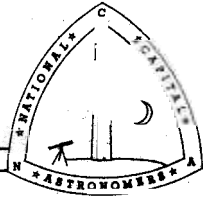


★ STAR DUST



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DECEMBER CALENDAR — *The public is welcome.*

Friday, December 1, 8, 15, 7:30 PM — Telescope-making classes at American University, McKinley Hall basement. Information: Jerry Schnall, 362-8872.
Saturday, December 2, 6:15 PM — Pre-meeting dinner at the Thai Room II, 527 13th Street, NW, between E and F Streets. Reservations unnecessary.
Saturday, December 2, 8:15 PM — NCA monthly meeting at the Department of Commerce Auditorium, 14th and E Streets, NW. Program to be announced.
Monday, December 4, 11, 18, 7:30 PM — Telescope-making classes at Chevy Chase Community Center, Connecticut Avenue and McKinley Street, NW. Information: Jerry Schnall, 362-8872.

NOVEMBER LECTURE

The November meeting of National Capital Astronomers heard Dr. Kent S. Wood, U. S. Naval Research Laboratory, describe the High-Energy Astronomical Observatory (HEAO-1) X-ray survey now in progress.

He described the satellite as the largest unmanned craft yet orbited, except for Skylab. Launched in August 1977 and expected to reenter in early 1979, the craft carries four experiments: A1 seeks new sources; A2 surveys the diffuse X-ray background and obtains spectra of sources over a wide range; A3 determines precise positions of previously known sources; A4 detects gamma-ray energies up to 10 MeV. Each of these instruments is about an order of magnitude more sensitive than its corresponding predecessors. None of the HEAO-1 instruments images; all use collimation and count rate and are directed by spacecraft orientation. Each detector comprises a gas ionization chamber, three sets of high-voltage electrodes, and a proportional counter.

Wood's emphasis was on the A1 experiment with which he is primarily concerned. Of the seven A1 detector modules, five survey by scanning spin, two are better collimated for detail study. The spin axis is directed toward the Sun and is updated daily. The observational plane is thus tangent to the ecliptic, and covers the entire sky every six months. Spin can be suspended during detail study. Because the scans all converge at the ecliptic poles, data are concentrated there. At the 30-minute spin period, an experiment having detectors on both sides of the vehicle can scan these regions every 15 minutes. The Large Magellanic Cloud, which is at the south ecliptic pole, has thus been scanned for over a year.

Count rates, integrated coherently over each day, add linearly; noise, being incoherent, increases as the square root of the number of samples. The signal is thus extracted statistically from the noise.

HEAO-1 operates in the sensitivity range where extragalactic sources predominate. Since galactic sources are distributed over an approximate disk, while the distribution of extragalactic sources is three-dimensional, the disk population increases inversely with flux, while the extragalactic population increases inversely with the $3/2$ power of flux. Earlier satellites, being less sensitive, recorded primarily galactic objects.

Construction of an all-sky X-ray catalog is in progress which is expected to include approximately twice the number of previously known sources.

Wood gave several examples of interesting HEAO-1 findings. Markarian 501, a BL-Lacertae object, has a redshift of about 0.05. It is a rather weak

NCA CONSTITUTION, BYLAWS AMENDED

In order to clarify the tax exempt status for donations to National Capital Astronomers, the governing documents of the Corporation were amended at the November 4, 1978 meeting as proposed by the trustees. The amendment, which replaces the previous corresponding portions, adopts wording suggested by the Internal Revenue Service. The proposal was distributed to members as a *Star Dust* supplement in the November issue. The full text as adopted follows:

FIRST: Said corporation is organized exclusively for educational and scientific purposes, including, for such purposes, the making of distributions to organizations that qualify as exempt organizations under Section 501 (c) (3) of the Internal Revenue Code (or the corresponding provision of any future United States Internal Revenue Law)

SECOND: No part of the net earnings of the corporation shall inure to the benefit of, or be distributable to its members, trustees, officers, or other private persons, except that the corporation shall be authorized and empowered to pay reasonable compensation for services rendered and to make payments and distributions in furtherance of the purposes set forth in Article FIRST hereof. No substantial part of the activities of the corporation shall be the carrying on of propaganda, or otherwise attempting to influence legislation, and the corporation shall not participate in, or intervene in (including the publishing or distribution of statements) any political campaign on behalf of any candidate for public office. Notwithstanding any other provision of these articles, the corporation shall not carry on any other activities not permitted to be carried on (a) by a corporation/organization exempt from Federal income tax under Section 501 (c) (3) of the Internal Revenue Code of 1954 (or the corresponding provision of any future United States Internal Revenue Law), or (b) by a corporation/organization, contributions to which are deductible under Section 170 (c) (2) of the Internal Revenue Code of 1954 (or the corresponding provision of any future United States Internal Revenue Law).

THIRD: Upon the dissolution of the corporation, the Board of Trustees shall, after paying or making provision for the payment of all of the liabilities of the corporation, dispose of all of the assets of the corporation exclusively for the purposes of the corporation in such manner, or to such organization or organizations organized and operated exclusively for educational or scientific purposes as at the time shall qualify as an exempt organization or organizations under Section 501 (c) (3) of the Internal Revenue Code of 1954 (or the corresponding provision of any future United States Internal Revenue Law), as the Board of Trustees shall determine. Any such assets not so disposed of shall be disposed of by the Court of Common Pleas of the county in which the principal office of the corporation is then located, exclusively for such purposes or to such organization or organizations, as said Court shall determine, which are organized and operated exclusively for such purposes.

source, but one of the most energetic, at about 10^{44} ergs per second. Its rise and fall through the sweep is irregular. Because its position is, in this case, already known, the irregularity can be interpreted as variability. The BL-Lac objects are notoriously variable in the radio and optical spectra. These objects represent one of the new populations appearing frequently with HEAO-1.

