VSS Workshop
Edinburgh

18th October 2008

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and
President, BAA

Why Variable Stars?

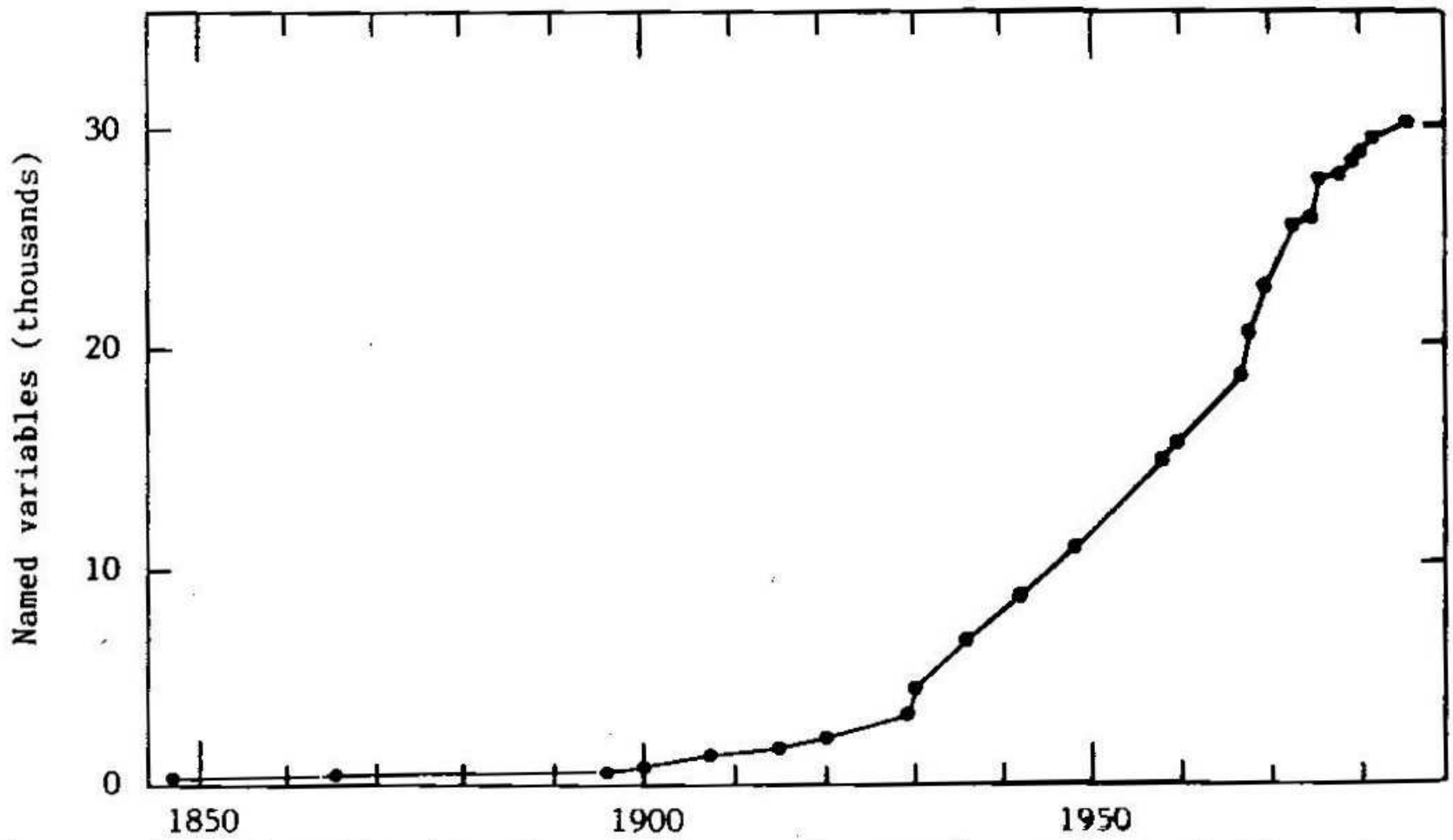


Figure 1. Growth in the number of catalogued variable stars, 1845-1986.

So, why observe variable stars?

Data provides information about many properties of stars including:-

Mass, radius, luminosity, temperature, structure, composition and evolution.

It’s fun, exciting and useful.

We usually observe variable stars by:

