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

Edited by R. Newton Mayall

PAPERS PRESENTED AT THE QUEBEC MEETING, 12-14 MAY 1967

The AAVSO held its 56th Spring Meeting on 13 May 1967 in Quebec, Canada, at the kind invitation of the Quebec Centre of the Royal Astronomical Society of Canada. Dr. Paul Marmet, of Laval University and President of the Centre, unfortunately was unable to be present, but Mr. Yvon Dufour, Secretary of the Centre worked hard and long to make this meeting a memorable one. Mr. Dufour was an able and gracious host.

Again we were blessed with excellent weather. Some attended Expo 67 before the meeting and others were going to Montreal after the meeting. On Friday evening Dr. Ian Halliday, Research Scientist with the Dominion Observatory, Ottawa, spoke to us about "Some Problems in Solar System Astronomy". When speaking of Mars he pointed out its rotation period is 24^h38^m; that it has a quarter million craters; 70% is continent and 27% mare; erosion by wind is great; yellow dust clouds cover many details of Mars; and the canals may be ridges instead of depressions. In addition, Dr. Halliday brought along a couple of tektites which varied in shape. What makes them so different is their lightness and lack of water. They have less water content than any stone on earth. If they are of extra-terrestrial origin it is thought they could not come from a more distant source than the moon. Therefore some lunar material may be already available on earth.

On Saturday, the morning and afternoon were given over to business and papers. Late in the afternoon, a few visited Mr. Dufour's observatory outside of town, and on a hill. Here he has a beautiful sky, and overlooks Quebec. The building houses a 5-inch(125mm) Unitron. His building is circular and has the typical dome.

Before our Spring Dinner, we were treated to a Vin d'Honneur, as guests of the Quebec Centre. Our dinner was a very enjoyable occasion. For about an hour, after dinner, we were entertained by the Les Fantaisistes, a French-Canadian group of 10 singers, who acted out many of their songs. Following Les Fantaisistes, Clint Ford showed us many slides of his trip to Egypt, which included pictures of the Helwan Observatory and the astronomers; many archeological pictures; his trip down the Nile; and the resetting of the sculptures which would have been under water by the construction of the Aswan Dam.

Thanks to the Quebec Centre were given by Frank DeKender in English and French. There is no doubt this was one of our more delightful meetings, made especially so by Mr. Dufour of the Quebec Centre.

Those who did not attend missed much -- the old City of Quebec on the North Shore of the St. Lawrence River: its walls and old buildings, and many fine restaurants.

The Diedrichs' and Arthur Stokes of Ohio won the distinction of having travelled the longest distance.

OBSERVING TOTALS 1962-1966, by Curtis E. Anderson

This report is a supplement to my long paper on AAVSO observing totals published about five years ago and covering the first fifty years of our history from 1911 through 1961. This list contains the records of 762 observers active in the fiscal years 1962 through 1966. Of these, 555 names appear for the first time, bringing the total observers for the first 55 years to 2109. This report is subject to the same limitations as the earlier one as far as sketchy records in some of the earlier years. Nevertheless, I am confident it is as close to official as we can ever get. For the past thirty or so years there are no omissions at all, and

any errors are strictly my own as I do not claim infallibility. The only new references used were the Annual Reports of the past five years. Again the dates listed after each name represent the years the name appeared in the Annual Reports, and not necessarily the actual years in which the observations were actually made. A list of the top observers of all time and a list of the leaders for the five year period were both published in Variable Views for March 1967. Our South African ace Reginald P. de Kock topped both listings.

