BRITISH ASTRONOMICAL ASSOCIATION

VARIABLE STAR SECTION

CIRCULAR 22

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BRITISH ASTRONOMICAL ASSOCIATION: VARIABLE STAR SECTION
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Change of address. Members are asked to note the Director's new address, as given on the cover of this Circular. (Arrangements have been made for mail addressed to 292 Caledonian Road to be forwarded but these will of course lapse shortly.)

Attention is drawn to the notice in BAA Circular 561 concerning the Dutch astronomical satellite. All observers are asked to communicate their results for the variable star concerned for the five-day interval centred on each window of observability, to reach the Director within 10 days. Full details should of course be sent to the Secretary as well at the end of the year, as usual.

Section Meeting. A VSS meeting, the first since 1967, will be held in Chester on the afternoon of Saturday, September 20, at the invitation of Chester Astronomical Society. The programme will be announced later, but meanwhile make a note in your diary. We want to have lots of speakers and anyone who is prepared to talk about anything is asked to contact the Director. Perhaps the co-ordinators of local observing groups might like to describe their activities?

Argelander's Method. The VSS "Methods" handout describes the two methods traditionally used by the VSS for making and recording light estimates, viz. fractional and Pogson's step. There is another method widely used by our European colleagues which seems to combine the advantages of both, as well as having advantages of its own, namely Argelander's method. This is a step method, but no attempt is made to make the step equal $0^m.1$ or any other particular magnitude interval. The step is in fact the smallest detectable difference of brightness, so its value will differ from one observer to another, and possibly from night to night, or even from field to field. The procedure is well described by Sidgwick ("Observational Astronomy for Amateurs" section 17.2.1) as follows: "Suppose that at a casual glance two stars, A and B, appear to be equally bright. Suppose, further, that A is now observed intently for several seconds, its brightness memorised, star B similarly observed, a judgment made as to which is the brighter (assuming that, as will often be the case, they no longer appear to be exactly equal), and the whole procedure then repeated several times. Then if A was judged to be brighter than B as often as B was judged to be brighter then A, they may be taken to be as nearly equal as the eye is capable of distinguishing, and their step difference will be 0. If one star is only occasionally judged to be brighter than the other, then their difference is 1 step; if one is never brighter than the other, but occasionally equal to it, the difference is 2 steps; if one is always brighter than the other, but at times only just so, their difference is 3 steps; and if one is continuously and clearly brighter than the other, 4 steps or more. Thus the final opinion regarding the step-difference between two stars is made up by the accumulation of individual estimates. It can be seen that the Herschel-Argelander method is precisely that one which attempts to utilise the observer's eye to its most critical limit." It should, of course, be pointed out that looking directly at a red star for several seconds is liable to lead to inconsistent results. If the colours of the stars to be compared are visible it is better to use quick glances or averted vision or extra-focal observation; there is a divergence of opinion on which of these alternatives is best.

In order to avoid confusion with the fractional and Pogson methods, observers using Argelander's method should use the notation given by Sidgwick, e.g. A(3)V,V(2)B meaning two steps brighter than B and three steps fainter than A. (Our European colleagues

use

use a notation which is identical with that we use for the fractional method.) These are of course two independant estimates. however, the observation may be reduced as if it were a fractional observation A(3)V(2)B. Ordinarily one will use two comparison stars, one brighter then the variable and one fainter. At a pinch one may use only one comparison star - in which case a value for the step must be assumed in order to reduce the observation - or two comparisons both brighter or both fainter than the variable - in which case the observation must be reduced in the same way as a fractional extrapolation.

Advantages of Argelander's method as compared with the fractional method include the following:

1. It may be used when only one comparison star is available.
2. The estimates are independant, so that if one comparison star is rejected the observation can still be used.
3. The estimates may be used to determine the relative magnitudes of the comparison stars if they require revision or are unknown.
4. Only two stars need to be compared at a time; an important point if the comparison stars are distant.

Advantages as compared with Pogson's method arise from the fact that no attempt meed be made to make the step equal $0^m.1$. Consequently:

1. No 'training' period is necessary.
2. The results are bound to be more accurate, provided the intervals do not exceed about 4 steps.
3. The observer is less likely to be influenced by the magnitudes assigned to the comparison stars.

An advantage over both methods arises from the fact that the procedure is more clearly defined, so that there should be less scope for errors of judgement or bias.

The Director agrees with his learned predecessor Dr. De Roy (Preface to Memoirs Vol.28) that the Section's present methods are entirely adequate for the observation of long-period and eruptive variables. However, we now have a number of smaller-amplitude variables under observation, notably in the Binocular Group and eclipsing binary programmes, and it is here that the advantages of Argelander's method are most likely to manifest themselves.

