

## A METHOD OF CREATING AAVSO OBSERVING CHARTS BY COMPUTER

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### Abstract

Computer scanning of photographs and a new program which makes all of the star images round promise new excellence in charts.

About two years ago a new computer was purchased for AAVSO work at the Stamford Observatory with a view to improving the chart-making process. The computer is an IBM clone based on a 25MHZ/386 chip, and was originally equipped with 4 megabytes of RAM. The RAM has now been expanded to 8 megabytes, and a Cyrix 387 math-coprocessor chip has been added. A Hewlett-Packard scanner running up to 600 DPI was purchased later, along with a CD-ROM drive and the *Space Telescope Guide Star Catalog* (STScI 1989) on CD-ROM disk. A Hewlett-Packard LaserJet IIP printer completes the equipment.

As the equipment was assembled over a period of several months, we began searching for a program that would allow us to make a base "template" for charts. It would have to store the frame lines and the layout of the text (Figure 1), and allow easy replacement of text for new charts. Several programs were considered. Obviously a high-end drafting program would work, but they cost several thousand dollars. Similarly, a good desk-top publishing program would work, but again they are quite expensive, although only in the several-hundred-dollar range. Late last year advertisements began appearing for an inexpensive but fairly powerful desktop publishing program called AVAGIO (Unison World Software). After other lesser programs had been tested and found wanting, AVAGIO finally appeared on the market and was purchased on a trial basis. It was a bit difficult to learn, but proved fully capable of doing what we wanted.

Additionally, we needed a program that could handle the scanned photographs. Z-Soft's PC-Paintbrush IV+ was our first choice, and has worked very well. It handles the scanning of the image at resolutions up to 600 DPI, and can then scale the chart up or down, and filter small specks to eliminate photo-grain effects. The scanned photo can be cropped at will, and a variety of text fonts allow magnitudes to be placed next to comparison stars. All this was a great step forward, but the charts still looked like photographs, with slightly irregular or even trailed images (Figure 2). We needed a program to make star images truly round, and if possible, to allow us to scale star images up or down so that the charts would be easier to use. After deep and careful consideration of what name would be scientifically acceptable for such a program we called it "Roundify".

At this point we enlisted the aid of Gilbert Weingarten, a member of the Fairfield County Astronomical Society (our local club). He is a programmer and also interested in astronomy, and took the project as a challenge. It challenged him for many weeks of spare time, but he has written a program that does all we want and more. It has considerable image processing capabilities. The first step in "Roundifying" a chart image is to have the program read the scanned image,

identifying all stars, locating their centers as defined by the pixel raster, and totaling how many pixels comprise each image. The result is a list of all these data. We then critically examine the scanned image, noting the size of the smallest star images we wish to keep, and whether or not they are large enough to recognize on the final chart. At this point we decide how to scale the star images so that the smallest will be easily seen under red observing light, and the largest images are big enough that they will stand out. All stars fainter than the minimum will be rejected by the second step of the program, which creates the new star chart with perfectly round star images, and all new images will be scaled to our specifications.

The "Roundify" program not only allows us to produce round star images, but since it lists the exact center of each star image, and how many pixels make up that image, we can do astrometry and photometry. For photometry we need to have known standard stars on the photograph from which to derive a characteristic curve of magnitude versus pixel count. For astrometry we need to locate SAO or other precise star positions from which we can calculate the position of virtually any star on the photo.

If the chart already has a sequence, we are ready to enter the magnitude numbers next to the comparison stars, plot the variable, and label any other variables or named stars on the chart. To identify the other variables we use two steps. First a program written by one of us (RAL) scans the *General Catalogue of Variable Stars* (GCVS)(Kholopov *et al.* 1985), for a given area around the variable being charted. This gives us a list of all variables, and even suspected variables nearby. If any are bright enough to be "discovered" by observers, or should be observed in their own right, they are plotted. A quick check of positions for these variables is obtained by running a program named "Superstar" (Pico-science, Fremont, CA). For bright variables this is usually sufficient to identify them, but for fainter ones we may need to go to the source reference listed in the GCVS if it is readily available, or go to the *Space Telescope Guide Star Catalog* on laser disk.

Next, another program by RAL scans all available photoelectric data for SAO stars in the vicinity. This takes a list of the SAO stars obtained from the Superstar program, and compares that list with the cross-reference between the SAO and HD numbers, and then scans several lists of photometric data to come up with the magnitudes of any measured stars in the area of interest, including BD or other stars with no SAO or HD number.

We are now in the process of upgrading many of the charts for stars that have very poor phase coverage. Examination of the list of these stars from the *AAVSO Bulletin* reveals that most of them have poor charts and many of them are stars having only preliminary charts. Another problem seems to be a prejudice on the part of observers against going much below the equator even when the horizon permits. This problem is similar to the one of obtaining data for circumpolar stars. Observers just seem to forget that they are there year round.

