggests that this may indicate a two-stage collapse of the 20-solar-mass blue supergiant, Sanduleak -69 202, perhaps first to a neutron star, then to a black hole! If so, we should know after the remnant fades completely out.

Supernovae are ordinarily expected to signal the demise of red giants, not blue giants such as the type O Sanduleak star. Environmental conditions in the LMC dwarf galaxy are very different from those in the usual spiral galaxies, where supernovae have previously been observed. Panagia speculates that internal events, perhaps not unusual but indiscernible under other circumstances may, in this different environment, explain the unusual early behavior. As a hypothetical scenario, he postulates a normally evolving star, one about to become a supernova, but one which is losing mass more rapidly than it would in another environment, thus exposing the higher temperature (bluer) interior. The smaller radius would allow escape of radiation signalling interior events not otherwise seen.

The expanding gas shell has not yet thinned sufficiently to be transparent to some wavelengths; much more is still to be learned in coming months and years. However, it is now clear that the progenitor was indeed the first suspected 12th-magnitude blue supergiant — the first supernova progenitor ever known or observed prior to the event.

With its fine resolution and sensitivity, the Hubble Space Telescope will be able to follow up on SN 1987A. Thus, this will be the first supernova ever to be studied from its origin to its end.

Robert H. McCracken

TO THE MEMBERS OF NATIONAL CAPITAL ASTRONOMERS

It has been my pleasure to serve as president of NCA for the past two years — two years filled with triumph and tragedy in the scientific community. Who can ever forget the Voyager flyby of Uranus, the apparition of Comet Halley or the disaster of Challenger.

NCA has grown these past two years and has become more actively involved with the scientific community. Our meetings are now held in the Albert Einstein Planetarium of the National Air and Space Museum and we participate more heavily in their programs as well as those of the Washington Academy of Sciences and the U.S. Naval Observatory. Our growth is due in no small part to the efforts of the directors, officers, and members of NCA and I take this opportunity to thank them for their tireless help.

Congratulations are also in order to Walter Nissen and the other newly elected officers. I wish them well and sincerely trust that their tenures will be as rewarding as was mine.

Sincerely,

Stanley G. Cawelti

Stanley G. Cawelti
President

OCCULTATION EXPEDITIONS PLANNED

Dr. David Dunham is organizing observers for the following occultations. For further information call (301) 495-9062 (Silver Spring, MD).

UT Date	Time	Place	Vis Mag	Pcnt Sunlit	Cusp Angle	Min Aper
08-14-87	09:11	Brandywine, MD	8.3	70	17N	5 cm
08-28-87	17:31	Ellicott City, MD	1.2	17	15N	5 cm

TREASURER'S REPORT

Two Years: 1985 1 July - 1987 30 June*

1. GENERAL FUND		FY1986		FY1987
INCOME				
Dues		$8,185.00		$9,112.50
Sale of *Observerr's Handbooks*		325.00		330.00
Orders for other publications		174.63		66.50
Telescope-making classes		257.00		175.00
Interest		376.29		354.32
Donations		278.00		59.00
Total Income		$9,595.92		$10,097.32
EXPENSES				
Sky and Telescope subscriptions		$3,659.50		$5,209.00
Purchase *Observer's Handbooks*		310.00		310.00
Purchase other publications		191.65		66.50
Star Dust - Printing	$1,138.60		$ 854.61	
Postage	1,385.45		1,191.05	
Star Dust; total		2,524.05		2,045.66
Speakers' Dinners		177.87		166.23
Astronomical League dues		373.80		423.48
Insurance - Liability		250.00		305.00
Telephone		359.64		346.48
Security services		0.00		810.00
Admin. incl. postage and copying		850.20		1,337.32
Total Expenses		$8,696.71		$11,019.67

Total income, FY1986-FY1987	$19,693.24
Total expenses, FY 1986-FY1987	$19,716.38
Excess expense over income	$23.14
Balance on hand 1 July 1985	4,741.65
Balance on hand 30 June 1987	4,718.51

*Halley's Comet has been blamed for many mishaps and disasters which it could have had nothing to do with; however, that the treasurer was unable to produce a timely report for FY 1986 can justly be ascribed to its disruptive influence. Because of the comet, many FY 1986 bills were not submitted, much less paid, until well into FY 1987, so that a report on our financial status as of 30 June 1986 would have been very misleading. Matters have now been straightened out and should proceed in an orderly manner henceforth.

The treasurer would also like to express long overdue thanks to Dr. Joan Bixby Dunham for gifts totaling $400.00 made during the two years of her tenure as secretary.

