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

Edited by R. Newton Mayall

PAPERS PRESENTED AT THE GEORGETOWN MEETING, MAY 18 - 19, 1962

The 51st spring meeting of the AAVSO was held at Georgetown University, Washington, D.C., at the kind invitation of Father Heyden, director of the Observatory. Although we can sympathize with some whose plans to attend the meeting were changed,possibly by the extreme heat, those who did attend were well rewarded, for Father Heyden had arranged a most interesting program, and an exciting trip to the Goddard Space Flight Center. Also we are indebted to Majorie Williams, the Chairman of the local Committee, for her part in making this a successful meeting. From Thursday on, the temperature was in the high 90's; but air conditioned meeting rooms and a sumptuous hotel, with swimming pool, alleviated the heat.

Friday evening we met in the beautiful Hall of Nations in the Walsh Building, to hear Father McCarthy tell the story of the Vatican Observatory, which was set up for purposes of calendar reform under Pope Gregory XIII. Through the years it had its ups and downs; but Father McCarthy pointed out that it was here that Father Secchi designed the photometer which he used in the discovery of the stellar spectrum sequence. A monument to Secchi may be seen in the Villa Borghesi, in Rome.

It was at Georgetown University that Father Hagen began his famous atlas, Stellarum Variabilium, which he continued at the Vatican Observatory. The 20th Century has seen the old observatory rise to a prominent position in astronomical circles.

Vatican Observatory is situated on the grounds of Castel Gandolfo, built before the 14th Century, and it commands one of the most beautiful views in the world. Below it are the famous gardens and the Crypto Porticum which dates from the 2nd century.

The present director is our friend and member, Father O'Connell, who has done so much on variables and the solar green flash. Also at the observatory is the Julian Calendar plaque commemorating the calendar reform instituted by Gregory XIII.

Many of us will never see this famous summer residence of the Popes, but those who have were particularly impressed with the completeness of Father McCarthy's descriptions, both oral and with color slides. Every important detail of history, geology, day by day life and the town fiestas was set forth, so that one could say he had been there. In fact, Father McCarthy showed us more than we might see on a personal visit.

A pleasant social hour followed the talk and small groups gathered in the restaurant of the hotel and carried sociability in to the wee hours.

Saturday dawned bright and clear and very hot. The meeting for papers (see abstracts) convened in the Faculty lounge. At noon the usual photograph was taken. Promptly at 1:15 we boarded a bus to take us to the Goddard Space Flight Center, which is the nerve center for keeping track of our satellites, both manned and unmanned. We spent the afternoon visiting the various laboratories, the communication center, computing center and so forth. We saw a satellite being put together and had the opportunity to examine many of its parts at close range. The technical staff were generous with their time and gave us many physical demonstrations with models, of the problems involved and how some had been solved.

This was a wonderful treat for all of us. It was exciting, entertaining, and educational. A most profitable visit. Upon leaving the center each person was given a kit containing background information on an orbiting solar observatory (OSO), orbiting astronomical observatory (OAO), project Mercury Ground communications network, basic problems in space science, sounding rockets, cut-a-way diagrams of the atmospheric structure satellite and the energetic particle satellite (Explorer XII), together with photographs.

The kit will be a very useful thing for members to have, when they are asked questions about satellites, by the lay public.

Prior to dinner we gathered in the Faculty lounge for a social half hour and apertifs. Dinner was a delight and was followed by a talk by Miss Jocelyn Gill, (see abstracts) who has been working with our astronauts, Shepard, Glenn, et al.

This was followed by a short reel of movies, and color slides of several meetings that were taken by Clinton Ford, and a few slides of Bradley Observatory in Decatur, Georgia, taken by J.H. Carlisle.

After dinner we visited the observatory, which is well equipped with the usual astronomical instruments and a small digital computer. The University stretches along the banks of the Potomac River. The observatory is at an elevation high enough to afford a good view of Washington, which is particularly striking at night.