TABLE ONE
Top 25 Observers in the Last Five Year Totals

Reginald P. deKock,S.Africa	25,482	Marvin E. Baldwin,Missouri	11,012
Cyrus F.Fernald,Me., Florida	19,340	William I. Lowry, California	8,646
Carolyn Hurless, Ohio	18,294	John E. Bortle, New York	8,403
Thomas A. Cragg, California	16,995	Domingo Taboada, Mexico	7,001
Curtis E. Anderson,Minnesota	15,549	Ferdinand Hartmann, New York	5,818
Leslie C. Peltier, Ohio	15,117	Lancaster Hiett, Virginia	5,696
Edward G. Oravec, New York	14,223	Larry Bornhurst, California	5,472
Rodrigo de la Vega L., Chile	14,014	Etsuiku Mochizuki, Japan	5,411
Robert Monske, Pennsylvania	13,625	Miguel A. Cerruti, Argentina	5,188
Mario Vattuone, Argentina	13,160	Diane Lucas, Ohio	4,931
Roger S. Kolman, Illinois	12,491	Robert F. Swanberg, Montana	4,568
Robert M. Adams, Missouri	11,876	Hideo Honda, Japan	4,405
Clinton B. Ford, Connecticut	11,512		

TABLE TWO
The 10,000 Club

Reginald P. deKock, S. Africa	1934-	142,639
Cyrus F. Fernald, Maine,Florida	1937-	123,784
Leslie C. Peltier, Ohio	1918-	111,224
Edward G. Oravec, New York	1943-	66,320
Ferdinand Hartmann, New York	1932-65	61,238
Giovanni B. Lacchini, Italy	1912-63	52,812
Eugene H. Jones, New Hampshire	1924-44	44,763
Thomas A. Cragg, California	1945-	44,284
Curtis E. Anderson, Minnesota	1952-	37,712
Rhadha G. Chandra, India	1920-54	37,215
Paul Ahnert, Germany	1928-65	36,817
Robert M. Adams, Missouri	1949-	34,006
David W. Rosebrugh, Florida	1933-	32,586
James M. Baldwin, Australia	1914-41	30,710
Clinton B. Ford, Connecticut	1928-	29,909
Domingo Taboada, Mexico	1945-	25,173
Tilton C.H. Bouton, Florida	1912-47	24,040
H.E. Houghton, S. Africa	1926-42	23,589
Carl J. Renner, Michigan	1944-65	22,776
Rodrigo de la Vega L., Chile	1959-	22,063
Eppe Loreta, Italy	1934-41	21,067
Carolyn J. Hurless, Ohio	1959-	19,391
Joseph W. Meek, New Mexico	1930-53	19,187
Demetrius P. Elias, Greece	1946-56	18,349
William L. Holt, Maine	1934-47	17,563
Constantin Chassapis, Greece	1946-65	15,071
G.E. Ensor, S. Africa	1926-40	14,952
Morgan Cilley, West Virginia	1923-50	14,906
Robert Monske, Pennsylvania	1965-	13,625

Mario Vattuone, Argentina	1964-	13,160
H.C. Bancroft, New Jersey	1912-21	13,126
Roger S. Kolman, Illinois	1962-	12,491
Walter S. Houston, Connecticut	1932-	11,989
Charles Y. McAteer, Pennsylvania	1912-24	11,903
Ralph N. Buckstaff, Wisconsin	1929-65	11,582
Marvin E. Baldwin, Missouri	1961-	11,220

PROGRESS REPORT ON PREPARATION AND AVAILABILITY OF NEW AAVSO CHARTS FROM FLOWER OBSERVATORY SEQUENCES, AS OF MAY 1, 1967, by Clinton B. Ford

Since its inception over one year ago (See these Abstracts for May 1966), the project of making new AAVSO Charts from "Olivier Sequences" has progressed as follows:

1. Eight of the ten new charts listed in the May 1966 AAVSO Abstracts have been completed in final ink tracing, and standard blueprint copies are now available from AAVSO Headquarters. The two exceptions are 152703 WW Ser d, and 085300 TU Hya b, which are awaiting slight revisions.
2. Final ink tracings are completed, and blueprints now available for: 022132 S Tri d; and 051316 X Lep e.
3. Pencil tracings for the following have been completed and given at least a preliminary sky-check:

