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PHOTOMETRY OF STARS IN
THE FIELD OF THE MIRA EL LYRAE

EL Lyrae is a little-studied Mira having a maximum brightness around visual magnitude 11 and a period near 234 days. At the request of Charles Scovill of the American Association of Variable Star Observers, I observed several stars in this field as a check on an existing comparison sequence on the AAVSO chart for the variable. The new sequence covers the magnitude interval $10.2 < V < 13.7$ with ten stars.

The observations were made on 25 August and 5 September 1992 UT using the Lowell Observatory 53cm photometric telescope. The stars were observed through a 19-arcsec diaphragm with Strömgen y and b filters. Each observation consisted of a minimum of four 10s integrations on 'star' and two 10s integrations on 'sky', with greater numbers of integrations for the fainter stars. All the standard stars are from the lists of Landolt (1983a, 1983b, 1992). The V magnitudes were adopted directly, sometimes supplemented with values from Menzies et al. (1991). The $b - y$ colors were determined using same telescope against primary Strömgen four-color standards. The data for each night was reduced separately using linear transformations. Atmospheric extinction was estimated on these nights from measurements taken on other nights near this time. Average per star residuals (standard deviation) were ± 0.004 in V and ± 0.006 in $b - y$ on 25 August, and ± 0.006 and ± 0.001 on 5 September.

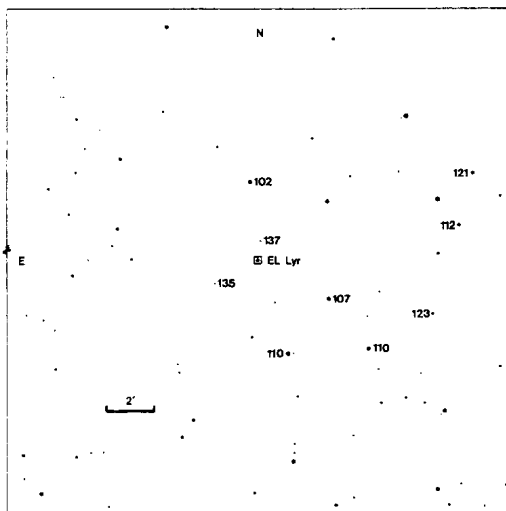


Figure 1. The field of EL Lyrae showing stars from the GSC. V magnitudes are indicated to the nearest tenth of a magnitude with the decimal point omitted.

Table 1. Standard Star Observations

Name	V (std)	$b-y$ (std)	V (obs)	$b-y$ (obs)	n
HD 315	6.440	-0.078	6.444	-0.074	1
HD 5319	8.046	0.601	8.043	0.601	2
BD -00°3353	9.332	0.967	9.324	0.967	1
HD 161817	6.982	0.135	6.981	0.133	2
BD +04°3508	9.326	1.188	9.324	1.187	1
HD 172829	8.465	1.385	8.472	1.386	1
HD 175544	7.395	0.144	7.400	0.142	1
HD 184914	8.178	0.799	8.176	0.795	1
BD -00°4073	9.905	0.776	9.907	0.779	2
HD 200340	6.509	-0.031	6.510	-0.046	1
HD 209796	8.933	0.734	8.943	0.742	1
HD 215141	9.239	0.962	9.238	0.960	2
HD 218155	6.783	-0.005	6.782	-0.000	3

Table 2. Photometry of Stars in the Field of EL Lyrae

Name	RA (2000)	Dec (2000)	V	$b-y$	remarks
BD +31°3510	19 ^h 13 ^m 22 ^s .3	+32°06' 35"	10.17	1.04	M0; n=2
			.01	.02	
GSC 2657-2001	19 13 06.8	+32 01 41	10.68	0.68	
			.02	.02	
GSC 2657-2310	19 13 14.8	+31 59 23	10.99	0.78	
			.01	.03	
GSC 2657-2081	19 12 58.9	+31 59 35	10.99	0.73	
			.02	.03	
GSC 2657-1594	19 12 41.1	+32 04 46	11.17	0.35	
			.02	.03	
GSC 2657-1946	19 13 20.8	+32 03 18	11.88	1.48	= EL Lyr,
			.03	.03	1992 Aug 25.2 UT
GSC 2657-2313	19 12 38.3	+32 06 56	12.12	0.79	
			.02	.03	
GSC 2657-2465	19 12 46.4	+32 01 02	12.35	0.37	
			.03	.03	
anon	19 13 29	+32 02.5	13.54	0.35	
			.05	.05	
GSC 2657-1986	19 13 20.3	+32 04 06	13.72	0.39	
			.02	.03	

The standards observed are listed in Table 1 along with the adopted and observed V and $b-y$ colors, and the number of observations 'n'. The mean deviations of the observed averages from the assumed values listed in Table 1 are: $V = 0.001 \pm 0.005$; $b-y = 0.000 \pm 0.006$. The red stars in this field necessitated the use of standards other than the canonical ones defining the four-color system. The main goal was V magnitudes for use of visual observers, so the $b-y$ colors were needed solely to determine the color term in the instrumental V magnitudes, and not for temperatures or other indices ordinarily derived from Strömgren photometry. Among the stars observed here, only EL Lyrae itself is redder than the reddest standard; linear extrapolations of the transformations were used

to determine its magnitude and color. Since the transformations appear to be linear over the range $-0.08 < b - y < 1.38$ (avoiding dwarfs later than about K0), there would seem to be little concern in extrapolating them by a tenth of a magnitude.

The results for the EL Lyrae field are given in Table 2, listed in order of decreasing brightness. Only the brightest star appears in a common star catalogue. Identifications and J2000 positions from the Guide Star Catalog are provided for the remainder. Except for BD +31°3510, the stars were observed on only one night. The uncertainties listed in the second line of each entry are thus the rms errors on each batch of integrations; these should be representative of the external uncertainties. Because the stars are fairly faint for the telescope involved and since they were observed on only one night, the data are given to a precision of two decimals instead of three, as is usual for Strömngren photometry.

The M-giant star BD +31°3510 showed no variation beyond observational errors in the ten days between the two observations.

For the convenience of observers, a chart based on the GSC is shown in Figure 1. The comparison stars are indicated by their magnitudes rounded to the nearest tenth of a magnitude (decimal point omitted) in the style of visual variable-star charts.

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