VSS Workshop Edinburgh

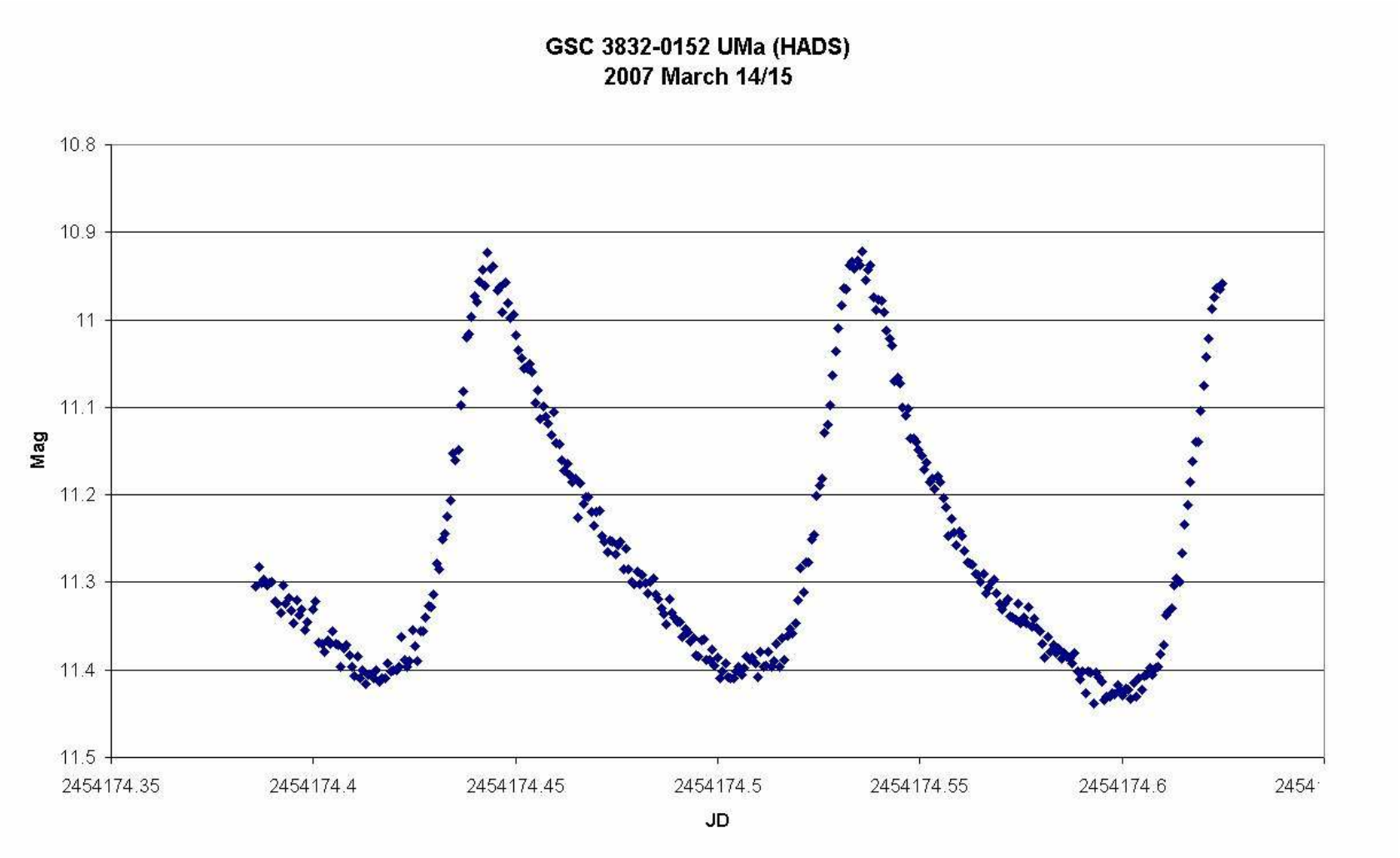
18th October 2008

Roger Pickard, Director BAA VSS
and
President, BAA

CCD Observing

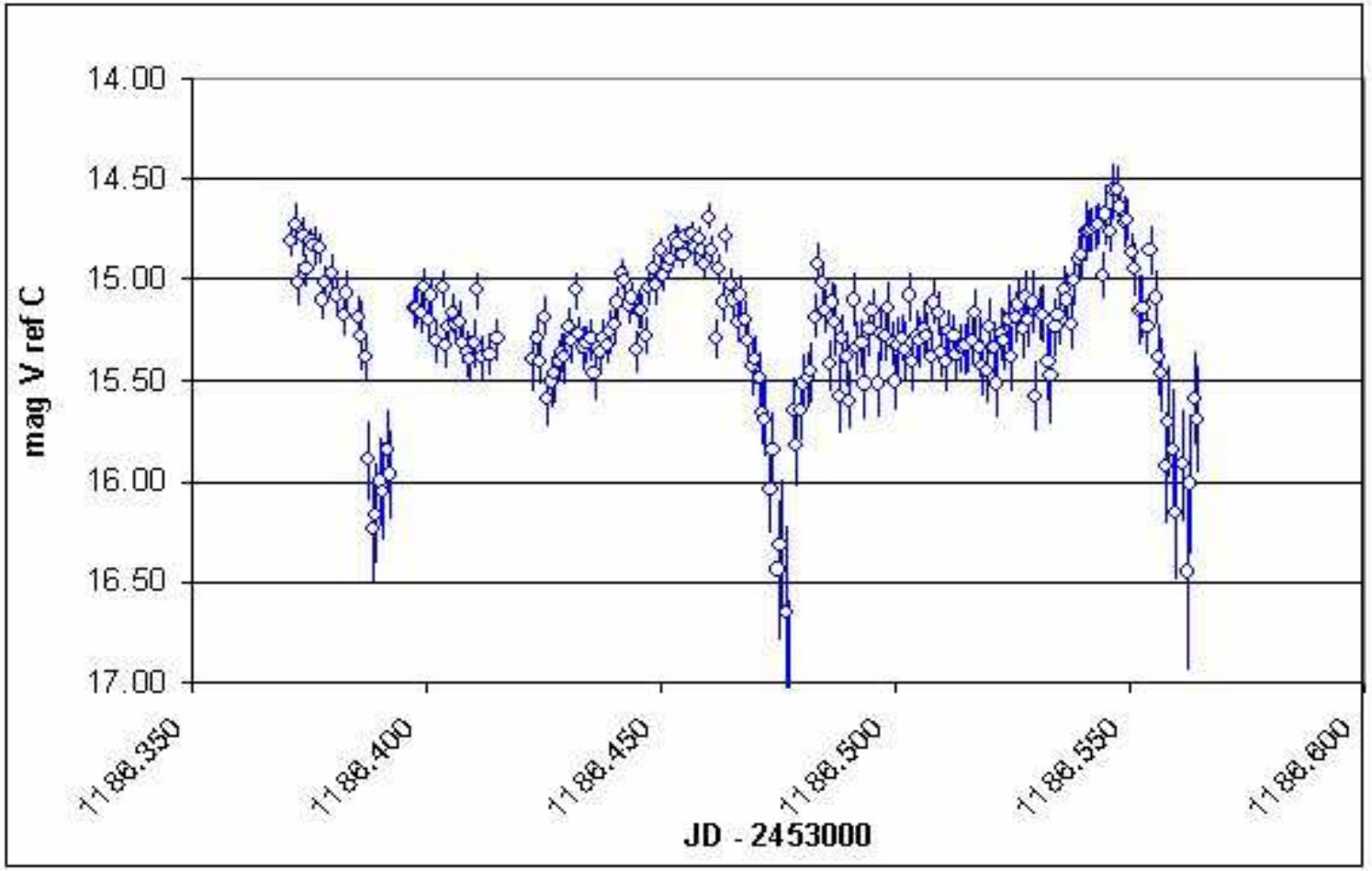
CCD Observing

CCD Observing


GSC 3832-0152 UMa (HADS)
2007 March 14/15
10.8
10.9
11
11.1
11.2
11.3
11.4
11.5
Mag
2454174.35
2454174.4
2454174.45
2454174.5
2454174.55
2454174.6
JD

