



## A'HEARN TO DISCUSS SPECTROPHOTOMETRY OF COMETS



DR. A'HEARN

Dr. Michael F. A'Hearn, Astronomy Program, University of Maryland, will discuss his work in the spectrophotometry of comets, at the June 3 meeting of National Capital Astronomers.

Although spectroscopy of comets has a long history, spectrophotometry is of much more recent origin. At the expense of a loss of spatial and spectral resolution, it provides an absolute calibration of the cometary emission features, and thus an accurate determination of the abundances. The variation of these abundances with heliocentric distances in a single comet can tell us about the types of ices controlling the vaporization of the cometary nucleus. This, in turn, can disclose the physical conditions that were present in the pre-solar nebula when the comets were formed. From the variations in abundances among many comets the homogeneity of the

pre-solar nebula can be inferred. Comets thus offer the only direct probe of the conditions under which the planets and entire solar system formed.

Michael F. A'Hearn received his B. S. in physics from Boston College in 1961, his Ph.D. in astronomy from the University of Wisconsin in 1966. For many years he has been engaged in both observational and theoretical studies of comets, and, with others, has developed a Fourier-transform spectrometer which allows spectral measurements of relatively large areas. He has been involved in ground-based optical, radio, and satellite ultraviolet observations, and theoretical studies of the fluorescence and vaporization processes in comets. He is an active member of the International Astronomical Union, the American Astronomical Society, the Institute of Navigation, the American Association for the Advancement of Science, and Sigma Pi Sigma.

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

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

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

Friday, June 13, 20, 27, July 11, 18, 9:30 PM; August 1, 8, 15, 9:00 PM — Observing with the NCA 14-inch telescope 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, June 7, 6:15 PM — Dinner with the speaker at the Thai Room II, 527 13th Street, NW. Reservations unnecessary.

Saturday, June 7, 8:15 PM — NCA monthly meeting at the Department of Commerce Auditorium, 14th and E streets, NW. Dr. A'Hearn will speak.

Saturday, June 14, 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. Planetarium if cloudy. Information: Bob McCracken, 229-8321.

## MAY LECTURE

Dr. David W. Dunham, NCA member and President of the International Occultation Timing Association, addressed the May 3 meeting of National Capital Astronomers. He described recent efforts on solar eclipse expeditions to measure possible variations in the Sun's radius by precise timings of Baily's-bead phenomena.

Dr. Dunham participated in a National Science Foundation Solar Eclipse expedition to India on February 16, 1980. The Baily's-bead experiment group, headed by Dr. Alan D. Fiala of the U. S. Naval Observatory, also included David Herold of Woden, Australia, NCA members Dr. Joan B. Dunham and Debra Johnson, and a group of students from East Carolina University.

Interest in such variations has been spurred by recent computer modeling studies of the solar interior which suggest that relatively small (about 500 km) radius changes with attendant luminosity fluctuations may occur on a timescale of several years to perhaps several centuries. Such radius changes may result from inhomogeneities in the Sun's convective zone (the region surrounding the solar core, characterized by convective rather than radiative energy transfer). Local instabilities within the convective zone would not involve the more massive and stable core region, therefore any resultant effects on solar output, while significant, would not produce catastrophic events on Earth.

Information on the Sun's radius in the past may be derived from three kinds of astronomical observations: meridian-circle transit observations, transits of the planet Mercury across the disk, and solar eclipse studies. Meridian-circle observations accumulated over the past 200 years have been analyzed by Dr. Jack Eddy of Harvard Observatory and appear to show a decrease in the solar radius of about 1 arcsec per century. This variation is much greater than that predicted by computer modeling and is sufficient to have generated very marked climatic effects on Earth. However, atmospheric turbulence and gradually increasing background light scatter due to industrialization are believed to contribute errors which would account for the apparent radius decrease.

Observations of transits of the planet Mercury do not corroborate the meridian-transit observations, and in fact are consistent with a constant solar radius. Mercury transits are themselves subject to substantial observational uncertainty which could mask the radius changes on the order of 0.5 arcsec predicted by the computer studies. This uncertainty arises from the black-drop effect which complicates the accurate timing of Mercury-transit contact events.

During a solar eclipse the Sun's radius may be determined by precisely measuring the width of the Moon's shadow on the Earth's surface. Unfortunately, an accurate determination is not possible unless observers are situated near both edges of the shadow path rather than on the eclipse centerline where the maximum duration occurs. Most of the historical eclipse observations made from the centerline are of little value in making precise solar radius determinations. A notable exception is a record developed by Sir Edmund Halley concerning an eclipse observed in England in 1715. By good fortune Halley received reports from observers which appear to permit a determination of the eclipse path width to a high degree of accuracy. The derived solar radius is approximately 450 km (about 0.6 arcsec) larger than the value determined from recent eclipse data. Interestingly, the 1715 eclipse occurred at about the end of the "Monder minimum," a 65-year period of very subdued solar activity which apparently coincided with an interval of unusually cold weather frequently referred to by climatologists as the "Little Ice Age." Some speculate that an increased solar radius, marking a resurgence in solar energy and energy output, would be consistent with the end of this long period of abnormal weather and solar behavior.

