



DOLAN TO REPORT NEW HIGH-ENERGY X-RAY DISCOVERIES



DR. DOLAN

The March 5 meeting of National Capital Astronomers will hear Dr. Joseph F. Dolan, of Goddard Space Flight Center, who will discuss recent discoveries in the 20keV to 3MeV energy range.

This high-energy X-ray range, bordering on gamma, has provided new insight into several sources. The Crab Nebula's power-law spectrum to 500keV is consistent with its production by relativistic electrons streaming from the pulsar. The accretion disk around the Cygnus XR-1 must have a region of relativistic electron thermal velocities to explain the remarkable pivoting of the spectrum at 6keV. The different spectra of Centaurus-A one year apart indicate the continuing production of relativistic electrons in the nucleus of this peculiar radio galaxy. A high-energy X-ray eclipse of binary pulsar

Vela XR-1 is exactly in phase with that at lower energies, which rules out circumstellar material as the cause of the onset of eclipse. Cygnus X-3 is another variable which has the same period and modulation above 20keV as below. The X-ray spectrum of X Persei to 100keV corroborates the model which requires a very massive black hole as the primary.

Other interesting results of work in this energy range, which is just being exploited by satellite observations, will also be discussed.

Joseph F. Dolan received his B.S. in physics from Bonaventure University in 1961, his A.M. and Ph.D. in astronomy from Harvard, the latter in 1966.

Dr. Dolan is a National Academy of Sciences Senior Research Associate at Goddard Space Flight Center, NASA, since 1975. Previously he was a Smithsonian Astrophysical Observatory physicist, a Jet Propulsion Laboratory scientist, and an assistant professor of astronomy at Warner and Swasey Observatory, Case Western University. His fields of interest are X-ray astronomy and astronomical polarization.

Dr. Dolan is a member of the American Astronomical Society, the international Astronomical Union, and Sigma Xi, and has authored numerous papers in leading journals.

MARCH CALENDAR — *The public is welcome.*

Friday, March 4, 11, 18, 25, 8:00 PM — Telescope-making classes at American University, McKinley Hall basement. Information: Jerry Schnall, 362-8872.

Saturday, March 5, 6:15 PM — Dinner with the speaker at Bassin's Restaurant, 14th Street and Pennsylvania Avenue, NW. Reservations unnecessary.

Saturday, March 5, 8:15 PM — NCA monthly meeting at the Department of Commerce Auditorium, 14th and E Streets, NW. Dr. Dolan will speak.

Monday, March 7, 14, 21, 28, 7:30 PM — Telescope-making classes at Chevy Chase Community Center, Connecticut Avenue and McKinley Street, NW. Information: Jerry Schnall, 362-8872.

Saturday, March 30, 8:00 PM — Smithsonian lecture at the National Air and Space Museum: *Discovery of our Galaxy*, Charles Whitney. Reservations required. For free tickets and information, call 381-4193.

FEBRUARY LECTURE

The February 5 meeting of National Capital Astronomers heard Dr. Robert H. Becker describe current X-ray work in the intermediate (2-20keV) energy range. Dr. Becker is a National Research Council Research Associate with Goddard Space Flight Center.

Dr. Becker described the detectors aboard the Orbiting Solar Observatory (OSO-8) satellite and recent significant observational results.

About two-thirds of the observed X-ray sources are within our galaxy. The others include a few individual galaxies, Seiferts, quasars, and clusters of galaxies.

Of the three inert-gas-filled proportional detectors, two have 5° fields and are oppositely aimed along the axis. The third has a 3° field centered 5° from the aft axis.

The X-ray spectrum of the radio source, Cassiopeia A, a supernova remnant, features an iron line at 6keV which confirms that the source is thermal. The iron abundance deduced from the line strength agrees within a factor of 2 with that of the Solar System. Another (unknown) source is similar, and agrees with the position of a radio-discovered supernova remnant; it is within the error box of η Carinae, a slow supernova. Nine known X-ray supernova remnants correlate with radio energy and temperature measurements. The smaller, younger sources show higher temperatures, as expected, with the 6.5keV line prominent; other lower-energy lines are unresolved.