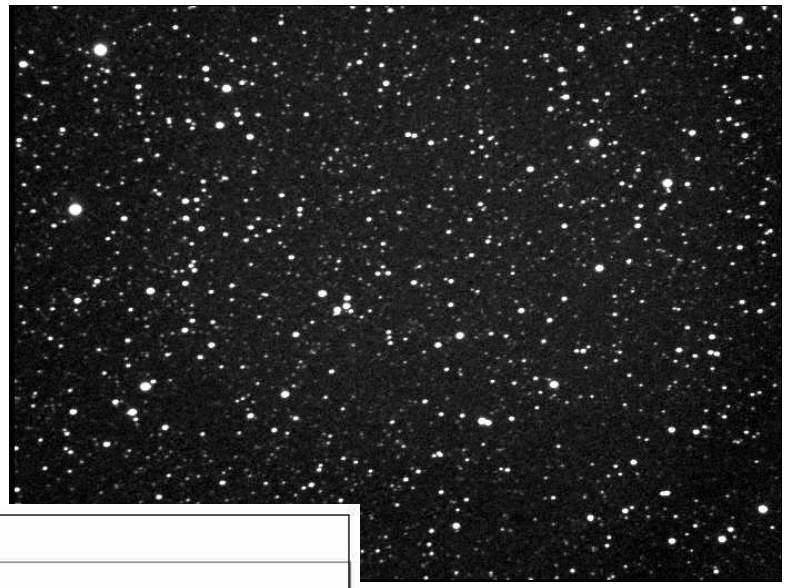
CCD Observing

DV UMa 070326

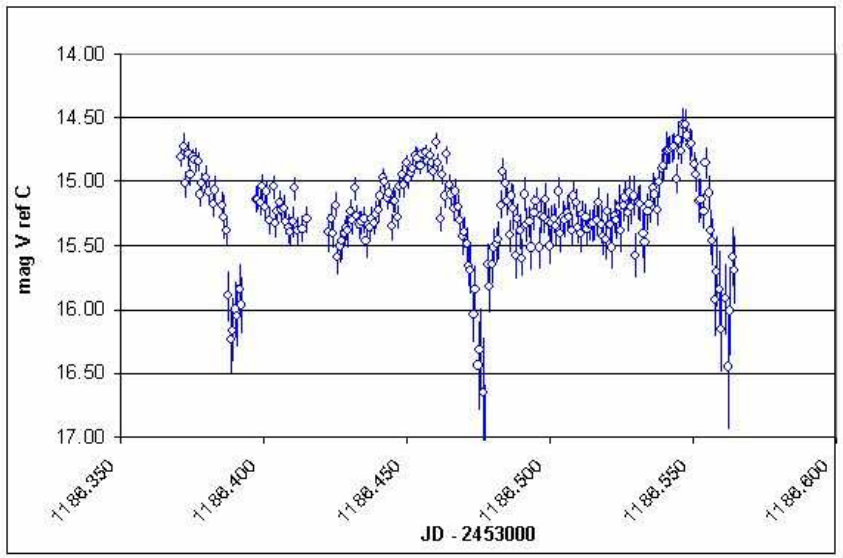


CCD Observing

But how do you get from -

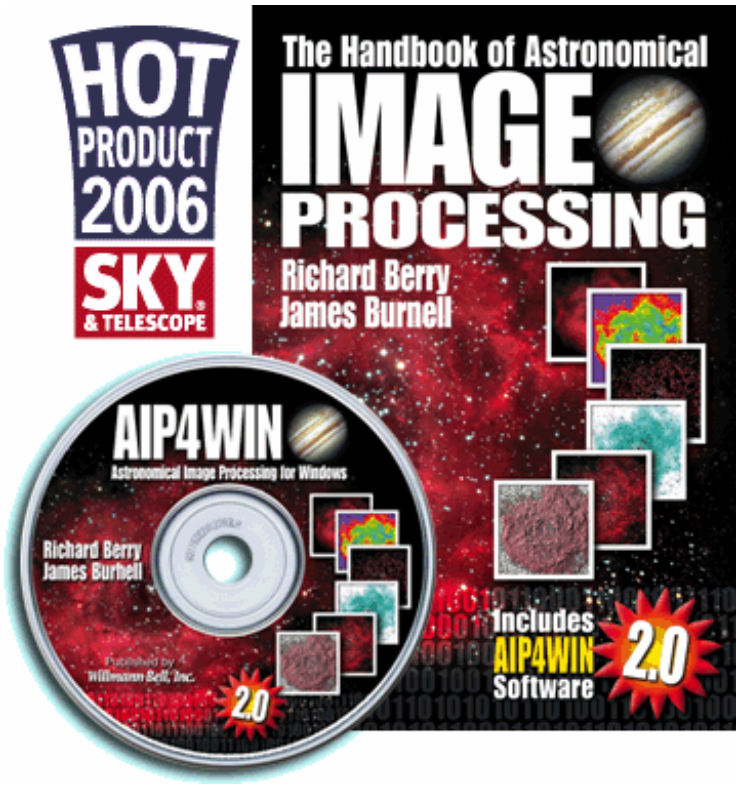


