ABSOLUTE MAGNITUDES OF RR LYRAE VARIABLES

S. V. M. CLUBE
Royal Greenwich Observatory, Herstmonceux Castle, Hailsham, England

My remarks concern the kinematics of *a*-type RR Lyrae variables with large $\Delta s (\geqslant 5)$, supposedly halo members, which have relatively well determined proper motions (μ) and radial velocities (ϱ) as well as accurate photoelectric photometry (m). The number of variables fulfilling these criteria is about 60. Using procedures which need not be discussed in detail here, it is possible to determine the statistical kinematic properties of these stars – that is, their solar motion (v) and velocity dispersion (σ) – in two different ways:

$$\{\varrho, l, b\} \rightarrow v_\varrho, \sigma_\varrho$$

$$\{\mu, l, b, m, M, A\} \rightarrow v_\mu, \sigma_\mu$$

where magnitudes are assumed to be visual and M is an *arbitrary* assumed absolute magnitude, and A is an estimate of absorption. Two separate estimates of the true absolute magnitude may be obtained from

$$M_1 = 5 \log \frac{v_\mu}{v_\varrho}$$

$$M_2 = 5 \log \frac{\sigma_\mu}{\sigma_\varrho}$$

if $M = 0$. The observations give

$$M_1 \approx + 0\overset{\mathrm{m}}{.}35$$

$$M_2 \approx + 1\overset{\mathrm{m}}{.}35$$

and similar results are implicit in the earlier investigations of Woolley *et al.*, van Herk, and Missana and Plaut working with different groups of stars. The currently accepted value for $M_0 \approx +0\overset{\mathrm{m}}{.}85$ results from an average of these figures. However, the discrepancy is over 3 times its associated standard error, and it is questionable whether an average of this kind is meaningful or right.

There are, it seems, two reasonable ways of attempting to reduce this discrepancy. Since both v_ϱ and σ_ϱ are apparently sound and in good agreement with the globular cluster kinematics, either v_μ is too small or σ_μ is too large. The former would imply some systematic error in the proper motions and the latter a random error. Though the latter has been preferred as an explanation in the past, the random error implied by the discrepancy is 0\".05 pa which is much greater than any permissible estimate. On the other hand, a relatively small correction of about 0\".01 pa to the secular parallax of the field stars to which the proper motions of all the RR Lyrae variables are re-

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ferred, can equally well remove the discrepancy. According to the published proper motions, the average secular parallaxes of the reference stars in question is $0\overset{''}{.}013$ pa, and the implied correction therefore leads to a secular parallax of about $0\overset{''}{.}020$ pa towards a revised apex. The plausibility of such a correction does not seem previously to have been suspected and is in fact well confirmed by the recent determination of secular parallaxes by Fatchikhin and Vasilevskis for field stars at high and medium galactic latitudes where most of the halo RR Lyraes are observed. The result is that $M_1 \rightarrow M_2$ and the absolute magnitude of these RR Lyrae variables is much fainter than previously supposed. In fact, $M_0 \approx +1\overset{m}{.}30$, a result which is not in serious disagreement with Christy's models. However, it does cause distinct difficulties elsewhere which I need only refer to briefly here:

(1) Arp's determination of $R_0 = 10$ kpc is based on $M_0 = +0\overset{m}{.}30$ for globular cluster RR Lyraes. This result therefore makes $R_0 \approx 6.3$ kpc, all other things being equal.

(2) It conflicts with RR Lyrae calibration by main sequence fitting in selected globular clusters.

(3) It conflicts with the conventional zero point of Cepheid variables since it reduces the distance of the Magellanic Clouds. Indeed, had the result been available 20 yr ago, perhaps the faintness of RR Lyraes in the Clouds and M31 would not have occasioned any surprise, and the zeropoint of the Cepheids would not then have been brought into question.