Father Heyden was a gracious host and made us feel right at home.

Credit for travelling the longest distance goes to the Morgan's, from Montreal, Canada, and to Donald Zahner, from St. Louis, Missouri.

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PREDICTING THE NEXT SUN-SPOT MAXIMUM, by Charles H. Smiley

About seven years ago, I presented to the AAVSO a set of six predictions of the sunspot maximum then approaching, made by five of my students and myself. They were:

Wackerling	1957.1	130	
Barstow	1957.1	145	AAVSO
Smiley	1957.5	166	SDB
Watts	1957.5	192	119-20
Ray	1957.7	105	
Hohol	1958.5	86	

For comparison, the maximum was 1957.9 195

Now with the highest maximum in sunspot history behind us, we can begin to think of the next minimum and of the following maximum. It has been said that it is not possible to predict the time and height of a maximum until the minimum preceding it has occurred. It has been customary to predict a maximum on the basis of the rapidity of the rise following a minimum. I have shown that the curvature of the sunspot curve at minimum is about equally valuable for predicting the next maximum.

Recently I gave an advanced class in astronomy at Brown University the problem of predicting the next minimum <u>and</u> the next maximum, both in time and height. They were to evaluate a whole series of coefficients of correlation, looking for a relation that would be useful for prediction purposes; they were then to predict both the minimum and the maximum. Because the problem looked interesting, I tried my hand too. It is not possible to offer here all of the various methods examined and used for prediction. Concerning my own prediction, I can say that I assumed that the last maximum was a maximum of maxima, that is, that it will prove to be higher than the preceding and following maxima. I also assumed that a basic similarity exists among the various maxima of maxima, best described in terms of "second differences of maximum values, measured in units of the highest maximum value". I also used a second approach in which I assumed that after 16 sunspot cycles, the sunspot curve may be obtained by adding a relatively simple function to the function which described the earlier cycle; this amounts to an extrapolation of a small corrective function. One can argue in support of this approach, by calling attention to a method of predicting planetary conjunctions with the sun.

The predictions offered are these:

James Dodge	9.0 at	1963.8	and	170 at	1967.4
Robert Brown	10.1	1963.8		164	1968.1
Charles Smiley	6.9	1964.6		133	1969.3
Walter White	9.7	1964.0		100	1969.0
Wesley Green	10.7	1964.9		62	1970.7

When the minimum is past, my young colleagues and I feel that we can predict the next maximum with greater certainty. We have agreed that the maximum after the next one will be unusually low.

FILTER PHOTOMETRY PROGRAM FOR THE AAVSO, by Charles Giffen

The human eye adapted to stellar photometry is a curious organ. It is a rather sensitive instrument and has a very fast response time. For photometry, it also suffers from a variety of defects. One such defect is that it must always be used as a comparator between two stars; for the ability of the eye to accommodate to varying levels of illumination prevents it from making absolute or direct brightness measurements. But that is not so serious

The principal defects arise from the eye's reaction to color. The two sensitivity levels, day and night vision, have their maximum sensitivities in different colors -- day vision is most sensitive to yellow light at 5500 angstroms, and night vision is most sensitive to green light at 5100 angstroms. The "crossover" between these two sensitivities (i.e., the point at which day vision becoms inoperative) occurs from 2 1/2 to 4 magnitudes above the visual threshold. The Purkinje effect is that notorious defect of comparing stars of different colors: light of a given wavelength appears to the eye to become brighter relative to light of a shorter wavelength as one increases the total light of the system; conversely, light of a given wavelength appears to the eye to become fainter relative to light of a longer wavelength as one increases the total light of the system. Note that the Purkinje effect is not limited to red light; it occurs whenever there is a color difference among the stars being compared.