To -



CCD Observing

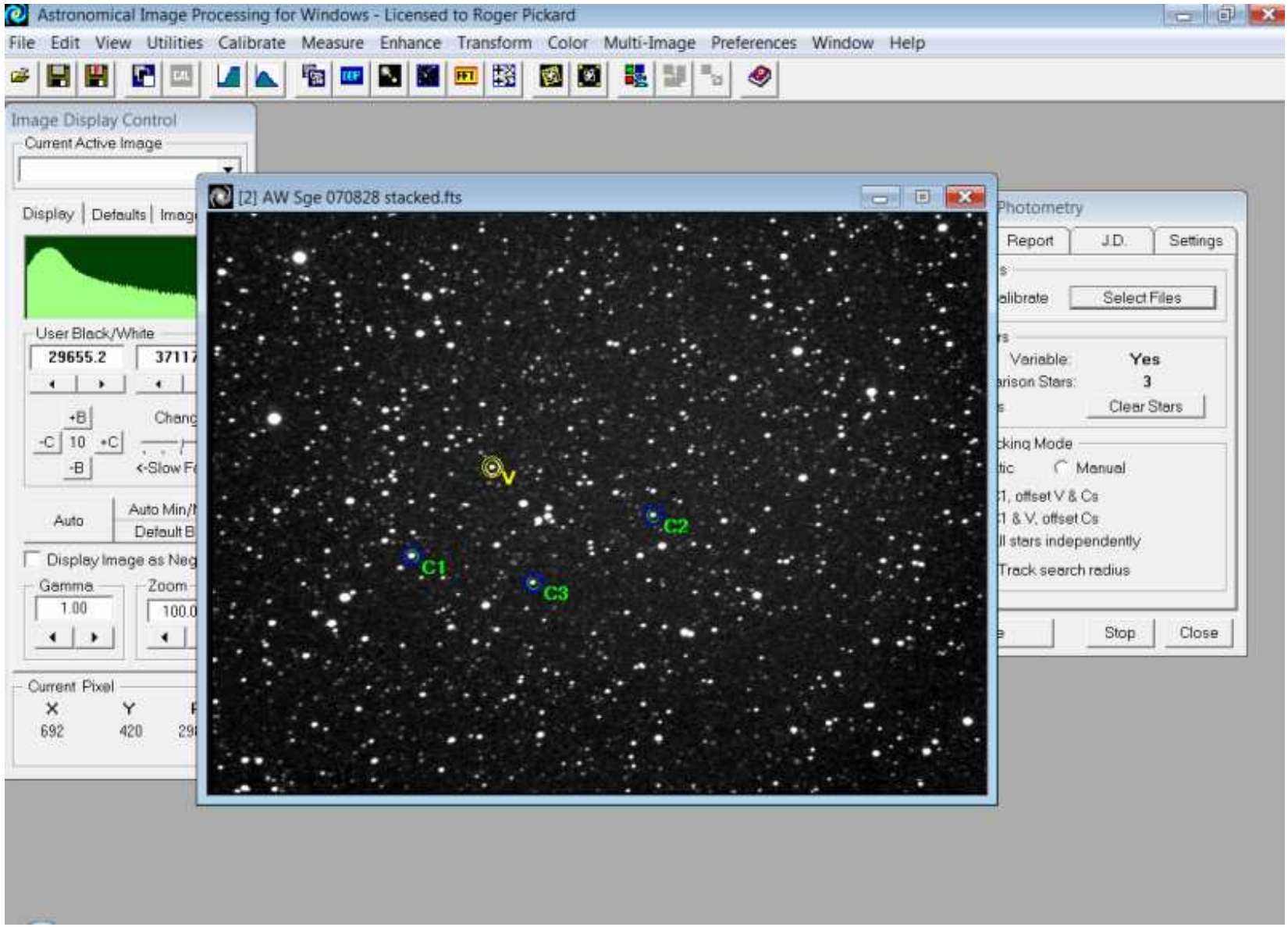
One example is AIP4WIN



The VS Section has developed an Excel program
Takes output from AIP4WIN
Does all the hard work for you

