# Optical Photometry of the Eclipsing LMC Supersoft Source CAL 87

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**Abstract.** We present optical photometry of the eclipsing supersoft source, CAL 87. We find the eclipse structure to be stable over $\sim 4$ y, derive an improved ephemeris of $T_o =$ HJD $2450111.5144(3) + 0.442674(7)E$, and see new structure in the light curve morphology.

## 1. MACHO Project Photometry

We show in Fig. 1 optical photometry of the eclipsing supersoft source, CAL 87, obtained via the MACHO project from 1992 Aug – 1996 May (see Alcock et al. 1996). The broad primary eclipse is $\sim 0.2$ mag deeper in the blue, and
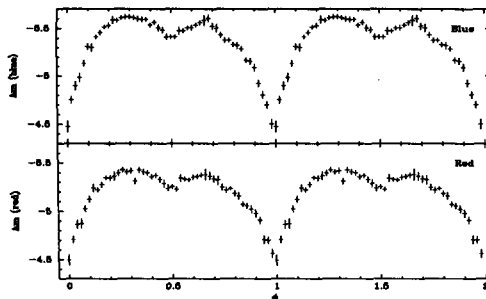


Figure 1. The blue and red MACHO light curves of CAL 87. The data are folded and averaged into 50 phase bins.

a shallower secondary dip is seen in both passbands at $\phi \sim 0.5$. The latter probably results from obscuration of the irradiated face of the donor star (van den Heuvel et al. 1992). The $B - R$ colour (not plotted) shows pronounced
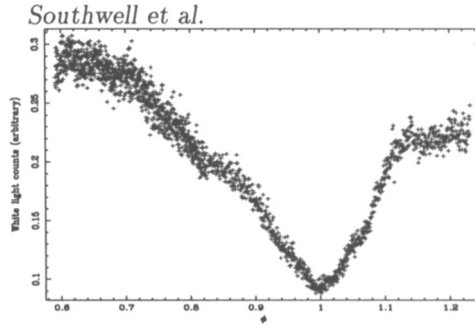
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Figure 2.     SAAO high speed white light curve of CAL 87. Note the obvious structure at $\phi \sim 0.82 - 0.87$ and $\phi > 1.1$.

reddening through the primary eclipse, and also marginal evidence for a slight reddening centred on $\phi \sim 0.55$. Examination of the yearly data-sets from 1992-1996 failed to reveal any significant changes in the orbital period or overall morphology, although the step in the egress at $\phi \sim 1.1$ (see also Fig. 2) sometimes seemed more pronounced. We derive $P = 0.442676 \pm 0.000007$ d from the complete dataset in each filter, consistent with previous measurements (e. g. Schmidtke et al. 1993).

## 2. High speed photometry

Fig. 2 displays a white light curve of a single eclipse, consisting of continuous $10 - 20$ s integrations, obtained with the UCT CCD and SAAO 1.9 m telescope. We derive an ephemeris of $T_o = $ HJD 2450111.5144(3) for the time of minimum light. The extended ingress and kink at $\phi \sim 0.82 - 0.87$ may be explained by variable obscuration by the thickened accretion disc rim (Callanan et al. 1989; Armitage & Livio 1996; Alcock et al. 1996). A turn-over is observed in the egress for $\phi > 1.1$. This is similar to the variability seen in Z Cha (Cook & Warner 1984), caused by the presence of a hot spot on the disc. In CAL 87, an analogous component may be the strongly irradiated inner-surface of the accretion disc bulge.

## References

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