★ STAR DUST

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GRAHAM OBSERVING FORMATION OF NEW STARS

DR. GRAHAM

Dr. John Graham of the Department of Terrestrial Magnetism, Carnegie Institution of Washington, will deliver the February 1 National Capital Astronomers lecture. He will discuss his present study of new stars now forming in the Milky Way Galaxy.

Stars are being formed throughout the Milky Way at the present time. Most of the activity is going on within giant molecular clouds of which perhaps the most well known example is the great complex of young stars in Orion. Of particular interest is the observation of the formation of new stars similar in size to the Sun, since planetary systems like our own are almost certainly being formed at the same early evolutionary stage. By studying such events, we are hoping to get some insight into the early history of the planet Earth and into its relation to other members of the solar system.

Dr. Graham's main interests are galactic and extragalactic astronomy, variable stars, and star formation.

Born in Sydney, Australia, John Graham received his Ph.D. from the Australian National University. Subsequently, he was associated with the Leiden Observatory in South Africa and Holland in 1964 and 1965, The Kitt Peak National Observatory at Tucson, Arizona from 1966 to 1968, The Inter-American Observatory at Cerro Tololo, Chile from 1969 to 1985, when he came to the Carnegie Institution. Curently, he is a Vice President of the American Astronomical Society.

FEBRUARY CALENDAR -- ***The public is welcome.***

Saturday, February 1, 6:00 pm -- Dinner with the speaker at the Ding How Restaurant, 1221 E Street, NW. Reservations unnecessary.

Saturday, February 1, 8:15 pm -- NCA monthly meeting at the U.S. Department of Commerce Auditorium, 14th Street and Constitution Avenue, NW. Dr. Graham will speak.

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

Friday, February 7, 14, 21, 28, 7:30 pm -- Telescope-making classes at American University, Mckinley Hall basement. Information: Jerry Schnall, 362-8872.

Friday, February 7, 14, 28, 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, February 15, 8:00 pm -- Discussion group: Early results Uranus flyby. U.S. Department of Commerce, Conference Room 1415 (Formerly D).

Thursday, February 20, 8:00 pm -- Joint NCA - Cornell Club lecture: *The Origin of the Universe* Dr. Yervant Terzian, Chairman of the Astronomy Department, Cornell University. U.S. Department of Commerce Auditorium.

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JANUARY LECTURE

Dr. Tycho T. von Rosenvinge, Project Scientist for the International Cometary Explorer (ICE) Spacecraft, delivered the January NCA lecture. He detailed certain aspects and results of the 1985 September 11 ICE penetration of Comet Giacobini-Zinner. Some early results were discussed by Dr. John Brandt in his December NCA lecture.

The craft was originally the International Sun-Earth Explorer-3 (ISEE-3), part of a joint study by NASA and the European Space Agency of the interaction of the solar wind and the Earth's magnetosphere. Its usefulness could therefore be extended to a study the interaction of the solar wind with the atmosphere of comets. At first, however, some of its other instrumentation seemed inappropriate for comet study — instruments which would not have been included if the craft had been designed for comets. These worked remarkably well, yielded excellent results, and now would probably be included on such a mission.

Some problems were anticipated. The chance of missing the comet because of non-gravitational perturbations by uneven evaporaton were estimated at 10 percent. The craft was sent 50 times as far from the Earth as it was designed to go; signal strength would be reduced by a factor of 2500. Use of the Deep-Space Network would be necessary to receive the data. Dust particles impacting at high velocity might damage the solar panels. The mission was, however, a spectacular success.

The solar wind (charged particles, about 10 per cc at the Earth, constituting the outer solar atmosphere) encounters the geomagnetic field at about 400 km per second — about 10 times the velocity at which disturbances can propagate along the magnetic lines. Ionized by the solar wind, the upper atmosphere interacts with the solar magnetic field, resulting in the bowshock. The solar wind drags the geomagnetic field out to form the magnetic tail of the Earth.

In studying the Earth's magnetosphere, as in astronomy generally, one cannot alter the conditions experimentally, but can only observe. It is helpful, therefore, to examine other subjects having different parameters. Thus, to understand the Earth we probe other celestial bodies.

On its first mission, the study of solar-wind-Earth interaction, the ISEE-3 craft was launched in 1978 into a halo orbit around the Lagrangian L-1 point between the Earth and the Sun. Comets have insufficient gravity to hold an atmosphere, and no intrinsic magnetic field; their interaction with the solar wind will be different from that of the Earth.