063026a	BR Gem	d and e	160710	DN Her	d
073400	GK Mon	d and e	162623	DO Her	d
083013	UY Cnc	d	164907	V970 Oph	d
085203	WW Hya	d	165504	V855 Oph	d
142204	AE Vir	d	171904	V759 Oph	d
155420	AH Ser	d	175423	FU Her	d
155502	BC Ser	d	181512	V450 Oph	d

4. Final sky-checks are completed, and pencil tracings are now ready to be inked for:

055610	DP Ori	d	081710	GG Hya	d
061925	VV Gem	d and e	172703	WW Ser	b
063909	FX Mon	b,c and e			

5. Rough verifax copies of most of the pencilled charts listed in items 3 and 4 above have been made and sent to a selected list of active and interested observers with large telescopes. These copies (black on white) will eventually be superseded by final blueprints.

All of the usable original photographs and field sketches covering Dr. Olivier's observing program from 1928 to 1954 have now been received from him, and a careful inventory of the material indicates that new AAVSO charts should eventually be producible for a total of 78 long period or semiregular variable stars which are not now on the AAVSO observing list.

In addition to working with this Olivier material, it is now planned to make new and revised ink tracings for the following, the basic material being furnished by observers as noted:

000612	2.1937 Cet (= HV 8002)	b and e	Bornhurst, Cragg
181141	Nv Her 1963	d and e	Houston, Ford
183138	LL Lyr	d	Cragg
041831	AH Eri	d and e	Cragg

It is expected that as Cragg's AAVSO Cepheid observing program expands, final re-

visions of his charts for these stars will be ink-traced and made available for general blueprint distribution.

Sky-checking of pencilled tracings has been done with the writer's 12 1/2-inch reflector in Connecticut, and also by Cragg with the 6-inch refractor at Mt. Wilson Observatory. Other observers who have received the preliminary verifax chart copies are asked to note errors and omissions and send corrections to the writer, for inclusion in final inkings.

With continued excellent cooperation from Dr. Olivier who has furnished most of the basic material, our Clerk R.N. Mayall who has generously furnished high-quality tracing cloth and much advice on drafting, Messrs. Cragg, Dornhurst, and others who may help in the work of sky-checking the new charts, it is hoped that during the next year many more of the 78 new variables can be added to the AAVSO observing list.

AN INFRA RED PHOTOELECTRIC PROGRAM ON CERTAIN M TYPE VARIABLES, by Arthur J. Stokes

For many years AAVSO members have been making visual observations of the brightness of long period variable stars. A survey of the catalog list of observed variables shows that the greater part of these stars fall into spectral class M, and a further distribution into the M type subclasses shows a concentration in types M3 through M7.

In a discussion of M type stars with Nancy Houk at the Warner & Swasey Observatory in Cleveland, she suggested the possibility of a photoelectric program on measurement of V minus I magnitudes of a selected list of stars. She subsequently made up a list of 42 stars which might be observed. To this list I have since added another 25 stars taken from the Arizona-Tonantzintla Catalog. In general, the stars selected are those which are fairly bright at maximum. With the low sensitivity of the infra red photomultiplier tubes, there is some uncertainty at this point as to how far down these stars can be observed with my equipment. The slides showed the list of selected stars.

After a considerable delay, I am finally getting started with this work. My original plan was to use Kron's color system referred to in his paper on Photoelectric Photometry of Galactic and Extra-galactic Star Clusters, published in 1960. The recommended Schott filters were obtained for use with an RCA 7102 infra red photomultiplier tube. With this system several stars were observed in the visual and infra red color bands.

With the more recent work of Johnson on Interstellar Extinction in the Galaxy and the publication of the Arizona-Tonantzintla Catalog, it appeared that the color system should be modified to bring it as close as possible to the Johnson color standards. In a letter from Dr. Johnson I have learned that interference filters were used in his work. I am presently checking on the possibility of obtaining the same type filters for this program. The color transformation curve of my observations plotted against the Arizona-Tonantzintla V-I values indicates a greater difference between my color system and that used by Johnson. The peak of the V color band used by Johnson is at 5400 Å and the infra red color band at 8600 Å with the long wavelength cutoff set by the photomultiplier tube at 12000 Å.