This weird behavior of the eye on two counts, different maximum sensitivities and the Purkinje effect, leads to nearly all of the inaccuracies in observed magnitudes of stars through visual methods. One interesting anomaly is brought about by the varying dark-adaption of the eye during observing and by eye fatigue at the retina caused by subjecting it to light for varying lengths of time: these alter the effective amount of total light on the retina and can thus introduce the Purkinje effect in a matter of seconds as one is observing. And with different apertures used by observers, the errors are grossly large: observers using alternately 5' and 16' telescopes under otherwise identical conditions have recorded discrepancies of greater than a magnitude!

The reason for selecting a filter to reduce these errors is rather obvious: with the proper filter the eye sees essentially monochromatically. Observed light with such a filter is so nearly one effective wavelength that the color defects of visual photometry cannot and do not arise. But in choosing such a filter, one also needs the fulfillment of several criteria which are set forth below.

In order to be at all practical the filter used must have its maximum transmission at a wavelength near the greatest eye sensitivity. The effective wavelength of the eye-filter combination must remain quite constant whether the eye is seeing with day vision or with night vision. Hence, with extremely faint stars it must be possible to remove the filter and not alter the effective wavelength of an observation -- that is, when dimming of the field caused by the filter becomes bothersome, it must be possible to remove the filter to make an unfiltered observation and still observe at the same effective wavelength. This dictates two things: first, that the effective wavelength of all observations, and hence with the filter, be at 5100 angstroms, which is the maximum sensitivity for night vision; and second, that the filter dimming not exceed 2 to 2 1/2 magnitudes so that there will be no brightness range where unfiltered observations, when necessary, would be made using day vision. The filter should be compatible with existing standardized photometric systems if possible. Of course, in the end, the chosen filter must cause a decided improvement over observations made without one.

The Kodak Wratten 57 filter has very nicely satisfied the above criteria. Two and a half year's tests have shown that the Wratten 57 yields the following principal gains over unfiltered visual photometry: 1) errors arising from color defects are completely suppressed to negligible amounts; 2) absolute and probable errors and standard deviations obtained from actual observations are fantastically small in the light of those which have heretofore been possible; 3) sky background is actually reduced considerably with the filter -- a side effect as a bonus. Other points in favor of the filter are: 4) the filters are inexpensive, making it possible to obtain a large quantity at an extremely reasonable cost; 5) there is no essential alteration of observing procedure necessary; 6) the filters have been calibrated and rechecked for three years and are stable; 7) the effective wavelength of the eye-filter combination is 5100 angstroms and is constant to a high degree of accuracy between day and night vision; 8) the dimming caused by the filter is only 0.95 magnitude -- well within the limits required above.

The observational procedure that has been adopted with the Wratten 57 filter is as follows. An observation of the star in question is made with the filter if possible; if it is so faint that an observation would be at or below the threshold with the filter, then the observation is made without the filter. Magnitudes thus obtained with the filter are followed by "G" (record 10.3 G for an observation of 10.3 with the filter); magnitudes which cannot be obtained with the filter but which are determined by the eye without the filter are followed by "E" (record 14.8 E for such an observation without the filter).

Seventy-five variables of various types and the Orion Nebula variables are listed for special concentration with the Wratten 57 filter. They should be observed as often as possible, due respect being given their periods.

