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

Edited by R. Newton Mayall

PAPERS PRESENTED AT THE NANTUCKET MEETING, JUNE 12-15, 1958

The 47th Spring Meeting of the AAVSO was held on Nantucket Island,Massachusetts, at the kind invitation of Dr. Dorrit Hoffleit, Director of the Maria Mitchell Observatory. It was our privilege to be a part of the 50th Anniversary Celebration of the founding of the Maria Mitchell Observatory. Also it is interesting to note that the AAVSO met on Nantucket exactly 28 years ago on the same date, June 14, 1930. This meeting also set two records -- the longest meeting and the largest. Nearly 100 arrived by air or by sea.

Nantucket lies almost 30 miles south of Cape Cod, Massachusetts. It is a gem of an Island, and we were blessed with perfect weather both day and night. Nantucket was a famous whaling center until the late 1800's and much of this great period in its history is reflected in its museums and stately homes. It is truly an island paradise. It was here that Maria Mitchell discovered the comet which won her fame.

The Maria Mitchell Association perpetuates her name, and keeps her birthplace as it was when she lived there. Beside her homestead is the Observatory, a small brick building set well back from the street, and next to the Observatory is the Director's residence. The three buildings frame a small lawn surrounded by flowers. Across the narrow street is the attractive Maria Mitchell Science Library, where our meetings were held. Our meeting time was purposely extended so that everyone would have at least one free day to tour the Island, which is only about 12 miles long and 3 miles wide. Most of our members took to bicycles, which is the approved form of transportation. Some enjoyed swimming; others hiking, visiting museums, and sailing. There was much for everyone to do in their spare time.

The treasured antiques of three centuries are well preserved, in its architecture, narrow lanes and streets. The cobble-stoned Main Street is one of its treasures. With never a land breeze, and the soft nights, made this one of the pleasantest meetings we have ever had. Friday night we had our usual lecture, which was given by Dr. Edward Lilley, of Yale Observatory, who spoke on Radio Astronomy and Rockets. This was followed by a sound motion picture in color, telling the story of Explorer I.

Among our members are many bird watchers, who went out early Sunday morning for a bird walk, under the guidance of Mrs. Clinton Andrews of Nantucket. To say it was successful would be an understatement to a birdwatcher, for at least 46 different kinds were recorded.

Among the distant members present were Maurice Barnhill of North Carolina, and the Charles Goods and Francis Morgans of Montreal. The ribbon for the greatest distance travelled goes to Marjorie Leavens of Denver, Colorado.

* *

THE FIRST FIFTY YEARS OF MARIA MITCHELL OBSERVATORY, by Margaret Harwood

Before briefly outlining the life of Maria Mitchell, Miss Harwood told of the first two observatories on the Island, those of Walter Folger, Jr., and William Mitchell, Maria's father. On October 1, 1847, Maria Mitchell was the first discoverer of a new comet, the discovery of which brought her fame and also added glory to this whaling center in the Atlantic. She was the first American and the first woman anywhere to receive the Gold Medal given by the King of Denmark for a comet too faint to be seen without a telescope. She became the first professor of astronomy at Vassar College when it was founded in 1865. In 1902 the Maria Mitchell Association was founded to perpetuate her name and accomplishments. The Association was incorporated in 1903 and the present Observatory was dedicated on July 15, 1908. It was built for the 5-inch Alvan Clark refractor which had been given to Maria Mitchell by the women of America in 1858. Miss Ida Whiteside, Vassar 1904, came as the first observer to use the telescope. She was followed by Dr. Florence Harpham of Columbia, South Carolina. It soon became obvious that a scholarship fund should be created, and the Association raised $10,000 which was matched with $15,000 from the Carnegie Foundation. Miss Harwood held the first fellowship from 1912-1915, and became the first Director of the Observatory in 1916.

In 1912 she worked on the variable stars TT Lyrae and Y Camelopardalis. Her next work was on asteroids which vary in brightness. This work began in December 1913, as soon as a 7 1/2-inch Cooke triplet refractor was installed in the same dome,using the 5-inch for a guiding telescope. Seventy-four asteroids which were brighter than the 10th magnitude at maximum were studied. Her next project was a Scutum Region, looking for variables and studying those already known. Other projects on meteors and eclipses of the sun were carried out.

