★ STAR DUST

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TREXLER TO DISCUSS INSTRUMENT-OBSERVER MATCH

JAMES TREXLER

NCA President James H. Trexler will speak at the April 7 meeting of National Capital Astronomers on the relationships between instrument and observer, and the optimal matching of their parameters in the personalized design of rich-field telescopes.

Trexler has made many measurements of observer parameters and accordingly optimized individual optical systems to them. Those who attended the 1978 MERAL Convention in Rockville had the opportunity through Trexler's computer terminal to define the optimum rich-field system for their own circumstances.

James H. Trexler, shown here at the controls of the Naval Research Laboratory's 18-inch Fecker telescope, did undergraduate work in radio and electrical engineering at Southern Methodist University until the beginning of World War II. Under a Federal grant he studied radio interference by meteors. During the war he worked on radio direction-finding problems at NRL, where he has remained until the present. After the war, he headed the Radio Physics Branch and established a large program in Moon-relayed radio communications. His voice was the first to be passed over the Earth-Moon-Earth circuit. From 1956 to 1962 he was Director of the Naval Radio Research Observatory at Sugar Grove, West Virginia. From 1962 to 1978 he was Head of the Space Technology Branch, and since 1978 has been Consultant for the Space Systems Division. Trexler also operates an 18-inch IGOR tracking telescope facility in southern Maryland.

APRIL CALENDAR — *The public is welcome.*

Monday, April 2, 9, 16, 23, 30, 7:30 PM — Telescope-making classes at the Chevy Chase Community Center, Connecticut Avenue and McKinley Street, NW. Information: Jerry Schnall, 362-8872.

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

Saturday, April 7, 6:15 PM — Dinner with the speaker at the Thai Room II, 527 13th Street, NW. Reservations unnecessary.

Saturday, April 7, 8:15 PM — NCA monthly meeting at the Department of Commerce Auditorium, 14th and E Streets, NW. James Trexler will speak.

SMITHSONIAN PRESENTATIONS OF INTEREST

Saturday, April 7, 9:00 AM — Star clusters will be featured at the National Air and Space Museum lecture in the Albert Einstein Spacearium. Free, but arrive by 8:45 AM to assure admission.

Wednesday, April 18, 8:00 PM — George O. Abell, professor of astronomy at UCLA, will discuss the morphology of the universe. Free, NASM Spacearium.

MARCH LECTURE

Dr. Minas Kafatos spoke on Active Galaxies and Black Holes at the March 3 meeting of National Capital Astronomers. The George Mason University professor and Goddard Space Flight Center researcher concentrated on the central regions of galaxies.

Less than one percent of all galaxies have great activity occurring in their centers. These active galaxies are classified as radio, Seyfert, BL Lacertae, and Quasar.

M 82 (Centaurus A) and M 87 (Virgo A) are examples of radio galaxies. The first exhibits an explosive jet, the second has a newly found X-ray source at its center, and the third may have a 5-billion-solar-mass black hole at its center, inferred from motions of surrounding stars.

NGC 4151 and 3C120 are Seyfert galaxies, typically spiral in appearance, with very bright nuclei. The first has a strong central X-ray source; the brightness of the second varies on a scale of months.

3C273 is one of the nearer quasars at a distance of 3 billion light years; it is one of the intrinsically brightest sources in the universe.

BL Lac objects are similar to quasars but smaller, having shorter periods of variability and surrounded by less gas.

The spectra of all types of active galaxies are very similar in their gross aspects. As observations move toward shorter wavelengths, the flat or slowly steepening spectra at radio wavelengths become quite steep in the infrared and optical. At X-ray wavelengths spectra are flat, but become very steep again in the gamma region, where intensity varies as E^{-3}.

To date, three galaxies have been observed as strong gamma-ray emitters: NGC 4151, 3C273, and Centaurus A. The second emits energy at 10^{46} ergs per second, equivalent to one solar mass per year.

Four sources of this gamma-ray emission have been suggested: 1. A series of supernovas at the rate of one per year. 2. A mixture of matter with anti-matter. 3. A large magnetic body in very rapid rotation. 4. A giant black hole. Our speaker dealt primarily with the black hole idea.

Theory has developed two black-hole concepts. One, the Schwartzchild black hole, is non-rotating, with mass concentrated at a central singularity in which both space and time lose meaning according to the concepts of general relativity. Such a black hole can be observed by X-rays generated by the frictional heating to millions of degrees of matter falling into the event horizon — the surface of the sphere within which electromagnetic energy and matter are forever trapped.

The X-ray source Cygnus X-1 may be a supergiant star associated with a compact Schwartzchild black hole.

The other black-hole concept, the Kerr black hole, is formed in the ever-increasing spin of a gravitationally collapsing star as angular momentum is conserved.

The surface of a sphere extending from A/M=.998 to 0 is the ergosphere surrounding the black hole. A is angular momentum, M is mass.

In the area between two concentric spheres surrounding the event horizon, the radius of marginally bound orbits and the radius of marginally stable orbits, high-energy particles can still move around in Keplerian motion, spiraling slowly inward. According to the Penrose process, particles injected into this region at speeds half that of light can escape with increased energy. A photon of 10 keV will release an electron with four times rest-mass energy. X-rays will do this. High-energy photons falling into a rotating black hole will split into electron-positron pairs which will escape, generating radio waves. The process is unstable, so rapid intensity variations would be observed in black holes of 10^7 to 10^9 solar masses. Larger black holes could generate X-rays by this process.

