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Infrared magnitudes (*JHKLM*) for 105 chemically peculiar A- and B-stars (*)

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Summary. — For 105 Bp- and Ap-stars 410 photoelectrical measurements in 5 spectral bands (*JHKLM*) from 1.25 μ to 4.8 μ are presented. These measurements were collected in three observation periods. The observations, reductions and errors are discussed in detail. In addition we give IR-excess for the brightest *M*-measurements. An analysis of the data-like correlations of the IR-excess with stellar parameters and determination of effective temperatures will be published in subsequent papers (Groote and Kaufmann, 1983 ; Groote, 1983).

Key words : chemically peculiar stars — infrared magnitudes.

1. Introduction.

In two previous works (Groote *et al.*, 1980 ; Groote and Kaufmann, 1981) an infrared excess of early-type peculiar stars at 4.8 μm (*M*-band) was reported. These measurements plus new observational data are reduced to a homogeneous set of infrared magnitudes for a large sample of peculiar stars, ranging from B0 to F0 (30 000 K > T_{eff} > 7 500 K). For the first time IR-measurements were primarily performed to study the detected IR-excess but they are also useful to determine effective temperatures, angular diameters (see Blackwell and Shallis, 1979) and interstellar extinction (Groote, 1982). The first work established a correlation between this excess and the strength of a magnetic field for B-type helium-variable stars.

The second work extended the measurements to cooler chemically peculiar (CP) stars (cooler B-stars, A-stars, F0-stars) and it was found that about 60 % of the full sample showed excess of more than 20 % in the *M*-band, the excess starting sometimes at 3.6 μm or even at 2.2 μm. The correlation with the magnetic field was however not valid for the cooler stars.

In the present work we have collected more measurements (Dec. 1980) and present all the individual data. We also describe in detail the observations and reductions. Our measurements show very good agreement relative to other photoelectrical measurements and theoretical fluxes. Also, as most of the CP-stars are spectrum-variable, we measured most of the stars several times to find variations in the infrared magnitudes and a possible correlation of these variations with the period of rotation.

(*) Based on observations obtained at the European Southern Observatory , La Silla, Chile.

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2. Observations and reductions.

The infrared magnitudes presented in this paper are the result of 3 observation periods at the ESO 1 m-telescope of La Silla (2.4-10.4, 1979 : D.G. ; 29.3-5.4, 1980 : D.G./J.P.K. ; 18.12-28.12, 1980 : D.G./J.P.K.). The IR-photometer is the same as used by Groote *et al.* (1980) and Groote and Kaufmann (1981). In the first period useful observing hours were from 7^{h} to 24^{h}, in the second and third period from 17^{h} to 11^{h}. In total 380 hours were available, about half of the time was lost due to bad weather or technical failure. Of the 200 observable hours, 100 hours had good « seeing ». We measured about 120 stars. In this paper we present the IR-magnitudes for 105 known CP-stars, in total 410 measurements mostly of *JHKLM,* that is about 4 measurements for each star.

Because of the varying observing conditions during 18 hours of the day (7 hours with the sun above the horizon), we carefully watched the zero-point by measuring standard-stars at least every two hours (under good and constant weather conditions). More than 30 standard stars of the list of Engels *et al.* (1981) were used and all observations were reduced to this system which is based on the measurement of stars at La Silla during 7 years time. Figure 1 shows the shift of the zero-point in all filterbands during 24 hours and also the small scatter of the standard stars around the mean curve.

Each observation consisted of a couple of 4 measurements, each with 5 s integration time, in total 20 s. The performance of the ESO-system [3] in the *M*-band is : magnitude 6 for a signal to noise ratio of 1, and 1 s integration time. Under good weather conditions we reproduced this performance (magnitude 7, S/N = 10, integration time 250 s, i.e. 12 observation cycles). To

[3] See the ESO User manual.

obtain a satisfactory S/N ratio, repetition of the observations in L and M was chosen rather than the increase of the integration time per cycle. We always watched the signal on a strip-chart recorder. Whenever there was an indication of the signal not being constant, we again centered the star and repeated the measurement.

The total error for one measurement (1 σ) given in table I contains :

a) the mean signal to noise ratio,
b) the standard deviation of the mean signal,
c) the accuracy of the zero-point (deviation of the standard stars from a mean curve (see Fig. 1)).

For the filters J, H, K the errors from a) and b) are less than 1 % while from c) we get 2 to 5 %, so the latter error was adopted. For filters L and M, errors from a) and b) are comparable to or larger than the error from c) and all three were added quadratically. To achieve a maximum homogeneity in the presented data, we reduced all raw observations again after the last observation run. There are no systematic differences in the infrared magnitudes of measurements obtained in different observation periods above $0^{m}03$, the 1 σ error of the single measurement. As we suspected many of the CP-stars being variable, we repeated the measurements on different nights. The mean of these measurements is also given in table I together with the standard deviation, which is a measure for intrinsic variation if compared with the standard deviation of the single measurement. The excess in filter M (given in table I only for the brightest M-magnitude as E_M) was determined by Groote (1982) and represents the excess flux above the theoretical flux of an adopted model atmosphere (Kurucz, 1979). The slope in the infrared slightly varies with temperature and interstellar extinction. To determine both, T_{eff} and E_{B-V}, Groote (1982) has taken all available photometric data from the IR to the UV and has adapted the best fitting Kurucz-model. The excess values given in the present paper are related to these model fluxes. For stars with more than one measurement, the model was adapted to the mean magnitudes. Excess is noted only when larger than 20 %.

In a subsequent paper we draw deductions from our measurements especially correlate the excess with stellar parameters like galactic distribution, magnetic field, rotation velocity, peculiarity index $\Delta\alpha$.

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TABLE I. — *HD-number, Julian Date, JHKLM-magnitudes (individual measurements) with 1 σ-errors in 0.01 mag, mean magnitudes with error of the mean and maximum excess in M (E_M in %).*