The Observatory was founded expressly for the people of Nantucket. Before there was a permanent fellow, persons trained to use a telescope had the Observatory open to visitors, especially the school children of Nantucket,at least twice a month the year round. The fellow and director continued this practice, and many good observers have been found among Nantucket residents. During the years 1912-1914 the Zodiacal light was observed at two stations on Nantucket nearly a mile apart, by Mrs. Eugene S. Morris and Margaret Harwood. Mrs. Morris also became an enthusiastic observer of variable stars and in 1919 she and another observer, Mrs. Madeleine Norcross of Nantucket,joined the AAVSO. The 4-inch Clark refractor which Mrs. Morris bought from Mr. Leon Campbell was willed to the Association, and came to the AAVSO after her death in 1936.

It was not long before it became necessary to have assistance at the Observatory during the summer months, and in 1925 Miss Harwood's first assistant arrived in the person of Margaret W. Mayall, the AAVSO's present Director. Miss Harwood served as the Director of the Maria Mitchell Observatory until June 1, 1957 when she retired, and Dr. Dorrit Hoffleit was appointed the second director and is ably carrying on valuable research. Miss Harwood showed many slides depicting the work and personnel of the early years. (ED.)

THE CEPHEID VARIABLES AND THE REVISED DISTANCE SCALE, by Francis P. Morgan

Recent work made at Mount Wilson and Palomar Observatories by Walter Baade, Allan Sandage, Halton Arp,and others, have shown that the Cepheids obey a period-luminosity relation that is 1.5 mag., or four times brighter than the law for the cluster type. Accordingly, the distances of the neighboring galaxies were doubled, and since these provided distance yardsticks for determining the distances of the more distant galaxies and clusters of galaxies, the extent of the entire known universe was doubled accordingly. By 1955, it became evident the work of revising the cosmic distance scale would not be that simple. While the average brightness of the Cepheids was still 1.5 mag. brighter than former estimates, there was found to be a spread of 1.2 mag. for Cepheids of the same period. A probable reason for this is found by the work of Robert Kraft of Indiana, who has studied four galactic star clusters containing Cepheids. The distances of moving clusters can nowadays be determined with some precision. He finds the Cepheids in them to average 1.2 mag. brighter than the original estimates, in good agreement with Baade's estimates of 1.5 mag. brighter.

It was once believed that the period as well as the brightness depended on mass, but if age is also a determining factor, then the spread in the period-luminosity law is explained. While this helps us to understand more about the nature of Cepheid variables it complicates the problem of revising the distance scale. Therefore, a re-determination of the distances of the Magellanic Clouds and M31 has been made by a different method, that is, by a determination of the apparent magnitude of the novae appearing in them at maximum light.

Using this method, the distances of the clouds have been increased to 230,000 light years, almost three times the original estimates, and that of the Andromeda Nebula to 2,600,000 light years, or 3 1/2 times the original estimate. For the remaining members of the local group, an increase by a factor of three or of 1 1/2 times for the 1952-53 estimates, may not be far out. For distances beyond the local group, a much greater revision appears to be in order. There is much work still to be done. All that we can safely say at present is that the known universe is from 5 to 10 times larger than was formerly believed, our local group about three times more extensive, and the galaxies correspondingly larger than they were formerly believed to be.

Our galaxy was once believed to be unique in size. It appears that any conclusion which makes our position in the universe look conspicuous in any way should be looked upon with suspicion. It now turns out that our galaxy is only a little larger than average, and that one of our nearest neighbors, the Andromeda Nebula, is larger than ours. The age of the universe is increased by the same proportion as its extent. According to the old distance scale, the universe could not have started expanding earlier than 1.8×10^9 years ago. Since the oldest rocks were at least 2.7×10^9 years old, this put us in a dilemma. According to our present knowledge, the age of the universe could be 5 to 10 times greater than this, according to what the true distance scale should be, or 9×10^9 to 18×10^9 years.

NOVA SAGITTARII 1932, by Jean Anderson

Dr. Dorrit Hoffleit, Director of the Maria Mitchell Observatory, has been directing a program for the systematic determination of magnitudes of selected variable stars in MWF 193. In the course of estimating the magnitudes of the variable IR Sgr, I discovered a nova 30 seconds from IR. The first observation of the nova was at 15.4 magnitude on October 3, 1931; the next observation at 11.6 on April 3, 1932, and maximum brightness was observed to be 9.1 on a plate taken two days later on April 5, 1932. Then follows a slow rate of decline of about 1 magnitude in 100 days.

