

On December 8, the Md.-DC NCJA met at the Chevy Chase Community Building. We discussed observing the members of the solar system and each of the eleven members present contributed his share of observing hints. We discussed telescope power, mirror or lens diameters, and good focal lengths, for making good observations of the planets. Also included was a discussion of making drawings, and photographing the members of the solar system.

This meeting ended our discussions of the solar system, at the next meeting we will start a new series on another phase of astronomy.

The place of the next meeting will be announced later. We have requested the permission of St. Paul's Lutheran Church, 4900 Connecticut Ave. at 36th and Everett Streets, N.W., to use one of their classrooms for our meeting place. We have not heard as of yet from them.

Ernest Goodwin, Jr. Editor

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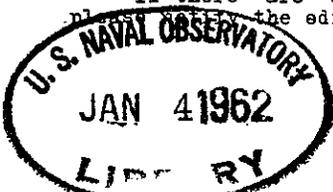
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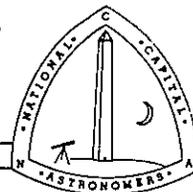
DIRECTORY

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* STARDUST

Published monthly except August by and for members of the NATIONAL CAPITAL ASTRONOMERS, INCORPORATED, a non-profit, public-service organization promoting interest and education in astronomy and the related sciences. President, Mrs. John Stolarik, RE-6 4321; Vice President, Ellis Marshall; Secretary, Morton Schiff; Treasurer, Roger Harvey. Trustees: Leo W. Scott, Sam C. Feild, J. G. Robert Wright, and James Krebs. Editor, Mrs. John Stolarik. Assistant Editor, Mrs. Ellis Marshall. Junior Division Editor, Ernest Goodwin, WO-6 4058. Astronomy Editor, Alexander L. White. Publicity, Mrs. William Lipscomb. Publicity Distribution, Morton Schiff. Photography and Production, Sam C. Feild, Jr. Deadline: tenth of each month.



THE STRUCTURE OF THE UNIVERSE



To start the new year we will have as our speaker Dr. Ernst J. Öpik visiting professor of astrophysics University of Maryland, and research (on leave), Armagh Observatory in Northern Ireland. In the past Dr. Öpik has lectured to us on Comets and the surface conditions of Venus. This time Dr. Öpik will speak on Cosmology.

The large-scale structure of the Universe, its possible origin, age and ultimate fate will be considered. From atoms to clusters of galaxies, the known part of the Universe is built according to the hierarchical principle, smaller systems are being grouped into larger systems of a higher order. The empty space be-

tween the higher-order systems increases: as pointed out by Charlier, even an infinite Universe built in this way will look dark as the night sky, and not bright as the sun (the paradox of Olbers). Thus, contrary to what is often said even in modern books, the darkness of the sky is not, in itself, an indication of the finiteness of the Universe.

Cosmological theories should comply with the principle of "Minimum hypotheses": new laws of nature should be advocated only when they explain facts which are not accounted for by established laws. Failure to observe this rule has led to speculations tantamount to fantasy: the theories of spontaneous creation of matter and of a steady-state expanding Universe, fascinating as they are they belong to this category; recent observational evidence is against them, and there is none to support it.

The understanding of the whole Universe depends on the study of its parts. As to age, the Universe must be older than its oldest parts. The Earth and the meteorites are 4.5 billion years old; this is also probably the age of the solar system. The oldest stars have been spending their hydrogen fuel for six billion years at least. Hoyle ascribes to some cluster stars in our Galaxy an age of 15 billion years, but this depends upon an arbitrarily chosen initial composition favoring longevity; their age is probably not more than one-half Hoyle's value. From the helium to hydrogen ratio, the age of the Galaxy is less than 12 billion years, and that of its oldest cluster (NGC 188), less than 11 billion. If half the helium in the beginning, and the other half was produced by hydrogen burning in stars, the age becomes 6 billion years.

From the redshift of extragalactic nebulae, interpreted as an expansion of the whole Universe, its age or the time elapsed since the Universe was in a highly condensed state, is most probably about 8 billion years, although the figure is rather uncertain and could range from 6 to 12 billion years. If the radioactive elements were mainly produced in the early dense state, 6 billion years would be the upper limit of age.

New observational evidence, such as the magnitude-redshift relation of the galaxies, and the distribution of radio sources those mysterious galaxies in collision, indicates that the world is rapidly (i.e. in a few billion years) changing by expansion, and is strongly in favor of an oscillating model of the Universe. Over a period of 20-30 billion years, it would alternately expand (or explode) from an overdense state 100,000 billion times denser than water, and collapse back into this state. Whether the Universe does, or does not change after each oscillation, is a matter of conjecture. A noticeable rotational tendency (angular momentum) in the Universe could greatly modify the picture, preventing collapse into a very dense state. A small angular momentum can be absorbed into nuclear spin and magnetic moment of the collapsed state.