HD Number	JD 2440000+	J 1.25	H 1.65	K 2.2	L 3.6	M 4.8(μ)	E_M (%)	Rem.
315	4597.545	6.73 4	6.71 3	6.81 3	6.66 3	5.85 19	130	
	4599.461	6.72 3	6.77 3	6.84 4	6.88 5	6.11 14		
	4601.380	6.71 3	6.74 3	6.78 3	6.76 4	6.66 15		
		6.72 1	6.74 3	6.81 3	6.77 11	6.21 41		
3326	4597.557	5.62 4	5.50 3.	5.47 3	5.37 3	5.39 7		
	4601.476	5.53 3	5.49 3	5.43 3	5.35 3	5.06 5	30	
		5.58 6	5.50 1	5.45 3	5.36 1	5.23 23		
3980	4593.483	5.65 3	5.71 3	5.68 3	5.55 4	5.42 10		
	4594.481	5.68 3	5.63 3	5.64 4	5.52 7	4.92 15	90	
	4597.417	5.66 3	5.68 3	5.71 3	5.79 3	5.32 10		
		5.66 2	5.67 4	5.68 4	5.62 15	5.22 26		
5737	4330.153	4.64 3	4.73 3	4.70 3	4.70 4	4.56 5		
	4593.509	4.58 3	4.67 3	4.68 3	4.62 3	4.62 9		
	4594.503	4.64 3	4.70 3	4.73 3	4.65 5	4.27 5	50	
	4599.491	4.64 3	4.70 3	4.72 4	4.68 5	4.62 6		
	4601.389	4.62 3	4.67 3	4.68 3	4.69 3	4.38 7		
	4601.483	4.67 3	4.68 3	4.69 3	4.67 3	4.49 7		
		4.63 3	4.69 2	4.70 2	4.67 3	4.49 14		
6619	4593.517			6.38 3	6.34 6	5.55 24	95	
	4599.508	6.45 3	6.39 3	6.37 4	6.23 5	5.60 12		
	4600.579	6.51 3	6.41 3	6.39 3	6.33 3			
		6.48 4	6.40 1	6.38 1	6.30 6	5.58 4		
10783	4595.598	6.70 3	6.67 3	6.69 3	6.74 4			
	4599.525	6.63 3	6.62 3	6.63 4	6.56 5			
	4600.597	6.64 3	6.62 3	6.64 3	6.58 3	6.11 9	55	
		6.66 4	6.64 3	6.65 3	6.63 10	6.11		
12447	4595.531	3.84 3	3.83 3	3.78 3	3.70 5	3.80 9		
	4599.556	3.76 3	3.77 3	3.73 4	3.70 5	3.82 5		
	4600.604	3.83 3	3.78 3	3.78 3	3.73 3	3.68 5		
		3.81 4	3.79 3	3.76 3	3.71 2	3.77 8		
12767	4595.545	5.00 3	5.04 3	5.08 3	5.09 5	4.91 9		
	4599.568	5.00 3	5.06 3	5.09 4	5.05 5	4.85 7	25	
	4600.613	5.04 3	5.06 3	5.08 2	5.08 3	4.98 6		
		5.01 2	5.05 1	5.08 1	5.07 2	4.91 7		
15144	4595.557	5.77 3	5.79 3	5.72 3	5.81 9			
	4599.582	5.76 3	5.67 3	5.65 4	5.62 5	5.44 6	20	
	4600.621	5.77 3	5.76 3	5.72 2	5.62 3	5.73 7		
		5.77 1	5.74 6	5.70 4	5.68 11	5.59 21		
18557	4596.491	5.72 3	5.70 3	5.69 3	5.62 4	5.62 4		
	4599.603	5.78 4	5.64 3	5.53 4	5.63 5	5.20 9	45	
	4601.426	5.76 3	5.70 3	5.64 3	5.61 3	5.34 16		
		5.75 3	5.68 3	5.62 8	5.62 1	5.30 9		
20320	4596.474	4.41 3	4.27 6	4.25 3		4.35 10		
	4599.590	4.38 3	4.24 3	4.21 4	4.18 5	4.26 6		
	4600.628	4.40 3	4.26 3	4.21 2	4.16 3	4.20 6		
		4.40 2	4.26 2	4.22 2	4.17 2	4.27 8		
22470	4329.322	5.55 4	5.55 2	5.53 2	5.54 4	5.30 9		
	4596.502	5.53 3	5.56 5	5.62 3	5.58 4	5.25 6	35	
	4599.634		5.51 3	5.54 4	5.54 5			
	4600.640	5.57 3	5.55 3	5.59 3	5.63 3	5.39 8		
		5.55 2	5.54 2	5.57 4	5.57 4	5.31 7		
22920	4596.553	5.84 3	5.89 3	5.91 3	5.83 3	5.93 20		
	4600.649	5.86 3	5.90 3	5.93 3	5.90 3	5.42 15		
	4601.437	5.85 3	5.86 3	5.93 3	5.90 3	5.15 7	105	
	4601.503	5.88 3	5.87 3	5.94 3	5.97 5	5.24 8		
		5.86 2	5.88 2	5.93 1	5.90 6	5.44 35		
23281	4596.570	5.25 3	5.14 3	5.13 3	5.02 3	5.15 6		
	4601.496	5.27 3	5.16 3	5.14 3	5.04 3	5.13 8		
		5.26 1	5.15 1	5.14 1	5.03 1	5.14 1		
24155	4596.583	6.41 3	6.41 3	6.43 3	6.41 3	5.69 9	95	
	4601.512	6.46 3	6.44 3	6.48 3	6.44 3	5.74 13		
		6.44 4	6.43 2	6.46 4	6.43 2	5.72 4		
24712	4596.597	5.48 3	5.30 3	5.30 3	5.24 4	5.21 7		
	4600.656	5.46 3	5.34 3	5.32 2	5.21 3	5.05 7		
	4601.522	5.49 3	5.34 3	5.31 3	5.29 3	4.97 8	30	
		5.48 2	5.33 2	5.31 1	5.25 4	5.08 12		
25267	4330.363	4.91 4	4.93 3	4.93 3	4.97 4	4.91 9		
	4596.611	4.84 3	4.85 3	4.90 3	4.83 4	4.84 6		
	4600.662	4.90 3	4.87 3	4.91 2	4.91 3	4.81 6		
	4601.528	4.88 3	4.87 3	4.90 3	4.85 3	4.90 8		
		4.88 3	4.88 3	4.91 1	4.89 6	4.87 6		
26591	4596.656	5.60 4	5.54 4	5.53 4	5.37 6	5.54 9		
	4601.536	5.53 3	5.51 3	5.50 3	5.42 3	5.10 8	40	
		5.57 5	5.53 2	5.52 2	5.40 4	5.32 31		
27376	4329.446	3.86 4	3.87 2	3.90 2	3.91 3	3.90 5		
	4330.385	3.89 4	3.88 3	3.87 3	3.87 4	3.90 7		
	4593.678	3.76 3	3.85 3	3.84 2	3.84 4	3.88 6		
	4594.671	3.79 3	3.86 3	3.87 2	3.85 3	3.78 5		
	4595.583	3.86 3	3.90 3	3.90 3	3.95 4	4.04 6		
		3.83 5	3.87 2	3.88 3	3.88 5	3.90 9		
28843	3592.290	6.06 4	6.07 3	6.10 2	6.05 3	5.60 15		W.S.
	3594.294	6.12 4	6.14 3	6.17 3	6.12 4	6.01 7		W.S.
	3735.107	6.02 3	6.06 2	6.10 4	6.07 3			G.S.
	3736.111	6.07 5	6.11 3	6.22 3	6.05 5	5.63 5		G.S.
	3970.294	6.07 3	6.13 3	6.22 3	6.14 4	5.55 9	70	
	3970.368	6.09 3	6.12 3	6.20 3	6.15 4	5.80 20		
	3973.442	6.09 3	6.14 3	6.18 3	6.15 4	5.65 18		
	3973.476	6.09 3	6.10 3	6.16 3	6.13 4	5.76 8		