Although the real observational part of this program has not started, it is hoped that results will be reported at future meetings of the AAVSO.

THE GRAZING OCCULTATION OF OMEGA CANCRI, by David Dunham

A little over a year ago, Mr. Van Flandern and I organized an expedition to successfully observe a grazing occultation of 13 Tauri about 30 miles east of Montreal. Timings were secured with the U.S. Naval Observatory's cable apparatus. During Sunday evening, May 14-15, we have an opportunity to repeat this observation. The grazing occultation of 5.9-magnitude Omega Cancri will be more favorable, in some respects, than the grazing occultation of 13 Tauri, and will be visible about 40 miles southwest of Quebec City. All observers are invited to participate in this expedition.The U.S.N.O. cable will be used again for timings.

Since the grazing occultation of 13 Tauri in April last year, the Milwaukee Astronomical Society, and three groups in California, the Mt. Diable Astronomical Society, the Riverside Astronomical Society, and the Santa Barbara Star Cluster, have built cable equipment similar in principle to the U.S. Naval Observatory's apparatus. During the past year, 9 grazing occultations have been successfully observed using such equipment.

(The expedition to observe the graze was set up near Lourdes, Quebec, early Sunday evening. Two members of the French Centre in Montreal joined the Yale-AAVSO contingent. Nine stations were originally manned, using the U.S. Naval Observatory cable, but amplifier failure disabled the entire cable during last minute tests, and only independent timing equipment could be used. Six stations functioned during the graze, but high cirrus clouds made the star difficult or impossible to see for all but two observers. David Dunham definitely saw a miss at his station, and Lawrence Nadeau made some questionable timings further to the South, though it will not be known until further analysis whether the events actually occurred or were due to seeing effects. Several independent observers made efforts to observe the graze from Maine, but it is not known whether they were successful or not. In any event, the observations of Dunham and Nadeau indicate a large unpredicted southern shift in the moon's position. -- Lawrence B. Nadeau)

THE CHANGES IN SHAPE OF THE LIGHT CURVE OF 185243 R LYRAE, by David Florkowski

185243 R Lyrae varies in brightness with a period of about 48 days. Individual cycles differ greatly in period and shape. In a previous paper the variations in the period of R Lyrae were studied. In this paper the variations in the shape of the light curve are studied.

R Lyrae was discovered by an English amateur astronomer, Baxendell, in 1856. Since its discovery R Lyrae has been studied by several people. Okouneff (1926) shows that many values have been reported for R Lyrae's period. Baxendell found a 48 day period, Yendell found a 0.97955 day period, and Pannekock found a 47 day period. Payne-Gaposchkin (1938) lists a period of 50 days. Ashbrook (1948) gives a period of 45 days. None of these studies included any work on the changes in shape of R Lyrae's light curve.

The light curve of R Lyrae used in this paper was made from visual observations published in the AAVSO Quarterly Reports #19-26(1953-60), and four years of the author's observations made in 1962-66 with a 2.4' refractor. Lightcurves obtained from this method may be distorted due to the tendency of an observer to avoid or prefer estimates equal to the brightness of the nearby comparison stars. To overcome this difficulty, the shape of the light curve to be studied was expressed in terms of three parameters, the amplitude, epsilon, and zeta.

The amplitude may be defined as

$$\text{Amp.} = Mg - mg$$

Amp. = amplitude
Mg = magnitude at maximum
mg = magnitude at minimum

Epsilon may be defined as

$$\varepsilon = \frac{(\text{phase of M}) - (\text{phase of m})}{p}$$

M = maximum
m = minimum
p = period in days
ε = epsilon

Zeta may be defined as

$$\zeta = \frac{m'(\text{phase} = .5) - \bar{m}}{\text{Amp.}}$$

$\bar{m}$ = average magnitude $= {}^1/_2 (Mg + mg)$
$m'(\text{phase} = .5)$ = magnitude at which interval between rising and descending branches is $^1/_2$ the period
ζ = zeta

Before these parameters are discussed some terms used in this paper should be clarified. Minima and maxima were determined by the method of Campbell and Jacchia(1941). In order to be considered a minimum there must be a drop of at least .2 magnitude because the probable error is about $\pm$ .2 magnitude. It should be noted that maximum and minimum magnitudes do not refer to extreme magnitudes, but the magnitude at the date of maximum and minimum. Minima were used to determine cycles because they are more sharply defined on the light curve. The period was considered to be the time elapsed between successive minima.

