RECENT TRIGONOMETRIC PARALLAX MEASUREMENTS OF MK LATE-TYPE SPECTRAL STANDARD GIANT STARS

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ABSTRACT. Trigonometric parallaxes are reported for ten bright, southern late-type MK giant stars. The plate material was obtained with the 66 cm Yale-Columbia refractor at the Mt. Stromlo Observatory and measured with the PDS 1010A at Mt. Stromlo. The ten stars include HR 794 (K0 III), HR 1247 (M2 IIIab), HR 2245 (M2.5 III), HR 2773 (K3 Ib), HR 3518 (K3 III), HR 3803 (K5 III), HR 5287 (K2 III-IIIb), HR 5603 (M3 IIIa), HR 6832 (M3.5 III), and HR 6913 (K1 IIIb). The modern parallaxes are compared with earlier results and the luminosity calibration for these stars is discussed.

1. INTRODUCTION

The problem of the calibration of absolute magnitudes of stars on the red-giant branch has generally been approached through statistical parallaxes, and trigonometric parallaxes have contributed only to a limited extent. This is a consequence of the relatively small parallaxes of most of the astrometrically observed giants, and that the size of these parallaxes are comparable to the average error of older parallaxes (0.010 - 0.020 arcsec). Most recently maximum-likelihood statistical methods have been applied to the giants by Mikami and Heck (1982), and Egret, Keenan, and Heck (1982), the latter including the most up-to-date MK classifications.

Keenan (1971) has advocated determining more trigonometric parallaxes for bright G, K and M class III stars since the spectral classes for these stars have been improved to more closely define their luminosities (Keenan and Pitts 1980). However these objects remain neglected in modern parallax programs in part owing to their observational difficulty. There are additional reasons for adding the

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apparently bright stars to parallax programs. Since a number of these bright stars have never had parallax determinations, it would be useful to complete the sample, and many of the existing parallaxes, especially in the southern hemisphere, have been measured at one observatory only. Single observatory parallaxes are known to be less reliable. The prospect of substantially improved trigonometric parallaxes suggests this most fundamental method may make a greater contribution to the calibration of spectroscopic luminosity classes for the giants over the next few years.

2. RESULTS AND DISCUSSION

The BSC data and final absolute magnitudes for our ten stars are displayed in Table I and Figure 1. The statistical corrections to absolute parallax were taken from the tables of Binnendijk (1943). In several cases these corrections are of the same size as the relative parallaxes. The errors in the absolute magnitudes are estimated as $\sigma_M = 2.7\sigma_\pi/\pi$ using the errors in the relative parallaxes. The early relative parallaxes listed for comparison in Table I are all Yale results with the exception of the first entry for the last star which is an early McCormick parallax. Given the large errors in these parallaxes, they are mostly in agreement with our new results.

Of the stars in this list of southern hemisphere giants, four have trigonometric parallax absolute magnitudes which are discordant with published spectral classes: HR 794 (Iot Eri), HR 3518 (Gam Pyx), HR 5287 (Pi Hya), and HR 5603 (Sig Lib). The parallax values obtained herein for these four objects lead to the absolute magnitudes presented in Table I. The absolute magnitudes for Iot Eri and Gam Pyx are substantially in agreement with the absolute magnitudes expected for their respective spectral classes. The absolute magnitude of the star Pi Hya is in good agreement with previous determinations, but is somewhat fainter at + 1.8 than one would expect for a luminosity class III/IIIb star. The results for Sig Lib (M3 IIIa) indicate a luminosity of - 0.9 which seems about right for this class. The earlier parallax measurement for this star gives an absolute magnitude of + 2.3 which is much too faint for this class.

HR 3803 (N Vel) and HR 6832 (Eta Sgr) have measured parallaxes fairly consistent with their spectral classes. The parallax measured for the star HR 6913 (Lam Sgr) yields an absolute value of +2.2 compared with a value of + 1.4 from the BSC data where the parallax is a mean of two earlier determinations. The mean of all three parallaxes would still give an absolute magnitude rather fainter than expected for the spectral classification.

The stars HR 1247 (Del Ret) and HR 2245 (Eta^2 Dor) have parallaxes which are essentially zero giving large uncertainties in the absolute magnitudes, but nevertheless the absolute magnitudes are not inconsistent with their spectral classes. The last star in our sample HR 2773 (Pi Pup) is classified as a K3 Ib star (Garrison 1984). Its derived absolute magnitude of - 1.9 is, again, not inconsistent with its spectral class.

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Table I. Early Parallaxes and Final Results

HR	Sp	GCTSP Parallaxes			Abs. Par.	M_V
794	KOIIIb*	547.	+0".0032	±0.015	0".317	+1.62±0.25
1247	M2IIIab	889.	- 7	16	56	-1.70 1.82
2245	M2.5III	1460.	+ 4	15	61	-1.06 1.42
2773	K3Ib*	1716.	26	16	124	-1.83 0.60
3518	K3III	2114.	28	15	151	-0.10 0.46
3803	K5III	2276.	17	15	382	+1.04 0.23
5287	K2III-IIIb	3205.	42	18	506	+1.79 0.13
5603	M3IIIa	3400.	59	19	144	-0.92 0.63
6832	M3.5III	4191.	41	16	299	+0.49 0.28
6913	K1IIIb	4239.	30	15	752	+2.19 0.13
			67	16		

* Spectral classification from Garrison (1984).

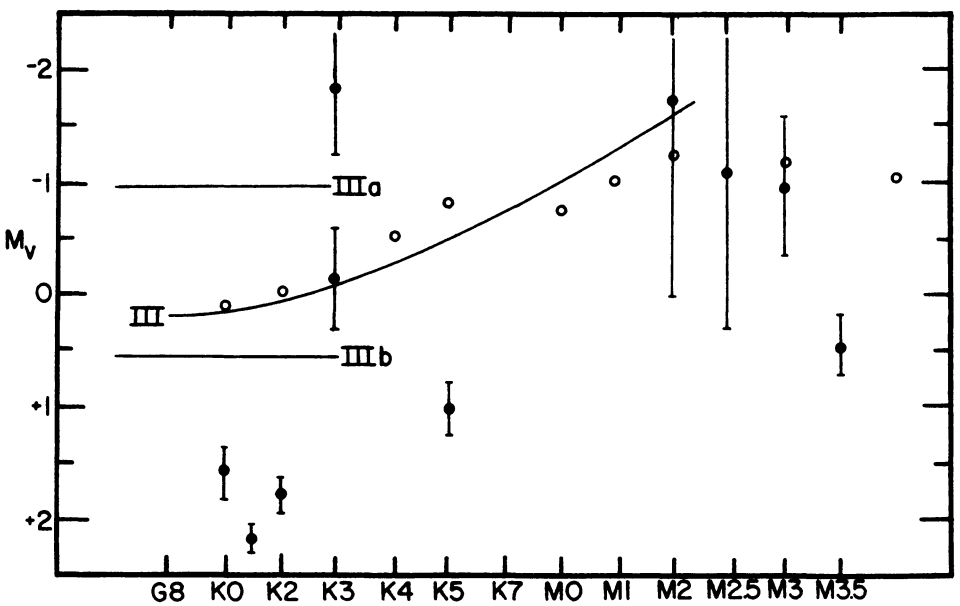

Fig. 1 Absolute magnitudes for ten late-type giants; the error bars are the standard errors. Calibrations of Mikami and Heck (1982) are shown as open circles; solid lines are from Egret, Keenan and Heck (1982).

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