	4597.633	6.03 3	6.05 3	6.11 3	6.07 3	5.91 15		
		6.07 3	6.10 3	6.16 5	6.10 4	5.74 16		
29009	4596.742	5.92 3	5.98 3	6.01 3	5.96 4	5.87 9		
	4599.683	5.93 6	5.97 3	6.00 4	5.93 6	5.76 8	20	
	4601.544	5.95 3	5.97 3	6.01 3	5.99 3	5.78 6		
		5.93 2	5.97 1	6.01 1	5.96 3	5.80 6		
29305	4329.397	3.44 4	3.50 2	3.49 3	3.51 4	3.45 7		
	4330.397	3.56 4	3.55 3	3.54 3	3.52 4	3.55 6		
	4593.689	3.52 3	3.52 3	3.51 2	3.45 4	3.60 6		
	4594.686	3.50 3	3.50 3	3.53 3	3.47 3	3.59 5		
		3.51 5	3.52 2	3.52 2	3.49 3	3.55 7		
33254	4328.321	5.11 4	5.01 3	4.96 3	4.97 4	4.89 15		
	4329.413	5.07 4	5.00 2	4.92 2	4.90 4	4.84 6		
	4597.651	5.09 3	4.96 4	4.94 3	4.85 3	4.92 6		
		5.09 2	4.99 3	4.94 2	4.91 6	4.88 4		
33904	4328.330	3.53 3	3.56 2	3.57 2	3.56 3	3.56 6		
	4329.428	3.56 4	3.63 2	3.60 2	3.60 4	3.60 5		
	4330.407	3.62 4	3.59 3	3.60 3	3.57 4	3.59 7		
	4597.658	3.56 3	3.57 3	3.54 3	3.53 3	3.64 6		
		3.57 4	3.59 3	3.58 3	3.57 3	3.60 3		
34719	4596.678	6.77 3	6.76 3	6.82 3	6.71 5	6.58 13		
	4599.715	6.72 3	6.78 3	6.79 3	6.76 6	5.67 10	170	
	4601.607	6.83 3	6.84 3	6.87 3	6.86 3			
		6.77 6	6.79 4	6.83 4	6.78 8	6.13 64		
35548	4596.749	6.61 3	6.64 3	6.63 3	6.63 3	6.48 10		
	4600.708	6.67 3	6.64 3	6.68 3	6.59 3	5.20 5	270	
	4601.701	6.76 3	6.68 3	6.70 3	6.60 3	5.80 16		
		6.68 8	6.65 2	6.67 4	6.61 2	5.83 64		
37017	3592.296	6.86 7	6.87 3	6.94 5	7.01 5	6.25 20		W.S.
	3593.428		6.99 3	7.03 3	7.11 6	6.31 10		W.S.
	3594.307	6.94 3	6.93 5	7.02 3	7.01 6	6.30 10		W.S.
	3735.070	6.90 3	6.92 2	6.92 4	6.96 3	6.22 5		G.S.
	3736.034	6.85 5	6.92 3	6.96 3	6.90 4	6.83 9		G.S.
	3970.378	6.90 3	6.91 2	6.97 3	6.90 5	6.00 14	175	
	3972.490	6.92 3	6.90 3	6.98 3	6.89 5	6.78 7		
	4333.406	7.07 4	7.37 5	7.36 6	7.49 7	6.36 12		excl.
	4597.665	7.06 3	6.92 3	6.99 3	7.01 3	6.31 14		
		6.92 7	6.92 3	6.97 4	6.97 7	6.39 27		
37058	3594.344	7.75 3	7.76 2	7.83 4	7.68 5	6.76 15	160	W.S.
	3970.472	7.72 3	7.74 3	7.79 4	7.86 12	7.44 21		
	4601.713	7.72 3	7.79 3	7.79 3	7.97 6	6.78 16		
		7.73 2	7.76 3	7.80 2	7.84 15	6.99 39		
37129	4596.759	7.47 3	7.48 3	7.55 3	7.53 9			
	4601.722	7.50 3	7.53 3	7.55 3	7.66 6	7.06 20	75	
		7.49 2	7.51 4	7.55 0	7.60 9	7.06		
37321	4601.748	7.26 3	7.26 3	7.26 3	7.13 3	6.07 7	225	
37479	3592.326	7.06 4	7.04 3	7.04 3	6.95 3	6.54 14		W.S.
	3593.446	7.05 3	7.09 3	7.11 3	6.82 5	6.12 7		W.S.
	3594.381	7.06 3	7.00 3	7.00 3	6.85 4	6.71 6		W.S. M?
	3969.419			7.01 3	6.80 4	6.11 6		
	3970.390	7.03 3	6.99 3	6.98 2	6.95 5	6.21 13		
	3972.506	7.02 3	7.05 3	7.09 3	6.98 6	5.72 8		
	4328.369	7.06 3	7.04 3	7.06 3	6.89 5	6.13 15		
	4329.509	7.04 5	7.05 2	7.03 2	6.81 6	5.51 10	508	
	4330.380	7.01 7	7.07 5	7.08 4	6.91 7	6.42 25		
	4330.426	7.02 5	7.12 4	7.10 4	6.99 6	5.94 12		
	4330.508	7.11 5	7.07 5	7.06 4	6.88 6	5.81 20		
	4331.520	7.02 3	6.98 4	6.98 3	6.90 4	5.67 10		
	4332.411	7.11 5	7.09 5	7.11 5	6.97 7	6.09 19		
	4593.793	6.99 3	7.03 3	7.00 2	6.90 5	5.66 12		
	4595.710	7.00 3	7.04 3	6.95 3	6.80 5	5.93 12		
	4596.535	7.09 3	7.08 3	7.09 3	6.95 6	7.00 20		M?
	4596.631	6.98 4	7.00 4	7.04 4	6.83 6	6.52 16		
	4596.711	7.01 3	7.01 3	7.00 3	6.87 4	6.52 12		
	4597.568	6.92 4	7.03 3	7.11 3	6.92 3	6.15 10		
	4597.732	7.09 3	7.04 3	7.06 3	7.07 3	6.32 8		
	4597.783	7.03 3	7.02 3	7.04 3	7.07 3	6.26 6		
	4599.545	7.03 5	7.07 4	7.12 4	6.96 5	6.63 23		W.S.
	4599.595	7.09 6	7.08 4	7.06 4	7.12 6	6.10 14		W.S.
	4599.626	7.03 6	7.04 4	7.03 4	6.95 6	6.85 30		W.S.
	4600.674	7.09 4	7.03 4	7.02 4	6.93 4	6.07 10		
	4600.697	7.11 4	7.05 4	7.08 4	7.00 4	6.29 27		
	4600.726	7.11 4	7.11 3	7.15 3	6.90 4	5.92 12		
	4600.748	7.12 4	7.11 3	7.11 3	7.04 6	6.27 17		
	4601.596	7.03 3	6.97 3	6.99 2	6.84 4	5.99 16		
	4601.731	7.03 3	6.99 3	6.97 2	6.75 4	5.85 12		
		7.05 5	7.04 4	7.05 5	6.92 9	6.05 26	270	
37776	3592.334	7.47 4	7.47 4	7.55 6	7.67 4	6.90 60		W.S.
	3594.400	7.35 4	7.39 3	7.44 3	7.39 6	6.91 10		W.S.
	3970.415	7.33 3	7.37 3	7.41 3	7.21 4	6.51 17		
	3973.487	7.39 3	7.52 4	7.56 3	7.34 9	6.22 20		
	4330.523	7.39 5	7.39 5	7.43 4	7.30 8	7.09 40		
	4331.538	7.32 3	7.33 3	7.41 3	7.38 5			
	4596.642	7.45 4	7.43 4	7.43 4	7.37 6	6.54 16		
	4596.733	7.34 3	7.39 3	7.42 3	7.34 7	6.74 13		
	4597.583	7.39 4	7.41 3	7.47 3	7.48 3	6.15 15	155	
	4601.756	7.35 3	7.38 3	7.44 3	7.35 4			
		7.38 5	7.41 5	7.46 6	7.38 12	6.63 34		