RR Lyrae project. Attention is drawn to the enclosed Information Sheet No.2 on a European programme on RR Lyrae stars. The Director hopes that participants will try to use the Argelander method on these objects in order that personal comparison star magnitudes can be worked out for each observer.

Notes on 1974 GCVS Supplement. This gives revised information on 2196 stars in the 1968 GCVS and its 1971 supplement, and also details of 2490 new variables named in 1972 and 1973. The total number of named variables is now 25140. Three new types of variability have been introduced:

S Dor (abbreviation SD) - high luminosity stars of spectral classes Bpeq - Fpeq with irregular light variations. The sole representative in the VSS programme is P Cyg.

γ Cas (abbreviation γC) - irregular variables of spectral class BeIII - V. Usually rapidly rotating shell stars. Representatives in the VSS programme are Cas, BN Gem, V2048 Oph, X Per and BU Tau.

ZZ Cet (abbreviation ZZ) - rapidly variable white dwarfs with periods measured in minutes. Some of these objects may be old novae. There are no representatives in our programme.

Notes on some of the stars observed by the VSS, including

recent

recent novae, for which the details have been revised appreciably are given below.

DZ And: Given as type RCB, V range 10.3 - (14.0.
R Aql: Period given as 300.3 days up to JD 2427800 and 293.0 days thereafter. "Sudden period variations."
V450 Aql: Range now given as 6.30 - 6.65 V and period as 40± days.
V1293 Aql: This is the object referred to as CSV 101855 in the BG catalogue and on the chart, but it was in fact named V1293 Aql in 1973. Given as type SRb, p range 8.3 - 9.0; v range will be about 6.4 - 7.0.
AB Aur: "Usually in maximum, minima occur over quite irregular intervals of time. Connected with a nebula, which is illuminated by it. Star with envelope. Infrared excess of radiation."
NO Aur: Given as type Lc, V range 6.13 - 6.30. If the range is really as small as this it cannot be observed effectively visually. However, the star will be retained on our working list as it is conveniently near +31° 1048.
U Boo: The VSS report (Journal 1972 Oct) is now taken as the standard reference for this star, and is the source for the revised catalogue data: type SRb, range 9.8 - 13.0, period 201.3 days, M-m = 0.50 P. "Period varies from 166d to 235d. Amplitude varies from 0m.9 to 2m.4."
UV Boo: Type amended from Ia to Isb.
TW Cam: Mean period given as 86.26 days but "sudden period variations".
V CVn: Range now given as 6.7 - 8.8 V. "Amplitude of brightness variation strongly varies."
V358 Cas: Type now given as Lc.
IV Cep (Nova 1971): Given as type Nb, v range 7.5 - 17.5, maximum on JD 2441141.
NN Cep: This is the object referred to as CSV 8815 in the BG catalogue and on the chart, but it was in fact named NN Cep in 1973. Given as type RR?, p range 8.2 - 8.7, period 0.5 or 1 day. Our observations may enable us to determine the period, but it may not be possible to identify it unambiguously because most observers will have made only one estimate per night. It is suggested that members make estimates of this object at hourly intervals to establish the approximate length of the period, and communicate the results to Alan Pickup, who is using his Fourier analysis program in an attempt to find the period.
CH Cyg: Range increased to 6.4 - 8.7. "Usually light variations with the mean cycle 97d are observed. Mean brightness varies with the period about 4700d. Sometimes small outbursts which can be explained by the intensification of an ultraviolet continuum are observed as also light decreasings and rapid light fluctuations. Probably the star is an eclipsing system with the period 4.85 years. The next eclipse of the hot component is expected in the middle of 1975."
CI Cyg: "Besides flares observed in 1911, 1937 and 1971 fluctuations near the main brightness (~12m.1) are observed as also Algol-like decreasings about 0m.7, which are represented by the elements: Min = 2411902 + 855.25 E with D = 0d.3."
V460 Cyg: Range now given as 5.6 - 7.0 v.
V477 Cyg: Range now given as 8.50 - 9.34 V.
V973 Cyg: Given as type SRb, period 40±d. "According to photoelectric observations in 1964 - 67 V: 6.10 - 6.62."
P Cyg: "From the XVIII century the light of the star varies within 4m.6 - 5m.6 vis."
NQ Gem: This is the object referred to as +24° 1686 in the BG catalogue and on the chart, but it was in fact named NQ Gem in 1972. Given as type SR?, V range 7.4 - 7.8, period not given. "In the spectrum of carbon star in February 1970 the hydrogen emission