The presence of iron, the most abundant heavy element, is also evident in the absorption spectrum of interstellar matter. The photon-absorption probability function of energy displays discontinuities resulting from the various energy levels in the iron atom. Our speaker showed numerous examples of these discontinuities — absorption edges — in OSO-8 observational data, which indicate the presence of iron in the intervening matter. Iron abundance in the absorbing medium, indicated by the prominence of the absorption edges, again agrees well with Solar System abundance.

Hercules X-1 is an eclipsing binary showing day-to-day absorption changes and three intensity periods: a 35-day period of high intensity for 9 days and very low intensity for 26 days, with a 2-hour turn-on to 25 times the low intensity; a 1.7-day binary eclipse period; and a 1.24-second pulse repetition period which is eclipsed at the 1.7-day intervals. This system is interpreted as a neutron star spinning at the 1.24-second period (pulsar), which is eclipsed at 1.7-day intervals by its large companion. The larger star is filling its Roche lobe and spilling through the Langrangian L_1 point onto an accretion disk of the neutron companion. Precession of the tilted accretion disk alters the absorption at the 35-day period. The pulsar period is decreasing with time as the angular momentum of the accretion disk is conserved.

Dr. Becker announced that within a few days preceding the talk another eclipsing binary pulsar was discovered by reduction of OSO-8 satellite data from X-ray observations made in August 1976. A 528.4-second period was noted on August 26 from a source which showed no pulse on August 25. On August 28 the period was 529.3 seconds; August 29, no pulse; August 30, 528.4 seconds; August 31, 529.1 seconds; September 1, 527.5 seconds; and on September 2, no pulse. The pulsar Doppler and eclipse period indicate an orbit diameter of about 50 light seconds, or 15Gm (10 million miles). These data have not previously been published. This is the tenth eclipsing binary pulsar to be discovered.

Another very recently discovered type of source is the X-ray burster: a low-energy source whose normally soft radiation suddenly increases by as much as 100 times — up to 20keV — within less than a second, then decays in a few tens of seconds. Of the 25 X-ray bursters now known, 10 were found by OSO-8.

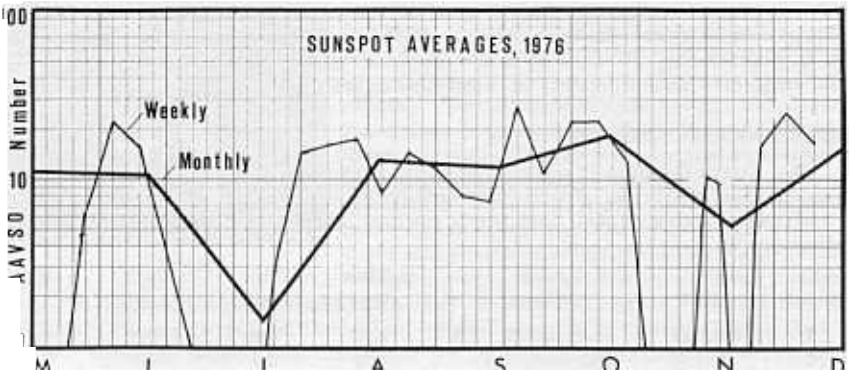
The 100-keV resolution of the new High-Energy Astronomical Observatory (HEAO) satellite telescope is expected to aid substantially the investigation of these newly discovered sources. The HEAO series will be launched in 1977, 1978, and 1979.

SOLAR ACTIVITY INCREASING

It is now virtually certain that the monthly sunspot minimum of the current solar cycle occurred in July 1976. The July average sunspot number was 1.4, compared with 2.1 for September 1964, the previous minimum. There were 23 spotless days in July; September 1964 had only 19.

