Is the *Guide Star Catalog* Usable for Making Variable Star Estimates?

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Abstract Amateur estimates of variable stars magnitudes are widely recognized as valuable for many kinds of scientific objectives. I will concentrate here on the long-term following of large-amplitude cool red variable stars of the Mira type.

1. Discussion

It is well known that some Mira stars are subject to long-term changes in period. R Hya and R Aql, two Mira stars whose changes in period have been long known, provided the impetus to look more closely at these kinds of stars, using data provided by the Hipparcos satellite (Van Leeuwen *et al.* 1997). More recently, a similar phenomenon was shown for T UMi (Gál and Szatmáry 1995; Mattei and Foster 1995).

It may be important to find new cases of such period changes. All that is needed is to keep track of the epoch of maxima for as many stars as possible, which can be done without many observations for each star, and without need for utmost precision in magnitude estimation. On the contrary, use of amateur estimates for a more precise analysis of light curves, including, for example, searching for long-term periodic components, needs more precision and the cooperation of multiple observers in order to get statistical compensation for errors; for instance, the long-term analysis of the light curve of o Ceti (Mira) (Barthès and Mattei 1997) made use of a large number of rather precise observations, using a well-tested comparison sequence.

Among Miras in the northern hemisphere, more than 1,000 are observable at maximum using medium-sized amateur telescopes, but nobody is looking at them because no AAVSO standard chart is available; such charts exist (most of them in preliminary form) for approximately 600 stars. Drawing new charts is very slow, because one needs precise photoelectric magnitude measurements for comparison stars.

For obtaining nothing more than the epochs of maxima, it would be possible to use only direct eye estimates. But the drawing of charts directly while at the eyepiece (or by personal photography) would be very tedious. For that reason, I decided to use charts drawn from the *Guide Star Catalog* (GSC, Space Telescope Scinece Institute 1992), which goes down to 14th or 15th magnitude, and which is very easy to use on a computer. It is generally stated that GSC magnitudes are imprecise, in fact not better (but not really worse) than visual estimates, although for the above-described purpose they may be sufficient. In fact, the main problem

for a lot of those stars is that position in the *General Catalogue of Variable Stars* (GCVS, Kholopov *et al.* 1985) positions are often wrong; those errors are well-known to the authors of the GCVS (Samus undated), but for different reasons it was not possible to publish corrected values. In most cases, after some months of observing, the variable star is quite obvious.

Two years ago I started a program of following approximately 150 such Mira stars, selected on the basis of the GCVS maximum magnitude being brighter than 12 visually (if the GCVS magnitude is "P" (photographic), I assume a color index of 1.5). In most cases the star was easily located and an acceptable light curve could be drawn.

With regard to GCVS magnitudes, which are mainly *V* in the northern hemisphere, the author of the catalogue claimed a standard deviation of 0.5 magnitude. In fact, all tests I made on fields having a definitive AAVSO chart showed a standard deviation not greater than 0.2, which is not worse than naked-eye estimates. Of course, for some stars in the field, the difference can reach 1 magnitude. The GSC magnitude scan gives an indication of the real magnitude of the comparison stars, but the observer should remain critical and select only "good" comparison stars—those which are approximately equal to (or in agreement with) the GCVS magnitudes.

References

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