Some EROS Survey Results for Variable Stars in the Magellanic Clouds

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Abstract The EROS project (Expérience de Recherche d'Objets Sombres) has given, as a by-product, numerous and good quality light curves of Cepheid stars in both the Large Magellanic Cloud (LMC) and Small Magellanic Cloud (SMC). A catalogue of such objects will be presented, and focus will be made on the particular aspect of the metallicity effect on the Cepheid distance scale.

1. Introduction

EROS is a French collaboration between astronomers and particle physicists. As with other similar experiments (Cook, these proceedings), the principal aim is the search for baryonic dark matter in the galactic halo through microlensing effects on more distant stars of the Magellanic Clouds. A first approach involved the ESO Schmidt telescope, with which 290 photographic plates were exposed. A second approach was to use a 0.4-m refurbished reflecting telescope and a mosaic of sixteen abutting CCDs. The observations have yielded about 250,000 light curves from the CCD data and six million light curves from the Schmidt plates. Among this very large amount of data there are numerous light curves that are sampled well enough to conduct large-scale studies on intrinsically variable stars of different kinds. Various results are presented here.

2. Eclipsing binary stars in the bar of the LMC

A catalogue of seventy-nine certain or probable eclipsing binary stars located in the bar of the LMC has been constructed from CCD observations (Grison *et al.* 1995). The systems mostly exhibit blue colors and have periods of less than ten days. The complete catalogue and light curves are available electronically from the CDS, Strasbourg, under the Reference Catalogue J/A+AS/109/447.

3. Pre-main-sequence stars in the bar of the LMC

We discovered seven blue and variable massive pre-main-sequence (PMS) stars in the bar of the LMC (Beaulieu *et al.* 1996). They are the first PMS stars observed outside the Milky Way. They are more luminous and more massive than their Herbig AeBe galactic counterparts. This is probably due to the lower LMC metallicity; in effect, with a smaller dust-to-gas ratio in the LMC, the stars become visible through their dust cocoons earlier and thus appear brighter than those in our galaxy.

4. Differential studies of Cepheids in the Magellanic Clouds

Three million measurements were used to investigate the pulsational properties of ≈ 500 Magellanic Cepheids as a function of metallicity (Beaulieu *et al.* 1997; Sasselov *et al.* 1997). A small metallicity effect on the period-luminosity relation has been empirically found; a systematic error is thus made when interpreting the color shift of Cepheids due to metallicity as a reddening. With the known average difference in metal content between LMC and SMC Cepheids, a relation is derived between the distance modulus correction and the metallicity. When this result is applied to recent [1997] estimates of the H_0 Hubble constant based on HST Cepheids observations, it makes the low-H_0 values higher and the high-H_0 values lower, bringing those discrepant estimates into agreement around a value of 70 km/s/Mpc.

5. The present and near future: EROS II

A new generation of the experiment has been mounted at La Silla using a 1-m telescope. Apart from the microlensing detection project (today extended towards the galactic center) and the by-products presented here, EROS II is also devoted to the detection of Type I supernovae. This will represent *a new class of astrophysics*, allowing various astrophysical phenomena to be examined on a very large scale. As a contribution to this ambitious goal, the construction of a database on variable stars from the EROS survey is currently under way.

References

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