☆ STAR DUST

Volume XXVII July-August, 1971 Number 11

SECOND-MAGNITUDE GRAZE OBSERVED NEAR D. C.

An expedition was organized and led by Bob Bolster and Bob McCracken to observe the grazing occultation of σ-Sgr (Nunki) by the nearly-full moon on the night of July 7 - 8. A few miles wide, the graze path crossed Virginia and the northern suburbs of Washington.

Most of the team, composed largely of NCA members, was distributed along the occultation cable system on a dirt road crossing the graze path about 30 miles west of Washington and paralleling U. S. Highway 15. A few were strategically deployed at widely-separated sites for bracketing and correlation, in Arlington, McLean, and Northwest Washington.

The cable system comprises a large number of 400-foot sections, individually reeled, which are connected end-to-end, with a connector for an observing station at each junction. A push-button "beeper" or electronic tone generator of different frequency (pitch) is provided to each observer who thus, using prearranged signals, transmits his observations to the central station via the cable.

At the central station, Bob McCracken recorded the observation signals from The northern and southern lines, along with continuous radio time signals, on two magnetic tapes. An observing post, manned by Rene Lamadrid, was also located at the central station.

A few minutes after midnight eyes and thumbs were busy as the electronic nocturne began detailing the northern lunar terrain. Five minutes later the show was over -- but captured in the magnetic tapes -- as Nunki rapidly separated from the lunar limb.

The tapes have now been completely transcribed by Bob McCracken and the observer positions reduced to a common reference by Bob Bolster, but rigorous interpretation must await the computer analysis. A first look, however, indicates that the position of the graze limb may have been as far as one-half mile north of the prediction.

The object of the occultation program (including totals as well as grazes) is refinement of positional data -- not mapping per se -- thus, among other things, to improve the usefulness of the moon as a time standard.

Because of the moon's irregular shape, its orbital inclination to both the earth's equator and the ecliptic, and the gravitational perturbations by the many moving bodies in the solar system, it should not be surprising that positional refinements continue to be needed.

With present knowledge of the problem there are more than 3,000 terms in the moon's orbital equation -- and the number is growing rapidly with the increasing understanding.

Among the still-missing terms are expressions for some apparent forces which are not accounted for by our present mathematical model of the moon's motion. For example, motions of the moon between 1820 and 1860 cannot be reconciled with its motion since then by present lunar mathematics.

Recent lunar photography from satellites and surface exploration have provided minute detail over the whole surface of the moon; laser ranging now achieves phenomenal distance measurement; occultations, however, yield the vital positional data of the lunar profile relative to the stars and the earth. Thus, besides determination of lunar position, the use of occultations of many stars enables corrections to be made to star positions. From a large number of such corrections adjustments to the coordinate system itself can be derived.

It is interesting to see how far-reaching occultation results can be. Dr. Thomas Van Flandern, of the U. S. Naval Observatory's Nautical Almanac Office, points out that, using the Naval Observatory's occultation analysis for coordinate corrections, Japanese astronomer S. Aoki has developed proper-motion corrections, from which, in turn, he has obtained corrections for the rate of galactic rotation, which enabled him to evolve a correction for the mass of the galaxy -- increasing the former figure by a factor of three!

Others who participated in the expedition were Dr. Van Flandern, Alan Fiala, also of the Naval Observatory, Joseph Strong, Joey Jordan, Tommy Olson, Dr. Victor Slabinsky of Comsat, Fred Cornelius, Charles Cook, Peter Fiekowsky, Billy Marsland, Dr. and Mrs. John Legowik, Raymond Finkleman, Glen Key, Jean Radoane, and Jay Miller. Dr. Henning Leidecker arranged for observations to be made at American University, Jim Elkins and Richard Blake at McLean High School Observatory, Peter Espenschied of the USNO Nautical Almanac Office observed in NW Washington, and William D. Young of Comsat volunteered an observation from Arlington. John and Bonnie Legowik hauled much of the equipment, and supplied lots of hot coffee besides observing.

CALENDAR

August 10 (Tuesday), 8:00 PM -- Mars Party at Travilah, sponsored by the Maryland - DC Juniors. Meet at Chevy Chase Library, 8005 Connecticut Avenue near E-W Highway for rides. Information: Jean Radoane, 434-0443.

August 12 (Thursday), 7:00 PM -- Father Heyden Dinner, Marriott Key Bridge, $8.50 per person. Information: Bob Wright, 384-6748.

August 21 (Saturday), 4:00 PM -- Picnic and Star Party, sponsored by the Maryland - DC Juniors. Meet at Chevy Chase Library, 8005 Connecticut Avenue near E-W Highway for rides. Bring telescopes and plan to stay out late. Information: Jean Radoane, 434-0443.

August 28 (Saturday), 8:30 PM -- Exploring the Sky, jointly presented by the NCA and National Park Service. Military and Glover Roads, NW, near the Rock Creek Nature Center. Information: Bob McCracken, 229-8321.

