Magellanic Cloud Eclipsing Binaries : Primary Distance Indicators

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Abstract. Our collaboration involves groups in Denmark, the U.S.A. Spain and of course New Zealand. Combining ground-based and satellite (*IUE* and *HST*) observations we aim to determine accurate and precise stellar fundamental parameters for the components of Magellanic Cloud Eclipsing Binaries as well as the distances to these systems and hence the parent galaxies themselves. This poster presents our latest progress.

The utility of double-lined, eclipsing binaries for the measurement of fundamental stellar parameters as well as distances, including systems in the Magellanic Clouds, has recently been reviewed by a number of authors (e.g. Guinan, Bradstreet & DeWarf 1996, Hilditch 1996, Paczyński 1997) so we shall not repeat that here except to make the following important points. The distance to an eclipsing binary system can, in principle, be determined directly, without relying on intermediary calibrating objects. The method is essentially geometric and relies on the determination of the physical stellar sizes and the intrinsic radiated flux.

The physical dimensions of the two components of an eclipsing binary are determined from light curves and the two radial velocity curves for the two components. Modern analysis tools (see Wilson 1994 for an excellent review) allow for accurate and precise modelling of well-detached, semi-detached and even complicated contact systems.

The distance is then determined simply by comparison of an apparent flux with the corresponding absolute flux. This generally relies on the estimation of the effective temperatures of the two components either via spectral classifications, multi-colour photometry or spectrophotometric flux fitting.

An ongoing collaboration between groups in New Zealand, Denmark, the U.S.A., Spain, Britain and Canada has, since 1984, been using telescopes in Chile, Australia and New Zealand as well as both the *IUE* and *HST* satellites to secure optical photometry, spectroscopic radial velocities and uv-spectrophotometry of Magellanic Cloud Eclipsing Binaries. With modern CCDs even 1m telescopes are adequate to obtain light curves with 1% or better photometric accuracy. For the radial velocities, 4m-class telescopes are the minimum requirement for groundbased observations of sufficient quality while one system (HV 2274) has been observed with the (now-defunct) GHRS on the *HST*. Flux fitting to uv-spectrophotometry obtained by satellites promises to be a useful technique for temperature determinations. Ten systems – six in the LMC and four in the SMC – have been observed with the *HST*'s (also now-defunct) FOS. All ten were also observed with the *IUE* and have modern CCD light curves, although some would certainly benefit from further observations. However only a couple have high precision radial velocity curves and HV 2274 is the only system to date for which all the requisite observations have been analysed to yield a distance determination of the highest quality – we determine a distance modulus of 18.49 ± 0.07 mag to HV 2274 and 18.44 ± 0.07 mag to the center of the LMC (Guinan et al. 1998). Our collaboration's efforts are therefore now focused on securing the photometry and spectroscopy still required for these systems plus other especially appropriate systems which have come to light as a result of recent microlensing projects such as EROS and MACHO.

The poster presented in Victoria can be downloaded from:
`http://www.phys.canterbury.ac.nz/~phys249/publications.html`

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