lines

lines and ultraviolet continuum emission have appeared. Similar activity has been observed in CH Cyg."
IQ Her: Range now given as 7.0 - 7.5 V. "Variations with more short period and small amplitude are superposed."
SX Lac: Spectrum amended from M0 to K2, and type from SRb to SRd.
RX Lep: Range now given as 5.0 - 7.0 v.
ζ^2 Lyr: Given as type SRc?, V range 4.22 - 4.33. If the range is really as small as this it cannot be effectively observed visually.
S Mon: Range now given as 4.62 - 4.67 V. If the range is really as small as this it cannot be effectively observed visually.
RV Mon: "The mean magnitude varies with the period of 10^{47d}."
V2048 Oph: Range given as 4.55 - 4.85 V but "together with irregular brightness variations typical for B-star with envelope, rapid flares with the amplitudes up to $1^m.8$ are observed. It is not excluded that the flares occur on a fainter companion star of later spectral type."
Orion Nebula Variables: A number of these are given reduced ranges from photoelectric V observations, while some are noted as possibly constant, including some which from our observations are undoubtedly variable. It must be remembered that these stars often spend part or most of the time nearly constant, so that photoelectric observations, however accurate, will not reveal the full range of variation over a short time interval.
RS Per: "According to Stothers and Leung (1971) the period of 152^d in Payne-Gaposchkin (1952) is too short."
SU Per: Period amended from 470^d to 533^d.
AD Per: Period amended from 320^d to $330:^d$.
GK Per: "Out of outburst the brightness of the star varies within 11^m - 14^m. On 24 August 1966 the brightness has reached $10^m.9$; in October 1970 $10^m.8$; in minimum light photoelectric observations reveal rapid light variations with the amplitude up to $0^m.36$."
TV Psc: Range given as 4.65 - 5.42 V. "Cycles with the duration 49^d are replaced by the cycles with the duration 70 - 85^d."
WZ Sge: "The star outbursted twice - in 1913 (JD 2420094) and in 1946 (JD 2432001) - as a recurrent nova. On the distance of 8" there is a red star of about the same stellar magnitude. The variable is also an eclipsing system with the elements Min = 2437547.?2845 + 0.056687847 E. The variations have large fluctuations within 15.2 - 15.4 V resembling in general the W UMa type stars. Min II 15.4 V. The primary minima are rather sharp and narrow."
V368 Sct: Type amended from N to Na.
R Ser: Range increased to 5.16 - 14.4.
Z Sex: Type amended from RV? to SRc.
BW Tau: "Periodogram analysis reveals possible periods 350^d and 22.5 years."
CH UMa: Given as UG, 10.7 - 15.9 p, ($400\pm^d$). The period is apparently shorter than this, as usual!
SW Vir: Range now given as 6.94 - 7.71 V.

The following new or reclassified objects will be of interest to observers, and some of them will be added to the programme.

KY Cep: (1950) $22^h\ 30^m.9$, $+57^\circ\ 20'$. One outburst observed, reaching $4^m\pm$ at maximum and lasting 65 seconds. Continuous spectrum. The object has not been identified at minimum and the co-ordinates are rough.

V482 Cyg: (1950) $19^h\ 57^m.8$, $+33^\circ\ 50'$. Previously unknown type, now listed as RCB?, 11.8 - (15.5 p, Sp M5III (!)

EZ Peg: (1950) $23^h\ 14^m.4$, $+25^\circ\ 27'$. Previously unknown type, now listed as UG?, 9.5 - 10.5 p, Sp G5Ve. "On 16 November 1943 the spectrum B; probably then the star showed a strong flare." If this were correct this would be the brightest dwarf nova at minimum. Of course, it is not!

TX Per: (1950) $02^h\ 44^m.9$, $+36^\circ\ 46'$. Previously given as SRd, now listed as RV, 9.8 - 12.5 v, 77.65^d, Sp. Gp(M2)-KOe(M2). M-m is given as 0.49 P which presumably should read 0.245 P. Charts for this star (3 sheets) are available from Steve Anderson, as it is being added to the list of RV Tauri stars included in the international project.

FH Vir: (1950) $13^h\ 13^m.9$, $+06^\circ\ 46'$. A likely addition to the binocular programme: SRb, 6.92 - 7.45 V, $70\pm^d$, Sp. M6III.

Chart Catalogue. A new chart catalogue, covering the telescopic, binocular and eclipsing binary programmes, is being prepared and will probably be issued in June. A copy may be obtained by sending a long SAE to Steve Anderson. It incorporates the latest information from the 1974 GCVS Supplement.