CCD Observing

AIP4WIN in use



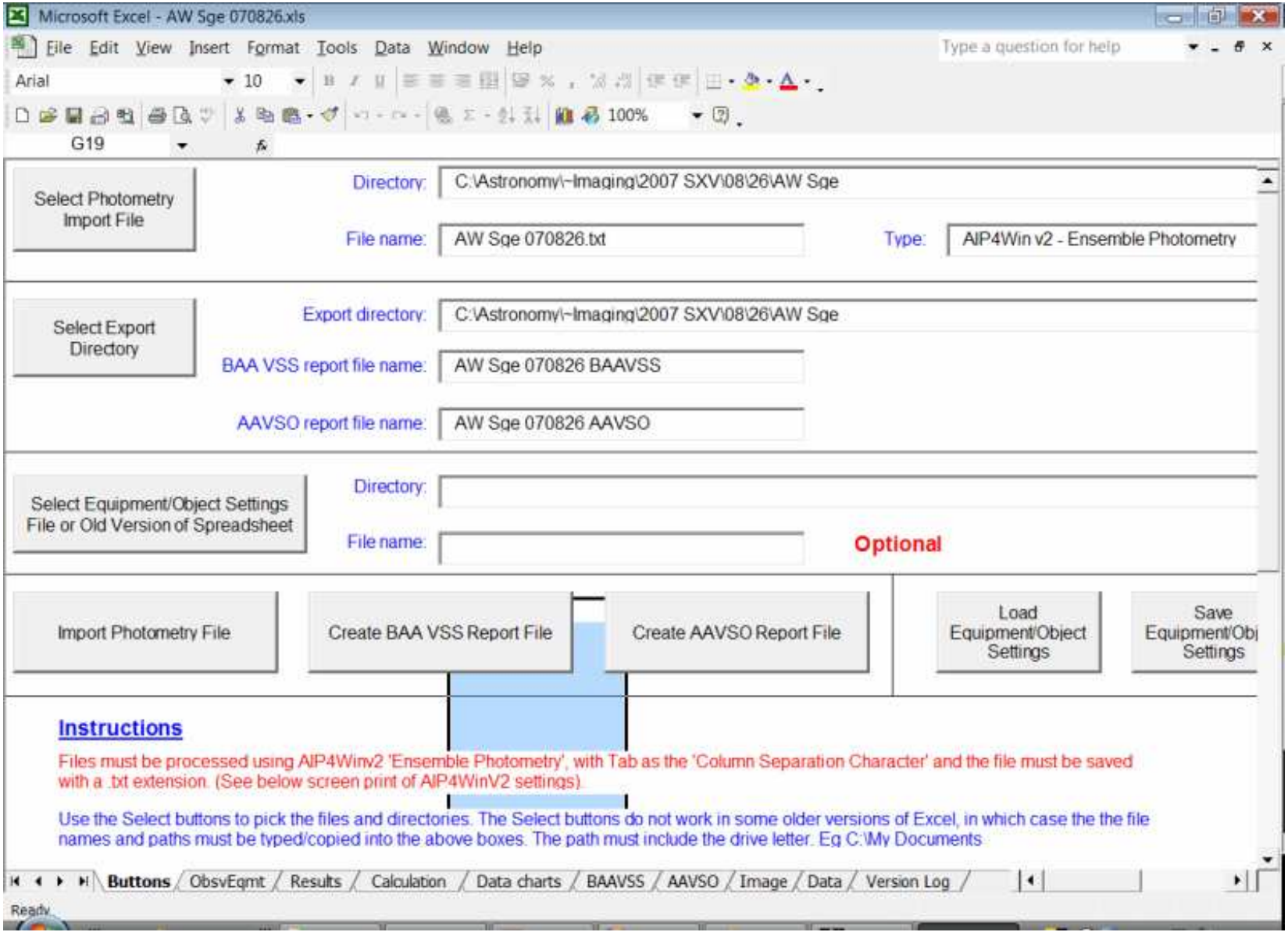
CCD Observing

AIP4WIN in use – A small part of the output file

AIP4Win Multiple-Image Photometry Tool
Ensemble Photometry Report
AIP4Win Licensed to: Roger Pickard
AIP4Win v. 2.1.10
Folder containing files: C:\Astronomy\~Imaging\2007 SXV\08\AW Sge
Filename of first image: IMG3491.FIT
Number of files selected: 44
Star aperture radius: 5
Sky annulus inner radius: 7
Sky annulus outer radius: 10
Star aperture pixels: 77
Sky annulus pixels: 94
Default integration time: 60.0
First Mid-exposure Date: 2007-08-26
First Mid-exposure Time: 20:19:11.000

