

NOVEMBER LECTURE

Dr. Michael F. A'Hearn, Acting Director of the Astronomy Program of the University of Maryland, addressed the 1985 November 2 meeting of National Capital Astronomers on the use of comet chemistry to study the earliest history of the solar nebula.

A dramatic comet appears every five or ten years. Recent examples are comets West, Kohoutek, and Ikeya-Seki. About fifteen telescopic comets are discovered each year. While A'Hearn has shown that they share many common chemical features, he focused his remarks, appropriately for this time, on Comet Halley.

Edmund Halley, a contemporary of Isaac Newton, studied the apparitions of many comets including the one that now bears his name. Applying Newton's law of gravitation, Halley calculated orbits for many previously observed comets. He found several which appeared to have the same orbits, and concluded that they were actually the same comets returning at regular intervals. Among them was one which seemed to return about every 75 or 76 years, and which Halley himself saw in 1682. On this basis, he predicted its return. He was correct in this case; the rest have been conveniently forgotten.

Recovery of the comet on Christmas day in 1759 eventually led to its being given his name, although there was widespread reluctance to accord him that credit at the time of its return.

The comet appeared again in 1835, and again in 1909-1910, when photography first made possible the many images of it we see published today. All apparitions of Comet Halley since the third century B.C. have been positively identified.

Spectroscopy had also been developed by 1910, which had revealed the presence of the cyanogen radical, CN, (related to the deadly gas, hydrogen cyanide) in comets. It was also known that the Earth would pass through the tail of the comet in the 1910 apparition. Since even in 1910 little was known about comets, these two facts heightened the still-lingering ancient superstitious fear of them; surely everyone would be poisoned! Charlatans exploited the fear by selling comet pills to protect against the poison. Windows and doors were sealed. The press reported Dark-Age rituals supposed to ward off the evil. Measurements made during that passage yielded no results. (The density is about that of a good laboratory vacuum.) A direct collision with the nucleus, however, may cause some extinctions.

Comet nuclei are believed to be less than 10 km in diameter, and to average about 5 km. Surrounded by a gas and dust coma larger than the Earth, the nucleus is hidden from direct observation. Although a few groups, including A'Hearn's, have claimed such observations, A'Hearn doubts the others.

The year 1950 saw three landmarks in comet physics: The solar wind was postulated years before it was observed, Whipple developed the "dirty snowball" model of comet nuclei, and Oort postulated the comet cloud in the extreme region of the solar system.

To explain the often observed non-gravitational perturbations of comets, Whipple proposed the "dirty snowball" model of the nucleus, according to this idea, uneven evaporation of the ices by solar heating results in gases spewing out of the nucleus, thus accelerating it in the observed ways. The dust particles in the nucleus then stream out to form the tail, which is swept by the solar wind to the anti-sunward direction.

The same year, Oort plotted the number of observed comets as a function of the reciprocal of their orbit sizes. A large delta function indicated many comet orbits of the same very high energy, loosely bound to the Sun. Upon traversing the solar system, comets' energies are altered by planetary perturbations; the distribution becomes much wider. The extremely narrow distribution indicates that these comets have never before entered the solar system, and must have been perturbed out of an orbit at a thousand times the distance of Pluto. Their arrival from random directions indicates a more or less uniform spherical distribution in a region now known as the Oort Cloud. The cloud is hypothesized to contain around a hundred trillion comets - an enormous extrapolation from observation!

Occasional stellar gravitational perturbations are postulated to cause comets to fall from the cloud toward the Sun. The first entrance of these comets into the planetary system accounts for Oort's delta function.

The Oort cloud seems to be material which was left behind in the gravitational collapse of the nebula which formed the solar system. Having never since been heated significantly they thus preserve the original molecular content of the solar nebula, and hold the key to its original temperature and density.

A'Hearn showed comet spectra from which 36 molecules have been identified, only three of which, ammonia, water, and carbon dioxide, are stable. The remaining unstable radicals are not, and cannot have been present in the comet's nucleus. They are formed, chiefly by the action of the Sun's light (photon absorption) and later collisions among them, when the original molecules are boiled off the comet's surface by solar heat. These reactions alter the original composition; what we observe are the chemical descendants of this history.

