Long Period Variables as tracers of Galactic Structure

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Abstract. Distances to a large sample of long period variables are derived using a PL-relation and a 3D model for the reddening. Their use as a tracer of galactic structure is discussed.

Almost all stars with initial masses $\lesssim 8$ M$_\odot$ will pass through the Asymptotic Giant Branch phase. One of the main characteristics of this phase is radial pulsation as Irregular (Irr), semi-regular (SR) or Mira variables. Many of the SR actually show well behaved light-curves, and so these stars and the Miras are called Long Period Variables (LPVs).

That Mira variables follow a period-luminosity (PL-) relation had been known for decades, but in the optical the scatter is large. The practical use increased with the extension to the K-band or bolometric magnitude, especially with sufficient phase coverage of the light-curve. Recently Whitelock *et al.* (2008) revisited the PL-relations in $M_{\rm bol}$ and $M_{\rm K}$ for Miras, including the Galactic PL-relation using the 2007 revised Hipparcos parallaxes and other observables as constraints. With the PL-relation as distance indicator one can make an attempt to study Galactic Structure using LPVs, see Figure 1.
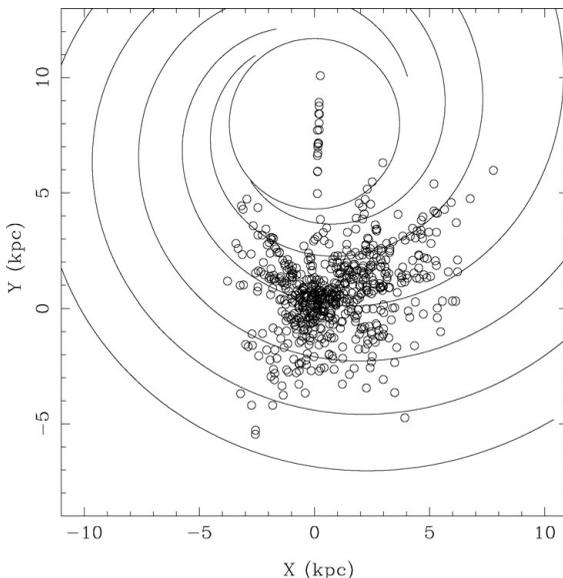
Figure 1. Location of 700 Miras, projected onto the Galactic Plane, with $|z| < 500$ pc. The Hou 4-spiral arm model is shown as reference. From the GCVS 4500 stars classified as Miras were selected, with periods in the range 50-400 d. Their K-band magnitudes were looked-up via SIMBAD (available for 1250). Using a PL-relation and a 3D model for the reddening (Groenewegen 2008) the distances were derived. I leave it up to the reader whether he/she believes that Miras trace Galactic Structure or not! The GCVS is clearly a very inhomogeneous source of information, so surveys like LSST and Skymapper will be essential in creating unbiased samples of LPVs.

References

Whitelock, P. A., Feast, M. W., & van Leeuwen, F. 2008, *mnras*, 386, 313
Groenewegen, M. A. T. 2008, *A&A*, 488, 25