A second group of charts being redrafted are those which are preliminary chart expansions of "standard" AAVSO charts; that is, charts where a 'd' or 'e' chart has been available for many years and a preliminary 'e' or 'f' chart was made to clarify crowded fields and/or provide fainter field or comparison stars. These new charts will be added to the regular chart catalogue.

A third group of charts to be worked on are those for stars in the HIPPARCOS observing program. Many of these stars become fainter than can be conveniently observed with the existing charts, so expanded charts will be drawn where needed. Most of these will be new standard charts, since we have photoelectric sequences for them.

All of the new or redrafted charts are being made directly from photographs taken through visual filters so that they will resemble the sky. This will also eliminate

some problems with misplaced star images, particularly for some faint comparison stars. In all cases where there are several charts for a star, e.g., 'b', 'd', and 'e', we will redraw all charts in the series for uniformity. We would like to hear from observers who have "pet peeves" about any chart or charts. Our aim is to improve the AAVSO charts so that we can provide observers with the best possible charts and make it easier for them to get those precious observations.

We thank Clinton Ford for granting funds to the AAVSO to purchase the computer equipment, and Michel Grenon of Geneva Observatory for providing computer-tape copies of large amounts of Geneva photoelectric data, and we thank Gilbert Weingarten for his efforts in writing the "Roundify" program. We also extend our thanks to the Stamford Museum for the use of the facilities of the Stamford Observatory.

### References

- Kholopov, P. N. *et al.* 1985, *General Catalogue of Variable Stars*, Fourth Edition, Moscow.
- STScI 1989, Space Telescope Science Institute, 3700 San Martin Drive, Baltimore, MD 21218, USA, CD-ROM.

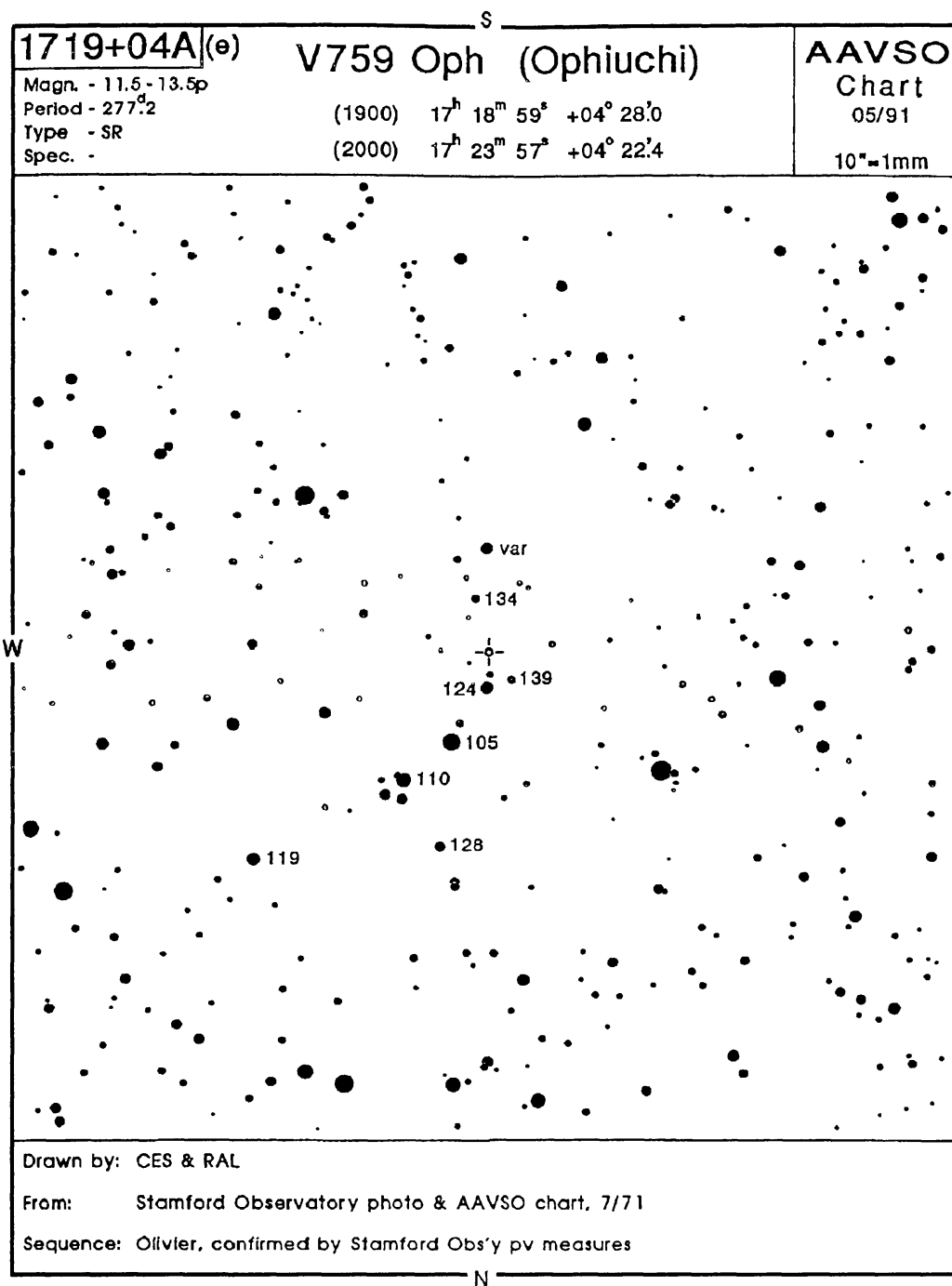


Figure 1. Format of new computer generated charts, showing outlines and text as created with the AVAGIO program. The star field images and magnitude text were imported from the PC Paintbrush IV+ program.