Variable Stars for Observation with Kodak Wratten 57 Filter

* 001838	R And	* 053531	U Aur	* 123160	T UMa	191629	AV Cyg
002725	TU And	054319	SU Tau	123459	RS UMa	* 193449	R Cyg
002725	C1 And	054920	U Ori	123961	S UMa	* 194632	X Cyg
002725	C2 And	060547	SS Aur	* 132422	R Hya	* 194929	RR Sgr
002725	"var" And	063308	R Mon	* 140528	RU Hya	195109	UU Aql
005840	RX And	065326	SW Gem	* 151714	S Ser	201520	V Sge
* 012502	R Psc	* 072820	Z Pup	* 151731	S CrB	203501	AE Aqr
013418	UV Cet	073520	Y Gem	* 154615	R Ser	* 204405	T Aqr
* 021143	W And	074922	U Gem	155526	T CrB	213843	SS Cyg
* 021403	o Cet	080319	RV Cnc	164025	AH Her	220843	RS Lac
021558	S Per	080362	SU UMa	164403	TT Oph	220843	RY Lac
021937	BI And	081473	Z Cam	165905	TX Oph	220912	RU Peg
033362	U Cam	082953	SW UMa	174406	RS Oph	* 221321	X Aqr
041619	T Tau	* 090425	W Cnc	181631	TU Lyr	* 225120	S Aqr
042215	W Tau	092720	AB Leo	183149	SV Dra	230552	RZ And
045514	R Lep	094211	R Leo	184137	AY Lyr	231040	TY And
050022	T Lep	094512	X Leo	184205	R Sct	232848	Z And
052801	V371 Ori	104814	W Leo	* 185512	ST Sgr	* 235715	W Cet
053326	RR Tau	115919	R Com	191350	TZ Cyg	** Orion Nebula Var.	

* - Long Period Variables on special AAVSO list for unusually faint maxima; see "Special Note for Observers" from the Director's office, October 1961.

** - In particular, T, Var #7, LP, HU, BM Ori.

COLOR IN SUNSPOTS, by Harry L. Bondy

Shortly after the AAVSO Solar Division was organized, several members followed the lead of James C. Bartlett, Jr., Baltimore, Maryland in gathering observations of sunspots that showed color. Bartlett observed color regions in sunspots from 1946 on with regularity. Previously he had observed color twice in 1942. In Popular Astronomy (Feb. 1948) Bartlett wrote: "It is a fact that quite early in the art, solar observers reported color in sunspots; and it is interesting to note that all were generally agreed on certain salient facts:

> color was a rarity;
> it was seldom vivid;
> it was confined largely to very large or active spots, i.e. to spots which might reasonably be looked to for something unusual.

"As early as 1759, Messier reported a deep brown color in 'the great spot' which appeared that year and which was remarkable for a peculiar S-shaped umbra."..."In 1926, Capocci reported violet in the form of a 'haze' surrounding a brilliant bridge over a 'double umbra', and I (Bartlett) saw a reddish haze of much the same nature in much the same kind of spot a few months ago(1947). In 1858 Father Secchi saw a rose-colored "promontory" in a naked-eye spot, and the work of both Schwabe and Schmidt contains many references to reddish, brownish, violet, and yellowish tints. Lockyer saw both violet and copper-red."

Bartlett's observations from 1940-1955 show the rarity of color in sunspots. Only 234 individual spots with color were observed in a total of 38,115 individual spots.

Walter Orr Roberts cooperated with the Solar Division and in an informal report(13 October 1952) he says: "In 1948, I asked observers of the Solar Division of the AAVSO to send summaries of any observations of sunspot colors to me. I also collected some data from sources other than the Solar Division. I felt that if the phenomena were beyond all question real -- an interpretation most solar astronomers appear to doubt -- independent simultaneous observations should confirm the colors and locations of the effect. Moreover, if the colors arise from prominences, then they should be very pronounced at the times when large solar flares, the most intense of all prominences, are present above sizeable sunspots.

"A substantial number of visual observations have now come to me, and they suggest the following conclusions:

a. The color phenomena are elusive -- so that colors detected by one observer may go undetected by another working at the same time.
b. The colors are reported with reasonable frequency, but for a decided minority of sunspot groups. Color in sunspots is a much less frequent phenomenon than solar flares, if we judge the evidence correctly.
c. Colors other than "rose" or "red" are reported, with brown, orange, yellow, and violet being commonly recorded.
d. Certain sunspot groups -- usually active ones producing numerous flares -- seem likely to be reported as colored. The color reports persist, as a rule, for several days for a given spot-group.
e. The times and locations of the color phenomena do not coincide with the times and locations of flares. Color observations at or near the times of flares have failed to show correspondence with the flares themselves. And many pronounced color reports have been for times when there were clearly no flares in progress. But flare-producing groups seemed to be favoured as color producers."