Ruth S. Freitag
Treasurer

2. NCA TRAVEL 1985 JULY 1 - 1987 JUNE 30

INCOME		EXPENSES	
Initial deposits on tours	$4,250.00	Reservatns to wholesaler	$4,250.00
Loans	3,127.62	Loans	3,127.62
Interest	193.09	Interest	134.66
Refunds	1,400.00	Cancellations	1,400.00
Commissions	2,719.00	Advertisements	1,125.91
TOTAL INCOME	$11,689.71	Printing	16.81
		Postage	24.40
		TOTAL EXPENSES	$10,079.40
BALANCE ON HAND	$1,610.31		
GENERAL FUND BAL	$4,718.51		

Robert H. McCracken
Trustee

3. TOTAL NCA BALANCE $6,328.82 30 June 1987

HARWIT TO DIRECT NATIONAL AIR AND SPACE MUSEUM

On June 24 Dr. Robert McCormick Adams, Secretary of the Smithsonian Institution, announced the appointment of Dr. Martin O. Harwit, professor of astronomy at Cornell University, to become Director of the National Air and Space Museum on August 17. He will succeed Mr. Walte Boyne, who resigned to pursue other interests.

Born in Prague, Dr. Harwit lived in Istanbul until his mid teens when shortly after World War II he came with his family to the United States. He majored in physics at Oberlin College and the University of Michigan, and received his Ph.D. in physics from M.I.T. in 1960. He became Chairman of the Astronomy Department at Cornell in 1971, and was Chairman of Space History of the Air and Space Museum in 1983. He chairs NASA's Working Group on Astrophysics Management, and is a member of the NASA Space and Earth Science Advisory Committee.

Dr. Harwit is an innovator. In his pioneering research in infrared astronomy from rockets and aircraft, theoretical astrophysics, cryogenic optics, Hadamard-transform optics, and the history of astronomic discoveries, he has authored many papers, patents, and three books which have been translated into several languages: *Astrophysical Concepts; Hadamard Transform Optics;* and *Cosmic Discovery: the Search, Scope, and Heritage of Astronomy.*

National Capital Astronomers joins the staff of the National Air and Space Museum in welcoming this eminent astronomer.

NASM/NCA TO PRESENT JOINT PROGRAM

National Capital Astronomers will participate with the National Air and Space Museum in a special summer program on Friday, August 7, 1987 from 6:00 to 9:00 pm. The program is called "Astronomy from Your Own Backyard."

NASM will offer a tour of the "Exploring the Planets" gallery at 7:00 pm and a lecture, "Comets and Planets" at 8:00 pm in the Albert Einstein Planetarium. After dark, weather permitting, NASM docent and NCA trustee Stanley Cawelti will present telescopic viewing of the night sky.

The program will include an NCA telescope fair and demonstrations of telescope making and optical testing. A variety of telescopes, homebuilt and commercial, will be shown and members will answer questions, advise on the selection, use, and care of telescopes, and discuss both NCA's scientific work and its other activities and services offered to the public.

