

JOHN O'KEEFE: UPDATE ON LUNAR STRUCTURE



JOHN O'KEEFE

From the motion of earthquake waves in the earth and the moon, we are sure that both bodies are solid except for a liquid core which starts 3,000 kilometers down in the earth, and a central zone of the moon which is still unknown. The response of the earth to tides tells us that it is as *rigid* as steel. Nevertheless, both the earth and the moon are much *weaker* than steel. The evidence suggests that stresses of a few tens of atmospheres are the maximum that they can resist in the shear direction. Continental drift indicates that, at least inside the earth, there is an especially weak layer.

Dr. John A. O'Keefe is Assistant Chief for Planetary Studies in the Laboratory for Space Physics at NASA's Goddard Space Flight Center. His current duties include the theoretical study

of the moon from the standpoint of planetology.

Dr. O'Keefe was born in Lynn, Massachusetts. At the age of eight, his grandfather, a mathematician, gave him a telescope. This started him on his scientific career. After preparatory school at Phillips Exeter, O'Keefe attended Harvard, receiving an A.B. Degree in astronomy in 1937. He went on to the University of Chicago, received his doctorate in astronomy in 1941, and then spent a year teaching astronomy and mathematics at Brenau College in Georgia before the onset of World War II.

Dr. O'Keefe served as the civilian Chief of the Research and Analysis Branch of the Army Map Service from 1942 to 1958. His adjustments of the mapping of China forms the framework of most American and European maps of China. He contributed to the determination of the velocity of light by radar and led the group which measured the flattening of the earth from Vanguard I.

Dr. O'Keefe joined NASA in 1958 to become Assistant Chief of Goddard's Laboratory for Theoretical Studies. At Goddard he collaborated on the discovery that the earth has a slight "pear-shaped" component in its form superimposed on the basic flattened sphere.

His studies include research on tektites, which he believes to have their origin in lunar volcanism, and related study of the moon's surface, calculations involved in the possibility of the moon's origin by the break-up of the earth, and work with the astronauts in planning experiments and evaluating data from their flights.

CALENDAR

- September 11 (Saturday), 6:15 PM -- Dinner with the speaker at Bassin's, 14th Street and Pennsylvania Avenue, NW. No reservations required.
- September 11 (Saturday), 8:15 PM -- Monthly meeting of NCA at the Department of Commerce Auditorium, 14th and E Sts., NW. Dr. John O'Keefe speaks.
- September 18 (Saturday), 2:00 PM -- Meeting for all NCA Juniors at the Chevy Chase Library, 8001 Connecticut Avenue, to discuss and plan activities for the coming year. Information: Jean Radoane, 434-0443.
- September 18 (Saturday), 8:15 PM -- Discussion Group at the Department of Commerce Auditorium, 14th and E Streets, NW. Highlights of the summer's astronomical activities, illustrated with slides, will be exchanged.
- September 25 (Saturday), 8:00 PM -- Exploring the Sky, presented jointly by NCA and National Park Service. South of Military and Glover Roads, NW, near Rock Creek Nature Center. Information: Bob McCracken, 229-8321.
- Each Friday, 7:30 PM -- Telescope-making class, McKinley Hall basement, American University. Information: Jerry Schnall, 362-8872.

NCA MEMBER JOINS MESSIER CLUB

Congratulations to Mrs. Karin Allen for observing and cataloging in detail 75 Messier deep-sky objects. She becomes the seventh woman in the Astronomical League to receive the League certificate for this feat. Only a 3-inch refractor was used.

THE ASTRONOMICAL LEAGUE - ALPO NATIONAL CONVENTION, 1971

More than 200 people, including Bob Wright, Bill Winkler, and Mabel Sterns of NCA, attended this annual gathering, held this year at Southwestern College, Memphis, Tennessee. The gorgeous campus provided several large, modern lecture halls and several air-conditioned residences for our use. The College's 31-inch reflector and 6-inch refractor, as well as a Memphis amateur's 18 $\frac{1}{2}$ -inch Newtonian, were used by the delegates. The three-day program was fast-paced, with amateur and invited professional papers scheduled between 9:00 AM and 5:30 PM each day. Evening tours and special meetings lasted until midnight. Charles Capen of Lowell Observatory and Winifred Cameron of NASA attended the entire convention, advising serious amateurs of their observing programs as well as giving really spectacular talks.

Two all-junior societies, the Astrogators of Florida and the Junior Texas Astronomical Society, Dallas, distinguished themselves by their extensive organized observing programs and well-done publications.

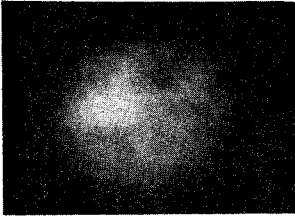
Dennis Milon of *Sky and Telescope* ran a fine session on the comet-search activities of ALPO, while Walter Scott Houston of "Deep Sky Wonders" fame was by far the wittiest speaker. He gave hints on finding the best seeing for solar observing.