Rotating-black-hole concepts appear able to explain the observed properties of active galaxies. Further, the breaks in the gamma-ray spectra of NGC 4151 fit the idea of multiplets of electron energies due to high-energy matter being

NOMINATING COMMITTEE REPORTS

The Nominating Committee, Benson Jay Simon, Chairman, James H. Trexler (ex officio), G. Robert Wright, and Robert H. McCracken, offers the following candidates for fiscal 1980 NCA offices:

President	Mary Ellen Simon
Vice President	Wolfgang Schubert
Secretary	Sharon Edmonds
Treasurer	Robert M. Lynn (incumbent)
Trustee (4-year term)	James Trexler
Sergeant at Arms	Charles Edmonds

Additional nominations may be made by written petition of ten full members in good standing, submitted to the trustees prior to the May 5 election.

NCA MAIL IRREGULAR? KEEP TREASURER INFORMED

Dr. Robert Lynn, NCA Treasurer, requests that those members whose *Sky and Telescope* is not arriving regularly please write to him: 7320 Baylor Avenue, College Park, Maryland 20740. If only *Star Dust* is irregular, notify Robert McCracken, 5120 Newport Avenue, Washington, DC 20016, 229-8321.

GRAZING OCCULTATION EXPEDITIONS PLANNED

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

Date	UT Time	Place	Vis Mag	Pcnt Sunlit	Cusp Angle	Min Aper
04-15-79	04:59	Cochrane, VA	5.6	92	14S	8 cm
04-20-79	09:07	Doswell, VA	5.9	43	05S	5 cm
04-30-79	01:12	Emporia, VA	5.3	13	00N	5 cm
05-01-79	01:46	Scaggsville, MD	6.5	21	-1S	5 cm

MINOR SATELLITE DISCOVERIES: FAR-REACHING IMPLICATIONS

Several recent observations of stellar occultations by asteroids have disclosed numerous secondary events; one asteroidal satellite has now been confirmed by widely separated observers. Largely a result of the work of NCA member Dr. David Dunham, President, International Occultation Timing Association, These discoveries are providing new information on the history of solar-system dynamics.

Writing in the March 2 issue of *Science*, R. P. Binzel, Macalester College, and NCA member T. C. Van Flandern, U. S. Naval Observatory, review the events leading to the discovery by J. H. McMahon and confirmation by E. Bowell and M. A'Hearn of the 532-Herculina satellite. The success was a direct result of last-minute prediction corrections by Dunham, based on astrometric data obtained by W. Penhallow, and Dunham's nationwide telephone prompting of observers.

The authors tutorially describe the dynamical implications of these discoveries and their impact upon theories of asteroid origins.

A following paper by E. F. Tedesco, Lunar and Planetary Laboratory of the University of Arizona, presents light-curve evidence for the existence of binary asteroids.

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injected into the Penrose-process region.

The Milky-Way Galaxy could have exploded as a Seyfert galaxy 10 million years ago, Kafatos said, for shock waves, possibly a result, are now observed to be moving through the galaxy at 40 to 50 km per second.

Dr. Kafatos suggested that the nucleus of every large galaxy may contain a black hole which will accrete matter until the galaxy erupts as a quasar.

The distribution and distances of known quasars suggest that more were formed early in the history of the universe when numerous young galaxies were

richer in gas and dust and had smaller percentages of stars. This matter would be falling into primordial black holes.

As to the masses of black holes powering active galaxies, Dr. Kafatos estimates NGC 4151 at 3 to 10 x 10^7, Cen A to be 10^7 to 10^8, and 3C273 at about 10^8 to 10^9 solar masses. The latter object may be the most massive in the universe.

During the question period following his talk, our speaker noted that the Virial theorem should be accurate to within a factor of two as close as 1 parsec to a black hole. Most matter escapes from the event horizon surface at the poles of a black hole; radio lobes can be expected to be oriented along the polar axis. wrw

EXCERPTS FROM THE IAU CIRCULARS

1. September 7 — Hackwell, Gehrz, and Grasdalen, University of Wyoming, and Cominsky, van Paradijs, and Lewin, M.I.T., observed coincident optical and X-ray bursts from MXB1837+05 (Ser X-1). The optical observation was made in ultraviolet and blue with the 230-cm telescope of the Wyoming Infrared Observatory, the X-ray observations with SAS-3.

2. January 23 — W. Liller, Center for Astrophysics, reported the discovery of a fast-moving object of magnitude 17 on exposures made at the Cerro Tololo Interamerican Observatory. The orbital elements by Marsden indicate that the object has an unusually high orbital inclination of 45°.76, and a period of 2.46 years.

March 4 — The Voyager team reported that Voyager I had detected a ring extending out to 128,300 km from Jupiter. The exposure of 6.2 seconds was made with the narrow-angle camera from a distance of 1.2 x 10^6 km while the spacecraft crossed Jupiter's equatorial plane.

Observers at the University of Hawaii reported detection of the ring on both sides of the planet at 2.2μm using the 224-cm Mauna Kea telescope.

Cloud plumes seen on the Voyager I images of Io, together with thermal emission detected by the infrared spectrometer, indicate that at least five volcanically active areas exist on the satellite.

This listing courtesy R.N. Bolster.

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