NCA WELCOMES NEW MEMBERS

David Barwell Family
9424 Horizon Run Road
Gaithersburg, MD 20879

Charles C. Brewer
1220 East-West Highway
Silver Spring, MD 20910

Daniel L. Cruz
9612 Commonwealth Blvd
Fairfax, VA 22032

Paul R. Gibson
1803 T Street, NW, Apt. D
Washington, DC 20009

Dianna F. and Joseph A. Godron
8865 Winding Hollow Way
Springfield, VA 22152

Fred Khoroushi
PO Box 60053
Washington, DC 20011

Justin Metcalfe
9412 Wadsworth Drive
Bethesda, MD 20817

Stanley P. Rodak
6209 Possum Trot Court
Manassas, VA 22111

Edward S. Sears
3526 Silver Park Drive, Apt. 13
Suitland, MD 20746

Edgar E. Seymour
13208 Locksley Lane
Silver Spring, MD 20904

Kenneth R. Short, Jr.
1619 Fieldthorn Drive
Reston, VA 22094

Mike Soria
2005 Columbia Pike, Apt. 829
Arlington, VA 22204

Michael E. Souaya
8203 Terra Grande Avenue
Springfield, VA 22153

Jonathan Worsley
Routh 1, Box 11
Port Tobacco, MD 20677

NCA VICE PRESIDENT JAY MILLER SERIOUSLY INJURED

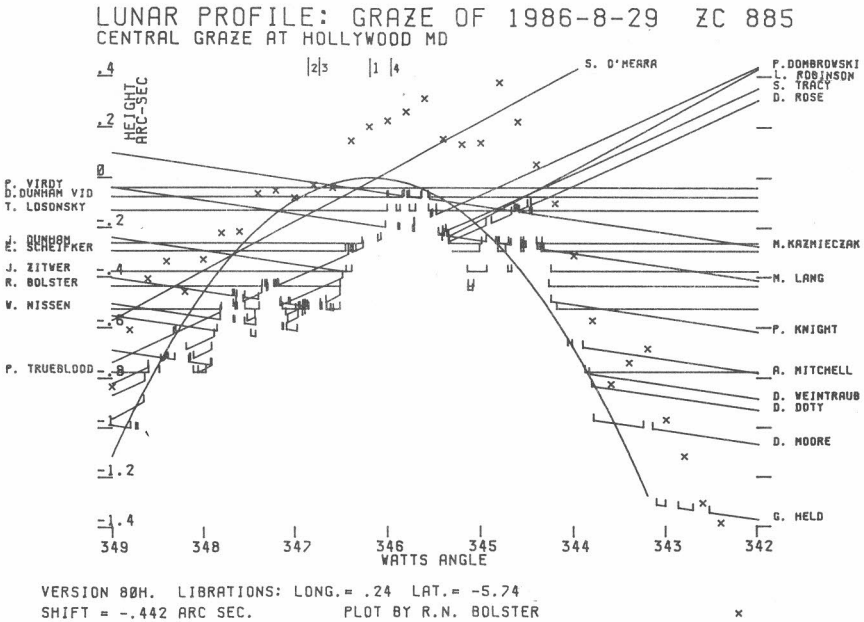
We are saddened to hear that our vice president, Jay Miller, was seriously injured on July 11 when struck by an automobile. At this writing he is expected to remain hospitallized for several weeks. We extend our sympathy to Jay and his family. He is in room 458, Suburban Hospital, Bethesda, Maryland 20817. For patient information call (301) 530-3117.

NEW GRAZE-PLOT SYSTEM BY BOLSTER SPEEDS OCCULTATION DATA REDUCTIONS

A new computerized system has been developed by Robert N. Bolster as part of an effort by National Capital Astronomers and the International Occultation Timing Association to expedite both the preparation for making observations and reduction of the data. The program runs on an Apple II computer and employs a pen plotter. This automated plotting system replaces the tedious manual process previously used.

Most of the calculations reducing the graze observers' to a common frame of reference are done by a mainframe computer at the U.S. Naval Observatory. These data are then entered into the Apple computer with the observed timings to produce the data for the plot. The observed limb height is also compared with the predicted to yield the shift or error which is the result of uncertainties in the star's position and the Moon's position and diameter.

The accompanying plot of the results from the grazing lunar occultation of ZC 885, which was observed in August 1986, is the first produced by the new system.



These timings were made by by 22 observers in four expeditions, in North Carolina, Rhode Island, Massachusetts, and by NCA at Hollywood, Maryland. The mean limb of the Moon is shown by the smooth curve, and the predicted profile by the X's. The straight lines show the apparent path of the star as seen by each observer. The tic marks and gaps show where the star was occulted and reappeared as features on the Moon's limb passed in front of it. On this graze one degree Watts angle corresponds to approximately 36 seconds of time, depending upon the angle and the observer's position. A total of 211 timings were made, providing an unusually complete plot of the profile.

The object of these observations is to identify precisely the limb of the Moon, hence, the libration. From this the precise position of the lunar orbit is derived relative to the celestial coordinate system at a particular point in time. The sensitivity of the method exceeds by far the direct resolution of any telescope on the Earth.

Important dynamical data on the solar system are derived from these expeditions. Combining the data from many such expeditions allows corrections of the celestial coordinate system itself to be made. They have even been used in refining the value for the mass of the galaxy!

The remarkable consistency of the fine detail as derived from the widespread observers' timings illustrates the power of the graze method, as well as the requirement for knowing each observer's position to within a few feet on the surface of the Earth — the approximate accuracy at the limb of the Moon.

WASHINGTON ACADEMY OF SCIENCES PUBLISHES 75-YEAR COLLECTION

Just off the press, the new book, *75 Years of Scientific Thought,* contains 25 of the best papers published in the *Journal of the Washington Academy of Sciences* during the Journal's first 75 years of existence (1911-1986).

Eight of these landmark papers were authored by Nobel laureates.

The book was compiled by the Academy's Committee on Scholarly Activities over an intensive two-year period of review. The Committee was chaired by Dr. Simon Strauss. Other members were Drs. Robert F. Blunt, Randall M. Chambers, Lloyd E. Church, Robert A. Owens, and Bhakta B. Rath. The papers cover a wide variety of scientific fields and provide a classic portrayal of scientific thought over the past 75 years.