Alternate theories, that of cosmological repulsion and the spontaneous creation of matter, will be discussed, their arbitrary character being pointed out. Philosophical problems of the relation of like and mind to the Universe will be touched upon.

Dr. Opik is a native of Estonia, a small country formerly independent, now under Communist rule. He graduated in astronomy at Moscow University in 1916, was an astronomer in Tashkent in Central Asia, and Tartu, Estonia; visiting lecturer at Harvard; Estonian Rector of Baltic University, which was run by Baltic refugees and the British Military Government in Hamburg after the war. His most recent popular book is "The Oscillating Universe" (a Mentor paperback).

CALENDAR FOR JANUARY

- 5 THE STRUCTURE OF THE UNIVERSE by Dr. Ernst J. Opik, Dept. of Commerce Auditorium, 8:15 P.M. Business meeting follows.
- 5 TRUSTEES MEETING at 7:30 P.M. Dept. of Commerce room 1851.
- 12 MD-DC JUNIORS MEETING at 2 P.M. New meeting place to be announced at the January 5th lecture. Subject: Stars and the H-R Diagram. Call Leith Holloway at 362-1961 for details.
- 8,15,22,29 ASTRONOMY REVIEW CLASS at the Naval Observatory at 8:15 P.M.
- 19 DISCUSSION GROUP 8:15 P.M. Dept. of Commerce Room 1851 Topic: Cosmology.
- 9,16,23,30 TELESCOPE MAKING CLASS in Bladensburg from 7:00 to 9:30 P.M. with William Isherwood.
- 4,11,18,25 MAKUTOV CLUB at the Chevy Chase Community Center with Hoy Walls 7:30 to 10:00 P.M.

N.C.A. Astronomy Review Course

The first session of the Astronomy Review Course will be held on January 8, 1963. Final announcements will be made at the regular N.C.A. meeting on January 5. However, here are a few guide lines for you.

1. All NCA members are eligible to join the class.
2. NCA members have volunteered to lecture, demonstrate and teach.
3. A textbook is optional, however, texts are good guides, Beginners or people needing basic astronomy may want to purchase "Introduction to Space Age Astronomy" by Prof. John M. Cavanaugh. Books will be available on January 8 at the first class session for \$2.75.
4. Classes are to be held at the U.S. Naval Observatory at 8:15 P.M. promptly.
5. US Naval Observatory Regulations require: (1) NCA membership card to enter; (2) respect for property; (3) a prompt group.

6. Regular attendance of classes is, of course, desired however not required. You therefore have the privilege of taking advantage of as many sessions as possible.
7. Classes are now planned to cover eight consecutive weeks every Tuesday, beginning January 8.
8. The course outline will be distributed at the first session.
9. Plan to join the class!

Margaret Noble & Educational Committee

TOPOGRAPHIC MAPPING OF THE MOON

At the December meeting of the NCA Mr. Albert L. Nowicki of the Army Map Service described the methods used and the problems encountered in mapping the more than 9,000,000 square miles of the moon's visible surface, an area greater than that of North America.

With manned lunar landings planned by the end of this decade there is an urgent practical need for many detailed and accurate maps of the moon. Space planners have not yet decided on a specific lunar landing site so for this reason lunar mappers must concentrate on large areas especially those in the band 20 degrees from the moon's equator where the geometry of space probe orbits permits longer visits on the moon before take-off. Some astronomers suggest a lunar landing in the crater Alphonsus where the Russians claim to have observed volcanic action in 1958 and 1959 whereas others advise landing near the straight wall. However, many space experts consider the crater areas too dangerous for space ships and so recommend landings on the lunar seas.

Although the moon's period of rotation and that of its revolution coincide, the orbital speed of the moon varies within its elliptical path around the earth. The interplay of these two motions, coupled with the 5-degree inclination of the moon's axis to its orbit, permits us to view at one time or another much more than merely one half of the moon's surface. The range of "libration" amounts to over 15 degrees in longitude and 10 degree in latitude. The maximum libration effectively creates a 65,000-mile baseline for observing the moon stereoscopically from the earth at a mean distance of 240,000 miles. By this means map makers can determine elevations on the moon relative to some reference level (taken to be 7000 meters on the floor of crater Mötting A) and draw relief maps of the lunar surface accurate to plus or minus about 250 meters and having a horizontal resolution of about one kilometer. The mountainous south pole of the moon towers about 35,000 feet above the low plains on the eastern side of the visible face.

Mr. Nowicki exhibited many colorful 3-D relief maps molded into various types of plastic materials some of which could be written on by a grease pencil by a future astronaut exploring the moon. Several of the beautiful lithographic maps which Mr Nowicki displayed attempted to represent the lunar landscape in its true colors. Maps of the moon differ from terrestrial maps in that they show no cultural landmarks, but they make up for this obvious deficiency with a wealth of topographical (or should we say selenographical?) features.

Leith Holloway