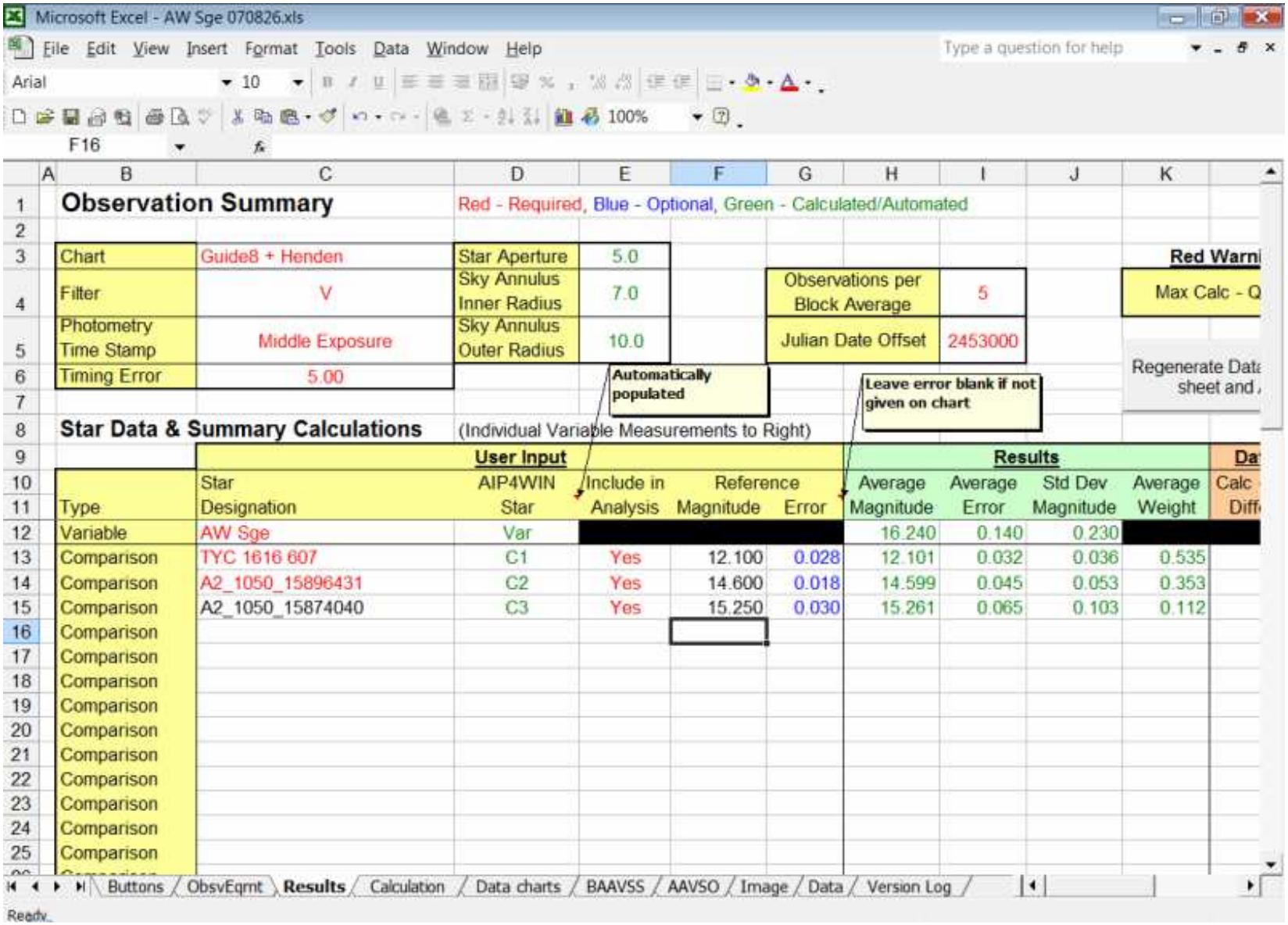
CCD Observing

The VSS Excel file – opening page



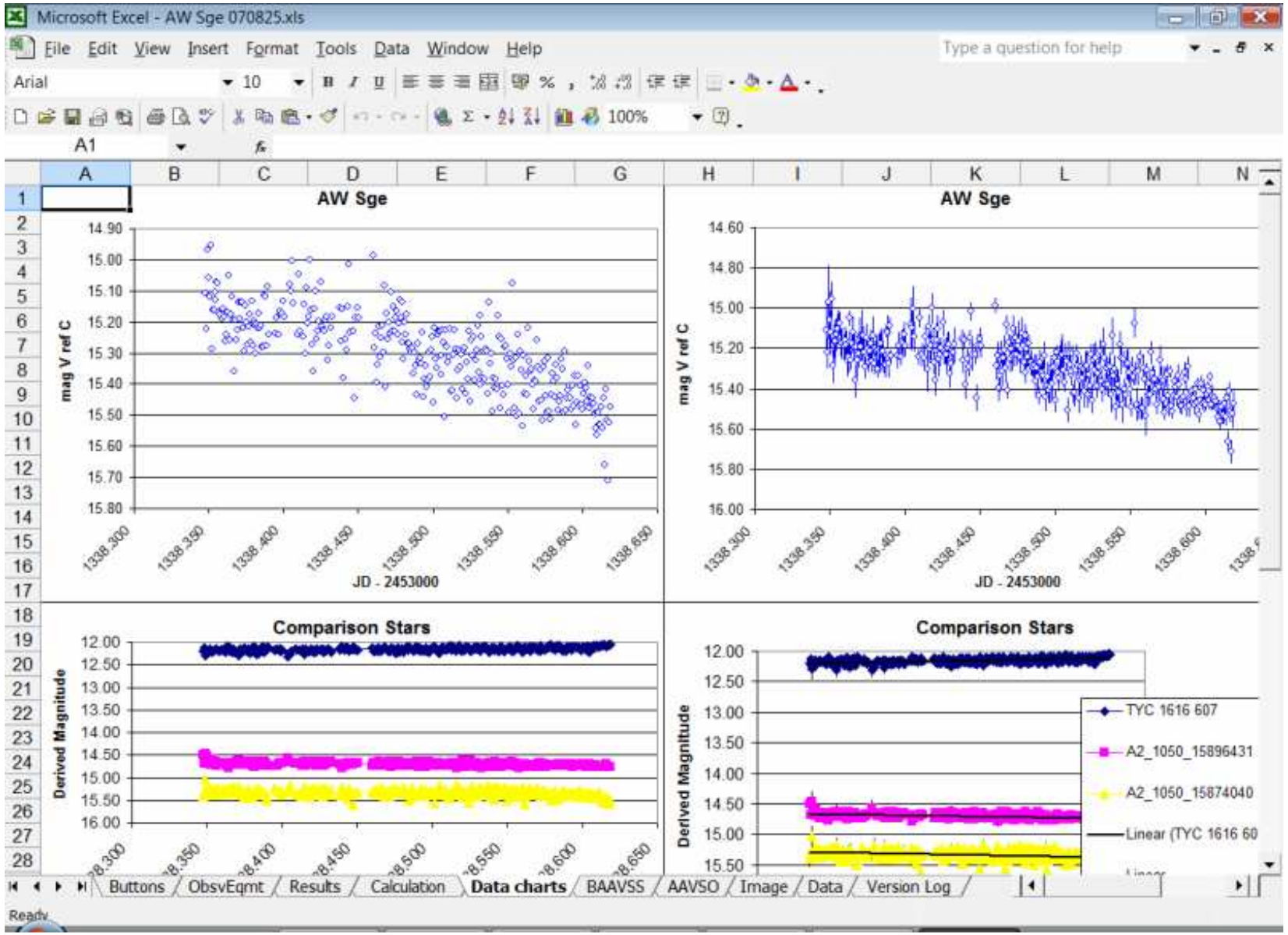
CCD Observing

The VSS Excel file – results page



CCD Observing

The VSS Excel file – data charts page



CCD Observing

Filters!

CCD allows much smaller magnitude variations to be detected than by NE

If you use **Photometric** filters CCD also allows much more information to be obtained from your data.

Photometric systems

- A **Photometric system** is a set of well-defined passbands.
- The first known standardized photometric system is the Johnson-Morgan or UBV photometric system (1953). At present, there are more than 200 photometric systems!
- Photometric systems are usually characterized according to the widths of their passbands:
- broadband (passbands wider than 30 nm (the most widely used is Johnson-Morgan UBV system)),
- intermediate band (passbands widths between 10 and 30 nm),
- narrow band (passbands widths less than 10 nm).