In all, some 1,475 plates were examined, taken between August 5, 1899 and May 23, 1958. No images of the nova were observed prior to October 3, 1931 nor subsequent to September 5, 1932. Within the approximately 8x10 degree field covered by the variable star survey VSF 193, ten novae have been previously discovered.

ASTRONOMY ON POSTAGE STAMPS, by Kenneth Baird

Mr. Baird is a summer resident on Nantucket, and it was there that he became interested in the sciences, particularly as related to the delineation of postage stamps. He began by collecting stamps depicting early scientists such as Copernicus, then astronomers, mathematicians and constellations. Mr. Baird pointed out that stamps can be used as a basic historical text which serves as an inducement to read further, thereby broadening one's knowledge in whatever field is memorialized on the stamps. Mr. Baird displayed a portion of his large collection, which was extremely interesting and beautifully exhibited. (ED.)

MISCELLANEOUS VARIABLE STAR NOTES, by Margaret W. Mayall

Charts hung around the room displayed up-to-date curves of several variables. Her commentary pointed out the interesting features of each curve. Of particular interest was one of Omicron Ceti (Mira) which showed a broad faint maximum in 1957-1958. Among other curves exhibited were those of Mira from 1922-1958, and of R Gem, AF Cyg, T Cas, and Z Cam; also a light curve of the RW Aurigae type variable, RR Tau, 1926-58.

UNUSUAL ASPECTS OF THE CURRENT SOLAR CYCLE, by Harry L. Bondy

Faculae and plages, corona and other solar phenomena seem to fluctuate in an 11 year period, in concord with the sunspot cycle. A typical cycle has three components: size, maximum and minimum. There are three types of cycles: 1) Low cycle, which has a slow advance; 2) Medium cycle, which has a maximum sooner; 3) High cycle, which has a maximum much sooner. It is necessary to determine the rate of rise of the cycle to determine the maximum. The lowest maximum was about 50 years ago. A large number of polar faculae were observed in 1952-54. (A more detailed report will be given in the Solar Bulletin. ED.)

SOLAR TETRAGONS, by James C. Bartlett, Jr.

The Winston Dictionary, college edition, defines a tetragon as "a plane figure with four sides and four angles; a quadrilateral." Not exactly the sort of figure one would expect to find in a sunspot. Notwithstanding, there is positive evidence for the existence of tetragonal sunspots, including photographic evidence. The form taken by the solar tetragon invariably is that of the rhombus; usually somewhat distorted but occasionally very perfect. This shape may be shared by umbra and penumbra alike; but frequently it will be confined to one or the other. Sunspot tetragons arise through an evolutionary sequence whereby a normally round sunspot is gradually transformed to the 'hard' shape of a tetragon. Moreover, this sequence is reversible. After attaining the tetragonal form it is not unusual for the spot to revert to a normally rounded shape.

Tetragonal spots are not to be regarded as separate sunspot types, but rather as peculiar states of development in the history of normal sunspots. Theoretically one might assume that all sunspots are capable of assuming the tetragonal form, but a glance at the statistics of their incidence suggests that very few sunspots become tetragons. Numbers of tetragons in relation to all sunspots counted:

Year	total spots	tetragons	Year	total spots	tetragons	Year	total spots	tetragons
1940	680	0	1946	2395	2	1952	1288	0
1941	6531	1	1947	3639	1	1953	632	2
1942	343	1	1948	6169	5	1954	69	0
1943	179	2	1949	6674	4	1955	2242	3
1944	127	0	1950	2956	5	1956	4951	5
1945	1520	1	1951	3787	2	1957	10122	5
						Grand Total	54304	39

Tetragonal sunspots therefore form a very small percentage of all sunspots observed, or one in every 1,392 according to the figures given. However tetragonal sunspots are commonly among the largest kinds, while the total of sunspots to which they are compared above includes thousands of very small spots. If comparison were made only to spots of comparable size the relative number of tetragons would certainly be increased, but in any case it is clear from their absolute totals that they would still be uncommon. The majority are quite large and among the most active types. Of the 39 tetragons observed since 1940 through 1957 no less than 23 were associated with bright bridges.

The tetragonal shape may occur in the whole spot or it may be confined to either the umbra or penumbra. Of the 39 tetragons considered, in 8 only the umbra was tetragonal with a normally roundish penumbra; in 16 the penumbra was tetragonal with rounded or at least non-tetragonal umbra; while in 15 both umbra and penumbra were tetragonal. This suggests that in most tetragonal spots the umbra and penumbra do not form a coherent system as we assume for sunspots in general. In other respects tetragons do not behave differently from other sunspots. A significant difference is found, however, in the apparent ages of tetragons as compared to other types. It was found possible to work out the average ages of 29 tetragons, yielding a mean age of 12.1 days. Five tetragons were found with apparent ages in excess of 30 days.