TABLE I *(continued)*.

HD Number	JD 2440000+	J 1.25		H 1.65		K 2.2		L 3.6		M 4.8(μ)		E_M (%)	Rem.
37808	4599.732	6.69	3	6.72	3	6.76	3	6.70	4	6.51	12	30	
	4600.766	6.75	3	6.77	3	6.82	3	6.67	5				
	4601.770	6.72	3	6.77	3	6.80	3	6.82	7	6.73	20		
		6.74	2	6.75	3	6.79	3	6.73	8	6.62	16		
42657	4599.743	6.33	3	6.32	3	6.34	3	6.25	4	5.41	11	135	
	4600.781	6.41	3	6.32	3	6.37	3	6.30	3	5.48	10		
	4601.799	6.33	3	6.32	3	6.34	3	6.31	4	5.92	9		
		6.36	5	6.32	1	6.35	2	6.29	3	5.60	28		
43819	4599.757	6.42	3	6.41	3	6.43	3	6.33	3	5.95	8		
	4600.796	6.45	4			6.43	4	6.39	4	5.56	7	115	
	4601.810	6.41	3	6.40	3	6.43	3	6.32	4	6.07	15		
		6.43	2	6.41	1	6.43	1	6.35	4	5.86	27		
49333	3593.447	6.47	3	6.52	3	6.53	3	6.46	4	6.21	15		W.S.
	3594.431	6.43	4	6.46	3	6.51	3	6.51	3	6.49	15		W.S.
	3733.160	6.38	4	6.46	3	6.56	3	6.58	7	6.56	40		G.S.
	3736.135	6.40	8	6.49	7	6.59	7	6.54	8	6.05	10		G.S.
	3969.559	6.47	4	6.44	2	6.52	3	6.51	3	6.65	10		
	3969.592	6.41	4	6.46	3	6.50	3	6.50	3	6.05	8		
	3969.611	6.39	4	6.46	3	6.51	3	6.47	4	5.90	12		
	3972.517	6.44	3	6.48	3	6.56	3	6.51	5	5.89	14		
	4600.827	6.52	4	6.44	4	6.52	4	6.62	4	5.54	20	150	
		6.43	5	6.47	3	6.53	3	6.52	5	6.18	37		
49976	4329.532	6.33	4	6.33	2	6.37	2	6.39	3	5.64	11	80	
	4332.497	6.39	5	6.34	5	6.32	5	6.40	7	6.08	15		
	4599.768	6.37	3	6.34	3	6.29	3	6.24	3	6.09	11		
	4601.824	6.29	3	6.40	3	6.31	3	6.37	4	5.69	9		
		6.35	4	6.35	3	6.32	3	6.35	7	5.88	24		
57219	3970.485	5.55	3	5.56	3	5.58	3	5.56	5	5.57	9		
	3972.533	5.49	3	5.52	3	5.59	3	5.53	5	5.36	8		
	4329.555	5.54	4	5.56	2	5.62	2	5.60	3	5.25	10		
	4593.763	5.57	3	5.63	3	5.59	2	5.57	4	5.43	14		
	4594.697	5.55	3	5.60	2	5.61	3	5.62	4	4.92	15	90	
	4596.801	5.48	3	5.58	3	5.59	3	5.61	3	5.70	6		
	4599.781	5.55	3	5.54	3	5.58	3	5.56	3	5.40	10		
	4600.850	5.54	4	5.54	4	5.61	4	5.59	4	5.18	10		
		5.53	3	5.57	4	5.60	2	5.58	3	5.35	24		
58260	3970.505	7.08	3	7.09	3	7.07	3	7.05	5	6.98	11		
	3973.508	7.04	3	7.05	3	7.16	3	7.19	6	6.06	11		
	4329.573	7.08	4	7.09	2	7.14	2	7.00	9	6.98	12		
	4333.462	6.95	4	7.07	5	7.18	4	7.09	8	6.93	20		
	4593.750	7.04	3	7.14	3	7.13	2	6.93	5	5.72	10	275	
	4594.707	7.04	3	7.15	3	7.13	2	7.27	4	5.80	12		
		7.04	5	7.10	4	7.14	4	7.09	12	6.41	61		
61641	4329.600	6.14	4	6.15	2	6.22	2	6.10	7	5.61	8	80	
	4593.816	6.10	3	6.17	4	6.20	2	6.21	3	5.86	18		
	4594.726	6.17	3	6.21	2	6.24	3	6.17	5	6.05	17		
		6.14	4	6.18	3	6.22	2	6.16	6	5.84	22		
62712	4329.608	6.71	4	6.72	2	6.77	2	6.71	6	6.06	20		
	4593.824	6.73	3	6.79	3	6.79	2	6.80	3	5.86	8		
	4594.734	6.70	3	6.80	3	6.88	3	6.75	5				
	4596.824	6.72	3	6.77	3	6.79	3	6.62	4	6.08	10		
		6.72	1	6.77	3	6.81	5	6.72	8	6.00	12	110	
64740	3592.428	5.24	4	5.24	3	5.32	3	5.35	3	5.22	5		W.S.
	3593.402	5.18	4	5.29	4	5.32	3	5.24	4	5.20	7		W.S.
	3594.448	5.14	3	5.23	3	5.33	3	5.36	3	5.15	5		W.S.
	3733.172	5.25	3	5.29	2	5.37	2	5.38	3	5.59	8		G.S.
	3733.200	5.22	3	5.30	2	5.39	3	5.39	3	5.38	4		G.S.
	3735.183	5.20	3	5.29	2	5.35	3	5.37	3	5.37	3		G.S.
	3736.197	5.24	5	5.31	3	5.37	3	5.35	5	5.15	5		G.S.
	3970.528	5.22	3	5.26	2	5.35	3	5.33	4	5.34	6		
	3972.561	5.21	3	5.26	3	5.32	3	5.31	5	5.26	6		
	4330.541	5.25	5	5.26	5	5.35	4	5.37	5	4.92	9	60	
	4333.482	5.17	4	5.29	5	5.33	4	5.40	5	5.02	9		
	4594.857	5.25	3	5.30	3	5.38	3	5.48	3	5.10	7		
		5.22	4	5.28	3	5.35	2	5.36	6	5.22	17		
72968	4329.624	5.79	4	5.76	2	5.76	2	5.67	5	5.24	7		
	4594.877	5.79	3	5.80	3	5.78	3	5.72	3	5.58	9		
	4596.833	5.78	3	5.78	3	5.77	3	5.78	3	5.70	7		
	4599.816	5.78	3	5.76	3	5.76	3	5.70	3	5.35	3		
	4600.864	5.85	3	5.79	4	5.83	4	5.74	4	5.16	10	70	
		5.80	3	5.78	2	5.78	3	5.72	4	5.41	23		
74196	4329.644	5.83	4	5.88	2	5.90	2	5.96	5	5.58	10	30	
	4593.833	5.90	3	5.91	3	5.98	2	5.90	3	5.68	9		
	4594.744	5.88	3	5.94	3	5.97	3	5.91	3	5.64	15		
		5.87	4	5.91	3	5.95	4	5.92	3	5.63	5		
74521	4330.563	5.86	5	5.82	4	5.75	3	5.77	6	5.50	6		
	4333.489	5.77	4	5.84	5	5.86	4	5.86	7	5.76	11		
	4596.841	5.83	3	5.83	3	5.87	3	5.89	3	5.65	10		
	4599.833	5.84	3	5.84	3	5.84	3	5.86	3	5.44	9		
	4600.919	5.83	4	5.87	4	5.91	4	5.82	4	5.38	8	50	
		5.83	3	5.84	2	5.85	6	5.84	5	5.55	16		
75333	4595.824	5.52	3	5.48	3	5.52	3	5.48	4	5.52	6		
	4595.875	5.51	3	5.49	3	5.49	3	5.42	4	5.31	10	20	