CCD Observing

Color Indices

Color index is defined by taking the difference in magnitudes at two different wavelengths.

Using the U, B, V colour filters, there are three independent possible such differences.

The B-V colour index is defined by taking the difference between the magnitudes in the blue and visual regions of the spectrum;

The U-B colour index is that between the ultra-violet and blue regions.

CCD Observing

Color Index Examples

Spica has apparent magnitudes U = -0.24, B = 0.7, and V = 0.9

The corresponding color indices are:-

B - V = 0.7 - 0.9 = - 0.2

U - B = -0.24 -0.7 = - 0.94

Generally, negative values indicate that a star is hot (most radiation coming at shorter wavelengths).

Antares B = 2.7 and V=0.9, and the B - V color index is

B - V = 2.7 - 0.9 = 1.8

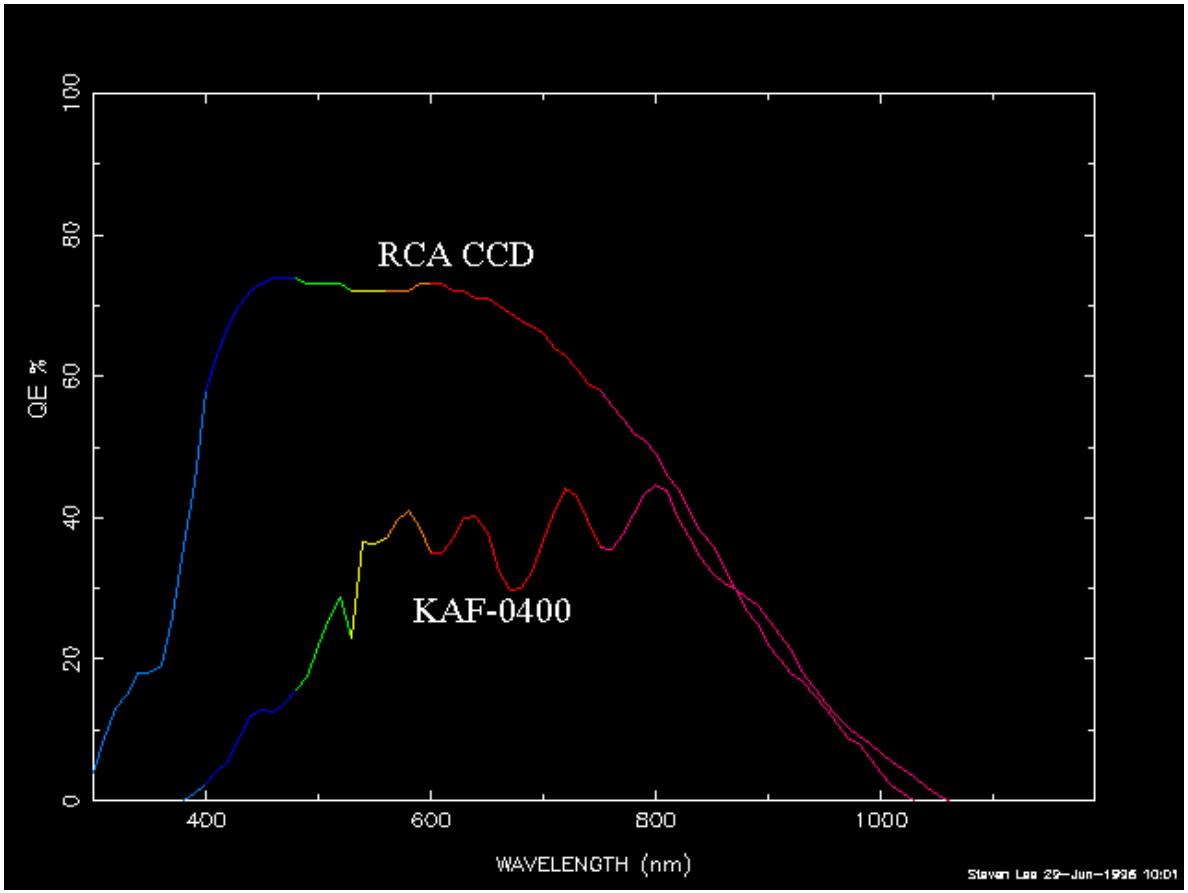
The positive value of B - V in this case is an indication that Antares is a cool star, with most of its radiation coming at longer wavelengths.

