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I- and JHK-band photometry of classical Cepheids in the HIPPARCOS catalog

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Abstract. By correlating the Fernie et al. (1995) electronic database on Cepheids with the "resolved variable catalog" of the HIPPARCOS mission and the SIMBAD catalog one finds that there are 280 Cepheids in the HIPPARCOS catalog. By removing W Vir stars (Type II Cepheids), double-mode Cepheids, Cepheids with an unreliable solution in the HIPPARCOS catalog, and stars without photometry, it turns out that there are 248 classical Cepheids left, of which 32 are classified as first-overtone pulsators. For these stars the literature was searched for I-band and near-infrared data. Intensity-mean I-band photometry on the Cousins system is derived for 189 stars, and intensity-mean JHK data on the Carter system is presented for 69 stars.

Key words: Cepheids

1. Introduction

Cepheids are important standard candles in determining the extra-galactic distance scale. The results of the HIPPARCOS mission allow, in principle, a calibration of the period-luminosity relation based on the available parallaxes. Feast & Catchpole (1997; hereafter FC) did just that based on pre-released HIPPARCOS data of 223 Cepheids available to them at that time. Now that the full catalog has become available (ESA 1997) it is interesting to have a look at the final sample of Cepheids in the HIPPARCOS catalog. A second topic addressed here is I and JHK-band data. The analysis by FC was based on B and V data which was available for all stars in the sample of 220 stars their analysis was based on. However, the intrinsic spread in the $M-P$ relation is smaller in I and JHK than in V (e.g. Tanvir 1999; Gieren et al. 1998), and so it might be interesting to collect data in these bands for further study.

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2. Sample selection

From the HIPPARCOS "resolved variable" catalog all stars were selected classified as "DCEP" (219 stars), "DCEPS" (31 stars), and "CEP" (23 stars). This number is consistent with the quoted number of 270 Cepheids in the HIPPARCOS Input Catalog (ESA 1989), and the discovery of 3 new Cepheids (CK Cam, V898 Cen and V411 Lac). These 273 stars were correlated with the electronic database of Fernie et al. (1995). An error was detected in the HIPPARCOS catalog as HIC 45949 is associated there with W Car, whereas the correct association is V Vel. Ten stars were not found in that catalog. Comparison with the electronic database of Welch (1997), six of them (EN Tra, KL Aql, V733 Aql, BB Her, T Ant, BB Gem) are classified as Type II Cepheids, and KZ Pup is in fact a RR Lyrae variable (see the General Catalog of Variable Stars, Kholopov et al. 1985). These are excluded.

For CK Cam the intensity-mean magnitudes are calculated (in the way described below) from data in Berdnikov et al. (1996), resulting in $< B > = 6.560$, $< V > = 7.541$ and $< B-V > = 0.990$. As no intensity-mean values for V and $B-V$ exist in the literature the values listed in the HIPPARCOS catalog have been adopted for the other objects (V411 Lac, V898 Cen). Periods also come from HIPPARCOS. At this point the carbon-rich CH-like Cepheid V553 Cen is discarded.

The electronic database of Fernie et al. (1995) was also cross-correlated with the SIMBAD catalog, to search for Cepheids in HIPPARCOS which are not in the "resolved variable" catalog. Seven were found, of which one (BD Cas = HIC 796 = Fernie et al. nr. 130.3) is classified as a Type II Cepheid by Fernie et al.. Of the remaining six, two (AU Peg, κ Pav) are not listed in Fernie et al. and are classified as Type II in the database of Welch, and hence excluded.

This leaves 270 stars that may be considered Type I Cepheids. As a next step, 10 stars are removed that are classified as Double-Mode Cepheids in Fernie et al. (GZ Car, TU Cas, VX Pup, AP Vel, Y Car, UZ Cen, BK Cen, U Tra, BQ Ser, EW Sct).

Next, stars with an unreliable solution in the HIPPARCOS catalog are removed. Criteria are a large fraction of "Data-Points-Rejected" (DPR, field H29), and/or a large value for the "Goodness-of-Fit (GOF, field H30). The introduction to the HIPPARCOS and Tycho catalogues (ESA 1997) only mentions that a "large" value of DPR indicates a model mismatch without quoting a specific value, and that values of GOF larger than 3 usually indicate a bad fit to the data. Often these stars are also flagged as having a "Number-of-Components (nc, field H58) of 2, indicating a binary system. Stars removed on the basis of their DPR and/or GOF flags are: UX Per (DPR=36, GOF=5.30, nc=2), RW Cam (DPR=12, GOF=2.27, nc=2), BM Pup (DPR=6, GOF=5.75, nc=2), HK Car (DPR=8, GOF= 2.37, nc=2), SU Cru (DPR=20, GOF=2.09, nc=2), SY Nor (DPR=8, GOF=3.23, nc=1), TW Nor (DPR=8, GOF = 2.83, nc=1). In the remaining sample all objects have DPR $\leq$ 7; the two stars with DPR=7 have GOF $<$ 1.32. There are 2 stars with GOF $>$3.0, however with DPR of only 0 and 2%, that were therefore kept.

