A A V S O   A B S T R A C T S

Edited by R. Newton Mayall

PAPERS PRESENTED AT THE SPRING MEETING MAY 23, 1953

After 14 years, all AAVSO members that could bought tickets to or turned their autos once again toward Ann Arbor, where the University of Michigan campus occupies the center of this thriving community; and not too far distant, in the country, are two observatories. An ideal spot for our spring meeting, and we are grateful to Dr. Leo Goldberg and his staff for making our visit a memorable one; and above all they arranged for perfect weather during our stay. Some of those who arrived from the east ran into the only discomfiting part of the round trip -- a tornado, which devastated Port Huron, Michigan and Sarnia, Ontario.

The usual pre-meeting evening lecture was given by Dr. Dean McLaughlin, Friday night. After the session for papers on Saturday, a pleasant luncheon prepared everyone for a happy return home via Portage Lake and McMath-Hulbert Observatories.

****

VASTNESS OF CELESTIAL DISTANCES, by Dean B. McLaughlin

The origin of the astronomers' conception of the vastness of celestial distances is so well known that it is unnecessary to dwell at length upon it before this audience. We can see or photograph, or measure with a photomultiplier tube, as far as light can travel and yet have sufficient intensity. The inverse square law of light intensity sets the limit. It is quite otherwise with time. We live only in the present; the future has no existence until it has become the present; the past is only a memory and cannot be re-experienced. The individual's experience of time extends only backward and only as far as his memory. All else is hearsay. Yet astronomers talk glibly of millions of years, as if such intervals were part of their actual experience.

The vast time scale of the universe can indeed be supported today by astronomical evidence, but it is not of astronomical origin. As recently as fifty years ago, the astronomer could find no reliable evidence, within his own science, that could be used to refute the dictum of Archbishop Ussher, that the world was created in the year 4004 B.C., on October 12, at nine o'clock in the morning (probably Greenwich Mean Time). This famous pronouncement, made in the year 1650, was a millstone about the neck of the western learned world for a full two centuries. And the astronomer can claim little in the way of credit for the emancipation that came less than a century ago. As recently as 1904, Simon Newcomb, whose word was gospel, estimated that the diameter of the galaxy might be 6,000 light years. And in 1912, C. A. Young allowed 20,000 light years, with the further statement: "as to what lies beyond we are still more ignorant. If, however, there are other stellar systems of the same order as our own, they are neither the nebulae nor the clusters which the telescope reveals, but are far beyond the reach of any instrument at present existing."

Thus, at the beginning of our century, the astronomer might still believe in a time scale that embraced only six thousand years from the creation to the present day.

But as far back as the American Revolution, the beginning was made in the revolution of our conception of time. A Scottish physician gave up his practice and turned to agriculture. The soil had been plowed by millions of men before him, but it had never been plowed by a mind. Hutton was both an accurate observer and a logical thinker. His conclusions, published at first briefly in 1785, and then in two volumes in 1795, can be summarized by saying that he recognized the origin of the existing layered rocks of the earth's surface through deposition by water. They represented the debris or wreckage of pre-existing rocks, laid down as sands, gravels, muds, hardened into rock, raised up and again eroded. His picturesque statement is one of the most quotable quotes of scientific literature: "The result of this physical enquiry is that I can find no vestige of a beginning, no prospect of an end." Then, in 1903, it was discovered that radium emitted heat spontaneously and it followed that its parent uranium also emitted heat. All calculations previously made were thereby invalidated. At present the problem is, not how long did it take the earth to cool, but how did it ever manage to cool at all? The amount of uranium in a random chunk of New England granite is such that a surface layer of granite only a few tens of miles thick would account for all the heat flow from the earth's interior. Obviously the uranium is concentrated in the crust where, for better or worse, we are able to get at it and make things of it.

CONSTRUCTION OF AN EYEPIECE INTERFEROMETER, by Walter L. Moore

This instrument was constructed from a description given by W. S. Finsen in the Monthly Notices of the Royal Astronomical Society, Volume III, No. 4, 1951, pp. 387-92. Only the significant differences in design are here described:

1. The mechanism for controlling the slit separation was a shaft having right hand and left hand screw threads cut on it. These screws actuated two nuts fastened to the movable slit plates. Back lash was taken up by springs.