After about four years, a unique opportunity was pointed out by Dr. Robert Farquhar at Goddard, to retarget the ISEE-3 to measure the solar wind a day ahead of Comet Halley, before interaction with the comet, and to penetrate another comet, Giacobini-Zinner, on the way!

Through a complex series of maneuvers through the Earth-Moon system, the craft was targeted on the comet. Our speaker properly credited NCA's Dr. David Dunham, our expedition leader, with the mathematical design of the maneuvers. The craft was renamed International Cometary Explorer (ICE).

Other problems were anticipated. ISEE-3 was designed to operate in continuous sunlight; would the hydrazine lines freeze in the shadow of the Moon? In the dark, the solar power would cease; could all of the experiments be turned back on satisfactorily? The problems did not materialize.

The comet was penetrated on the tailward side very close to the nucleus — The first encounter ever of a craft with a comet. No other craft on the Halley mission will penetrate the comet's tail, but will pass through the sunward side of the coma. The highly successful ICE results therefore constitute a uniquely important part of the overall Halley mission.

Neutral molecules evaporating from the sun-warmed comet ices are ionized by the solar wind. The resulting plasma is sensed by the ICE plasma detectors. The ionization times of about a million seconds and ion speeds of kilometers per second result in an ion sheath around the comet which was detected out to millions of kilometers.

Von Rosenvinge likened the bending of the solar magnetic lines around the comet nucleus to spaghetti draped over a fork. Between the two magnetically opposed lobes, both of which were penetrated, was found the predicted current sheet. The maximum magnetic field encountered within the lobes exceeded the unperturbed field by a factor of about 10. A fortuitous (and temporarily puzzling) reversal of the external field occurred shortly after penetration of the current sheet. (Ed. note - Such reversals cause the tail-disconnectioon events discussed by Niedner in the June lecture. *Star Dust* XLII 5)

The predicted bow shock did not display the expected rapid density gradient, but does retard the solar wind. The 8,000-km gyro radius of the heavy, singly-charged water molecules indicates that the bow shock should be sought at a far larger distance than previously expected, von Rosenvinge suggested.

Electron density, measured by the plasma instrument and the radio electron-plasma oscillation frequency, reached 600 per cc — about 100 times the unperturbed value. Electron temperatures of 20,000 K were measured, about one tenth the free-space solar-wind temperature. The proton detector was the second instrument after the plasma detector to sense the comet. its 35-keV threshold indicated about 18 nucleons per cc at the 4-keV per nucleon imparted by the ion-pickup process. It is this energy transfer which retards the solar wind. Intensity fluctuations of the order of 1,000 were recorded. The ion-mass spectral range, reprogrammed for the comet, detected H_2O^+, CO^+, and unexpected Na^+.

The diversity of terminalogy among the various instrument teams will require a joint analysis for complete interpretation of the overall configuration of the tail, von Rosenvinge suggested.

ICE continues to a radial upstream of Comet Halley in late March where it will measure the unperturbed solar wind a day ahead of the comet, and record any other fortuitous observations.

RH McCracken

OCCULTATION EXPEDITIONS PLANNED

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

UT Date	Time	Place	Vis Mag	Pcnt Sunlit	Cusp Angle	Min Aper
Grazing Lunar:						
02-01-86	06:38	Ruther Glen, VA,	7.7	60	14S	10 cm
02-02-86	08:14	Petersburg, VA	6.8	48	16N	5 cm
02-15-86	23:44	Largo, MD, Alex, VA	6.9	42	13S	5 cm
02-06-86	23:36	Clarksburg, MD	8.4	52	13S	13 cm
02-19-86	00:47	Largo, MD, Anndl. VA	7.7	70	8S	13 cm
Asteroidal:			Star Mag	Delta Mag	Name	
02-01-86	00:19	E. New England	8.4	0.5	(2) Pallas	15p cm
02-05-86	02:50	Cent'l. America	8.6	4.3	(87) Sylvia	8 cm
02-08-86	05:03	DC, MD, N. VA	7.4	5.2	(444) Gyptis	5 cm
02-18-86	00:47	Florida	8.5	5.0	(90) Antiope	5 cm
02-21-86	07:57	Newfoundland	7.6	3.8	(48) Doris	5 cm
02-22-86	03:32	North Carolina	12.0	0.8	(337) Devosa	30 cm
02-24-86	00:08	Que.; VA by AGK3	8.3	6.3	(494) Virtus	5 cm