1. Watching (measuring) their variations over time, be it hours, days, weeks or months

2. These variations take the form of changes in brightness (magnitude).

Light curves

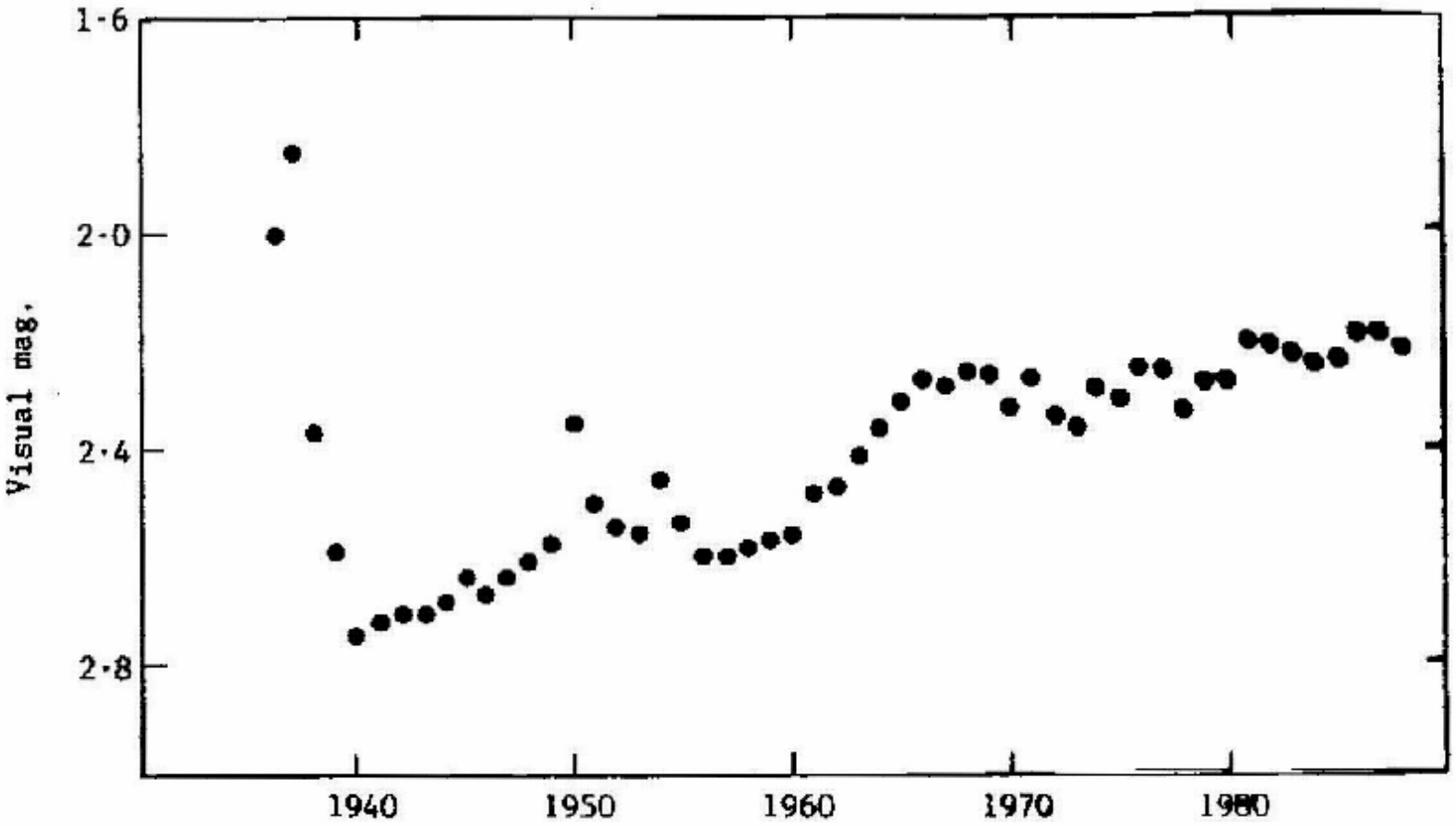
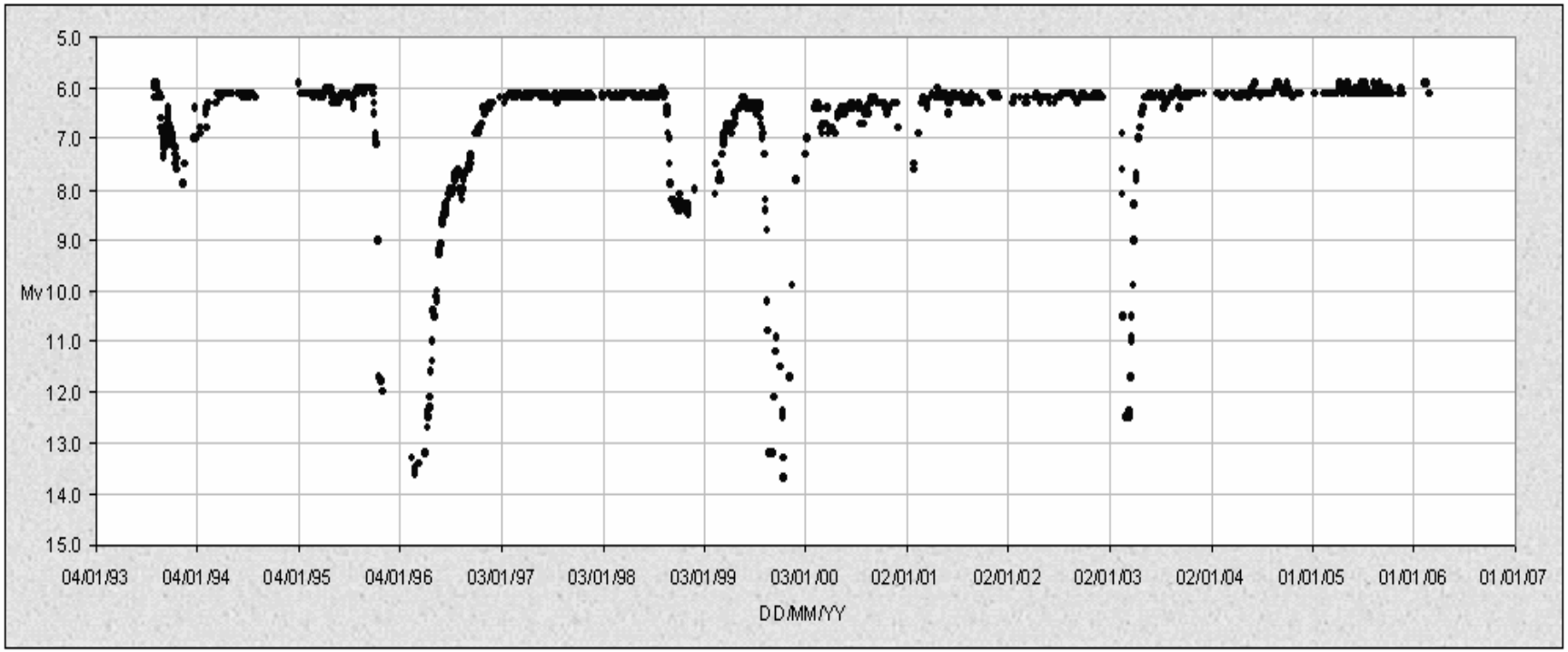