2. The slit plates were made of .002 inch brass shim stock. The circular openings forming the slits were made with a punch and die, making possible very accurate centering. By a single movement of the threaded shaft it is possible to get full aperture, lune shaped slits, and slits having one side straight and the other curved.

ROTATION OF SUNSPOTS, by Leland Haines

Sunspots have been observed systematically for nearly two hundred years. Yet today we know little of the nature and cause of them. Today the generally accepted theory is that sunspots are storms in the solar atmosphere, comparing to cyclones or whirlpools on the earth, differing mainly in size and temperature. The direction of rotation has been inferred from the polarity. Today most astronomers agree that this problem is not as simple as stated. I am now engaged in a continuation of Mr. Francis P. Morgan's study of Sunspot Rotation. Following are some of Mr. Morgan's results from his study during 1946 and 1947.

Using a six-inch refractor at Ville Marie Observatory for projecting the sun's disk on a white glossy surface, which gave remarkable detail, he noticed the following things: Whenever large spots at the same end of a group are sufficiently close to each other, the umbrae are displaced from the center of the penumbra towards the adjacent spots, and in some cases, there are no penumbra fringes at all on the side of the spots facing each other. In spots with multiple umbra, bright golden-yellow streaks are present between the umbrae against the light grey background of the penumbral regional. The larger the umbrae and the smaller the separation between them, the brighter these streaks appear. Another feature is that penumbral wisps or streams usually point towards the opposite ends of a group, especially in very large groups, as though the preceding and following members were oppositely charged, since unlike charges attract.

The direction of rotation has always been inferred from the polarity, but if spots contain high electrical charges, the polarity would depend on two things -- direction and charge. For instance, if the charge was positive and rotation counter-clockwise, the polarity would be north. But if either were reversed, then the polarity would be south, but if both were reversed the polarity would still be north.

Although the observational data is too scant at present, a tentative theory was proposed by Mr. Morgan: "The intermittent nature of the rotation, the lack of correlation between direction and polarity, and the fact that three of the twenty-seven observed groups were seen to reverse in rotation, suggests that the observed or peripheral rotation was caused by changes in the magnetic strength instead of the other way around. It is necessary to assume that the spots are highly charged. Otherwise, such magnetic charges would only induce electrical currents, without any movement in the mass as a whole.

This does not disprove the central vortex theory producing the magnetic field. The polarities are so consistent for most groups that we suppose the rotation of the central vortices and electrical charges also to be consistent. The observed rotation would depend on three factors -- polarity, charge, and direction of the charge in the magnetic field. The polarity would be determined by only two things -- charge and the direction of rotation. Since we know the polarity, we need only to know the direction of the rotation of the vortex to determine the sign of the charge.

Although the peripheral rotations show little correlation with position or polarity for individual spots, there seems to be a preferential motion that is direct for both preceding and following spots. There is good reason to believe that a change in the field strength, potentially inducing a rotation which coincides with that of the central vortex, would more likely be effective than that which would induce rotation in the opposite direction."

At present it appears that this sunspot phenomenon is due to some internal mechanism which brings about a segregation of electric particles, but data is too scarce at present for any definite conclusions. My study of rotation will be continued through the coming cycle.

From Mr. Morgan's past experience, here are a few pointers or hints in observing rotation: One of the most important factors in observing for sunspot rotation is the spot itself. In large spots there is no noticeable rotation, while smaller spots are too circular for study. Also irregular spots are likely to change their structure too rapidly for study. The most reliable spots for study are medium-sized circular spots with "tail" or oval spots. Spots for observation should be in the central zone, because an allowance must be made for the curvature of the sun's surface outside this zone, which results in complex observation.

Observations should be made daily of all spots in the central zone. The "tail" or major axis of oval spots should be noted in relation to the equator. By comparing any change of position of the "tail" or major axis with the original position, any degree of rotation can be noted. The location of the spot, the time, and the degree of rotation should be recorded as accurately as possible.