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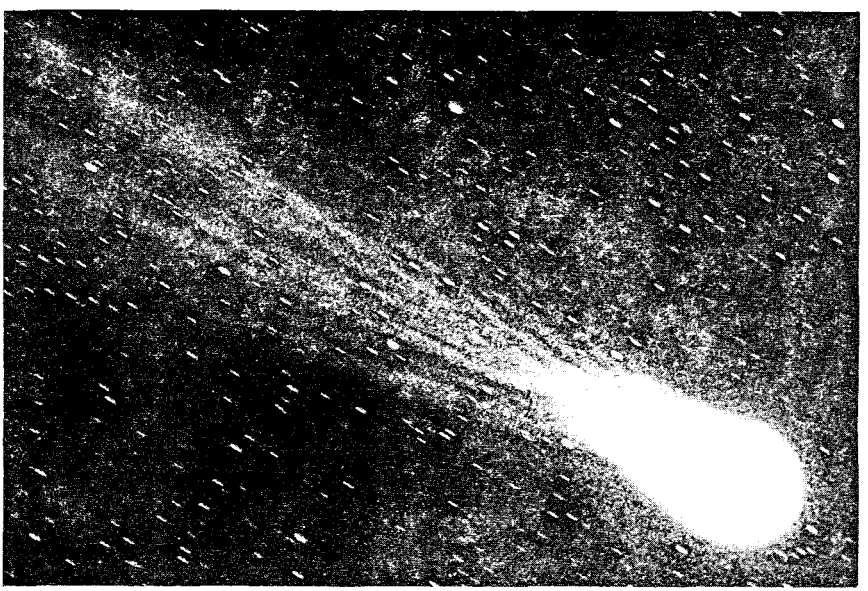

HALLEY

This Hopewell Observatory photo by Robert N. Bolster was made with the 30-cm F/4.1 Wright-Schmidt telescope. Scale: 1° = 11.5 cm. Exposure on gas-hypersensitized Eastman 2415 film was 29 minutes on 1986 January 8 23:30 to 23:59 UT.

EXCERPTS FROM THE IAU CIRCULARS

1. October 29 -- Brooke, Gabelle, Knacke, Noll, and Tokunaga reported the probable detection of water emission lines in the s0ectrum of Comet Halley at 1.4 and 1.9 micrometers.

2. December 14 -- D.J. Tholen, University of Hawaii, observed the transit of Charon across Pluto with the 2.24-m telescope on Mauna Kea. The rise from minimum was steeper than expected, perhaps due to darker material on part of the planet's disk.

3. December 22 -- Mumma, Weave, Larsen, Davis, and Williams detected four water emission lines in the spectrum of Comet Halley. They used a Fourier-transform infrared spectrometer on the NASA Kuiper Airborne Observatory.

4. January -- The Voyager Infrared Science Team reported the discovery of a satellite (1985 U1) of Uranus. The satellite is about 75 km in diameter and 86,000 km from Uranus. (Ed. note: At presstime Voyager 2 has discovered 15 satellites and 10 rings of Uranus!)

RN Bolster

TERZIAN TO ADDRESS NCA, CORNELL CLUB

Dr. Yervant Terzian, Chairman, Department of Astronomy, Cornell University, will address a joint meeting of NCA and the Cornell Club at 8:00 pm on Thursday, 20 February 1986 in the U.S. Department of Commerce Auditorium. His talk, *The Origin of the Universe,* will be an illustrated survey of present knowledge.

The recipient of the 1984 Clark Distinguished Teaching Award, Professor Terzian divides his time between the Arecibo Observatory in Puerto Rico and teaching popular undergraduate courses at Cornell University. He is active in many associations, has authored many papers, and edited four books.

NASM OFFERS VOYAGER 2 URANUS, HALLEY PROGRAMS

Dr. Joseph Tatarewicz, National Air and Space Museum Astronomy Historian and NCA member, will speak on observing Comet Halley at 9:30 am on Saturday, 1 February in the Einstein Planetarium.

Dr. Laurence A. Soderblom, leader of the USGS Voyager Imaging Team, will present the latest images of Uranus and discuss the encounter at 7:30 pm on Wednesday, 26 February in the planetarium.

FOR SALE

Criterion RV-6 reflector; 6x30 and 7x50 finders, clock drive, camera mounts, wooden two-wheeled transporter cart, assorted astronomy books. Negotiable. Daniel Costanzo, (703) 841-0051 (Arlington) evenings.

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