Referring to the definition of epsilon it can be seen that epsilon is always negative because maximum occurs before the next minimum and so has a smaller numerical phase value. It can also be noted that

If phase of M = $^1/_2$ p then ε = - .5
If phase of M ($^1/_2$ p then ε) - .5
If phase of M) $^1/_2$ p then ε (- .5

Referring to the definition of zeta it can be noted that if $m'(\text{phase} = .5) = \bar{m}$, then zeta will equal 0. This will occur if the slopes of the ascending and descending branches have the same absolute value. The value of zeta depends on the descending and ascending rates and the time spent at maximum.

If there is any regularity in the changes in shape of the light curve of R Lyrae, then one or more of these parameters should show some regular change.

From the light curve 69 minima and 31 maxima were determined. Gaps in the observations and times of nearly constant brightness did not permit some maxima and minima to be determined.

The calculated values of the three parameters were disappointingly scattered. The values were graphed using parameter-epoch (time) axes. There appears to be no

regularity in R Lyrae's change in amplitude. In the changes in the epsilon parameter there appears to be a possible 25 cycle period. Every 25 cycles epsilon is at its lowest point, or in other words the maximum occurs later than one-half the period. For the zeta parameter there may be a 22 cycle period, but this appears to be rather uncertain.

It must be concluded that there is no definite regular change in the shape of R Lyrae's light curve. More observations of R Lyrae over a longer period of time are needed. In the past the number of observations was small, giving large gaps in the light curve. More complete coverage is especially needed.

Although no definite results were made in studying the changes in shape of a light curve, this branch of study looks promising. It would be interesting to study the light curves of other variable stars, particularly 213244 W Cygni, and see if they exhibit any regularity in changes in shape of their light curves.

References

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(This paper made the Honors List of the Westinghouse Science Talent Search. ED)

055646b SV AURIGAE -- AN IRREGULAR VARIABLE, by Robert E. Crumrine

Located about two degrees northeast of β Aurigae is an interesting irregular variable -- SV Aurigae. The 1962 Chart Catalog gives its range as 10.8 - 11.3 pg, but observations from November 1966 through mid-April 1967 show a visual range of from 9.4 through 10.3. Between November and early February, observations were rather sparse but the star was seen to vary irregularly between 9.4 and 10.3. Since then, however, it has remained at 9.6, as observed in more closely spaced intervals.

As for the period, it seems to be irregular but the early sparse observations could have easily hidden a regular period. It is definitely steady now (mid-April), as it never changes by more than .2 mags. One night I observed it two times a couple of hours apart but no change was observed. I now observe it every night.

This star is an interesting one to follow and should be observed every night.

HOW TO RUN A CENTENNIAL PROJECT, by Charles M. Good

Mr. Good has set his goal on 100 occultations this year. He explained how he was trying to attain this number. Just what do you do to get people out to observe an occultation? Mr. Good is using various devices, including postal cards. He has obtained some cute and meaningful post cards upon which he writes notes to the observer. Some of the cards may be reminders of an occultation to be, and some may be gentle reminders that the observer goofed. (ED)

A STUDY OF SEVEN RR LYRAE STARS, by Marvin E. Baldwin

At the last Spring Meeting in Chicago a paper written by Robert Monske on observational studies of RR Lyrae stars was presented which dealt with our progress in organizing a visual observing program and some specific findings.

