★ STAR DUST

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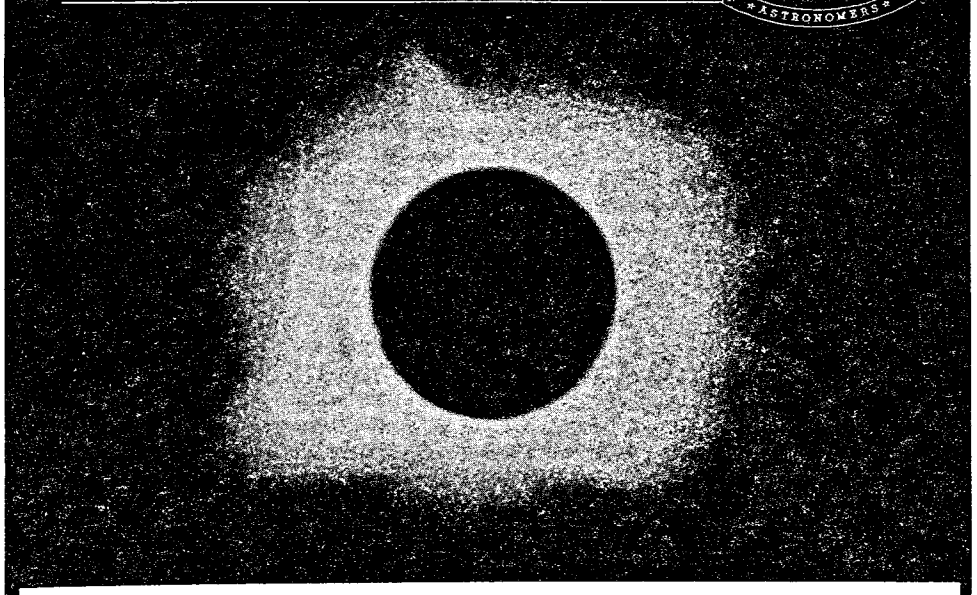

JAVA SOLAR ECLIPSE EXPEDITION A SUCCESS

The U. S. Naval Observatory's June solar eclipse expedition to Java, led by Dr. Alan Fiala, was a success. The purpose was to measure very accurately the diameter of the solar photosphere by recording and timing beads formed at the edge of the path of totality by known features on the lunar profile.

Dr. Fiala observed from a point about 60 km south of Surabaja. Participating NCA members were Drs. David and Joan Dunham observing from points on the north limit and Robert McCracken on the south limit about 10 km west of Fiala. From a large tour group at Surabaya a few volunteers also assisted.

There were problems: McCracken was clouded out, and Dunham had video trouble, but got some results. Altogether, it appears at first look that among the several stations sufficient data were obtained to yield useful results.

NCA thanks Mr. Richard Katzenstein of Hingham, MA for the photograph.

AUGUST CALENDAR — ***The public is welcome.***

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

Friday, August 5, 12, 19, 26, 7:30 pm — Telescope-making classes at American University, McKinley Hall basement. Information: Jerry Schnall, 362-8872.

Friday, August 5, 12, 19, 26, September 2, 9:00 pm — NCA 14-inch telescope open nights with Bob Bolster, 6007 Ridgeview Drive, off Franconia Road between Telegraph Road and Rose Hill Drive. Call Bob at 960-9126.

Saturday, August 6, 9:00 pm — ***Exploring the Sky,*** presented jointly by NCA and the National Park Service. Glover Road south of Military Road, NW, near Rock Creek Nature Center. Planetarium if cloudy. Information: Dr. John Lohman, 820-4194.

JUNE LECTURE

Dr. Alice K. Harding, Laboratory for High Energy Astrophysics, NASA Goddard Space Flight Center, discussed the "millisecond pulsar," 1937+214, at the June meeting of National Capital Astronomers. She described its discovery, its properties, and its effect on the theory of highly condensed matter.

Such objects were not to be expected on the basis of theory, hence were not sought earlier. She also announced the more recent discovery of a second millisecond pulsar.

PSR1937+214 was designated earlier as 4C21.53, a very compact radio source. It subtends less than 1 arcminute and shows strong linear polarization at radio frequencies. It is superimposed by chance on a Hydrogen-II region. Its properties, particularly its steep spectrum, suggested it as a candidate pulsar. Searches for periodicity down to 4 ms, made from 1972 to early 1982, found none. (Special techniques that use computer time prodigally are needed to find such short periods.)

In September 1982 a period of about 1.56 ms was detected. Since then the figures have been refined:

Period $P = (1.557806448 \pm 3 \times 10^{-9}$ ms

Rate of change of period $\dot{P} = (-1.1047 \pm .063) \times 10^{-19}$ sec/sec

Surface magnetic field $B_o = 4 \times 10^8$ Gauss

Surface linear velocity $V_o = .13c$ (c = velocity of light)

The state of the theory at that time required a very fast pulsar to spin down very quickly; the slow rate of deceleration was as unexpected as the fast spin. The low surface magnetic field proved to be an important clue to the pulsar's nature; the phenomenally high surface velocity strongly constrains theories of such objects.

New searches followed; Dr. Harding referred to the very recent discovery of a 6-ms pulsar.