The final session of the 1971 National was held aboard a Mississippi River boat. While it cruised the river on a soft August evening, we heard a talk on current infrared astronomy research by John Strong, famed optical physicist formerly of Johns Hopkins, and a history of Mississippi River boating by the Captain. We then held a short star party on a sand bar. Slides taken at this League Convention will be shown at the September Discussion Group.

STELLAFANE 1971

The 37th annual Stellafane meeting, held this year on August 13 - 15, got full cooperation from the elements, at least in the opinion of this observer, who recalls a particular rain-drenched Saturday a year ago. Purists from mountain

NOTES ON CURRENT RESEARCH



Bill Winkler photographed Jupiter's red spot on June 21, 1971, 0200 UT. Exposure was 1 sec. on Ektachrome-X with an 8-in. f/50 reflector. Printed on orthochromatic film.

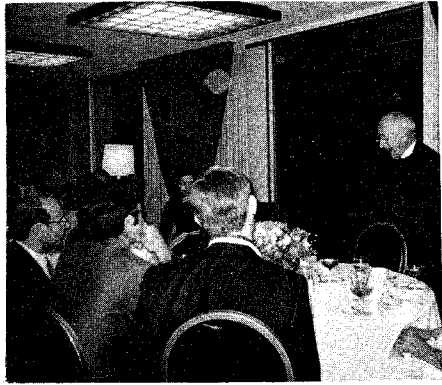
E. J. Reese summarizes the photographic appearance of Jupiter's Great Red Spot during the planet's 1969 - 1970 apparition in *Icarus*, June 1971. The mean length and width of the spot were 27,800 and 13,800 km, respectively. Between December 1969 and March 1970, it decreased in length by $2\frac{1}{2}^\circ$ longitude, but regained all this by August 1970. A previously noted 0.8° , 90-day oscillation in longitude was confirmed. Photographic photometry revealed that the Great Red Spot: South Tropical Zone brightness ratio increases rapidly from 0.4 at 3700 Å to 0.9 at 6200 Å; it then increases very slowly to less than 1.0 at 7900 Å.

Apples in a Spacecraft - Using as a model objects moving at random within an enclosed space (spacecraft), Alfven describes mathematically a tendency to align along the line of motion as well as contract about the center of gravity of the system. He feels that this might describe the formation of meteor clusters or even of comets. Thus, these systems may be growing rather than dissipating in their journey about the sun. See *Science*, August 6, 1971. P. 522.

ERRATUM

Delete K, Hubble's constant, from the Doppler shift equation given in *Important Equations in Astrophysics IV* in the July - August 1971 issue of *Star Dust*.

NCA said farewell to Father Francis Heyden of Georgetown University at a dinner given in his honor on August 12 at the Marriott Motor Hotel.



ranges in west Texas or Arizona might have noticed a slight haze, but not the New Yorkers or Bostonians who gathered on Breezy Hill in Vermont. Observing was conducted both Friday and Saturday nights using the recently-overhauled Porter turret telescope and also the many instruments that found their way to Springfield from as far away as Riverside, California.

There is only one criterion established for Stellafane telescopes: they must be amateur built. Commercial intrusions into the home of amateur telescope making are generally regarded with disdain. This has the happy result that even the shakiest mount receives a welcoming kick from Alan Mackintosh (and pasteboard Newtonians vie with off-axis Maksutovs for optical excellence (and some rather well).

The largest telescope brought in was a 16-inch, built by amateurs at the University of Toronto. It wowed the observers with spectacular views of M13 and the Dumbbell Nebula, although the longer focal length of the Porter telescope gave a more pleasing view of the former. Nothing really earth-shaking was produced in the way of novel optics or mounting design. An off-axis Mak made a return visit, as did a Schiefspiegler; Neither was ever satisfactorily aligned, which says something to portable telescope makers. *Cont'd. -P. 4*


Stellafane - Cont'd.

By far the most pleasing construction job was that of Mr. Jonas Carroll of Rockville, Maryland. NCA observers could recognize a couple of Hoy Walls' castings, albeit filed and sanded to perfection, and complemented with castings from Mr. Carroll's own foundry. He had also proved himself master of fiberglass (second most cussed material to pitch). Needless to say, his 6-inch Maksutov Cassegrain won first prize in its division for mechanical excellence. Another winner worthy of note was a sturdy mounting by Mr. Marcel Dumas, of Quebec, who added a touch of French Canadian poetry to his entry in the contest.

Talks under the tent included a new "Porter Pasadena Cassegrain Maksutov" design elucidated by John Gregory and a description of the resurrection of the turret telescope by Alan Rohwer. Fred Chellis gave a talk on Russell Porter; there was also an art exhibit of the late Mr. Porter's designs, drawings, and paintings.

The advanced telescope maker's workshop, conducted by John Gregory and James Daley, centered mostly on the Schupmann telescope. The design looks great when ray-traced, but practical considerations have kept it mainly in the hands of amateurs and computerniks.

NCA was represented by Geoff Hornseth, Bruce Muirhead, Darrel Freund, Bob Bolster, Bob McCracken, Ken and Phil Short, and the undersigned and his wife, Nancy. Jerry Hudson

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