Sunspot activity on all time scales was highly irregular during the six months since July 1. As shown by the graph, a two-week period in mid-July and another in early November were spotless, but the weeks before and after the November interval were much more active on the Sun than corresponding weeks in July.

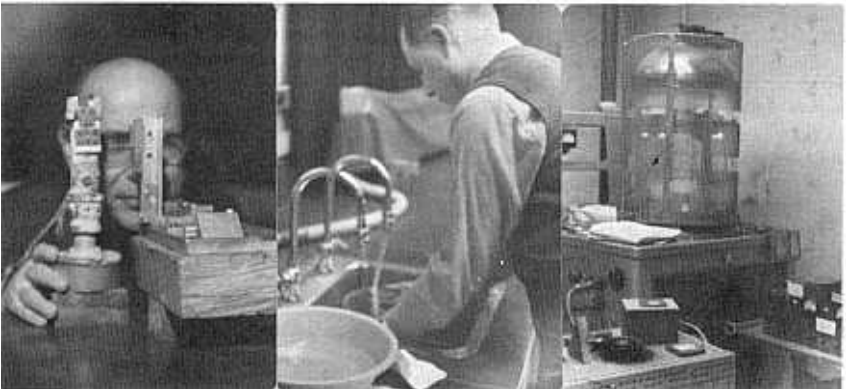
Based on observations roughly every four days with the NCA Clark refractor, slightly more activity on the solar Northern Hemisphere than on the Southern during the six months since minimum. wrw



OPTICAL INSTRUMENT CLINIC HELD

Some of the activities at the NCA optical instrument clinic held at American University on January 22 are shown in this series of photos by William Winkler.

Using the Foucault test, Jerry Schnall's practiced eye scrutinizes the figure of a telescope mirror. Robert N. Bolster cleans a telescope objective. In the vacuum aluminizing chamber numerous glow discharges form as high voltage is applied in the ion-bombardment cleaning of a telescope mirror. The reflecting aluminum film is applied by evaporation immediately afterward. The scrupulous cleaning by ion bombardment is necessary for good adhesion of the aluminum film.



EXCERPTS FROM THE IAU CIRCULARS

1. December 13 — P. Tempesti, Collurania Observatory, observed a V amplitude of 0.52 magnitude in the 8-hour period of V1500 Cygni, much greater than ever reported before. The mean magnitude was 12.85. Recent visual estimates by Bortle were 12.4 and 12.5.

2. December 14 — C. Kowal, Hale Observatories, recovered periodic Comet Taylor (1916 I = 1977a) with the 122-cm Schmidt at Palomar. Although the comet has a period of 7 years, it had not been observed since its discovery apparition. The 16th-magnitude comet is in Monoceros.

3. January 14 — A. Vittone, Asiago Astrophysical Observatory, obtained spectra of Nova Sagittae 1977 showing broad emissions of H, Fe II, Na I, and O I. Bordering absorption lines indicate an expansion velocity of 1200 km/s. Recent visual magnitude estimates by both Bortle and Morgan were 9.1.

4. February — Franz and Wasserman, Lowell Observatory, determined that the occultation of SAO 158687 by Uranus on March 10 has a northern limit, and will be seen only from southern Africa, the Indian Ocean, and western Australia. P. K. Seidelmann, USNO, also determined corrections to the position of Uranus and suggested an uncertainty of ±2500 km in the limit.

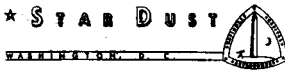
MARCH OCCULTATIONS

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

All are waxing phase, dark limb events. Raymond Finkleman plotted the graze paths.

March	EST	Place	Vis Mag	Pent Sunlit	Cusp Angle	Min Aper
	6:32P	Ladysmith, VA	5.3	96	9N	2"
	10:13P	Oakland, NJ	6.2	24	8N	4"
	07:38P	Olney, MD	9.0	41	7N	6"
	00:02A	Mattoax, VA	5.1	52	9N	2"

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