Dr. Harding discussed candidate origins for the 1.6-ms pulsar. The properties, behavior, and development of a pulsar reflect the behavior (equation of state) of extremely dense states of matter. Candidate theories lead to varying properties, so experimentally determined properties of such a body in turn rule on the credibility of different theories.

The millisecond pulsar might originate in a supernova explosion. The progenitor star would have to have a low magnetic field; it would lose much angular momentum if the field were not low to start with.

It could originate by spin-up by an accretion disk in a binary system; the lower the magnetic field, the smaller the momentum. This model seems wrong unless the primary becomes a supernova. It requires many coincidences.

The collapse of a white dwarf accreting matter would yield a neutron star.

Two neutron stars in a close binary system might coalesce. such a system would emit gravitational radiation for about 10^8 years, after which the low-mass member would disrupt; or, if they were of equal mass they could coalesce.

Dr. Harding displayed a plot of gravitational mass versus radii of neutron stars. Not all regions in the diagram are possible, and the limits depend strongly on theories of matter. Curves superimposed on the diagram indicated the boundaries between possible and forbidden properties for various theoretical equations of state for extremely dense matter. The actual parameters for the millisecond pulsar sharply limit the theories that can be considered now. (Ed. note: It seems infeasible to attempt to explain here all the theoretical implications of the diagram. This part of her talk has since been published by her: *Nature*, v. 303, p. 603.)

Dr. Harding concluded by pointing out that the millisecond pulsar seems to be the best clock so far observed; it may improve the standard for ephemeris time in about 10 years.

A question period followed:

Q: Are P and $\dot{P}$ really that stable?

A: We don't know.

Q: How is the 10^{-19} s per s rate of deceleration derived, since international

OCCULTATION EXPEDITIONS PLANNED

Dr. David Dunham is organizing observers for the following grazing lunar and asteroidal occultations. For information call Dr. Dunham: 585-0989.

UT	Place	Vis Mag	Pcnt Sunlit	Cusp Angle	Min Aper
08-03-83 07:04	Lake Milton, OH	6.3	36	10N	5 cm
08-04-83 08:48	Myersville, MD	8.8	25	13N	20 cm
08-05-83 09:48	Salvo, NC	6.5	16	14N	5 cm
08-14-83 00:47	Chula, VA	8.1	34	9N	10 cm
08-25-83 05:39	Hollywood, MD	6.5	97	28N	10 cm
08-27-83 04:20	Norwood, MD	8.2	88	15N	20 cm

		Star Mag	Delta Mag	Name	
08-05-83 01:07	E. USA?	9.3	2.9	(747) Winchester	8 cm
09-01-83 00:53	E. USA?	8.8	4.1	(120) Lachesis	5 cm
09-09-83 04:07	Ontario	9.5	2.9	(53) Kalypso	8 cm

NCA WELCOMES NEW MEMBERS

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Beaman T. White Fam.
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Alexandria, VA 22304

TREASURER'S REPORT

Income		Expenses	
Dues	$4,951.00	Sky & Telescope	$2,387.00
Publications	620.28	Star Dust (print'g)	527.85
Telescope Classes	96.00	Star Dust (Post'g)	804.54
Interest	266.05	Other publications	604.43
Donation	25.00	Administrative	796.19
Total Income	$5,958.33	Miscellaneous	231.67
			$5,351.68
Excess income over expenses:		606.65	
Balance on hand July 1, 1982		2,868.60	
Balance on hand June 30, 1983		$3,475.25	

Ruth S. Freitag, Treas.

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atomic time is not known that well?
A: This is done using the mutual consistency of the period, rate of change, and atomic time.
Q: How is the current work in this area coordinated?
A: Communication is by the IAU Circulars and "good contacts."
Q: What are the engineering requirements for finding such objects?
A: Equipment requirements are not very different for this task. "Frame of mind" counts; one must decide where to stop the search. The data are contained in the observational records, but it is a difficult search requiring fine resolution, huge amounts of computer time and magnetic tape. John B. Lohman

EXCERPTS FROM THE IAU CIRCULARS

1. May 11 — P. B. Feldman, Johns Hopkins University, and (NCA member) M. F. A'Hearn, University of Maryland, discovered a series of emission lines of diatomic sulfur near the nucleus of Comet IRAS-Araki-Alcock with the IUE spacecraft.

2. May 12 — R. Nolthenius, University of California, observed a 0.6-s occultation of SAO 98040 by the nuclear region of Comet IRAS-Araki-Alcock with a 20-cm telescope.

3. June 14 — K. S. Russell, U. K. Schmidt Telescope Unit, discovered a 16th-magnitude comet (1983i) with the 1.2-m Schmidt at Siding Springs.

4. June 15 — The occultation of a star by Neptune was successfully observed from the Kuiper Airborne Observatory near Guam, the Infrared Telescope Facility on Mauna Kea, and Siding Springs. No evidence of rings was seen.

5. June 28 — J. Davies reported the discovery of its third comet by the Infrared Astronomical Satellite. Comet IRAS (1983j) was confirmed by J. Gibson with the Palomar 1.2-m Schmidt, and found to be of 15th magnitude.

Robert N. Bolster

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WASHINGTON, D. C.

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FIRST CLASS