More recently I have completed a study of 1443 observations of seven RR Lyrae stars, BH Aur, TT Cnc, SZ Hya, VX Hya, DH Hya, RR Leo, and WW Leo. My method was to apply heliocentric correction to the individual observations, reduce the observations to a phase position relative to some established elements, align them in the order of their phase positions and group them for phase and brightness step averaging to obtain the points forming the mean light curve. The Pogson method was used to determine the point of maximum on the mean curve and plots of individual maxima were then overlaid on the mean curve to determine individual times of maxima.

The ease or difficulty with which this procedure could be applied varied greatly from star to star. The 11 maxima of DH Hya and 9 of RR Leo each fit the mean curves with textbook precision. The 6 maxima of WW Leo were almost as consistent although some maxima appeared slightly brighter than others. Fitting the 7 maxima of TT Cnc and 6 of BH Aur to mean curves became more difficult. Both stars sport very noticeable deviations in time of maximum, brightness at maximum and shape of the light curve.

If TT Cnc and BH Aur were difficult, VX Hya was almost completely unmanageable. In his paper of a year ago, Mr. Monske notes that VX tends to skip maxima. Of 15 scheduled maxima included in my study, 2 failed to appear and the remaining 13 varied from little more than detectible to about three times the mean brightness range. Further, VX is highly inconsistent relative to the time that it reaches maximum. I have found no cyclic tendencies to these variations, but with more data this could be an interesting search.

Eight maxima of SZ Hya display large and unmistakable deviations in maximum brightness, light curve shape and times of maxima -- made the more interesting when compared with a photographic study made by Leif Robinson, IBVS #69, 24 September 1964. He illustrates longer term variations that had been underway almost constantly for more than 50 years following the turn of the century. He also cites more recent observations, 1959 to 1962, indicating a lengthening period. My data indicate that this lengthening of period has been arrested.

This paper has outlined some of the specific short term results of an observing program for RR Lyrae stars. Let it suffice to say that much planning is required to obtain data at the proper time and the observer must develop a skill for differentiating between small differences in brightness without personal bias.

Mr. Monske and I would be delighted to have other serious observers join our program. My address is: 714 Langley Drive,Whiteman AFB, Missouri 65301.

THE INVASION OF THE GREY GIANT, by Margaret W. Mayall

Yes, the Grey Giant -- not the Jolly Green Giant -- has come to AAVSO. This is a beautiful IBM Key Punch, that is supposed to solve all our problems, except lunch. But it cannot help us solve these problems, unless the observers themselves cooperate, because the machine does not think. Also a key punch operator does not think. Therefore, it looks as though in trying to solve some major problems we are getting into some minor ones.

Mrs. Mayall mentioned several of these problems, which are going to be real sticky ones. Most of them concern the observers.

One of these is, that each observer must be very careful to get the proper designation number and star name correct. We are going to have to set up standard punch cards for each star and its designation, so that after all observations have been punched, the standard set can be used to throw out all wrongly defined stars. Now, you wouldn't want to see your observations being thrown out all over the floor, would you! The

way to avoid that is to be sure your designation and star name are correct.

Secondly, there is another grave problem which besets us now, but will be worse when the key punch operators get going, for we find they cannot read. That is, unless everything is very legible, the operator isn't going to waste time trying to find out what you have written. Therefore, you must be careful to have all your reports legible. No sloppy, careless, or overtyping can be used. The operator just can't be bothered. This is not a criticism of anyone's report in particular, but all observers must realize that as we go into mechanization we derive many benefits and your help is urgently requested so that we do not lose observations through illegility, carelessness, or what have you.

Mrs. Mayall emphasized the foregoing two points. There is also one more thing that should be mentioned. Be sure that you copy correctly from the records made at the telescope. So we have three things that are going to be important in the use of the Grey Giant:-

1. Correct designation and star name.
2. Legilibity.
3. Correct copying from telescope record.

Mrs. Mayall then displayed some of the cards that already have been punched. Doubtless we will hear more from Headquarters about instructions for your reports, as we get further into the working of the I.B.M. There are still a few minor problems to be solved, but they have nothing to do with the observer. It is very obvious that we have to be on our toes every minute or the Giant will find us out. (ED.)

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