A NEW TELESCOPE DESIGNED FOR VARIABLE STAR OBSERVING, by Edward A. Halbach

Having spent over 22 years observing variable stars for the association, I find it increasingly difficult to spend long hours at the telescope, for the simple reason that one's body continually fights the elements, particularly when the temperature falls below 40° F. It has long been my desire to design a telescope which would give all the convenience that an armchair astronomer has in doing his astronomy. One finds in the literature a number of such attempts to make more convenient telescopes, such as: Springfield Mounting, Harkness Turret, etc.

The proposed design for the convenient reflecting telescope designed specifically for variable star work places the reflecting telescope indoors with the optical train completed through two larger flats. One is placed at the junction of the polar declination axis and the second at the end of the declination axis. The telescope is mounted rigidly concentric with the polar axis, the eyepiece fixed in the conventional location. The first flat rotates about the polar axis, carrying with it the second flat which then rotates in the normal declination axis, scanning the sky from north to south. The motion of the pair of flats about the polar axis allows scanning the sky from east to west in right ascension, The only requirement now is that the optical flat be of such dimension and quality that they will do a satisfactory job in maintaining good stellar images.

The mounting details for the two flats have been planned but not detailed. In essence, the combination can be exemplified by showing two right angle elbows at the end of the telescope, each elbow containing the flat mirror placed at a 45° angle with the optical paths through the elbow. Note that the optical reflections are always at a 45° angle to the normal surface of the flat.

The cost estimate of a telescope of this kind has not been made, but it would be considerably in excess of a normal telescope because the two large optical flats require a lot of work to provide the necessary quality of images in the final combination. (A model of the foregoing instrument was exhibited. ED.)

DOMINION ASTROPHYSICAL OBSERVATORY'S NEW SPECTROGRAPH, by Andrew McKellar

(Dr. McKellar graciously presented extemporaneous remarks about the new spectrograph at Victoria, B. C. A brief summary of salient features is reported here. The new spectrograph is used in conjunction with the 72" reflector. The optical plate is mounted on a supporting member, similar to a large telescope mount. Three-point suspension is used. Easily accessible through doors in the side, so that it can be worked on in an easy and convenient manner. The optical plate is of aluminum. ED.)

THE CAMPBELL VOLUME, by R. Newton Mayall

The purpose of this talk is to acquaint you with the status of the Campbell Memorial Volume. The plots made by David Rosebrugh have been received. They have been sorted in order of period, each curve has been laid out and the arrangement on the plates has been determined. I have with me a sample plate, inked in; and a reduction of it to the size of the final printed page, for your inspection.

There will be about 53 plates, and now that the various factors of layout have been accepted, we are ready to go ahead with the final sheets, and they will be ready for exhibit at the Annual Meeting, October 10, 1953.

RISE AND FALL OF AN 18-INCH TELESCOPE, by Claude B. Carpenter

(An off-the-cuff humorous talk about one man's experiences in having an 18-inch telescope made. ED.)

OCCULTATION MODEL, by John J. Ruiz

A model for the study of occultations with a photo-electric photometer has been built. The model consists of an artificial moon and star at one end of the room, while at the other end a small refractor is provided with a photo-multiplier tube which records the instant of occultation on an Esterline-Angus recorder. On the same chart time signals from WWV are recorded. The chart is run at about 1½" per second. The time of occultation can be recorded also by tapping a telegraph key. It is of interest to know that visual observers using stop watches and the AAVSO technique can obtain results closer to that of the photo-multiplier tube than the observer with the telegraph key who is as much as $0^s.4$ slow. There seems to be a compensation of errors when using the stop watch. The main purpose of the equipment is the timing of actual occultations when the opportunity presents itself.

CHARTS AND GRAPHS, by Margaret W. Mayall

(Our Recorder brought along a sampling of various charts, graphs, curves, and what-not that she uses for show -- and an impressive one, too. Light curves are unrolled by the yard - - sometimes it seems by the mile. The curve of AE Aquarii was particularly interesting. ED.)

##########