	4596.854	5.49	3	5.49	3	5.52	3	5.68	3	5.48	7		
	4597.798	5.53	3	5.56	3	5.48	3	5.67	3	5.47	5		
	4599.847	5.49	3	5.51	3	5.53	3	5.47	3	5.47	9		
		5.51	2	5.51	3	5.51	2	5.54	12	5.45	8		
78316	4330.573	5.49	5	5.45	4	5.45	3	5.38	5	5.20	5	20	
	4595.835	5.45	3	5.43	3	5.49	3	5.43	4	5.45	9		
	4596.860	5.44	3	5.46	3	5.47	3	5.48	3	5.53	5		
	4597.819	5.49	3	5.48	3	5.54	3	5.44	3	5.35	11		
		5.47	3	5.46	2	5.49	4	5.43	4	5.38	14		
81009	4328.641	6.33	3	6.24	2	6.22	2	6.11	4	5.86	9		
	4331.600	6.24	3	6.26	3	6.21	3	6.21	3	6.09	7		
	4597.831	6.34	3	6.24	3	6.21	3	6.24	3				
	4599.885	6.38	4	6.34	3	6.39	3	6.15	4	6.03	10		
		6.32	6	6.27	5	6.25	5	6.18	6	5.99	12		
90264	4328.648	5.27	3	5.28	2	5.37	2	5.33	3	5.18	15		
	4330.586	5.33	5	5.32	4	5.39	3	5.38	4	5.21	7		
	4331.586	5.27	3	5.33	3	5.37	3	5.37	3	5.22	6		
	4333.572	5.25	4	5.37	5	5.32	4	5.41	5	5.01	8	40	
	4593.860	5.36	3	5.35	3	5.41	3	5.37	3	5.38	12		
	4596.876	5.26	3	5.29	3	5.34	3	5.33	3				
	4597.856	5.27	3	5.29	3	5.36	3	5.39	3	5.04	5		
		5.29	4	5.32	3	5.37	3	5.37	3	5.17	13		
90569	4328.668	6.13	3	6.09	2	6.10	2	6.00	3	5.40	10	80	
	4331.618	6.07	3	6.11	3	6.10	3	6.05	3				
	4595.888	6.10	3	6.07	3	6.04	3	6.03	3	5.80	15		
	4596.883	6.10	3	6.12	3	6.08	3	6.01	3	6.05	10		
		6.10	2	6.10	2	6.08	3	6.02	2	5.75	33		
92664	4333.543	5.81	4	5.88	5	5.97	4	5.85	6	5.44	10		
	4593.873	5.92	3	5.90	3	5.96	3	5.94	3	5.38	8	70	
	4594.780	5.80	3	5.88	3	5.89	3	5.74	4	5.60	20		
	4597.863	5.85	3	5.89	3	5.95	3	5.90	3	5.51	5		
		5.85	5	5.89	1	5.94	4	5.86	9	5.48	9		
92938	4594.802	5.09	3	5.17	3	5.21	3	5.16	4	5.17	7		
	4595.855	5.18	4	5.19	3	5.25	3	5.25	4	5.29	15		
		5.14	6	5.18	1	5.23	2	5.21	6	5.23	8		
93030	3970.556	3.33	3	3.37	2	3.49	3	3.50	4	3.62	6		
	3972.603	3.33	3	3.38	3	3.45	3	3.49	3	3.53	4		
	3973.557	3.27	3	3.38	2	3.48	2	3.48	3	3.54	5		
	4330.603	3.35	5			3.48	3	3.41	4	3.62	6		
	4333.560	3.29	4	3.39	5	3.40	4	3.48	5	3.50	6		
	4594.046	3.37	5	3.40	4	3.51	5	3.52	4	3.63	7		
	4596.026	3.28	4	3.37	4	3.47	4	3.49	5	3.41	6		
	4601.965	3.42	3	3.44	3	3.50	3	3.50	3	3.55	3		
		3.33	5	3.39	2	3.47	3	3.48	3	3.55	8		
94660	4328.702	6.18	3	6.12	2	6.18	2	6.14	5	5.71	14		
	4330.614	6.19	5	6.19	4	6.18	3	6.19	4	5.65	9		
	4594.819	6.27	3	6.16	4	6.20	4	6.16	5	6.13	13		
	4596.039	6.16	5	6.14	5	6.26	5						
	4599.860	6.25	3	6.19	3	6.17	3	6.08	6	5.44	9	100	
		6.21	5	6.17	2	6.20	4	6.14	5	5.73	29		
96446	3969.686	7.10	4	7.10	3	7.16	3	7.04	6	6.50	14		
	3970.567	7.07	3	7.12	3	7.29	4	7.16	6	6.42	20		
	3973.591	7.08	3	7.10	3	7.19	3	7.11	5	6.34	12		
	4329.656	7.12	4	7.12	2	7.14	2	6.86	8	6.05	12	200	
	4331.646	7.13	3	7.15	3	7.20	3	7.14	7	6.26	15		
	4333.621	7.06	4	7.13	5	7.28	4	6.82	7	6.19	15		
	4595.026	7.12	5	7.17	5	7.29	5	7.18	13				
	4596.045	7.06	5	7.02	5	7.16	5	7.14	14				
		7.09	3	7.11	4	7.21	6	7.06	14	6.30	17		
98088	4328.729					5.83	3	5.74	5	5.60	10		
	4329.671	5.88	4	5.79	2	5.78	3	5.78	7	5.19	12	60	
	4331.655	5.95	3	5.81	3	5.78	3	5.70	3	5.43	9		
	4595.034	5.95	5	5.78	5	5.79	5	5.67	7	5.44	10		M ?
	4596.063	5.87	5	5.71	5	5.79	5	5.73	6	5.74	33		
		5.91	4	5.77	4	5.79	2	5.72	4	5.49	24		
109026	4330.624	4.29	5	4.27	4	4.29	3	4.29	4	4.31	6		
	4331.668	4.28	3	4.27	3	4.32	3	4.28	3	4.34	4		
	4332.699	4.34	5	4.33	5	4.36	5	4.34	5	4.47	8		
	4592.921	4.26	4	4.25	4	4.30	5	4.29	3	4.24	6		
	4594.077	4.13	5	4.15	5	4.32	5	4.31	6	4.39	11		
	4594.833	4.29	3	4.30	3	4.35	3	4.34	3	4.37	5		
	4596.015	4.16	4	4.22	4	4.29	4	4.28	6	4.13	8		
	4597.094	4.26	4	4.23	4	4.27	4	4.34	5	4.54	8		
		4.25	7	4.25	5	4.31	3	4.31	3	4.35	13		
111133	4329.738	6.29	4	6.32	2	6.35	2	6.36	5	5.85	9		
	4331.738	6.46	3	6.40	3	6.36	3	6.30	3	5.91	15		
	4595.908	6.34	3	6.31	3	6.30	3	6.28	6	5.48	14	110	
	4599.985	6.38	3	6.35	3	6.32	3	6.30	3	5.97	9		
		6.37	7	6.35	4	6.33	3	6.31	3	5.80	22		
116485	4329.760	5.78	4	5.76	2	5.81	3	5.82	6				
	4331.753	5.71	3	5.74	3	5.77	3	5.67	3	5.38	9		
	4333.640	5.56	4	5.72	5	5.70	4	5.69	6	4.95	8	100	
	4594.069	5.71	5	5.64	5	5.75	5	5.79	6	5.21	22		
	4594.892	5.75	3	5.76	3	5.82	3	5.70	4	5.74	10		M ?
	4596.020	5.68	4	5.67	4	5.73	4	5.68	5	5.71	32		
	4597.088	5.82	4	5.79	4	5.73	4	5.81	4	5.77	20		
	4599.904	5.76	3	5.76	3	5.75	3	5.73	3	5.34	12		
		5.72	8	5.73	5	5.76	4	5.74	6	5.39	31		