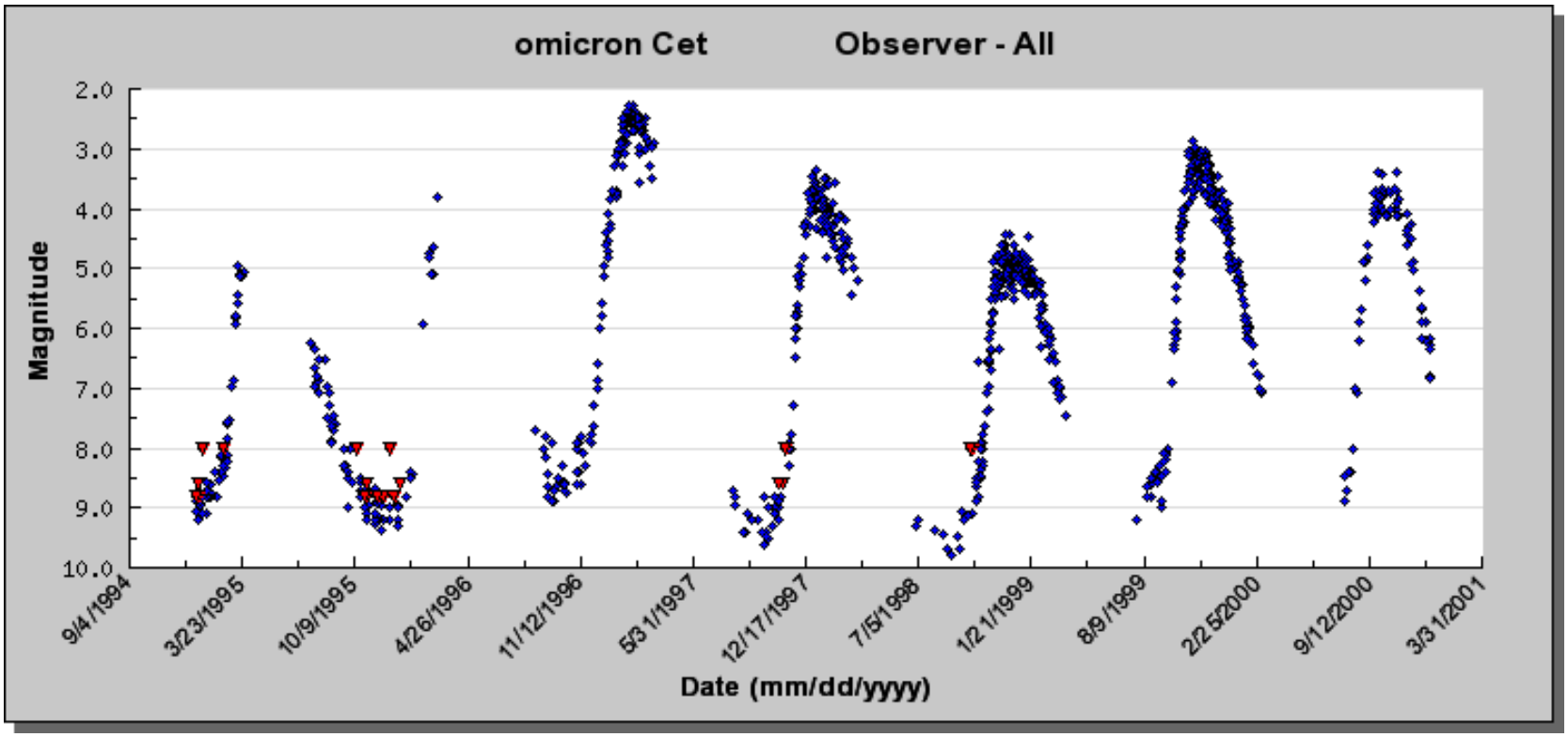
Figure 2. Light curve of Gamma Cas (type GCAS) in 1936-88, from annual means of observations by the British Astronomical Association (BAA, to 1959) and Junior Astronomical Society (JAS, from 1960).

Light curves

R Coronae Borealis



Light curves



Light curves

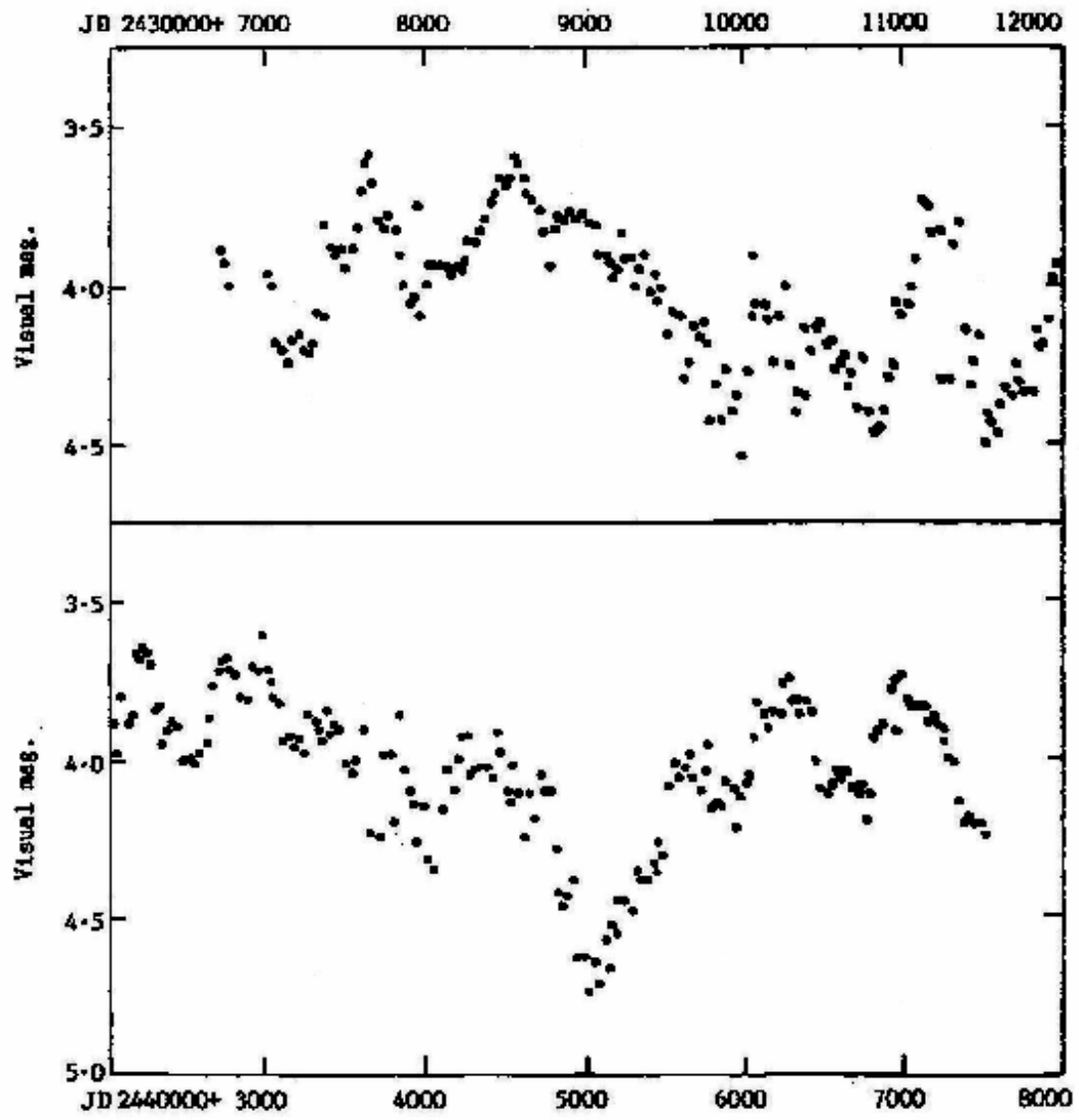


Figure 6. Light curve of Mu Cep (type SRC) in 1959–88, from 30d means of observations by the JAS and (1973–84) BAA.