Members of the AAVSO Solar Division have proof of real color in sunspots. Because of the friendly controversy a world wide observational program is needed. (A full and detailed account of this interesting phenomenon appears in the Spring 1962 Solar Bulletin, No. 158).

SOME OBSERVATIONS OF THE ORION NEBULA VARIABLES, by Stephen E. Burt

Most of my observations have been of the 12 brightest Orion Nebula variables: NU, LP, V361, V372, MX, KS, EZ, IU, AN, MR, NV, and T. Several of these stars, especially NU, have shown some very rapid variations of up to .5 magnitude.

For NU, the star which I have concentrated on, I have 533 observations distributed over several tenths of a magnitude with the following percentages: 7.2-1.5%, 7.1-25.5%, 7.0-39.4%, 6.9-23.8%, 6.8-3.2%, 6.7-2.8%, 6.6-2.6%, and 6.5-.75%. Of the 533, 33 are above magnitude 6.8(from 6.7 to 6.5); this represents a percentage of 6.225.

NU's normal variation is less than .1 magnitude and remains close to 7.0 or 7.0-7.1. During these times of near constancy, my observations seem to stay fairly well within .1 magnitude of 7.0. During two hour plus runs on NU by Donald Engelkemeir, using a photoelectric photometer, NU did not vary more than a few hundredths of a magnitude.

"Flares" seem to come in small groups of about three; the flares being separated by about 2 minutes. Between the flares, NU's magnitude drops from about 7.0 to 7.2 in about 40 seconds and rises again to about 7.0 before the next flare. When flaring, NU rises from about 7.0 to 6.7-6.5 in about 40-50 seconds and drops back to 7.0 in a similar length of time.

As far as long term variations are concerned, NU does not seem to have any. My observational mean magnitude for NU has dropped about a tenth of a magnitude over a period of a year or two, but this is probably just a result of a general change in my observing opinion.

A few of the other brighter Orion Nebula variables which I observe frequently seem to vary in ways similar to NU. The stars in this group of rapid variables are: LP, V361, AN, EZ, and MR. IU also may be a rapid variable similar to NU.

In order to definitely prove or disprove my observations, many hours of fairly accurate observations must be made. Long runs with photoelectric photometers would be by far the best; however, runs with visual photometers and even visual runs would help. In order for visual observations to be of much use, the observer should make two or more observations in a short period of time.

BINARY STAR OBSERVING, by George Lovi

During the last half century the AAVSO has shown the astronomical world that the amateur astronomer can be of definite service to astronomy by collecting much needed data which professional astronomers evaluate in their study of the properties of variable stars. The amateur has also made lasting contributions in fields such as solar, lunar, planetary and meteor observing, and it is perhaps without parallel in science that such non-professional aid can be enlisted by the professionals in the field. There is one field which is also suited to amateur observation, but one which has hitherto been neglected -- the observation of binary stars and their measurement.

Binary stars are of great importance to astronomers because they represent the most important and most reliable method of deriving stellar masses -- an extremely important type of data which is of vital importance in astrophysics. The components of a binary revolve around each other in gravitational orbits obeying the laws of Kepler and Newton. Accordingly, by observing the orbital motions of such stars, their masses can be determined using the standard formulae of celestial mechanics.

Although well within the capabilities of the amateur, equipment of considerably greater size and refinement than what most amateurs possess is required. The minimum telescope should be about a six-inch refractor and the telescope must be mounted on a sturdy, well adjusted mounting which has an accurate driving clock. The actual measuring is done with a filar position micrometer, a device with fine hairlines which is designed to measure the apparent separation and position angles of binaries.

