VARIABLE STAR SECTION.

CIRCULAR No. 179.

NOTES ON PROGRAMMES FOR VISUAL OBSERVERS.

SUMMARY: The attention of visual observers is directed to notes on three programmes, viz. observations of Classical Cepheids; Flare Stars and U Gem variables.

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INTRODUCTION:-

Below is an article by T.A. Cragg on a suggested Classical Cepheid Programme. The list of stars that was attached to his article is not reproduced here but a summary of the range of suitable stars is included in the article.

This programme has already been discussed by the Director with observers, both in New Zealand and in Australia. Cragg's article is now circulated more widely and observers are asked to advise the Director whether or not they will be able to take part when the programme commences. If the response from members is sufficient then reliable charts and sequences will have to be first produced for the majority of the southern stars.

Brief notes by the Director on visual observation of Flare Stars and U Gem variables follow the first article. These notes are for the general information of members.

CLASSICAL CEPHEID PROGRAMME.

T.A. Cragg.

With the publication of the 1970 General Catalogue of Variable Stars, it seems worthwhile to reappraise the Classical Cepheid programme because of other stars and newer information available.

To reiterate, the basic programme is to look for period changes which could be attributed to evolutionary changes in these stars. The period-luminosity law in classical cepheids demonstrates the longer the period, the greater the luminosity. We also find that the more luminous stars evolve much faster than the less luminous. Then it becomes evident that the long period cepheids are expected to evolve faster than the shorter period stars. The period of any pulsating star is clearly dependent upon the chacteristics of the interior, so one may expect rather evident period changes to correspond to rather small changes in the star's core. Some reflection upon these changes makes it seem possible that a period change in a star with a 30-day period might be noticable in the order of a decade.

To make this programme suitable for amateurs, it seems the best method of attack would be to determine several maxima of a star during an apparition and take the mean. This becomes the mean epoch for that apparition. A few years later a similar epoch is determined. From several of these epochs over a ten or more year interval one hopes a plot of O-C values (Observed minus Calculated) can be plotted showing a slope characteristic of the period change. It is possible several apparitions might be averaged to improve the accuracy of an epoch for one apparition. As an example, one might combine the efforts of 5-years of observing into one epoch, then do the same for the next 5-year interval, and

so on. In this manner rather small period changes should become evident. A number of maxima during each epoch would be desirable to be sure no change in shape of light-curve might be interpreted as a period change.

To choose stars applicable to amateur instruments and observing methods (visual), those were chosen satisfying the following characteristics: (1) The period should be 10-days or longer (the longer the better!); (2) it should have a range of at least 1.0 magnitude in (v); (3) its maximum should be brighter than 12.0 in (v).

The spectral range of most classical cepheids runs from early or mid-F at maximum down to mid-G or early K at minimum. This means in (v) most classical cepheids are between 0.7 and 1.0 magnitude brighter in (v) than in (B) (photoelectric blue) or (p) (photographic) at maximum, and the difference would be greater still at minimum/ For this reason one finds a number of stars on my list which appear outside the limits set forth before. Most of these have published magnitudes in (B) or (p) and after making the correction to (v) would be within the previously mentioned parameters.

It should be noted that both disk and halo population cepheids are included. Naturally, while acquiring data of this kind it would be wise to learn if there be any significant difference between Delta Cepheid and W Virginis types. In the case of the CW's (W Vir stars) one should be aware of the shoulder on the descending branch of their light-curves. It's feasible that in some cases this may blur the time of maximum to such an extent that the epoch may be better determined from the minima. This conclusion can be reached only after studying each individual to see what's best for it.

Several interesting conclusions have been made as a result of compiling a list of suitable stars:

1. There are only 117 classical cepheids fitting the parameters of our programme. Adding 18 probable or marginal stars makes the total only 135 at best.

2. Charts available currently exist for only 18 of the 135 stars.

3. Eighty of the 135 have declinations south of -20° demonstrating the ardent need of co-operation from observers in the Southern Hemisphere for any semblance of complete coverage. Of the 84 Delta Cephei type, 45 are south of -20°; and of the 26 CW type, 18 are south of -20°.

4. Any programme must be a co-operative affair through the various Variable Star Organisations and members of the Variable Star Section, RASNZ, should work through their Director who in turn has agreed to see that results are pooled with other bodies.

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NOTE ON VISUAL OBSERVATION OF FLARE STARS.

Frank M. Bateson.

For several years a few members of the Section have taken part in the international flare star programmes. It is now therefore possible to assess the value of such observations.

Considering the coverage obtained by both photoelectric photometers and photographic methods it appears that visual observations can only have value if:-

1. The observer is really experienced. In addition to long practical experience he must also possess the capacity to concentrate on observing a single star for long periods.

2. Observations must be made continuously for at least four hours on each clear night during a programme.

3. Has precise and accurate timing devices.

Given these three standards there is no doubt that visual observers are capable of not only detecting major flares but can also correctly record minor flares. It is their long practical experience that enables them to note any change in transparency that might pass as a flare.

It is equally clear from the records of the past few years that many members who have attempted to observe flare stars visually, and who possess suitable instruments of adequate aperture, have been disappointed in not recording many flares. As a result they prefer to continue on other programmes. Others again have failed to appreciate the necessity for long spells of continuous observing, or have had insufficient practical observing experience.

Others again have sent in isolated observations covering spells of ten minutes on widely separated nights. These records have little value.

It is suggested that visual observation of flare stars be discontinued except by those who can fulfill the three conditions given above.

However, the growing number of photographic observers can produce worth while results not only by monitoring, in accordance with the instructions in Flare Star Circulars, during international programmes but also in monitoring those flare stars that do not appear in any international programme. Charts for stars which are suitable have already been published in Series 5 of "Charts for Southern Variables." It is possible that some of these stars may be much more active than is realised and a photographic patrol would reveal whether this is correct. One example is 40 Eridani C which has certainly been active in some years.

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NOTE ON VISUAL OBSERVATION OF U GEM TYPE VARIABLES.

Frank M. Bateson.

During the past year or two several members of the Section have installed telescopes having apertures far in excess of those used by most visual observers. It is obviously non-productive to use instruments in the 16" to 20" aperture range to observe the brighter Mira Ceti variables that are very well covered by observers with more moderate size instruments.

The attention of observers with the larger instruments is directed to the value of observations of U Gem variables not only during outbursts but at minima. By observing each of the U Gem stars two or three times during each observing session it will be possible to obtain information of the start of each outburst through the pooling of results from several observers.

Probably each of these stars is a member of a binary system, some of which are so presented that it is possible to observe the eclipses. Naturally these are most accurately observed with photoelectric photometers and it is pleasing to record that several observers are adding these to their equipment. However visual observations at minima for these stars can be most useful in supplementing photometric data.

It is suggested to observers with large instruments that they endeavour to arrange their programmes so that they concentrate on U Gem variables in particular and on other faint stars in general leaving the brighter variables to those with more modest instrumental equipment. This will also avoid the over observation of such stars as R and S Car, etc.

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