INTRODUCTION TO THE CHARTS

These charts have been produced using Project Pluto's Guide 8 compiled by Bill Gray. Most are vertical but some, where the comprison stars lie more east-west, are horizontal. The scale is variable for the same reasons.

Historically, variable star charts have depended upon the availability of sequences and attempts to improve these from the visual values of the Cordoba Durchmusterung and similar visual catalogues have not always been successful. From about 1960 onward good photoelectric measures became available, but these were limited in the number of stars measured except for specific fields. Colour photometry does not need more than 3-4 comparison and check stars. More recently, satellite surveys have measured a very large number of stars but using filters which don't correspond to either the response of the eye or the V of the UBV system.

Many of these measures have, however, been transformed to a more or less standard system and are homogeneous at the bright levels which is what we're interested in. So values for all stars in the range of a particular star's variability are noted on each chart. Only known variable stars are not so marked. There is a margin at top and bottom of the sequence to allow for the eye's different response—and for the thought that some of the quoted ranges of these Cepheids might be slightly incorrect. No attempt has been made to select stars of a standard colour as this is not possible given the stars available. This introduces a minor problem which will be discussed later.

Traditionally, visual measures of variable stars are quoted to the nearest tenth of a magnitude. With the poor quality sequences there was little point in trying for more accuracy. As well, the traditional area for visual observing was of large amplitude variable stars—Miras, many semi-regular stars and cataclysmic variables with large ranges—so that 0.1 was quite adequate. There were also large numbers of targets, so that speed of measures became a factor in the equation—not always for the best!

This project has, at most, 15 visual targets—although you can try some of the others but the charts are less specific and not yet available. So there is no demand for great speed in observing. Quality is what is preferred. All comparison stars have been labelled to two decimal places and the magnitude differences are as small as can be managed with the available stars. In many case there are stars with differences of only a few hundredths. Trying to resolve these two stars in correct order would be a useful exercise.

The recommended method is to look quickly at the target star and make a rough estimate to decide on comparisons. Then familiarise yourself with these so that the difference appears correct. Then make a leisurely estimation in the usual manner. You can repeat this again if you think it has value.

Do not make more then one estimation of any star on any one night. The periods of the stars are relatively long so that the nearest minute is quite adequate.

Initially your measures will not be good but they will improve quickly.

Don't observe on poor nights. Passing clouds aren't a problem if they're hard-edged but they cause slight transparency changes (up to 0.03 magnitudes) which do not matter for this type of observing.

As well, try to measure all targets high in the sky. There is some differential colour extinction across the eye's response so bluer stars will appear fainter than an equivalent red one at a low altitude. But it's probably only a couple of hundredths of a magnitude at 30 degrees above the horizon. Each chart has a table (yet to be made) of spectral classes.

How much accuracy should you try for? Looking around the comparison star sequence will give you some idea of how precise you can be. Initially try for 0.1 values but as you improve you can try to make it 0.05 or 0.03. You're much more likely to be accurate to 0.1 if you're trying for 0.05. At this stage the whole concept is experimental, but people like Sebastian Otero in Argentina have shown that visual measures can be very much better than 0.1 magnitude.

All observations should come to Variable Stars South. The observing methods, charts and comparisons are all different from the AAVSO or the old RASNZ VSS (if they have charts for any of these stars) and neither group promoted Cepheid observing to any large extent. ***Do not*** use these older charts.

THE TARGET STARS

There are 8 stars which are ideally suited to visual measures. They have relatively large amplitudes, the periods are reasonably long and there is a history of changing periods. These are all luminous young Population I stars with the exception of kappa Pavonis which is an older Population II star, or W Virginis Cepheid with a very erratic period and some minor changes in light curve shape. To answer the inevitable question—the prototype W Virginis is tenth magnitude and outside the parameters of this project.