As pointed out by Charles Worley of Lick Observatory in his excellent series on binary star observing in the August, September, and November 1961 issues of "Sky and Telescope", the need for observing these stars has never been greater, since today we know of approximately four times as many binary systems than at the turn of the century when a considerable greater number of astronomers were engaged in this work. Today astronomy has grown in all fields to the extent where there is more work to be done than people to do it. As in the case of variable stars, observing binaries is a task which does not require professional skill and knowledge and the amateur can, as he did with variables, come to the aid of the professional.

However, such work requires rather elaborate equipment. Today, however, amateur astronomy has reached the point where serious amateurs are obtaining really sophisticated equipment. Despite the fact that the refracting telescope is the preferred instrument for this type of endeavor because of its greater optical and mechanical stability, reflectors can be very satisfactory if they are properly designed and built with special attention paid to constructing them in a manner which holds the optics firmly and allows for free ventilation. Dr. Van Biesbroeck of Yerkes and McDonald Observatories has successfully used the McDonald 82-inch reflector for the measurement of binary systems with separations as small as 0ʺ.1 and Dr. Kuiper has also used this instrument for much critical lunar and planetary work, fields which have heretofore almost exclusively been in the domain of the refractor. Similarly, the U.S. Navy is constructing in Flagstaff, Arizona, a 60-inch astrometric reflector for the measurement of trigonometric stellar parallaxes! Such an endeavor would have been scarcely thinkable only a decade ago. Clearly, the point I am trying to make here is that the reflecting telescope has been inferior to the refractor largely because of improper design and construction and it should be a challenge to all telescope makers to construct reflectors which measure up to refractors in performance, aperture for aperture.

I would like to urge amateurs to consider this field. It is quite challenging and interesting and almost all amateurs enjoy "splitting" doubles casually. Those that find merely splitting binaries interesting will surely derive much satisfaction from manipulating a filar micrometer and measuring these stars. And since binary star systems are among the most beautiful sights in our heavens, the observer engaged in observing them will always find something new and interesting as he proceeds to the next star on his list.

ATLASES, by Herbert Luft

Mr. Luft described and commented on the relative merits of several star atlases, both in print and out-of-print: But his most important news was that Schurig's HIMMELS-ATLAS has been reissued as an 8th Edition and it is a completely new work by Dr. Karl Schaifers. The stars and boundaries are for epoch 1950. The new edition contains a handy transparent scale for estimating positions of objects on the maps. The general format and appearance are that of the former editions of this old standby. This is indeed a welcome newcomer among atlases.

Commenting on various atlases Mr. Luft said: "many modern atlases are based on Atlas Celestes, by Delporte, now out-of-print. An atlas by de Callatay(French,German, and English editions)is not recommended because it contains stars only to 5.5 mag. The East German atlas by Kohl-Felsman only goes to magnitude 6 and is inverted in part, which is confusing.

Good atlases of naked eye stars are Norton's and the new edition of Schurig." (ed.)

V1211 SAGITTARII, by Dorrit Hoffleit

The RR Lyrae type variable, V1211 Sgr, has been examined at the Maria Mitchell Observatory on over 300 plates taken with three different telescopes:

92	taken with the Harvard 10-inch Metcalf	between	1924	and	1935	(MF)
44	" " " " 8-inch Bache	"	1935	"	1948	(B)
168	" " " Nantucket 7.5-inch	"	1957	"	1961	(NA)

These observations yielded a period of 0.867047 day. At the Leiden Observatory a period based on 286 observations between 1934 and 1938 had given a period of 0.867032 day, which, however, did not represent Leiden observations since 1950. Leiden Observatory had published a list of dates of maxima. My period satisfied all but the last of these. On requesting that the Julian date of this observation be checked, I learned the date of a subsequent maximum which had not been published, as it did not fit the Leiden period. It does, however, conform to my period. Thus we have two slightly different periods with apparently only one discordant observation for each. Dr. Oosterhoff recommended that we keep on trying to find one period to represent all of the observations.

