★ STAR DUST

Volume XXXV February 1979 Number 6

O'KEEFE TO REVIEW LUNAR TEKTITE THEORY

DR. O'KEEFE

Dr. John A. O'Keefe of the Laboratory for Astronomy and Solar Physics, NASA Goddard, will speak at the February 3 meeting of National Capital Astronomers. He will discuss the impact of the analysis of Apollo lunar soil samples on his theory of lunar volcanism as the source of tektites.

The source of these glassy, aerodynamically ablated objects is still unknown; the evidence for terrestrial, lunar, or cosmic origin is conflicting, mostly negative. O'Keefe will examine the various theories, all controversial, and show why he dismisses most, leaving only lunar volcanism as the seemingly very unlikely, but possible source.

John O'Keefe received his A.B. in astronomy from Harvard University, and his Ph.D. in astronomy from the University of Chicago in 1941. His broad experience includes such activities as professor of mathematics, specialist in the geodesy of China with the Corps of Engineers, technical designer of the military coordinate system, the UTM grid, leader of a National Geographic eclipse expedition. He has measured the velocity of light and the distance to the Moon, developed the occultation method of measuring long geodetic lines, calculated the Earth's size, led the team which showed the slight pear shape of the Earth from Vanguard data, and authored a book on tektites.

Dr. O'Keefe is a Fellow of the American Geophysical Union, the Meteoritical Society, and the American Astronautical Society, and a member of the IAU, the AAS, and other leading professional societies.

FEBRUARY CALENDAR — *The public is welcome.*

Friday, February 2, 9, 16, 23, 7:30 PM — Telescope-making classes at American University, McKinley Hall basement. Information: Jerry Schnall, 362-8872.

Saturday, February 3, 6:15 PM — Dinner with the speaker at the Thai Room II, 527 13th Street, NW. Reservations unnecessary.

Saturday, February 3, 8:15 PM — NCA monthly meeting at the Department of Commerce Auditorium, 14th and E Streets, NW. Dr. John O'Keefe speaks.

Monday, February 5, 12, 19, 26, 7:30 PM — Telescope-making classes at the Chevy Chase Community Center, Connecticut Avenue and McKinley Street, NW. Information: Jerry Schnall, 362-8872.

JANUARY LECTURE

Dr. David Thompson of the Gamma-Ray and Nuclear Emulsions Branch of Goddard Space Flight Center, NASA, discussed gamma-ray astronomy at the January 6 meeting of National Capital Astronomers. He pointed to the value of this highest-energy (greater than 10^6 eV) radiation as the uniqueness of the cosmic data it provides. He briefly described the observational techniques, gave some examples of data and their interpretation, and projected some future developments.

Since gamma rays are produced by the highest-energy processes in the universe, they provide a unique tool for the study of quasars, Seyfert galaxies, supernovae, pulsars, and black holes. They penetrate the interstellar medium (but not the Earth's atmosphere) with little attenuation, traversing the galaxy with less than one percent absorption. Most of the universe is thus rendered quite transparent back to very early times.

The potential of gamma-ray astronomy was recognized 20 years ago, but implementation came slowly—first with balloons, then short glimpses with rockets. Satellites now facilitate extended observations from well above the atmosphere. Thompson said the satellites SAS-2 and COS-B have provided most of the results to date.

Gamma-ray events are recognized by their characteristic pair-production signature. Cosmic-ray impacts are detected by plastic covers and scintillation counters and their effects are removed from the data by subtraction. Individual photon events are integrated into a computer-simulated photographic display of the gamma-ray field.

The gamma-ray flux is thus shown to be most intense along the galactic plane, especially near the galactic center, with some concentration evident along the spiral arms. Since collisions of cosmic-ray particles (protons) with those of interstellar matter are a prime source of gamma rays, these results are consistent with radio measurements of galactic mass distribution.

Concomitantly, given the mass distribution, gamma-ray production is to some extent an indirect indicator of cosmic-ray flux distribution. Theoretical efforts to link the isotropic gamma-ray background with a uniform cosmic-ray flux have failed, however; most cosmic rays apparently originate within the galaxy, Thompson said.

He pointed out that the diffuse gamma-ray background may not be truly isotropic, but may result from many unresolved sources. If it is uniform, however, it must have its origin far back in time and may offer clues to the early structure of the universe. The Baryon-symmetric big-bang cosmology, for example, envisions a universe of matter and antimatter supergalaxies producing gamma rays at their interacting borders. Energies of 60 MeV could be produced far enough back in time to yield a shift to 1 MeV, consistent with the observations.

Of the compact gamma-ray sources, the second most intense is NP 0532, the Crab Nebula pulsar, the only one of more than 300 radio pulsars that is detected in all parts of the spectrum examined, pulsating simultaneously at all wavelengths, with a 33-ms period. On the other hand, the Vela pulsar, PSR 0844, the most intense gamma-ray source, is detected only at radio wavelengths and extremely weakly (25th magnitude) in the optical band. It emits one radio pulse per 89-ms period, two gamma-ray pulses per period, both out of phase with the radio pulse, and two close-spaced optical pulses, both between the gamma pulses and out of phase with all the others. So far, extremely sensitive X-ray detectors on HEAO-2 have failed to detect the object. This strange behavior is at present not satisfactorily explained.