Some inferences can be drawn from these descendants. In the case of water, for example, photon interaction yields several species: H_2^+ and free electrons, H , H_2 , O , and OH . The relative abundances of the observed species are correct. Water has thus been inferred to be a major constituent of comets since 1950, although it was not directly observed until the 1970's. The emission lines of water are in the radio spectrum and require high sensitivity to detect. They were detected in Comet Iras-Araki-Alcock (IAA), which came very close to the Earth. The proximity of IAA made possible examination very close to the nucleus, where the ultraviolet spectrum disclosed diatomic sulphur, never before observed in any comet. Its presence indicates that the comet was formed from interstellar grains which were never warmer than 40 Kelvin.

The relative abundances of observed species are about the same in all

OCCULTATION EXPEDITIONS PLANNED

Dr. David Dunham is organizing observers for the following occultations. For further information call Dave at 585-0989.

Date	Time	Place	Vis Mag	Pcnt Sunlit	Cusp Angle	Min Aper
12-04-85	03:27	Truro, MA	3.6	62	3N	5 cm
12-08-85	08:49	Allentown, NJ	1.8 (Mars)	18	11N	5 cm
Asteroidal:						
12-08-85	23:51	N. South America	7.3	3.0	(115) Thyra	5 cm
12-09-85	08:07	North Pennsylvania	9.1	1.4	(69) Julia	5 cm
12-14-85	10:55	Los Angeles	6.7	9.0	(1639) Bower	3 cm
12-20-85	14:18	Southern California	8.6	1.7	(89) Julia	8 cm
12-30-85	02-05	Quebec	9.0	0.6	(18) Melpomene	10 cm

NCA WELCOMES NEW MEMBERS

David Abbou 6115 Rose Hill Drive Alexandria, VA 22310	Scott Graham and Barbara Berk 822 Loxford Terrace Silver Spring, MD 20901
John W. Allingham and Kevin Ward 5325 Wakefield Road Bethesda, MD 20816	Robert B. Hartford 6523 Old Farm Road Rockville, MD 20852
Howard E. Barnes 6500 Elmhurst Street District Heights, MD 20747	Roderick L. Jones 8084 Grandview Court Springfield, VA 22153
Michael Bottos and Barbara Selick 184 Laurel Way Herndon, VA 22070	Dr. Richard E. and Jacqueline Schoen 402 Deacon Brook Circle Reisterstown, MD 21316
Glen W. Brier 1729 N. Harrison St. Arlington, VA 22205	Anthony W. White 5872 Marbury Road Bethesda, MD 20817
Joel Edelman 310 Franklin Avenue Silver Spring, MD 20901	

NATIONAL AIR AND SPACE MUSEUM SYMPOSIUM, OPEN HOUSE, SAGAN

An international symposium, "Comet Quest," will feature speakers from many parts of the world on Friday, December 6 from 1:00 to 5:00 pm and Saturday, December 7 from 9:00 am to 1:00 pm.

The Friday talks will be followed from 5:00 to 10:00 pm by "Halley Night, which will feature a talk by Carl Sagan at 8:00 pm and, weather permitting, telescopic viewing of Comet Halley.

For information on these programs call 357-2700. Volunteers are needed; call Geoffrey Chester, O: 357-1529.

Comets. The solar nebula, then, must have been homogeneous both over the volume of the Oort cloud, and over the time required for formation of the comets.

So far, only the easiest species have been observed. There are more interesting species not yet detected; to do so seems to require *in situ* examination. The recent penetration of Comet Iacobini-Zinner (G-Z), the first ever, by the ICE craft has confirmed the postulated magnetic sheath and discovered ion streams, and will disclose much more as the data become available.

The coming spacecraft encounters with Comet Halley are expected to provide far more intimate measurements than possible from the Earth. Following its spectacular success at G-Z the ICE craft is continuing its journey to investigate the solar wind ahead of Halley. Other United States efforts involve the International Ultraviolet Explorer, Solar Maximum Mission, Pioneer 7, and the Shuttle-launched Astro 1. These will provide wide-angle imaging, ultraviolet imaging, UV spectroscopy, photometry, and polarimetry. Of interest emphasized by A'Hearn, is spectroscopy in the band from 400 to 3000 Å, where he is seeking argon, diatomic nitrogen, and deuterium, the presence of which would support the low-temperature formation hypothesis. These will be of great cosmogonic interest.

A'Hearn is a member of the advisory group on the use of the instrumentation.

The United States will also provide continuous Earth-based monitoring of morphology changes. (Ed note: NCA has contributed by recruiting island-resident scientist volunteers in the southern oceans for the worldwide NASA observation network.)