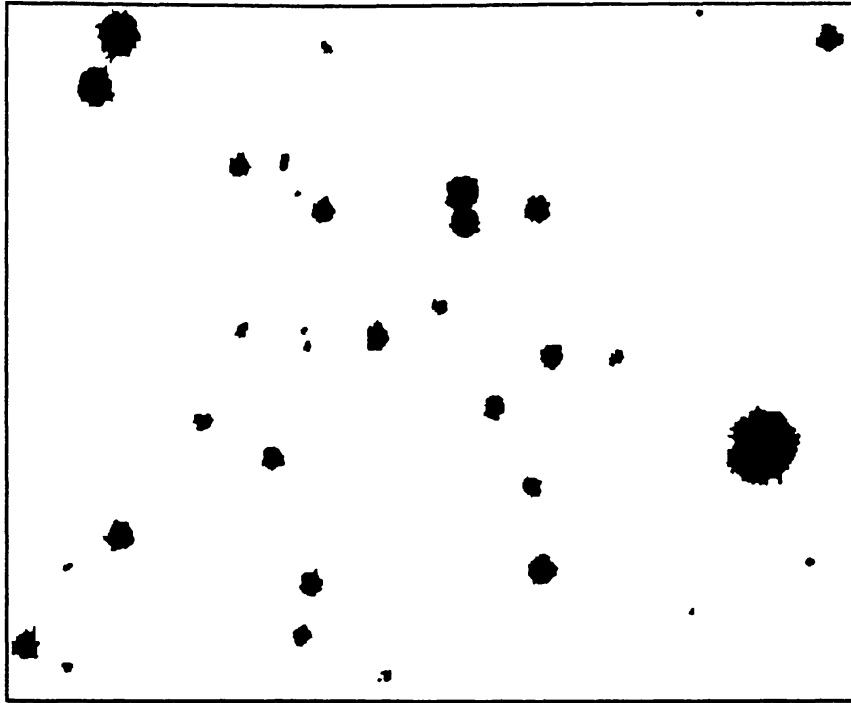


Figure 2. Typical section of raw photographic image showing irregularity of star images.

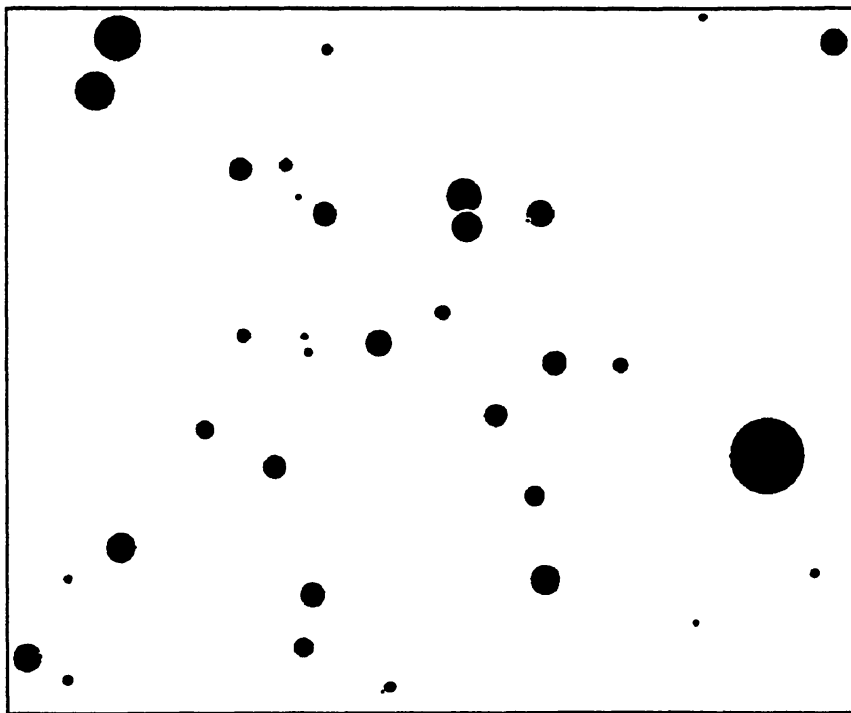


Figure 3. Typical star images from photo in Figure 2, after applying the "Roundify" program.