TABLE I *(continued)*.

HD Number	JD 2440000+	J 1.25	H 1.65	K 2.2	L 3.6	M 4.8(μ)	E_M (%)	Rem.
118022	4329.769	4.91 4	4.93 2	4.90 2	4.96 5	4.80 8		
	4595.043	4.99 5	4.88 7	4.91 4	4.88 5	4.90 12		M ?
	4596.070	4.87 5	4.87 5	4.91 5	4.86 6			
	4597.032	4.89 4	4.91 4	4.91 4	4.87 4	4.90 16		
	4600.011	4.86 3	4.913	4.87 3	4.86 3	5.11 8		M ?
		4.90 5	4.90 2	4.90 2	4.89 4	4.93 13		
124224	4328.922	5.28 5	5.26 5	5.37 5	5.33 5	5.23 10		
	4595.047	5.27 5	5.27 5	5.32 4	5.30 6			
	4596.075	5.22 5	5.23 5	5.32 5	5.32 6	5.40 8		
	4597.038	5.21 4	5.25 4	5.29 4	5.33 4	5.18 6		
	4600.022	5.23 3	5.26 3	5.31 3	5.21 3	5.42 8		
		5.24 3	5.25 2	5.32 3	5.30 5	5.31 12		
125248	4329.781	5.92 4	5.89 2	5.88 2	5.94 5	5.49 8		
	4595.074	5.95 5	5.89 5	5.91 5	5.90 5			
	4596.081	5.92 5	5.85 5	5.91 5	5.85 7	5.63 10		
	4596.909	5.93 3	5.91 3	5.90 3	5.86 4	5.74 13		
		5.93 1	5.89 3	5.90 1	5.89 4	5.62 13		
125823	3733.401	4.93 3	4.94 3	4.99 2	5.01 4	5.11 4		G.S.
	3736.389	4.94 5	4.93 3	5.01 3	5.02 3	4.92 4		
	3970.604	4.96 3	4.95 2	5.09 3	5.03 4	4.95 5		
	3972.610	4.92 3	4.93 3	5.01 3	5.01 3	4.98 5		
	3973.632	5.08 3	5.06 3	5.05 3	5.07 3	5.01 9		
	4329.796	4.87 4	4.93 2	4.98 2	5.06 4	4.96 8		
	4330.697	5.08 5	4.95 4	5.00 3	5.00 5	4.83 6	20	
	4594.060	4.85 5	4.86 5	5.00 5	5.02 5	5.16 14		
	4595.088	4.91 5	4.97 5	5.04 5	4.98 5			
	4596.094	4.90 5	5.01 5	5.01 5	5.04 5	5.14 14		
		4.95 7	4.95 5	5.02 3	5.03 4	5.02 11		
126515	4330.721	7.11 5	7.12 4	7.12 3	7.11 4	6.82 30		
	4595.057	7.11 5	7.08 5	7.11 5	7.01 7			
		7.11	7.10 2	7.12 1	7.06 5	6.82		
128898	4329.821	2.86 4	2.71 2	2.69 2	2.65 3	2.65 6		
	4332.790	2.94 5	2.90 5	2.77 5				
	4593.010	2.86 6	2.66 6	2.73 6	2.63 3	2.67 4		
	4595.094	2.89 5	2.73 5	2.89 5	2.74 5	2.95 10		
	4596.101	2.81 5	2.70 5	2.73 5	2.65 5	2.77 6		
	4600.042	2.70 3	2.70 3	2.65 3	2.60 3	2.67 5		
		2.84 8	2.73 8	2.74 8	2.65 5	2.74 13		
129174	4595.063	4.60 5	4.50 5	4.56 5	4.58 5	4.56 15		
	4597.054	4.57 4	4.61 4	4.57 4	4.50 5	4.30 12	25	
		4.59 2	4.56 8	4.57 1	4.54 6	4.43 18		
130559	4330.732	5.21 5	5.19 4	5.19 3	5.14 4	5.08 10		
	4595.069	5.21 5	5.25 5	5.15 5	5.12 6	4.93 25		
	4596.901	5.21 3	5.19 3	5.19 3	5.11 3	5.16 5		
	4597.060	5.27 4	5.17 4	5.17 4	5.17 5	5.15 12		
	4600.051	5.17 3	5.18 3	5.18 3	5.08 3	5.12 4		
		5.21 4	5.20 3	5.18 2	5.12 3	5.09 9		
133518	3970.611	6.69 3	6.70 2	6.74 2	6.69 4	6.48 25		
	3972.638	6.67 3	6.65 3	6.75 3	6.82 4	6.17 10		
	3973.640	6.86 3	6.76 3	6.72 3	6.80 5	6.40 13		
	4329.845	6.69 4	6.68 2	6.70 3	6.75 5	5.91 15		
	4593.099	6.78 5	6.76 4	6.71 9	6.95 12			
	4594.097	6.56 5	6.55 7	6.68 5	6.77 12	5.58 23	190	
		6.71 10	6.68 8	6.72 3	6.80 9	6.11 37		
133880	4330.740	5.96 5	6.00 4	6.00 3	5.97 4	5.74 12	25	
	4593.077	6.15 5	5.96 5	6.00 6	6.05 3	5.72 50		
	4594.103	5.85 7	5.77 7	5.97 5	6.06 7	6.03 22		
		5.99 15	5.91 12	5.99 2	6.03 5	5.83 17		
134759	4329.853	4.74 4	4.70 2	4.73 2	4.73 4	4.70 7		
135382	4329.860	2.85 4	2.79 2	2.69 2	2.71 3	2.71 5		
	4595.113	2.89 4	2.76 4	2.81 4	2.69 6	2.87 6		
	4596.107	2.77 5	2.74 5	2.71 5	2.66 5			
	4597.082	2.83 4	2.75 4	2.74 4	2.74 4	2.75 5		
		2.84 5	2.76 2	2.74 5	2.70 3	2.78 8		
137509	3970.638	7.14 3	7.22 3	7.47 3	7.53 6	6.34 25	65	
	4331.776	7.20 3	7.21 3	7.23 3	7.22 4	6.68 10		
	4595.131	7.33 7	7.50 6	7.35 5	7.02 15			
		7.22 10	7.31 16	7.35 12	7.26 26	6.51 24		
137909	4330.750	3.35 5	3.30 4	3.24 3	3.22 4	3.27 6		
	4598.033	3.36 3	3.25 4	3.29 3	3.24 3	3.29 4		
		3.36 1	3.28 2	3.27 2	3.23 1	3.28 1		
137949	4331.790	6.44 3	6.39 3	6.39 3	6.28 4	6.17 8		
140160	4329.870	5.29 4	5.28 2	5.26 2	5.20 3	5.26 7		
	4598.044	5.29 3	5.23 3	5.25 3	5.34 6	5.06 9		
		5.29	5.26 2	5.26 1	5.27 10	5.16 14		
142301	3733.412	6.03 3	6.05 3	6.04 2	5.98 4	5.65 8		G.S.
