

COLOUR PHOTOMETRY METHODS

There are no standardised stars in any of these fields for BVRI colour photometry. The following procedure is recommended using the charts provided separately:

We have selected appropriate comparisons in each field. You will need a comparison and a check star - perhaps two of each if the star has a large amplitude. With the fainter objects you may be able to get these on a single frame with the variable - with the brighter objects sequential photometry - a series of images of different objects - is needed. This does not reduce the accuracy if careful - conventional PEP uses this method to easily achieve the required accuracy of ± 0.03 magnitudes.

Since these stars are all red objects the comparisons are in the later spectral classes - G-K. M class stars are not recommended, they appear all to be variable at some level. Some suggested objects are listed in Table 1 and noted on the charts, all of which are 30' across unless noted otherwise. Most observers will be able to get the Co/Ck/V on one frame. In most cases there is little background on the fainter objects. On a star to star basis:

R Aquilae

The comparisons are $\sim 15'$ away at most times. When bright, saturation might be a problem in which case another comparison and sequential photometry will be needed.

BX Carinae

The 81 star should be included as much as possible. When the star is faint resort to the second set or establish some values in closer.

CK Carinae

The 85 Ma might be variable, although Ma is a very old spectral class and might be wrong. It's used only as a check. The star 89N is the nearer to the variable - 89F the farther.

CL Carinae

A low amplitude bright object and the first set of comparisons should be adequate.

R Centauri

There are no useful comparisons near this star and the chart is 2 degrees across. Sequential photometry will be required - Co, V, Ck, Co or Co, V, Ck, V, Co.

TT Centauri

Use the second set of comparisons when it's faint. The 70 star has a rather large B-V which may indicate variability. Hence the use of the 84 as the comparison initially.

UZ Circini

The comparisons are a bit distant so use the bottom 97 unless you can get the other on one frame. At minimum closer and fainter comparisons will be needed.

BH Crucis

At minimum there should be no problems but at maximum you may need to include the 73 and do sequential frames.

R Hydrae

This is the brightest target and is rather important. The comparisons on the chart will do when it's faint but at its brightest level others at a distance will need to be found.

R Normae

The marked stars are adequate when it's bright but closer, fainter stars will be needed near minimum.

FK Puppis

The comparisons are at 15' from the variable so two sets of frames might be necessary. The 76 comparison gives a better colour match than the other two.

BN Scorpii

The nearest stars of any brightness are ~10' away. Acquire values for the 78, 86 and 97 and use these for fainter stars in the field.

V 415 Velorum

When it's bright there is no problem but at minimum use the bottom right 100 star.

Star	Range	E Regn	Co1/Ck1	Co2/Ck2	Comments
R Aql	6.0-10.2	Equ'l	93/97	88/95	
BX Car	11.5-14.0	4-5	81/109	95/100	
CK Car	6.9-8.2	4-5	89N/85	98/89F	
CL Car	7.9-9.4	4-5	82/93	90/97	
R Cen	5.5-9.5	6	67/77	81/83	
TT Cen	9.6-15.0	5-6	84/70	??/94	
UZ Cir	9.0-14.3	6	92/97B	??/??	
BH Cru	6.5-10.0	5	73/95	95/101	
R Hya	3.5-9.5	5-6	??/??	91/98	
R Nor	6.0-13.0	6-7	89/91	??/??	
FK Pup	7.8-9.7	3-4	76/78	92/??	
BN Sco	9.6-<15.0	7	78/100B	??/??	
V415 Vir	9.8-12.6	4-5	94/84	100BR/96	

Standardising the Comparisons:

The V values quoted are from satellite imagery translated to the standard system and rounded to the nearest tenth. What is initially required is BVRI values for the comparisons and checks. The method of getting these is explained in ***Bright Star Photometry*** but a quick summary follows. R Aquilae will need special treatment using Landolt's equatorial standards.

Select a couple of stars in an E Region of suitable brightness and colour - in this case K or G classes are best, then measure these before and after the Co/Ck. The third column above shows the regions to use. In some cases the fields are within 20° so near the meridian the extinction can largely be ignored. Just measure E Region, field comps, field comps, E region. The E and F Region stars along with the LMC and SMC fields measured by the Cape Astronomers can be accessed at ***Cape Standard Regions***.

If the stars are some distance from region then the sequence is E Region X field comps, field comps, E Region Y. Work the field values from both regions then average them. This needs doing two or three times at intervals of a month or two.

Hopefully a number of people will be doing this so send results in to me as soon as they are available *stan.walker.varstars.org* and I'll ensure that all participants are informed.

We will also require attention to the visual sequences which seem to be made up of measures from a variety of sources and are not homogeneous. This is covered in *visual sequences*.

The charts are initially for working purposes and in time will be replaced with those showing correct magnitudes and colours.

The following excerpt from an article about transformations goes into rather more detail about the methods of obtaining suitable comparisons. In the cases where the E Region is close to the field the shortened method described above for some stars works quite well.

7.0 *Determining Standards in the Field of the Variable:*

The great advantage of differential photometry— particularly when CCD frames get rid of the need to make sequential sky measures and may have a suitable comparison star nearby or on the same frame— is that it effectively removes primary extinction.

If this 'comparison' is not an E Region or similar star it might be as well to determine its value in the following manner—even if it has a published value. You do not know the quality of the values of most stars outside the Regions mentioned earlier. In selecting this star it's better to use the brightest star available, although the V magnitude difference between it and the variable should not exceed 3-4 magnitudes for a CCD. A good PEP system has a much greater dynamic range. Obviously in some fields you might need a bright and a faint comparison star. Whilst we're talking about a comparison star you should always have a check star of known value which you treat as a variable in the reductions.

You need two E Regions and the particular field to be as close to the meridian as possible. Always select the Regions each side of the field you wish to work in. Then measure in the sequence—setting Region, target field, rising Region, rising Region, target field, setting Region. Everything is symmetrical and balanced. This method keeps the primary extinction to a minimum. The Cape astronomers suggested that within 20 degrees of the zenith extinction effects could be ignored but if you're in a city it is better to do it this way.

The standardisation should be repeated at intervals until you're completely sure there are no problems. Say now, in a month, in 3-6 months, then next year.