Light curves

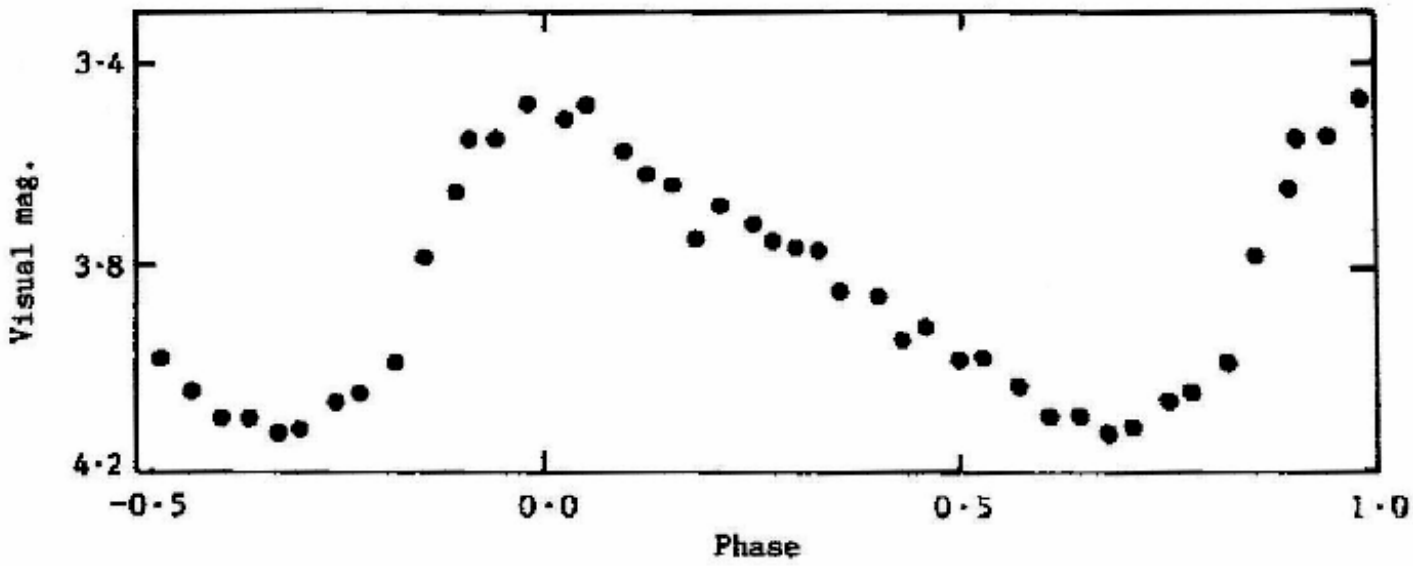


Figure 4. Mean light curve of Delta Cep (type DCEP) in 1987-8, from observations by the author. Each point is the mean of 11 estimates.

Period ~5.4 days

Light curves

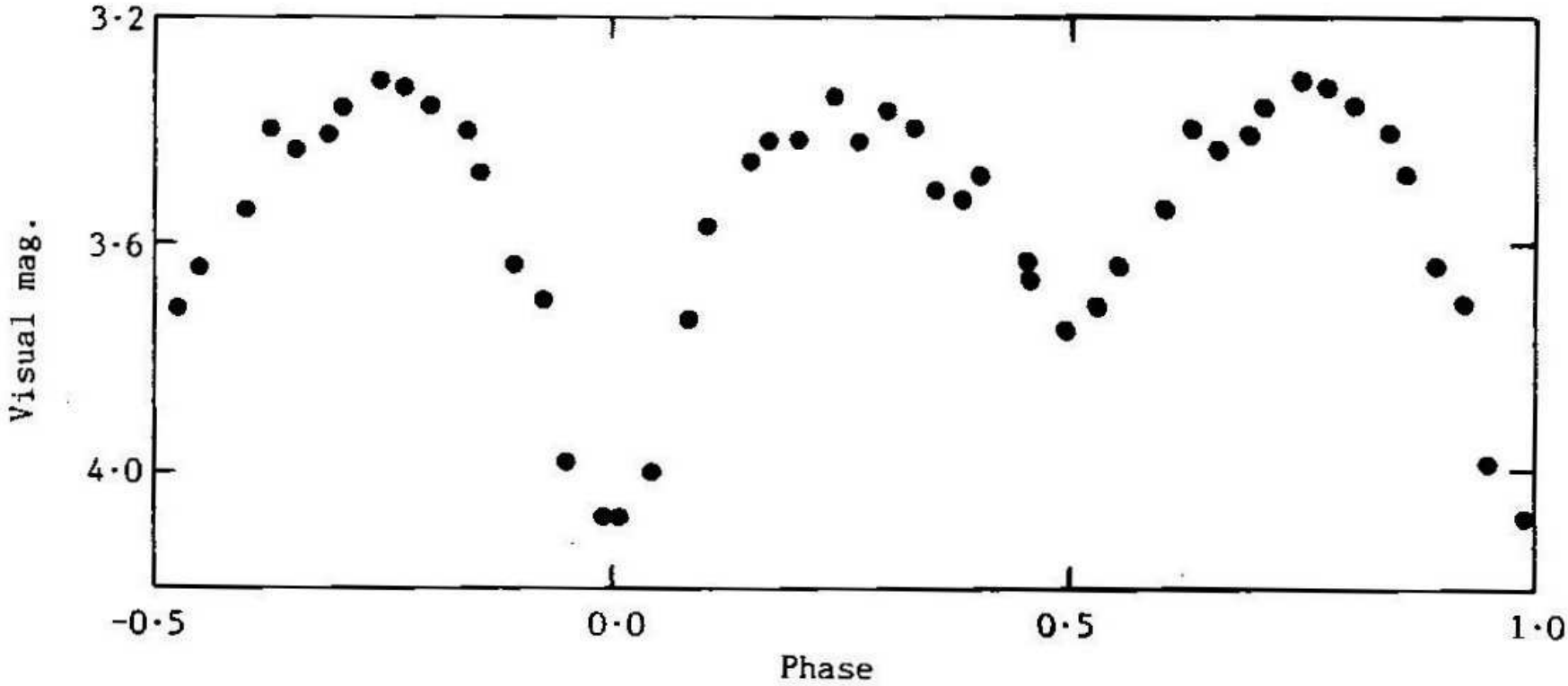


Figure 11. Mean light curve of Beta Lyr (type EB) in 1987-8, from observations by the author. Each point is the mean of 8 or 9 estimates.