Possibly of more specific significance is an apparent relation to color. Thus of the 39 tetragons observed no less than 17 displayed color. No significant relation between the numbers of tetragons and the phase of the sunspot cycle can be established. We may sum up the statistics as follows: Tetragonal spots represent special cases of ordinary sunspots, or rather special and peculiar developments in the life histories of ordinary spots.

Tetragonal sunspots always comprise a minute percentage of all sunspots observed.

Tetragonal sunspots, apart from their form, do not show any significant behavioral difference compared to all sunspots, except for greater individual longevity and for a much higher ratio of colored to black types.

THE BRIGHT RV TAURI VARIABLES, by Edward G. Oravec

I believe I would be safe in saying that every variable star observer has at one time or another observed the famous variable, R Scuti, and should be familiar with its characteristic variation of the alternating deep and shallow minima (similar to Beta Lyrae). This star is the brightest and certainly the best known member of the RV Tau class of variable stars. First recognition of this grouping is rather vague, but the first definite criteria for assigning stars to this class was published some 30 years ago. Previous to this, these stars, of which only a few were known, fell into the general category of the semi-regular variable, to which, broadly speaking, they still belong.

RV Tauri stars are a rather exclusive group of variables. In the 1947 edition of the Kukarkin and Parenago "General Catalogue of Variable Stars," only 72 RV Tauri stars appear, out of the 10,912 variables listed. Most stars in this category are rather faint; only three attain 7th magnitude or brighter at maximum. The better observed variables of this class are RV Tau, U Mon*, TT Oph*, TX Oph*, AC Her, R Sct*, DF Cyg, R Sge, and V Vul. Only those marked with an * have standard AAVSO charts. It has been suggested that the RV Tauri stars are a type of transitional group between the Cepheids and Long Period variables. Most RV Tauri variables are located close to the Milky Way and their intrinsic luminosities are high. All such variables show spectrum changes, becoming redder as they decrease in light. The radial velocity is also variable. The periods and magnitude ranges are greater than the Cepheids and less than Long Period variables in the great majority of cases. Also the spectra of these stars are of a later class than Cepheids, but earlier than long period variables. The spectrum of the RV Tauri stars range from late F through G, K, and early M classes.

As for the light curves of these stars, generally the longer the period the more irregularities are present. The variations in the light curve are quite complex as may be seen by the charts displayed: R Sct (1845 to 1958), U Mon (1951-1957) and AC Her (1952 - 1957).

THE STARS ARE MY PHOTOMETER, by Norman B. Godfrey

At the very threshold of my career as a variable star observer, an idea occurred to me which has worked out so well that I should like to pass it on. It concerns a method for observing variable stars which I believe possesses much of the accuracy of a photometric method, yet requires no extra equipment other than a good low power eyepiece having a fairly wide apparent field. Its applicability is limited to small refracting telescopes of perhaps three-inch aperture or less.

I customarily focus with both eyes open. In this way the telescopic field seen with the right eye is superimposed on the actual night sky as seen with the left eye. When both star fields are sharp, the telescope is correctly focused at infinity, and eye strain is held to a minimum. While carrying out this focussing procedure in a variable field, I noticed that the backdrop of naked-eye stars included a large selection of different magnitudes. Among them I found a comparison star for my variable which matched it in brightness almost exactly when the two were observed together, one with each eye. By bringing comparison stars from the chart successivly into the field and close to the naked-eye comparison star, I found one which was again a perfect match. Since things which are equal to the same thing are equal to each other, I now had the sought-for magnitude. Ever since, I have been making my observations by what might be called the "method of naked-eye comparison stars."

One great advantage of this method is that it makes comparison stars relatively far from the variable as easy and accurate to use as those within the same field. Even a star from the edge of the chart can be brought as close as we please to the naked-eye comparison star. If they are placed side by side and <u>too</u> close together, there is sometimes a tendency for both stars to merge into a single image. It is therefore preferable to observe one above the other, if possible. The best place to focus the attention while making a comparison is on a point midway between the two stars. I use a 1 1/4-inch war surplus Kellner eyepiece to good advantage for magnitudes down to 10 or 11, and a 10x Bausch & Lomb wide-field microscope eyepiece for the brighter range up to about 6th magnitude.