	3736.404	6.03 5	6.04 3	6.07 3	6.06 3	5.81 10		G.S.
	3970.656	5.99 3	5.99 2	6.03 2	6.02 4	6.01 12		
	3972.649	6.11 4	6.07 3	6.06 3	6.03 5	5.53 10	60	
	4329.883	6.03 4	6.06 2	6.06 2	6.00 5	5.70 11		
	4329.922	6.05 4	6.06 2	6.09 2	5.95 5	5.76 30		
		6.04 4	6.05 3	6.06 2	6.01 4	5.74 16		
142990	3733.428	5.69 3	5.75 3	5.82 3	5.78 4	5.76 9		G.S.
	3736.418	5.55 5	5.67 3	5.72 3	5.69 3	5.61 5		G.S.
	3970.663	5.62 3	5.69 3	5.70 3	5.70 5	5.76 12		
	3972.759	5.68 3	5.65 3	5.71 3	5.68 5	5.59 7		
	4331.848	5.83 3	5.75 3	5.82 3	5.76 3	5.53 10	20	
		5.67 10	5.70 5	5.75 6	5.72 4	5.65 10		
143699	4331.861	5.26 3	5.32 4	5.31 4	5.31 4	5.46 9		
144334	4331.873	6.01 3	5.97 4	5.99 4	5.93 4	5.47 12	55	
144661	4331.885	6.44 3	6.45 4	6.42 4	6.33 4	5.94 12	60	
146001	4329.906	5.98 4	5.91 2	5.92 2	5.83 5	6.13 30		
	4331.902	5.91 3	5.91 4	5.84 4	5.84 4	5.75 10		
		5.95 5	5.91 1	5.88 6	5.84 1	5.94 27		
148112	4329.933	4.63 5	4.59 3	4.57 3	4.56 4	4.45 7		
	4598.066	4.59 3	4.55 3	4.52 3	4.45 6	4.57 5		
		4.61 3	4.57 3	4.55 4	4.51 8	4.51 8		
148898	4329.940	4.35 5	4.29 3	4.25 3	4.21 4	4.21 8		
151525	4598.082	5.23 3	5.14 3	5.12 3	5.01 4	4.96 4		
153882	4598.094	6.20 3	6.14 3	6.13 3	6.26 4	5.48 10	70	
162374	4329.947	6.28 5	6.27 3	6.31 3	6.29 4	6.14 10		
	4331.949	6.13 3	6.21 4	6.19 4	6.14 4	5.69 11	75	
		6.21 11	6.24 4	6.29 14	6.22 11	5.92 32		
164258	4331.978	6.11 3	6.03 4	5.96 4	5.95 5	5.43 15	55	
168733	4331.985	5.52 3	5.56 4	5.61 4	5.68 4	5.56 10		
175362	4152.456	5.74 3	5.75 2	5.78 2	5.78 3	5.78 5		D.E.
	4153.619	5.72 3	5.69 5	5.73 2	5.71 4	5.70 6		D.E.
	4154.626	5.71 3	5.69 6	5.76 3	5.82 5	5.50 8		D.E.
	4332.030	5.67 3	5.72 3	5.79 3	5.80 4	5.49 9	25	
		5.71 3	5.71 3	5.77 3	5.78 5	5.62 15		
175744	4332.038	6.73 3	6.78 3	6.81 3	6.75 7	6.51 20		
176232	4332.045	5.47 3	5.38 3	5.35 3	5.36 5	5.35 15		
177517	4332.050	5.97 3	5.98 3	5.97 3	5.97 5	5.61 20		
179761	4329.956	5.48 5	5.43 3	5.42 3	5.42 4	5.06 9	40	
187474	4329.081	5.47 5	5.49 5	5.47 5	5.48 5	4.97 8	55	
201601	4329.103	4.35 6	4.26 6	4.16 6	4.13 6	4.02 10		
	4330.006	4.29 3	4.17 4	4.14 3	4.11 4	4.00 8		
		4.32 4	4.22 6	4.15 1	4.12 1	4.01 1		
203006	4330.042	4.77 3	4.72 4	4.70 3	4.66 4	4.60 7		
	4594.362	4.74 4	4.69 7	4.73 4	4.66 5	4.84 11		
		4.76 2	4.71 2	4.72 2	4.66 1	4.72 17		
206088	4329.139	3.26 6	3.17 6	3.08 6	3.01 6	3.03 8		
	4594.375	3.18 4	3.12 7	3.04 4	3.04 5	3.04 11		
		3.22 6	3.15 4	3.06 3	3.03 1	3.04 1		
206742	4330.052	4.48 3	4.46 4	4.47 3	4.49 4	4.46 6		
214484	4593.367	5.56 5	5.42 5	5.44 5	5.43 7	5.43 20		
	4594.403	5.55 4	5.54 5	5.51 3	5.49 6	5.27 36		
	4596.406	5.61 5	5.54 5	5.54 5	5.50 5			
		5.57 3	5.50 7	5.50 5	5.47 4	5.35 11		
220825	4597.502	4.96 5	4.96 3	5.04 3	5.00 3			
	4601.459	4.96 3	4.96 3	4.95 3	4.94 3	4.55 9	40	
		4.96	4.96	5.00 6	4.97 4	4.55		
221006	4330.067	6.01 3	6.03 3	6.16 3	6.18 4			
	4594.485	6.00 4	6.09 4	6.09 5	6.06 6	5.52 7		
	4596.413	6.02 5	6.05 7	6.12 5	6.08 6	5.98 10		
	4597.398	6.06 3	6.10 3	6.19 3	6.20 4	5.20 18	130	
		6.02 3	6.07 3	6.14 4	6.13 7	5.57 39		
221507	4330.076	4.61 3	4.63 3	4.65 3	4.61 4	4.58 6		
	4595.503	4.63 3	4.71 3	4.68 3	4.64 4	4.40 6	25	
	4597.387	4.60 3	4.62 3	4.66 3	4.82 4	4.62 5		
	4601.405	4.68 3	4.69 3	4.63 3	4.63 3	4.58 7		
		4.63 4	4.66 4	4.66 2	4.68 10	4.55 10		
221760	4330.084	4.60 3	4.54 3	4.51 3	4.47 4	4.53 5		
	4594.465	4.57 4	4.52 3	4.54 4	4.47 7	4.24 6	25	
	4597.376	4.56 3	4.54 3	4.52 3	4.46 3	4.38 3		
		4.58 2	4.53 1	4.52 2	4.47 1	4.38 15		
223640	4597.469	5.44 3	5.51 3	5.59 3	5.56 4	5.34 12		
	4601.467	5.49 3	5.52 3	5.52 3	5.54 3	5.53 7		
		5.47 2	5.52 1	5.56 5	5.55 1	5.44 13		
224926	4597.479	5.42 3	5.46 3	5.50 3	5.46 4	5.60 14		
	4601.447	5.43 3	5.46 3	5.47 3	5.50 3	5.27 7	20	
		5.43 1	5.46	5.49 2	5.48 2	5.44 23		