BL-Lac objects were predicted about five years ago to be X-ray emitters. Modeling of their synchrotron radio emission indicated that in a source of such volume inverse Compton X-rays should be produced. Failure to detect them raised a question for a time as to their distances as indicated by their redshifts. Now HEAO-1 is detecting these objects at flux levels of one-half to one-fourth those previously detectable.

Identification of X-ray sources with previously known objects is made by catalog searches within the error box. Such tentative identifications have usually proved to be correct.

In a region of about one-ninth of the sky, Wood showed galactic objects, clusters of galaxies, a quasar, BL-Lac objects, a supernova remnant, and

OCCULTATION EXPEDITIONS PLANNED

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

Date	UT Time	Place	Vis Mag	Pcnt Sunlit	Cusp Angle	Min Aper
12-06-78	00:08	Bowie, MD	8.9	38	4S	15 cm
12-08-78	00:01	Roxbury, VA	7.7	61	5S	10 cm
12-12-78	23:28	Frdrksbrg, VA	7.2	98	11N	15 cm
12-13-78	05:20	Colesville, MD	6.9	98	18N	13 cm
12-13-78	07:34	Woodbridge, VA	7.8	98	24N	20 cm
12-15-78	07:37	Gist, MD	7.7	99	27N	20 cm
12-23-78	11:24	Largo, MD	8.5	42	5S	13 cm
12-26-78	10:30	Tulsa, OK (Venus)	-4.3	15	2S	5 cm

According to recent data from Gordon Taylor, Royal Greenwich Observatory, during Monday morning, December 11, at 09:12 UT (04:12 EST), uncertain by 2-3 minutes, the asteroid 18 Melpomene will occult the 8.4-magnitude star SAO 114159 in Monoceros, for as long as 18 seconds. The 150-km-wide path of visibility will cross the United States, possibly in our area. In case of an occultation, the combined brightness will drop by 1.0 magnitude, so the event can be timed visually with small telescopes.

To receive a finder chart for the star, send a self-addressed stamped envelope to Dr. Dunham, PO Box 488, Silver Spring, MD 20907.

One or two days before the event it may be possible to predict the path within 100 km. Dunham plans to lead an expedition to station observers across the path to determine the asteroid's diameter. Call Dr. Dunham at 585-0989 if you are interested in joining such an expedition.

Observations locally would be valued in any case, since one or more satellites of Melpomene could occult the star briefly anywhere in the U.S.

The finder charts which Dunham distributed in October have been superceded by better charts. SAO 164788, to be occulted by 29 Amphitrite around 22:18 UT on December 6, is incorrectly shown on the October chart. The true star is the dot above "mp" in "Amphitrite." This December 6 occultation will probably occur far south of Washington with only a small chance for satellites to occult the star here.

others. He also showed the galactic center and the Large Magellanic Cloud.

A sample of other new sources found, positioned to within 1°, included five clusters, one BL-Lac, one quasar, and nine unidentified. Error boxes of the latter will be searched to about 18th magnitude for probable sources.

Wood gave a unique example of follow-up after tentative identification. The source in question had previously been detected by Uhuru and Ariel. Two candidate clusters were within the error box. A lunar occultation of the source, observed by HEAO-1 on three successive orbits, positioned the source between the two clusters.

Most X-ray sources are variable. Exceptions include supernova remnants and clusters of galaxies. Observations of each source can be made for 10 seconds every 30 minutes for about 8 days, with 1-microsecond timing resolution, and the entire sky is covered every 6 months. Thus, an extremely wide range of variability periods are observable.

HEAO-1 has discovered a new possible black hole, and has examined other suspected ones. The two most important characteristics were found: variability over a wide range of periods, and mass, measurable in a binary system, which exceeds the Chandrasakar limit, above which a neutron star cannot avoid gravitational collapse. Statistical evidence has been found for 3-ms pulses from Cyg X-1, a previously suspected black hole.

The 80-ms rise of an X-ray burster has also been resolved. Pulse-to-pulse

variability has been observed in part of the cycle of the pulsar Herc X-1.

During December the pulsar Vela X-1 will be observed to attempt to determine the structure of its neutron star. Variations in the pulse rate should disclose variations in torque resulting from mass accretion.

The most distant sources observed by HEAO-1 are clusters having redshifts greater than 0.2, or about 20 percent of the Hubble radius — a new record for X-ray astronomy. rm

EXCERPTS FROM THE IAU CIRCULARS

1. October — van Paradijs, Cominsky, and Lewin, MIT, reported rapid X-ray burster MXB 1730-335 has become active again, further supporting a pattern of active periods coming at intervals of 6.5 months.

2. October 27 — P. Wild, Astronomical Institute, Berne, discovered a supernova of 16th magnitude in an anonymous galaxy at 22h32.8m, 36°57'.

3. November — The orbital elements of Comet Fujikawa (1978n) have shown that it is a recovery of periodic Comet Denning (1888V), apparently not seen since the year of its discovery.

4. November — Kowal, Lo, and Sargent, Hale Observatories, reported the discovery of three dwarf galaxies believed to be members of the local group. Located in Andromeda, the objects are 3 minutes or less in size and of magnitudes 18 to 20.

This listing courtesy of R. N. Bolster.

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