The present-day technique developed and utilized by Dr. Dunham for determining the width of the Moon's shadow during an eclipse draws upon accurate calculation of the lunar orbital motion (derived in part from Apollo lunar ranging experiments) as well as an understanding of the effects of the lunar profile on the

## NCA ELECTS OFFICERS

At the May meeting NCA elected the following officers for fiscal 1981:

President	Mary Ellen Simon
Vice President	Wolfgang Schubert
Secretary	Nancy Hueper
Treasurer	Daniel Lewis
Trustee (4-year term)	Robert McCracken
Sergeant at Arms	Mark Trublood

## GREENBANK TRIP GREAT SUCCESS

Those who participated in the May 10-11 NCA visit to the National Radio Astronomy Observatory shared many privileged experiences. The public tour schedule was suspended for the day while our gracious hosts escorted NCA on an extensive, tailored tour of the installation. One highlight was the unusual opportunity, using the 300-foot (two-acre!) radiotelescope, to observe a number of pulsars both aurally and oscilloscopically.

We thank Wallace Oref, Mark Damashek, and William Brundage of NRAO, NCA's Paul Hueper for coordinating the trip, and Nancy Hueper for smoothing countless details.

## OCCULTATION EXPEDITIONS PLANNED

Dr. David Dunham is organizing observers for the following grazing lunar occultations in June and July. For further information, call Dave at 585-0989.

Date	UT Time	Place	Vis Mag	Pcnt Sunlit	Cusp Angle	Min Aper
06-05-80	06:39	Cooksville, MD	8.5	59	05S	20 cm
06-18-80	02:00	Everglades, FL	-1.3*	27	05N	5 mm
07-09-80	19:53	Pocopson, PA	-4.1#	08	11N	3 cm
07-16-80	03:46	Boundary Waters, MN	-1.3*	15	02N	1 cm

\*Jupiter

#Venus

### Asteroidal occultation:

06-15-80 02:25 The 11.6-magnitude asteroid (59) Elpis will occult a 9.3-magnitude star for a maximum of 17 seconds along a mid-Atlantic states path.

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phenomena observed near the edges of the eclipse path. Since the Moon is in the ecliptic plane during the eclipse, the libration in latitude is approximately the same for all eclipses; the bead phenomena in the polar regions of the lunar limb — observed from the edges of the path — may be compared among eclipses to determine the solar radius. Longitudinal librations differ among eclipses, complicating comparison of observations made from the centerline. Based on several eclipses observed using this technique and on experience gained in the analysis of stellar occultations, an accuracy of about 0.1 arcsec in the radius determination appears to be achievable. This is approximately 10 times the precision obtainable from Mercury transits. Since 1970 the Dunham team of observers has undertaken seven eclipse expeditions and has attempted this radius-measurement technique at the 1979 and 1980 eclipse sites. Comparison of the 1979 radius calculation with 1976 Australian data showed close agreement. Data obtained from the recent 1980 eclipse initially appear to indicate a slight increase in the solar radius since 1979, perhaps in association with the present solar maximum.

In describing his eclipse observations, Dr. Dunham emphasized the simplicity of the equipment used and the substantial contribution made by individuals with relatively little training. He concluded by showing a film of the 1980 polar-limb bead phenomena.

jkc

## EXCERPTS FROM THE IAU CIRCULARS

1. April 11 — Paul Wild, Astronomical Institute, Berne University, discovered a comet of 15th magnitude, (1980d) in Bootes. Orbit computations show that the comet has a period of 6.9 years, but had a period of 10.3 years before a close approach with Jupiter in 1976.

2. April — S. P. Synnott, Voyager project, Jet Propulsion Laboratory, found the shadow of a new satellite of Jupiter, 1979 J 2, on pictures taken by Voyager 1 on March 5. Seven other images were subsequently found. A diameter of 70-80 km and a period of 16h 15m were determined.

3. May — Harrington, Dahn, and Christy, U. S. Naval Observatory, reported that astrometry of Pluto and the star reportedly occulted by its satellite 1978 P 1 showed that the satellite and the star were within a fraction of a second of each other at the time, supporting the conclusion that the satellite occulted the star.

4. May 6 — M. F. Aller, H. D. Aller, and P. E. Hodge, University of Michigan, detected a major outburst of BL Lacertae at 14.5 and 8.0 GHz. The flux was twice that measured in April, and 5 times the minimum in 1979 August. rnb

## SMITHSONIAN OFFERS ARCHAEOASTRONOMY COURSE

The Smithsonian Institution is offering a course in archaeoastronomy during the week of June 15-20 featuring leading authorities and writers Anthony F. Aveni, John A. Eddy, Gerald Hawkins, and E. C. Krupp.

For further information, write: Selected Studies, A & I 1190A, Smithsonian Institution, Washington, DC 20560. Or, call (202) 381-6434.

## FOR SALE

Two reflecting telescopes, 4-inch and 6-inch. Matthew Gartenlaub, Box 4845, Washington, DC 20008, or 544-4238. Ask for Matthew.

## MERAL TO CONVENE IN WILMINGTON, DELAWARE

The Wilmington Astronomical Society will host the 1980 convention of the Middle Ease Region of the Astronomical League on June 20-22. Further details will be available at the NCA meeting or from R. H. McCracken, 229-8321.

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