This method of naked-eye comparison stars may be likened to a photometric method in which variation of an artificial star is replaced by selection of a real star of the proper magnitude. The selected star is then "calibrated" against the comparison stars from the chart. In my experience, the greater confidence which can be placed in the estimated magnitudes more than compensates for the slightly longer time required to make the observations. Only experience will prove whether the method is as accurate as I believe. I would like very much to hear of other observers' results.

NAKED EYE OBSERVATIONS OF ALGOL, by Frances E. Ruley

Miss Ruley is a sophomore in Nantucket High School. She exhibited a curve of Algol as observed with the naked eye from November 1957 through March 1958. Also she illustrated on large cards the method used to observe variables and the method of computing a light curve.

AROUND THE WORLD WITH MLLE. DEDEE LACERTAE, by John J. Ruiz

During the summer and fall of 1956, the Dutch astronomer, C. de Jager, conducted an around-the-world campaign to obtain photoelectric and radial velocity measurements on the fast variable No. 12 Lacertae (also known as DD Lac), which has a period of about 4 1/2 hours and variations in magnitude of only a few tenths. He had cooperation from 15 observatories, which included one amateur observer,and obtained several continuous cycles over a period of 24 hours on two occasions. A brief description of the equipment I used is presented on slides and exhibits. Actual records and curves also are shown. Work on reduction of the observations, which may take months, is now in progress at the Utrecht Observatory. (As usual, John's talk should be seen to be heard. He was the same old humorous John. His talk was fully illustrated with color slides and was accompanied by loud laughter and continuous applause. ED.)

MOON OCCULTATIONS, by Luiz Muniz Barreto

One of the most interesting and important types of observation is that of the occultations of the stars by the Moon. Up to relatively recent date, it was believed that the rotation of the Earth was uniformly executed, thus serving as a "clock" for the determination of time. The determination of time by the observations of meridian passages of stars, or by observations of orbital movements of the Moon and planets and their satellites, or by making use of terrestrial physical standards, must lead to the same results, and diversifications being accounted for solely by the little mistakes due to observations, table imperfections, or instrumental inaccuracies.

Since the end of the last century, it has been demonstrated by Newcomb that the fluctuations of the Moon's average movements could not be explained either by the Gravitation Theory, or by the table imperfections. The fluctuations are pointed out as the consequence of the Earth's rotation irregularities, which are of a changeable nature, thus producing advancements or tardiness in the duration of the day.

The study of the long period irregularities is done by the observed Moon's movement as compared to the calculated movement. This comparison can be achieved through the observations of the occultations of the stars by the Moon. As a matter of fact, the determination of the precise moment of an occultation, as compared with the calculated one, gives an excellent way of determining the difference between the terrestrial time given by the "clock" which marks the observed moment, and the time given by that "clock" which marks the calculated one, or "Newtonian" time.

It is believed that irregularities in the Earth's rotation belong to two different classes: those of long period and those of short period. Both are affected by irregular disturbing terms. The secular delay is due to the friction of the tides. The short period variations probably are caused by climatic-meteorological reasons, whereas the irregular disturbances are probably due to causes of geophysical nature which we have been unable to analyze with assurance and fail to foresee. The astronomical observations of the Moon, be it the occultations or meridian passages, have not achieved a degree of accuracy that may allow the discovery of the variations with a period shorter than a year, which are known as short period variations. On the other hand, the long period variations have been ascertained by these observations. The existence of short period variations became known through the constant temperature and pressure pendulums and by modern quartz clocks. In 1937 it was accomplished for the first time by Nicolas Stoyko, the study of the so-called "Newtonian time" or "ephemeris time."

OBSERVATORY ON KITT PEAK, by Charles A. Federer

Mr. Federer gave us a firsthand glimpse of the new National Observatory being constructed on Kitt Peak, Arizona. His slides showed the rugged terrain, and buildings both under construction and completed. (ED.)

CURIOUS LIGHT PHENOMENA, by Kenneth Weitzenhoffer

While flying over the sea en route to Nantucket, Ken looked out the window and observed a red horizontal streak extending over 90° of arc. The sun was above the line and its reflection was below. What was it? Several reasons were given, including a jet trail and fog.

* * * * * * * * * * * * * *

Abstracts of Dr. Edward Lilley's lecture on "Rockets, Radio and Astronomy," and Philip Seldon's paper "Magnitude Variations of Two Sputniks," were not received in time to be printed in this issue of the AAVSO Abstracts.