Period around 13 days

Light curves

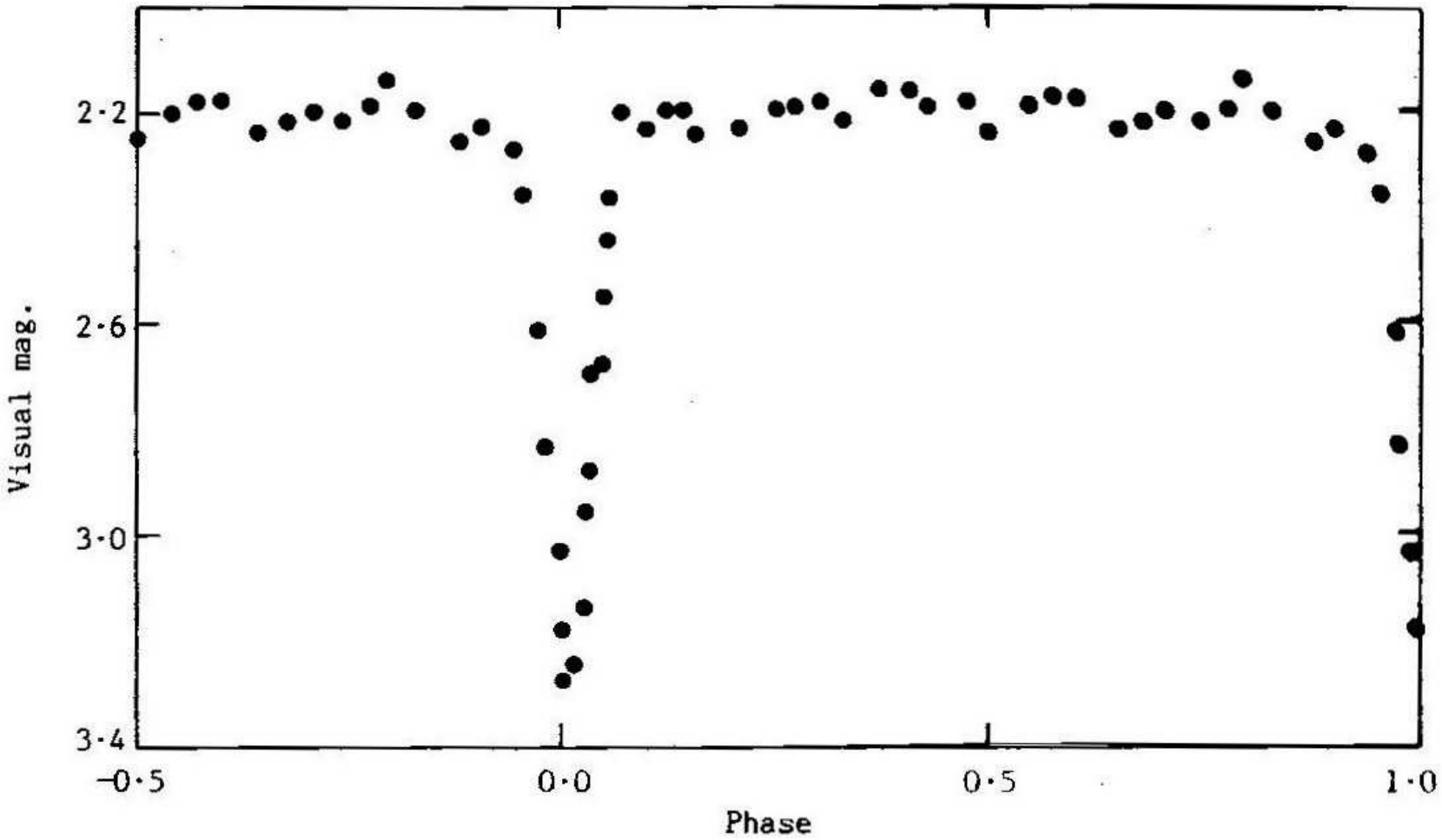


Figure 10. Mean light curve of Beta Per (type EA) in 1987-8, from observations by the author. Each point is the mean of 10 estimates.