CCD Observing

Table of example B - V and U - B mags

Star	Type	B-V	U-B
Y CVn	N	2.54	6.62
μ Cep	M	2.26	2.45
α Ori (Betelgeuse)	M	1.89	2.07
α Tau (Aldebaran)	K	1.54	1.92
α1 Cen	G	0.71	0.33
α CMi (Procyon)	F	0.42	0.03
40 Eri B	DA	0.04	-0.68
α CMa (Sirius)	A	0.00	-0.04
α Eri (Achernar)	B	-0.16	-0.66
ζ Pup	O	-0.27	-1.09

CCD Observing



Note: Unfiltered CCDs are usually red sensitive and so see red stars much brighter that visual observers do.

CCD Observing

Easy	**Basic**	**Time series**
AD And	V452 Cas	SV CMi
OO Aql	GO Com	ES Dra
AC Boo	KV Dra	HR Lyr
EG Cep	V478 Her	CG Dra
TZ Lyr	DV Dra	V1363 Cyg
ER Ori	HR Lyr	
	V1363 Cyg	
	V1316 Cyg	
	TY Vul	
	V630 Cas	

CCD Observing

Basic CCD Data – observe once per night reporting any changes

Star	RA (2000)	Dec (2000)	Type	Range
V452 Cas	00 52 19	+53 52	UGSU	14-17.5
GO Com	12 56 37	+26 37	UGSU	13.1-18.5V
KV Dra	15 50 38	+64 03	UGSU	13.4-17.7V
V478 Her	17 21 05	+23 39	UGSU	15.5-17.1p
DV Dra	18 17 25	+50 48	UGSU/UGWZ	15.0-<21p
HR Lyr	18 53 25	+29 14	N (or NR)	6.5-15.8v
V1363 Cyg	20 06 12	+33 43	?	13.0-<17.6p
V1316 Cyg	20 12 13	+42 45	UGSU	14.5 – 17.8C
TY Vul	20 41 44	+25 35	UG	14.0-19.0p
V630 Cas	23 48 53	+51 28	UG	12.3-17.1p

CCD Observing

Time resolved photometry – observe one star all night long, if possible.

Star	RA (2000)	Dec (2000)	Type	Range
SV CMi	07 31 08	+05 59	UGZ	12.6 17.1V
ES Dra	15 25 32	+62 01	UGSU?	13.9-16.3p
HR Lyr	18 53 25	+29 14	N (or NR)	6.5-15.8v
CG Dra	19 07 33	+52 58	UG	15.0-17.5p
V1363 Cyg	20 06 12	+33 43	?	13.0-<17.6p

Easy – instant results (well, a couple of hours)

Star	RA -2000	Dec -2000	Type	Max	Min I	Min II	Orbital Period	Comp V mag	Comp GSC
AD And	23 36.7	+48 40	EB	10.9	11.6	11.6	0.99 d	10.93	3641 0339
OO Aql	11.19.8	+09 18	EW	9.2	9.9	9.8	0.51 d	10.25	1058 409
AC Boo	14 56.5	+46 22	EW	10	10.6	10.6	0.35 d	9.39	3474 966
EG Cep	20 16.0	+76 49	EB	9.3	10.2	9.6	0.54 d	9.6	4585 413
TZ Lyr	18 15.8	+41 07	EB	10.6	11.3	10.8	0.53 d	10.06	3107 2554
ER Ori	05 11.2	-08 33	EW	9.3	10	10	0.42 d	9.25	5330 364

SUMMARY

- CCD observations are easy to make.
- Reducing the observations is made easier by the use of the VSS Excel spreadsheet.
- Filtered observations are something to work up to – if you wish.
- Professionals need your observations

Thank You