Under remarks (Rem.) we noted other observers : W. K. Sherwood (W.S.), G. V. Schultz (G.S.) and D. Engels (D.E.).

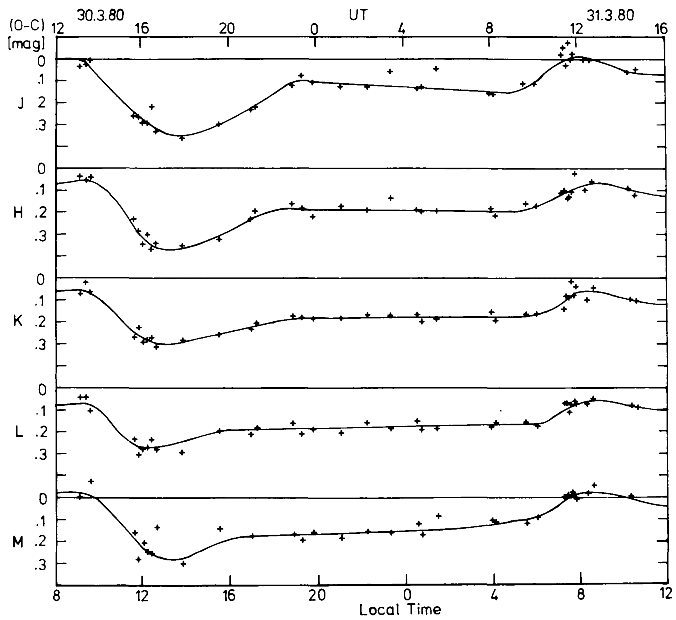

FIGURE 1. — Schift of zero-point (O-C) observed minus standard magnitude during 24 hours in *JHKLM*, measurements (+) of 30 different standard-stars are shown, curves are handdrawn.