Period 2.87 days

Light curves

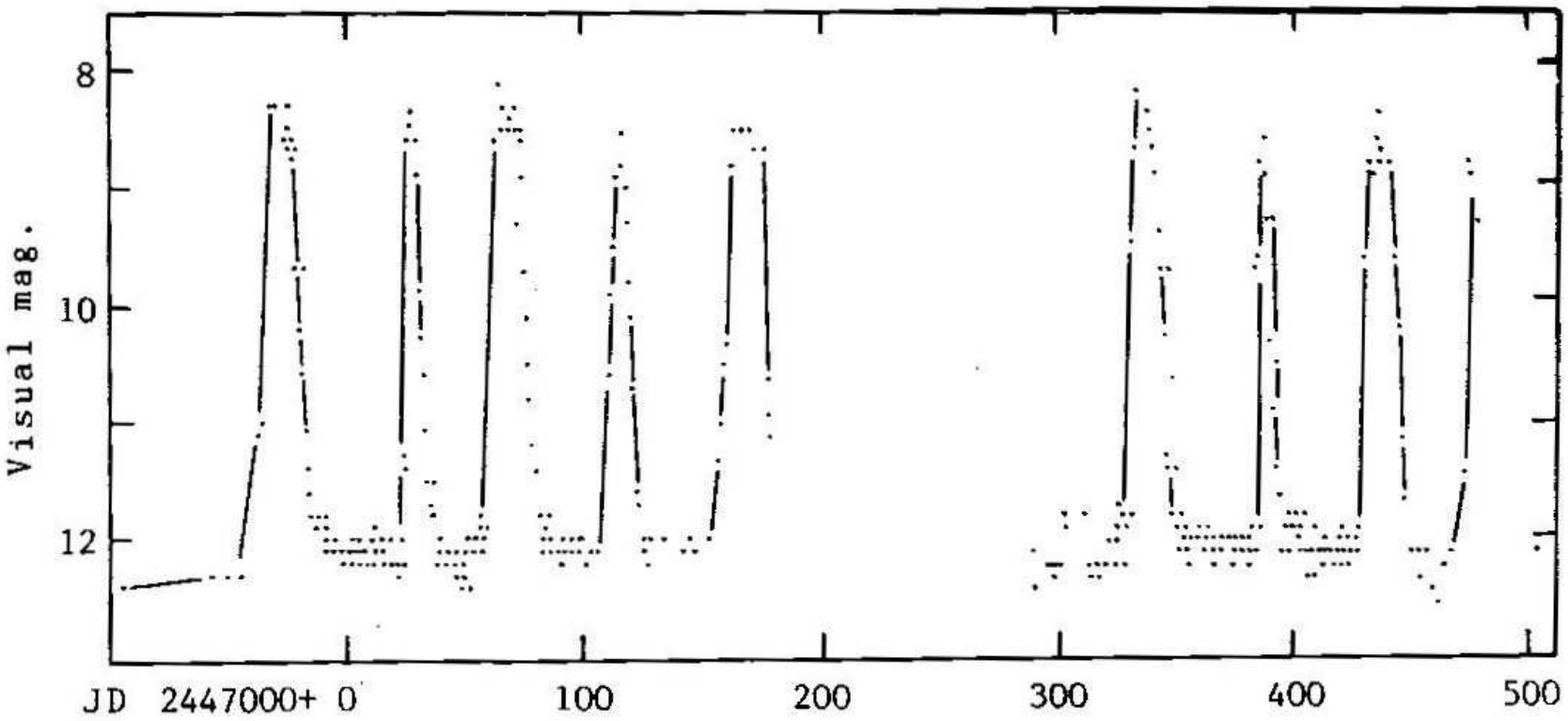


Figure 9. Light curve of SS Cyg (type UGSS) in 1987-8. The gap occurred when the star was unobservable from the author's observing site.

Period around 50 days

Light curves

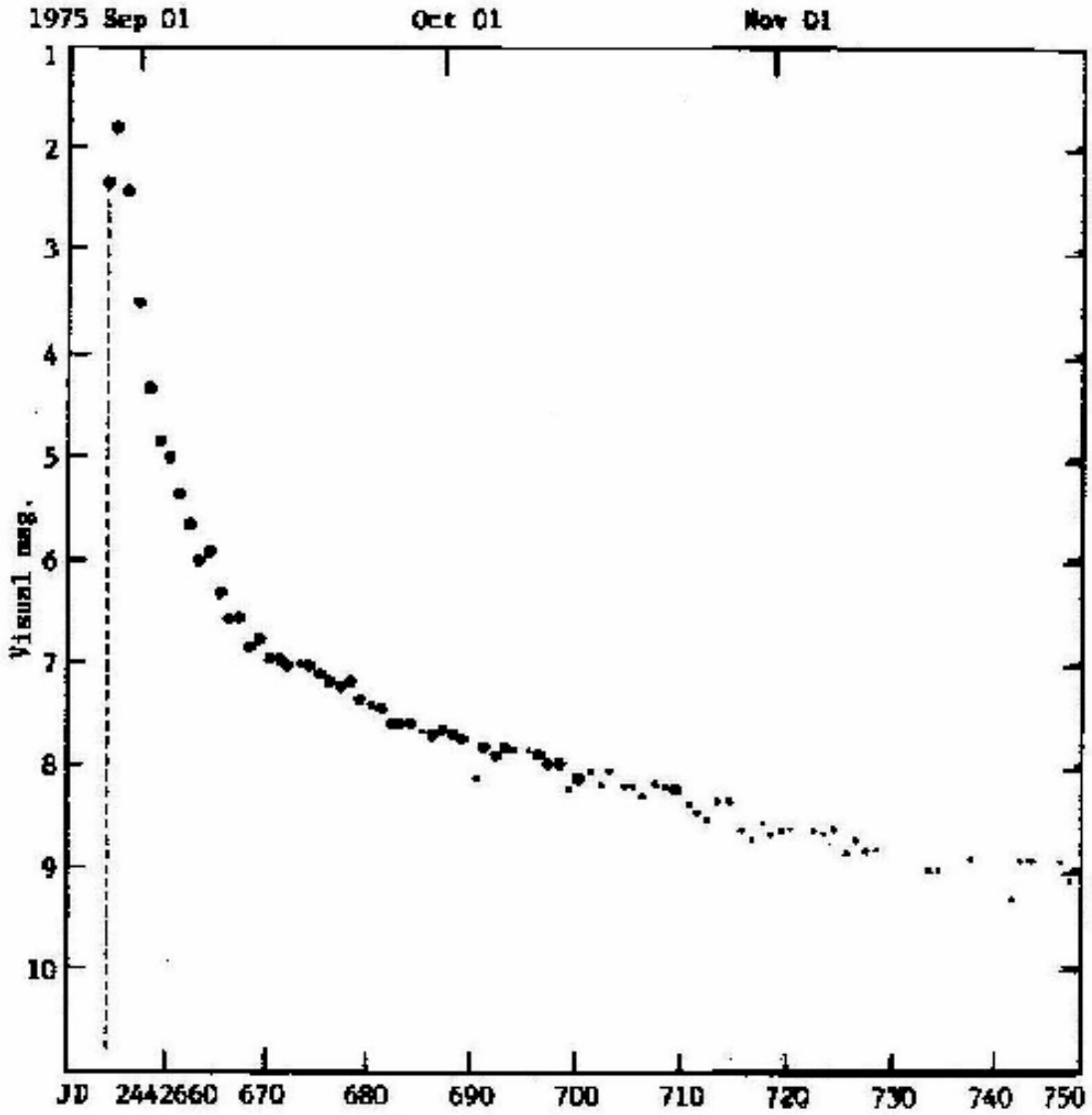


Figure 7. Light curve of V1500 Cyg (Nova 1975, type NA) in 1975, from daily means of observations by the BAA. The dashed line shows the rise as determined from pre-discovery photographs.

Can use any instrument

Naked eye!