A limited number of copies are available for sale on a first-come basis. The price to Academy members is $15.00, to non-members of the Academy who are members in good standing of an Academy affiliate, 25.00. To all others, $30.00. National Capital Astronomers is an affiliate of the Academy.

Non-members who wish to do so may simultaneously apply for membership in either or both organizations and purchase the book at the corresponding member price.

For a listing of the papers and authors, application forms, and other information, call NCA: (301) 320-3621.

USE THE NCA 5-IN CLARKE REFRACTOR — IT'S YOUR TELESCOPE

Have you received your pass to use NCA's 5-inch Alvan Clarke refractor at the Naval Observatory? It's your telescope, available for NCA members' use at any time after a simple wqualifying checkout. To make an appointment for your checkout on it call NCA: (301) 320-3621.

ASTRONOMY AND PERSONAL COMPUTERS

The best computer software for astronomical use both educates and performs useful calculations. This describes two packages, "Deep Space" and "Ace" which are very well prepared, quite educational, and perform useful calculations.

David Chandler, known for his "Star Dial," and his book on astronomy with binoculars, was distributing "Deep Space" at *Universe 87*. This diskette pair has programs and stellar position data to generate star charts for user-provided times and locations, with or without constellation labels, and with an option to generate a three-dimentional view. "Deep Space" also includes programming to plot planetary positions, and charts for asteroid and comet predictions when given the orbital elements. He has data taken from 18,000 stars taken from "Sky Map," to magnitude 7.2, which Chandler says are all he can fit on an MS-DOS 5.25-inch DS/DD floppy disk.

The "Deep Space" software is written in TURBO PASCAL, and uses an 8087 mathematics coprocessor chip, although the software is useable, but slower, in machines that do not have this chip. "Deep Space" expects an Epson or Epson-compatible printer, and will generate plots on the screen if the computer has a CGA board. Screen plots are necessary only when doing interactive labeling of the constellations. Chandler wants this to become a computer handbook guide to astronomy, and invites comments from people who try it. I am sending his package to PC users groups with public domain software libraries for distribution (with Chandler's approval), and will also distribute this at the Smithsonian's "Astronomy in your Backyard" program on August 7.

The other package I received, "Ace," the Astrosoft Computerized Ephemeris, is also a two-disk package of public domain software for MS-DOS computers. Some of "Ace" repeats the U.S. Naval Observatory's "Floppy Almanac," but in a format that the "Ace" authors feel is more convenient for astronomical observing purposes. This package provides a long list of computations, including positions of solar-system objects, astrophotography exposures, time computations, precession, calendar generation, eclipses, and phases of the Moon. "Ace" includes a small star catalog, the Messier catalog, and commentaries on many of the objects. The authors would like to hear comments, criticisms, and recommendations from users of "Ace".

Both of these packages are very professionally prepared and provide a useful set of programs for computerized astronomy. I can provide both packages for four disketts and a self-addressed mailer with sufficient postage ($0.56 or $0.74, depending upon the mailer size). "Ace" is available from FC-SIG (disks 692 and 693), and both "Ace" and "Deep Space" should become more widely available as their distribution increases.

Joan B. Dunham

EXCERPTS FROM THE IAU CIRCULARS

1. April 4 -- Sawyer, Baker, A. Cochran, and B. Cochran, University of Texas, obtained time-resolved spectra of the occultation of Charon by Pluto with the 2.1-m McDonald Observatory. The derived spectrum was flat and featureless, lacking the reddening and methane absorption of that of Pluto.

2. April 17 -- Larson, Mumma, Weaver, and Drapatz detected water vapor in Comet Wilson with an infrared spectrometer on the Kuiper Airborne Observatory. No methane emission was seen.

3. June -- Middleditch, Lyne, Brinklow, Becker, Clifton, and Kulkarni detected a millisecond pulsar in globular cluster M28 by analysis of data from the 76-m Jodrell Bank radiotelescope with a Cray XMP computer at Los Alamos.

4. June 22 -- Sicardi, Bouchet, Pizzarro, and Vega, Observatoire de Meudon, observed a stellar occultation by Neptune with the 3.6-m telescope at the European Southern Observatory. A possible secondary occultation was was recorded 3 hours later near the orbit of Triton.

5 Supernova 1987A -- The supernova has continued to fade since May 20. In early June, ultraviolet emission lines were detected by the IUE spacecraft. Radio emission at 22 GHz was first detected on June 20 at the Itapetinga Radio Observatory in Atibaia, Brazil.

Robert N. Bolster

FOR SALE

Ocular, Brandon 8-mm, new, unused. Retail price $85.00; will sell for $50.00. Victor Westhall, 8416 Thornberry Drive West, Upper Marlboro, MD 20772, or call (301) 627-4878.

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WASHINGTON, D. C.

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