Thompson cited two other compact sources which are not understood. One may be associated with Cygnus X-3, a radio, infrared, X-ray, and gamma, but not optical, source, with an X-ray period of 4.8 hours. SAS-2 recorded a similar gamma period. COS-B, however, detected only a steady source in approximately the same direction. The other intense, compact source, about 15° from the Crab pulsar, has no counterpart at other wavelengths. COS-B

NCA ORDERS 14-INCH TELESCOPE; YOUR CONTRIBUTION SOLICITED!

The trustees of National Capital Astronomers have ordered a 14-inch Celestron telescope.

The firm of Astro-Physics, Rockford, Illinois, has been selected to furnish the instrument and accessories. NCA President James Trexler has negotiated terms with Astro-Physics and an approximately $4,500 order has been placed, subject to confirmation. Your contribution is needed now.

NCA had earlier suspended acceptance of contributions from those who have pledged, pending clarification of our tax-deductible status with the Internal Revenue Service. During a lengthy interchange between our legal counsel and the IRS, NCA has complied fully with all requested filings and requirements to date, including the adoption into our bylaws of certain rewording suggested by the IRS. The trustees have therefore decided to proceed with the order rather than await final action by the IRS; the price rises 44 percent March 1. A favorable finding by the IRS, even later in the year, would allow income-tax deduction, by those who itemize, of contributions made now. In the (hopefully unlikely) event of an adverse finding, such deductions would not be allowable.

The new instrument will substantially extend NCA's observational capability, both technical and tutorial. Its transportability is expected to extend its usefulness to expeditions and other special occasions, and to facilitate its use at superior temporary sites. Management details are being developed to attempt to optimize utility and flexibility.

GRAZING OCCULTATION EXPEDITIONS PLANNED

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

UT Date	Time	Place	Vis Mag	Pcnt Sunlit	Cusp Angle	Min Aper
02-05-79	23:01	Germantown, MD	8.0	69	4S	15 cm
02-19-79	11:06	Port Deposit, MD	7.4	56	4S	10 cm
02-26-79	16:50	Manitoba, MT, or OR			Total solar eclipse	

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has discovered about 20 similar but much weaker objects lying along the galactic plane. Nothing more is known about them.

Among extragalactic gamma-ray sources, only active galaxies have been detected. The radio galaxy NGC 5128 (Cen A) was not detected at high-energy gamma by either SAS-2 or COS-B, but has been detected at low-energy gamma by a Rice University balloon experiment, and also at ultra-high-energy by a Harvard group. The Seyfert galaxy NGC 4151 was detected at low-energy gamma by a group at Max Planck Institute, but not at high energy by SAS-2 or COS-B. The quasar 3C273 emits enormous energy in radio, infrared, optical, and X-ray, but most of all, gamma.

These objects are not yet understood, but the limited sample, i.e., one radio galaxy, one Seyfert, and one quasar, does not justify any generalizations, Thompson said.

Regarding the future of gamma-ray astronomy, Thompson indicated some potentially fruitful areas to be investigated and pointed to more questions to be answered. The nature of bursters, for example, is completely unknown. A particularly powerful tool, now in an embryonic stage of development, will be gamma-ray spectroscopy. Lines in the gamma spectrum characteristic of nuclear reactions could reveal details of fundamental astrophysical processes such as heavy-element generation in supernovae. Our speaker noted that one small spectroscopic experiment will be flown on the Gamma-Ray Observatory (GRO), a 9-ton satellite planned for launch by Space Shuttle next year.

Dr. Thompson emphasized in conclusion that we have only scratched the surface of gamma-ray astronomy, and look forward to the first comprehensive gamma-ray sky survey to begin with the launching of the GRO. rhm, wrw

EXCERPTS FROM THE IAU CIRCULARS

1. November 30 — R. R. West, European Southern Observatory, found a probable comet trail on a plate taken by H. E. Schuster with the 100-cm Schmidt telescope. The object, in Phoenix, was of 18th magnitude and had a tail 1' long.

2. January — N. Marshall and M. G. Watson, X-ray Astronomy Group, Leicester University, reported that an analysis of Ariel 5 X-ray observations of Cygnus X-2 made between 1974 and 1976 revealed a significant modulation at 9.84 days. This is consistent with the optical observations reported by Crampton and Cowley.

3. December 16 — E. F. Guinan and G. P. Cook, Villanova University Observatory, found the minimum brightness of WZ Sagittae occurred 10 m earlier than predicted. The change in period may be associated with the recent outburst.

rnb

WANTED

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Published eleven times yearly for NATIONAL CAPITAL ASTRONOMERS, INCORPORATED, a non-profit, public-service organization promoting interest and education in astronomy and related sciences. President, James H. Trexler. *Star Dust*: Robert H. McCracken, 5120 Newport Avenue, Washington, DC 20016. Deadline: 15th of preceding month.