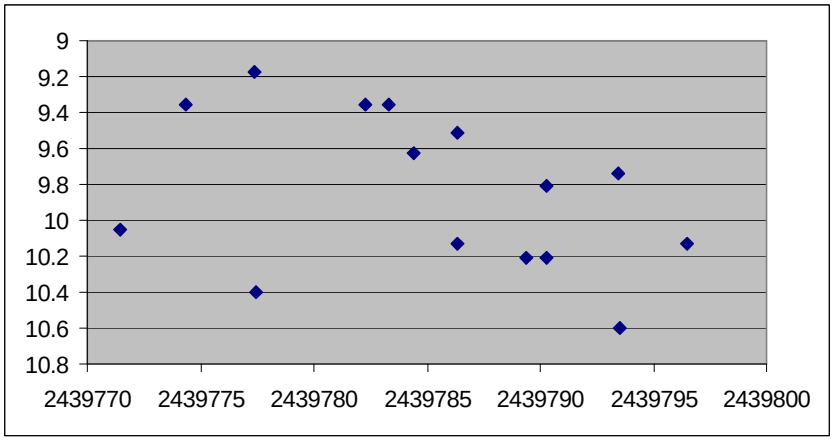
Binoculars (best ~7X50)

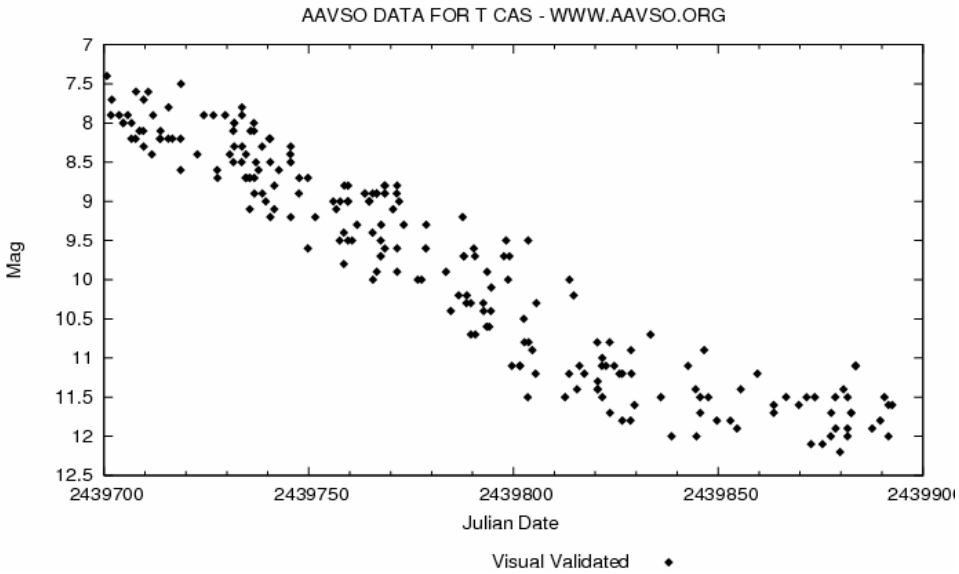
Telescope

Telescope with CCD camera

Make use of those short gaps in the cloud!

My first observations - T Cas





2439771	10.05	Pickard
2439774	9.36	Ikki
2439777	9.17	Jones
2439777	10.4	Pickard
2439782	9.36	Ikki
2439783	9.36	Jones
2439784	9.63	Pickard
2439786	9.51	Ikki
2439786	10.13	Pickard
2439789	10.21	Jones
2439790	9.81	Ikki
2439790	10.21	Jones
2439793	9.74	Munford
2439793	10.6	Pickard
2439796	10.13	Pickard

But now can put stars in Plough
In correct order of magnitude.

THE BAA VSS DATABASE

- Almost 2 million observations
- Oldest in world with observations going back to before 1890
- Over 900 stars
- 30 Stars with more than 10,000 observations
- Professionals ask for this data

Observing Programmes

- **The Telescopic Programme**

  This has been the mainstay of the Section's work since about 1910. Consists mainly of Mira and cataclysmics although there are other types as well.

- **Binocular Programme**

  Mainly red semi-regular stars.

- **The Recurrent Objects Programme**

  Generally under-observed CVs with periods in excess of one year, includes some stars which may have been misidentified with regard to variable type.

- **The Eclipsing Binary Programme**

  Mainly visual and photoelectric observations although CCD observations are now starting to be made.

Observing Programmes (Contd)

- **Nova/ Supernova Search Programmes**

  This programme is run in conjunction with the Deep Sky Section of the BAA and the Astronomer Magazine. In the last three years five UK amateurs have discovered 23 supernovae.

- **The Eclipsing Dwarf Novae Programme**

  Only recently set up to attempt to discover eclipses in these objects where none has been seen to date.

- **The ICCE Variable Star Programme**

  (Identification, Characterisation, Correction of Erroneous GCVS entry's)
  Photographic survey to attempt to discover new variables.

- **CCD Programme**

  A new programme designed to help those with CCDs to obtain scientific results.

The Binocular Programme

Star	RA(2000)	Dec	Type	Range		Period	Chart
X Cnc	08 55	+17 04	SRb	5.6	7.5	195	231.01
RS Cnc	09 11	+30 58	SRc	5.1	7	120?	269.01
RT Cnc	08 58	+10 51	SRb	7.1	8.6	60?	1972Jul29

The Telescopic Programme

Star	RA (2000)	Dec	Type	Range			Period	Chart	Prog	Alert
T UMa	12 36	+59 29	M	6.6	-	14	257	066.01		
SU UMa	08 12	+62 37	UGSU	10.8	-	15	19	018.03		
SW UMa	08 37	+53 29	UGSU	9.7	-	16.5		019.03		*
BC UMa	11 52	+49 15	UGSU	10.9	-	18.3B		Henden 990606		
BZ UMa	08 54	+57 49	UG	10.5	-	15.3B		AAVSO 021011		*
CH UMa	10 07	+67 33	UG	10.6	-	16.0B	204	020.02		
DV UMa	09 47	+44 47	UGSU+E	14	-	19.8B		AAVSO 040405	R	*

SUGGESTED LIST OF VARIABLE STARS

- **Binocular variables:-**
  UU Aur
  X Cnc
  RS Cnc
  RY Dra
  Z UMa
  SS Vir (Near 3C 273)

- **Telescopic variables:-**
  R And
  T Cas
  T UMa

- **Cataclysmic variables:-**
  (Telescopic)
  AB Dra
  TZ Per
  SU UMa

- **Eclipsing binaries:-**
  (Binocular & Telescopic)
  RZ Cas
  Beta Per (Algol)
  TX UMa
  AD And
  HL Aur

The VSS Mentoring Scheme

Intended for those new to VS Observing – both visual and CCD

Communication by e-mail, telephone, sharing observing sessions or even snail mail.

Further information on Section's web site or from the Director.