Each Friday, 7:30 PM -- Telescope-making class, McKinley Hall, American University. Information: Jerry Schnall, 362-8872.

RECENT OBSERVATIONS

During the week of July 14-21, the sun was remarkably active; sunspot groups large and comples appeared in both hemispheres, with the southern one being somewhat more active. Nine groups containing 38 sunspots were visible in a 4-inch telescope on July 15.

Many NCA members have commented on the intense, pink color of Jupiter's red spot. Winkler obtained Ektachrome-X slides showing it, using an 8-inch reflector on June 21. Don and Karen Allen note its brilliance as seen in a 3-inch

refractor. Sidney Opie and several neighbors saw prominent preceding and following dark spots associated with the red spot in late June with 4- and 8-inch telescopes.

Mars has been showing a large and intense white polar cap during early morning hours this summer; a dark and prominent border surrounds it.

Sterling Anderson has obtained a magnitude estimate for V1057 Cigni, the intrinsic variable star discussed in July *Sky and Telescope*. He used his $12\frac{1}{2}$-inch reflector, aided by a superb collection of star atlasses.

Ken Short has been using both his 6-inch refractor and the NCA 5-inch to observe Mars during early morning hours.

TRUSTEES VOTE DUES INCREASE

The NCA trustees signed a resolution approved July 1 to increase the dues for all classes of membership, in view of increased mailing costs, costs of incidentals for meetings, and steady price rises of services required by the club. The new rates, effective July 1, (fiscal year 1972), are: Junior, $2.50. Junior with *Sky and Telescope*, $7.50. Regular, $9.50. Joint or family, $11.50. Sustaining, $250.00.

Auditing of the Society's books was done by Robert Bolster, with William Winkler, Jerome Schnall, John Legowik, and Charles Shepard present.

NCA FALL SPEAKERS

Vice President John Eisele has announced the following speakers for NCA lecture meetings this fall: September 11, Dr. John O'Keefe, NASA; October 2, Dr. Seth Shulman, NRL; November 6, Dr. Robert Kreplin, NRL; December 4, Dr. Fred Singer, Interior Department.

IMPORTANT EQUATIONS IN ASTROPHYSICS -- IV

One of the most important equations in observational astrophysics is that describing the *Doppler Effect*, the shifts from normal positions of an astronomical body's spectral lines due to the line-of-sight velocity of the body.

$$\Delta\lambda = K\frac{\lambda v}{c}$$

Where $\Delta\lambda$ is the difference between the normal and the observed wavelengths of a spectral line, λ is the normal wavelength of the spectral line, c is the speed of light, v is the radial velocity of the body, and K is Hubble's constant, determined from Cepheid variable star observations. The normal positions of spectral lines are measured in the laboratory.

NOTE ON CURRENT RESEARCH

A faint, nebulous object, YM 29 in Gemini, has been labled a planetary nebula, and not a supernova remnant, as some had argued, because the object's 318 and 606 MHz radio emission is thermal in origin. This planetary was discovered in 1955, and is discussed by Terzian in the June 15 *Astrophysical Journal*.

ERRATUM

Apologies to Science Fair judge and member Wolfgang Shubert, whose name was misspelled in the June issue.

AUGUST OCCULTATIONS

Date & Time (UT) D H M S	Phenomenon	Star	Magnitude	Position Angle	Notes
17 07 01 29	R	1055	5.8	332	
17 07 48 19	R	ZO6672	7.6	226	Double star
18 08 27 19	R	1187	7.1	300	
30 01 12 41	D	Z16293	7.2	60	
31 22 43 29	D	2750	2.1	16	) Bright star, daylight
31 23 13 24	R	same	2.1	332	

GRAZING OCCULTATIONS FOR WHICH EXPEDITIONS MAY BE CONSIDERED

D H M	Closest point	Star	Mag	Limb	
17 09 50	10 miles south	ZC6800	7.2	North	Twilight
29 01 26	59 miles se	ZC2300	7.7	South	
September					
26 00 29	115 miles nw	ZC2397	6.5	South	

FOR SALE

12 1/2-inch Pyrex mirror blank (University Optics), tool, all abrasives, pitch, Barnesite, $50.00. Fiber tube 8 feet long, 16 inches diameter, $15.00. Call Ed Kemon, 538-4193.

* STAR DUST *

Published eleven times yearly by NATIONAL CAPITAL ASTRONOMERS, INC., a non-profit, public-service organization for the promotion of interest and education in astronomy and the related sciences. President, William Winkler, 1001 Rockville Pike, Apt. 1033, Rockville, Md. 20852 (762-5135); Vice president, John Eisele; Treasurer-membership, John Legowik (946-8996). STAR DUST production, Mabel Sterns and Robert McCracken. Deadline: Fifteenth of each month.