Since nearly 600 observations are satisfied by the periods already determined, it seemed reasonable to expect that any other period would be related to these "stroboscopically." Although I had previously made tests for spurious periods, I assigned the task of searching for additional trial periods to my class in advanced general astronomy at Yale. Using Father Miller's paper "On the Determination of Periods of Variable Stars." (Ricerche Astronomiche, Vol. 1, No. 12, 1946) as a guide, the students set up programs for period and phase determination on the IBM 1620.

On the basis of the equation, $\frac{1}{P'} = \frac{m}{P} \pm \frac{n}{p}$,

where m and n are integers, P is the assumed period and p is the interval between the observations (or a common factor of the intervals). P' is then another period which might satisfy the observations if p is sufficiently constant. Most spurious periods arise from a value of p equal to one sidereal day, when all of the observations have been made when the star is close to the meridian.

The students had been given only the observations from the MF and NA plates. Numerous spurious periods were found to represent one or more small groups of observations, but none to fit the whole array. One of the students, Miss Mary McKillin, found 0.866987 fit the given observations almost as well as the original periods, but it would not satisfy the last Leiden observation. Upon my return to Nantucket I found it would not satisfy the observations on the B plates either. Thus we conclude, either the period is variable, we do not yet have the correct period, or one of the observations is misleading.

R HYDRAE, by Margaret W. Mayall

Over the years, many of the long period variables have been suspected of having changes of period, but very few of the changes have been substantiated. In 1936, Theodore Sterne and Leon Campbell made a statistical study of nearly 400 variables with periods in excess of 100 days. The stars included nearly all of the best observed long period variables.

Sterne and Campbell found no evidence of any secular increase or diminution of period of an evolutionary nature, among the long period variables as a whole. They did find that, statistically, about 20 of the nearly 400 variables studied, could be suspected of having changes, and of those 20, 5 were fairly certain of having changing periods. The most reasonable choices of the 5 were R Hydrae, R Aquilae, U Bootis, R Cancri, and S Serpentis. The first two probably had diminishing periods and the last three sinuously changing periods. The statistics show that most of the other previously reported changes of period can be reasonably interpreted as merely statistical fluctuations.

R Hydrae had an interesting early history. It was not on Bayer's famous star chart "URANOMETRIA", published in 1603. Hevelius observed it as of 6th magnitude in April 1662 and included it in his Catalogue. In April 1670 Montanari, who discovered the variability of Algol, observed it and inserted it by hand, as a 4th magnitude star, in his copy of the Uranometria, but neither Hevelius nor Montanari suspected it of variability. In 1702, an Italian astronomer Maraldi (1665-1729) saw Montanari's plot of the star on the Bayer charts and looked for it in the sky, but failed to find it. He saw it for the first time, at 4th magnitude in 1704, and observed its appearances and disappearances several times before 1712. During the 17th and 18th centuries, the period of R Hydrae must have been something over 500 days.

In the 19th century, the period of R Hydrae had decreased to around 450 days. It has continued to decrease, until now it is somewhat less than 400 days.

The star has been very well observed throughout its history. Its light curve is most interesting in its many deviations from the mean curve. The heights of its maxima and the depths of minima change considerably. At times, the maximum may be nearly 3rd magnitude, and at other times it will be fainter than 6. Most long period variables have minima of constant depth, but those of R Hydrae change from about 9 to 11th magnitude. A Study of the light curve seems to show a tendency to a decrease in the overall range of the variation. The curves of recent years are much flatter than formerly. But only time and observations over future years will show if this is a true change.

R Hydrae is a bright variable and is easily observed with binoculars and small telescopes. It has an interesting spectrum, with many peculiarities and is one of the stars on the AAVSO list for special observations, especially at times of faint maxima. (Further details and light curves will be included in the Director's Variable Star Notes, which are published regularly in the Journal of the R.A.S.C.).