Name of Star	H.D.	Epoch	Period		Maximum	Minimum
W Sagittarii	1801-29	43374.77	7.59503		4.29	5.14
kappa Pavonis**	1856-67	40140.167	9.09423	CW Type	3.91	4.78
beta Doradus**	0533-62	40905.3	9.8426		3.46	4.08
VY Carinae	1042-57	10009.58	18.99		6.87	8.05
RZ Velorum	0835-43	34845.57	20.39824		6.42	7.64
l Carinae**	0943-62	40736.9	35.53584		3.28	4.18
U Carinae*	1055-59	37320.05	38.7681		5.72	7.02
RS Puppis	0811-34	35734.43	41.3876		6.52	7.67

Some shorter period stars which observers might like to try include:

Name of Star	H.D.	Epoch	Period	Maximum	Minimum
V Centauri	1428-56	40308.6	5.493839	6.43	7.21
Y Sagittarii	1818-18	40762.38	5.77335	5.25	6.24
S Triang Aust	1556-63	40734.45	6.32344	5.95	6.81
X Sagittarii	1744-27	40741.7	7.01283	4.2	4.9
Eta Aquilae	1949+00	36084.66	7.176641	3.48	4.39
R Muscae	1239-69	26496.29	7.510211	5.93	6.73
S Muscae	1210-69	40299.42	9.66007	5.89	6.49

OBSERVING

Since some of the participants will be new to naked eye/binocular observing a few comments about methods might be helpful. The best way to observe is from a deck chair or similar with a table beside with charts and the recording notebook on this. Time to the nearest minute is adequate. Dew is not a problem if you're on a house deck or similar as the residual heat keeps it away for a while.

Quite obviously this method restricts you to about half the sky but you can always change to the other side of the house as required. Experience has shown that accuracy improves dramatically with comfort—so don't be bashful about it. With our first research grant at the Auckland Observatory we purchased two comfortable chairs, one reclining, and on wheels, which made everything much easier. With binoculars, the backrest also makes for steadier viewing. You can, of course, just lie on your back but this isn't as convenient or comfortable.

NOTES ABOUT THE CHARTS

beta Doradus:

This is a large 20 degree horizontal chart. Even so, the comparison stars are inadequate. This star is better left to electronic observers but some may wish to try their hand as this star reaches magnitude 3.5.

RS Puppis:

This chart is 5 degrees across, vertical orientation. The fainter comparisons are rather scattered but this is unavoidable.

RZ Velorum:

This chart is 5 degrees across, vertical orientation. Some of the comparisons are rather scattered, others are close to bright stars, but this is unavoidable. There is considerable magnitude compression of the very bright stars—but otherwise the faint end of the sequence would be invisible.

l Carinae:

This is a large 20 degree horizontal chart with adequate comparisons, although a bit scattered in a bright field. Avoid using p and q Carinae, the third magnitude stars marked 'v' in the left centre of the chart. Not far from l Carinae is R Carinae which can be very bright.

U Carinae:

A rather difficult target as it is near the eta Carinae series of clusters and nebulae. Many of the stars in the area are variable so do not suggest alternative comparisons. Even so, several of the comparisons have NSV designations but these are probably due to poor photometry in the past. QZ Carinae and eta Carinae are marked at the right centre but observations are not required by this programme. The chart is 5 degrees wide and the size of the brightest stars has been compressed to allow clarity of those in the variable's range.

VY Carinae:

This is about 3 degrees north of the U Carinae field but the same comments apply. Variables and nebulosity are frequent. There is no comparison in the 6.5-6.8 region which would be good for determining maximum. Extrapolating from the 691 699 stars, which is not liked, may be better than using the 622. The chart is 2 degrees high but is oriented horizontally for better comparisons

R & S Muscae:

These appear on a 10 degree horizontal chart. The comparisons are a bit scattered but the best that can be managed. There is again magnitude compression of the brighter stars.

V Centauri:

This is a 5 degree vertical chart. There are adequate comparisons. The brighter stars on the chart are compressed in scale.

S Triangulum Austrinae:

A 5 degree vertical chart with comparisons a bit scattered.

W & X Sagittarii:

Both these stars are bright and the chart is 10 degrees horizontal to include sufficient comparisons. Even so, the gaps in the sequence are rather large.

Y Sagittarii:

This is a 5 degree vertical chart. There are adequate comparisons. The brighter stars on the chart are compressed in scale.

kappa Pavonis:

Another large chart 20 degrees vertical in a sparse part of the sky. The sequence could be better but there is little choice. This is a W Virginis type Cepheid so tends to be erratic.

eta Aquilae:
Another bright Cepheid in a sparsely populated patch of sky. The sequence is poor in the important bright end but the analysis methods can overcome this provided it is well observed at mid-brightness.