The USSR is sending two craft through the coma upstream of the comet. They are well equipped for mass spectrometry, measurement of neutral gas, all ions and dust particles, and for imaging. The European Space Agency's Giotto is similarly equipped. Japan is sending two craft forward of the comet, one without comet instruments, mainly to test the vehicle system, and one which will photograph in Lyman-alpha and measure solar wind.

He concluded by reviewing the geometry of this apparition of Halley, unfortunate for the Northern Hemisphere. J.B. Lohman and R.H. McCracken

EXCERPTS FROM THE IAU CIRCULARS

1. October 9 -- U. Thiele, Max Planck Institute for Astronomie, discovered a comet of 13th magnitude in Orion with the Hamburg Schmidt telescope at Calar Alto.

2. October 10 -- R.O. Evans, Hazelbrook, New South Wales, discovered a supernova of magnitude 13.5 in NGC 1433.

3. November -- Sheeley, Howard, Koomen, and Michels, N.R.L., announced that the P78-1 Solwind spacecraft had discovered two more Sun-grazing comets in 1981 November and 1984 July.

4. November 2 -- W. Liller, Vina del Mar, Chile, discovered another possible nova of 10th magnitude in sagittarius.

5. November 8 -- Jacqueline Cifredo, CERGA, discovered a comet (1985p) of 10th magnitude in Taurus with a 90-cm Schmidt telescope.

SPECIAL PUBLIC HALLEY PROGRAM AT BURKE LAKE PARK

On December 14 at 7:00 pm, Geoffrey Chester will offer public telescopic comet viewing at Burke Lake Park in Northern Virginia. Volunteers with telescopes and binoculars will be needed to assist. Call Geoff for details at H: (703) 379-8218, or O: (202) 357-1529.

VOLUNTEERS WANTED

1. To present shows and answer questions for elementary students at T.C. Williams High Schol Planetarium in Alexandria. Training available on new console. for Information call Bob McCracken. O: 320-3621.

2. To assist regularly in the NCA telescope-making class. Call Jerry Schnall, 362-8872.

* * * * * GIFT MEMBERSHIPS IN NCA LAST ALL YEAR * * * * *

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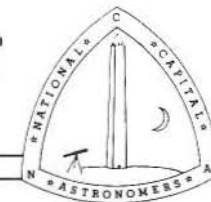
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FIRST CLASS

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BRANDT TO DISCUSS IHW, PRESENT EARLY GZ RESULTS



DR. BRANDT

The December^{7th} meeting of National Capital Astronomers will hear Dr. John C. Brandt, Chief of the Laboratory for Astronomy and Solar Physics of NASA Goddard Space Flight Center. He will discuss the international program, now underway, for extensive comet observation during the next two years, and present some of the early results.

During this two-year period six spacecraft are planned to intercept comets Halley and Giacobini-Zinner.

The combination of these data, results from ground-based networks coordinated by the International Halley Watch, and observations from Earth-orbiting spacecraft will begin a new era in cometary astronomy.

The ICE encounter with Comet Giacobini-Zinner on 11 September 1985. The initial results will be discussed.

John C. Brandt received the B.A. in mathematics from the Washington University in St. Louis in 1956, the Ph.D. in astronomy and astrophysics from the University of Chicago in 1960, and the M.B.A. from Loyola College in 1983. He is the author of a dozen books on astronomy and is a member of the American Astronomical Society, the International Astronomical Union, and is a Fellow of the American Association for the Advancement of Science.

DECEMBER CALENDAR -- *The public is welcome.*

Monday, December 2, 9, 7:00 pm -- Special Halley nights at 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.

Tuesday, December 3, 10, 7:00 pm -- Special Halley nights at 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.

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

Wednesday, December 4, 11, 7:00 pm -- Special Halley nights at 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.

Friday, December 6, Saturday, December 7 -- NASM symposium with NCA participation. See page 15. Call Geoffrey Chester, 357-1529, to volunteer.

Saturday, December 7, 6:00 pm -- Dinner with the speaker at the Ding How Restaurant, 1221 E Street, NW. Reservations unnecessary.

Saturday, December 7, 8:15 pm -- NCA monthly meeting at the U.S. Department of Commerce Auditorium, 14th Street and Constitution Avenue, NW. Dr. Brandt will speak.

Saturday, December 14, 7:00 pm -- Halley Special public program at Burke Lake Park with Geoffrey Chester. Volunteers with telescopes needed. See page 16.

Friday, December 20, 7:30 pm -- Telescope-making classes at American University, McKinley Hall basement. Call Jerry Schnall, 362-8872.