ASTRONOMY FOR ASTRONAUTS, by Jocelyn Gill

Miss Gill has worked with astronauts Shepard, Glenn, and the others, in trying to teach them what they might expect to see and what would be important for them to look for. The astronauts receive their astronomical training at the Morehead Planetarium. Chapel Hill, North Carolina, where the flight path of the capsule can be projected against the background of stars.

Some of the things suggested that astronauts could do and look for are:

1) Gegenschein, solar corona, and zodiacal light.
2) Identify a constellation and count stars in a specific group. This would be an interesting comparison with the number of stars observed in the same group from earth.
3) Look for comets.
4) Look for airglow(5571 line).

These are but a few of many things an astronaut can do and look for. The big problem for Glenn was dark adaptation. He was unable to get dark adapted, due to conditions within the capsule. Carpenter will concentrate on time of sunrise and dark adaptation.

Miss Gill mentioned a remarkable photograph, in color, taken at sunset showing the sun stretched out like a frankfurt.

Glenn sighted and measured earth's dust cloud. (Charles Giffen remarked that the dust cloud acts like tides, and that AAVSOer Don Bradley did the original research leading to the theory of this cloud).

Miss Gill mentioned that Glenn's flight report is available to anyone from the Superintendent of Documents,Washington 25, D.C., cost $1.25. (Since our meeting,Carpenter has repeated Glenn's flight,and he was able to make some astronomical observations.Ed)

A MODIFIED DANJON CAT'S-EYE PHOTOMETER, by Stephen Burt

In the Danjon cat's-eye photometer a bright comparison star is routed into a variable star field by means of two prisms, and a diaphragm is used to reduce the magnitude of the comparison until it equals that of the variable. Since the light gathering area of the prism is much less than that of the main telescope, the comparison will "lose" a certain number of magnitudes relative to the variable. A further loss of light will result from the type of prism reflection -- the least light is lost from internal reflections. Other sources of light loss in the prisms are from glass absorptions and extraneous reflections.

The light of the comparison star is reduced to equal that of the variable by means of a diaphragm. The magnitude of the variable is then found by adding together the magnitude of the comparison star, the constant number of magnitudes lost as a result of the small size of the prisms, and the number of magnitudes cut out by the diaphragm.

The prisms can be arranged so as to use internal reflections from both, internal from one and front surface reflection from the other, or front surface reflections from both. They must be mounted in such a way to allow all these arrangements. (It must be remembered that both reflections must be 45 degree reflections.)

The center prism is mounted so that it can be aimed in any direction perpendicular to the optical axis of the telescope. The second prism must be mounted so that it can be aimed in any direction parallel to the main optical axis. The mounting system allows one to aim the outside prism toward any part of the sky and, therefore, toward any comparison star.

A counterbalance is attached to the center prism's angle sections opposite the outside prism mounting in order to balance the latter.

My Danjon photometer has not given consistent magnitudes for known stars,probably because my comparison stars were not the same color as the stars observed. This problem should be solvable by using filters, remembering that a corrected comparison star magnitude must be used for different filters.

The photometer can be accurately calibrated for all prism arrangements; however,this is not needed for variable star work.

Some suggestions are:

1. Keep the prisms clear of fog and dust while in use.
2. Each prism should be at a uniform temperature. This does not mean that the prisms must be heated; however, heating would help reduce fogging while keeping the temperature uniform.
3. Do not use small openings of the diaphragm(less than 5/16")because diffraction pattern may result.
4. Do not use low quality prisms because bad images result.

Two improvements in the system could be; to use declination circles so that finding the comparison star would be easier, and to use gear arrangements on the moving parts so that they can be operated more easily from the observing position.

(A detail drawing of Mr. Burt's instrument is being prepared. Any one interested in obtaining a copy should send his order to headquarters before August 1,1962, so that a sufficient quantity may be printed. The cost will be $1.00.)