Other info on the VSS Web Site

- Charts – To help you locate and estimate the variable
- Publications –Observing Guides
- Circulars for members
- Web Site – http://www.britastro.org/vss - very extensive

What are Variable Stars?

Three main types (as far as the visual observer is concerned):-

Pulsating: Eclipsing: Eruptive:

Pulsating Stars

- Variations caused by star physically pulsating –
  like a balloon blowing up and down – only outer layers involved.

- Periods range from hours to years, depending type.

- The range in brightness from about 0.5 magnitudes to over 10.

Eclipsing Binary Stars

- Variations caused by two stars actually revolving around one another - stars must lie in our line of sight.

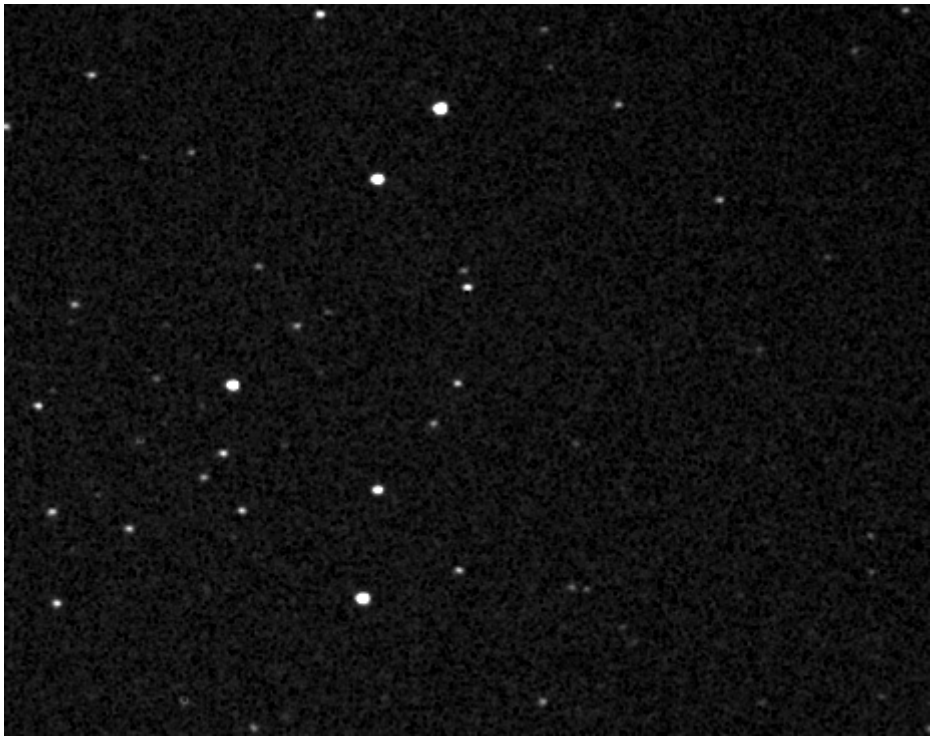
- Periods range from hours to many years.

Eruptive Stars

- These show variations from gentle sun-like ones to gigantic explosions we call supernovae.
- Many are actually binary stars in which the eruptions are due to an exchange of material from one star to the other, often via an “accretion disc”.
- One of the most interesting areas of observing

Eruptive Stars - 4

U Gem in Outburst



Why Variable Stars Are Important

Professionals need the observations (too many VS and too few professionals to observe them).

VS tell us so much about stellar evolution and ultimately, the fate of our own Sun.

It is one of the few areas where an amateur can make a contribution to science – and you don’t even need a telescope!

Which Binoculars to use?

Answer – any! Well, almost any.

10 X 50s or 7 X 50s are good.

Anything more than 10X and difficult to hold unless mounted.

8X40s are lighter and also good.

Don’t be fooled into getting a pair of 20X80s – they need to be mounted.

If you’re not sure if you really are going to take up binocular observing don’t spend more than say £50.

Which Telescope to use?

Answer – any! Well, almost any.

Alt-az; Equatorial.

Refractor or reflector.

Newtonian Schmidt-Cassegrain.

Wide field of view is good.

NOT a Tasco though!

Orion StarBlast Telescope

Sources of further information

Books

Webb Society, Deep Sky observers handbook Volume 8 - Variable Stars.
John Isles, Packed with information on types of variable, methods of observation, analysis etc. Includes over 200 charts and sequences. Highly recommended for the beginner and experienced variable star observer alike.

Observing Variable Stars
Gerry A. Good, Springer-Verlag ISBN 1-85233-498-3, A very good section on the types of variable star and other much useful information.

Cataclysmic Variable Stars
Coel Hellier, Springer-Praxis ISBN 1-85233-211-5, How and why they vary. An excellent introduction to this most interesting topic.

Understanding Variable Stars
John Percy, CUP ISBN 978-0-521-23253-1. Intended for those with some prior knowledge.

Sources of further information

CD-ROMS

Guide 8
http://www.projectpluto.com
Not the prettiest, but the most comprehensive in terms of catalogues included or those that can be added.

SkyMap Pro 9
http://www.skymap.com/
More attractive that Guide and it is English! But there are star position and magnitude errors.

The Sky
http://www.bisque.com/
Expensive but comes free with their range of CCD cameras.

MegaStar
http://www.willbell.com/software/megastar/index.htm
Liked and used by many.

Sources of further information

The Internet

BAAVSS: The Web pages of the BAA Variable Star Section can be found at http://www.britastro.org/vss/ These pages contain upto date light curves, statistics, charts, news, articles etc.

BAAVSS-Alert Group: For speedy communication of interesting news about stars currently observed by BAAVSS members.
http://groups.yahoo.com/group/baavss-alert/

The Astronomer Magazine: Published monthly, this is the premier magazine for the fast dissemination of news and observations.
http://www.theastronomer.org/index.html

AAVSO: http://www.aavso.org. A News Flash service for variable star alerts is also available.

All the above pages also contain many links to other useful Web Sites.

CCD Observing

- The introduction of CCDs to the amateur market has also revolutionised the way some observers undertake their observations.

- VSS has introduced a CCD target list of variable stars suitable for different levels of interest, equipment and observer skills.

SUMMARY

- Why observe variable stars?
- It’s simple and fascinating to watch stars that are billions of miles away changing in brightness, and to learn about these systems from data that is obtained using your own eyes.
- Your data, when combined with other observers’ data can be valuable and unique, and can make a real contribution to science.
- Professionals need your observations
- Finally, you make many friends all over the world sharing your interest.

Thank You