Y Lac (DPR=8, GOF=4.44, nc=1) and RY Sco (DPR =13, GOF=1.94, nc=1) are special as their DPR and/or GOF values in the HIPPARCOS catalog indicate an unreliable solution, and would have been discarded for this reason. However, both are among the stars reanalysed by Falin & Mignard (1999) using software from the HIPPARCOS FAST consortium but adding additional data, in particular related to multiplicity. The solution they obtain is remarkably better, with for Y Lac values of DPR = 0 and GOF = -0.13 and for RY Sco they derive DPR = 0, GOF = 1.06. This is solely due to the fact that duplicity was allowed for. For Y Lac the binary component is at $2.6''$ distance and has a magnitude difference of 3.0, for RY Sco these numbers are $14.4''$ and 2.4 mag, respectively. None of the other Cepheids in the sample are in Falin & Mignard (1999).

There remain seven stars for which Fernie et al. do not list the intensity-mean V and $B-V$. DP Vel is discarded (as was done by FC) because the photometric data are too sparse, LL Pup, LR Pup and VV CMa because no $B-V$ is listed in the HIPPARCOS catalog (the Welch database does not list references to any photometry either). For HL Pup, FN Vel and LX Pup, V and $B-V$ are taken from HIPPARCOS.

There remain 248 stars of which 22 are classified as overtone pulsators in the Fernie et al. database. Recently, Sachkov (1997) identified some new overtone pulsators; FN Aql, V1162 Aql, SU Cas, X Lac, SZ Tau are in our list and not identified as overtone pulsators by Fernie et al. Furthermore, V473 Lyr is a second overtone pulsator based on the analysis of Van Hoolst & Waelkens (1995) and Andrievsky et al. (1998) and we have added four more overtone pulsators (IR Cep, BP Cir, AV Cir, DX Gem) from Antonello et al. (1990). In total there are therefore 32 overtone pulsators and 216 fundamental mode pulsators in the sample.

3. *I*-band photometry

The largest database on I-band photometry is that of Caldwell & Coulson (1987, hereafter CC). However, they list *magnitude*-mean $V-I$ values instead of the traditional intensity-mean. Gieren et al. (1998) mention they add a correction of -0.03 mag to the magnitude-mean I to estimate the intensity-mean. However, by comparing some entries in Gieren et al.'s Table 3 to the data in CC it turns out that they actually added $+0.03$ mag.

In view of this, I decided to perform a literature study and to calculate whenever possible the intensity-mean $< I >$ magnitude, as well as the intensity-mean $< V >$-magnitude (all V magnitudes are on the Johnson system) for the same dataset as the available I-band data, from the original sources. The intensity-mean magnitude is calculated according to Tanvir (1997):

$$< m > = -2.5 \log \sum_{i=1}^{n} 0.5\,(\phi_{i+1} - \phi_{i-1})\, 10^{-0.4\, m_i} \qquad (1)$$

where ϕ_i and m_i are the phase and magnitude of the i-th epoch after folding with the period, and with $\phi_{n+1} = 1 + \phi_1$ and $\phi_0 = \phi_n$.

Johnson-I photometry was transformed to Cousins-I using the formula presented in CC. Washington photometry was transformed following Coulson et al. (1985). If necessary, the phases of the individual observations were calculated, and/or the phases ordered, in order to apply Eq. (1).

The intensity-mean $< I >$, and $< V > - < I >$ are presented in Table 1. It contains 283 datasets for 189 stars. Also listed are the number of data points in the light curve used, the reference to the data, and the original photometric system (C = Cousins, J = Johnson, W = Washington). In three cases (l Car, β Dor and S Nor) the data of Dean et al. (1977) and Dean (1981) were combined beforehand to calculate the intensity-means. The data in Table 1 does not contain *all* known I-band datasets, but is intented to contain all published datasets with photometry in the Cousins system, and all datasets

Table 1. Intensity-mean I-band data

Name	points	$< I >$	$< V > - < I >$	Reference	system
U Aql	39	5.284	1.164	Moffett & Barnes (1984)	J
	6	5.265	1.173	Dean (1977)	C
	7	5.205	1.247	Berdnikov & Turner (1995a)	C
SZ Aql	21	7.066	1.545	Moffett & Barnes (1984)	J
	6	6.957	1.503	Dean (1977)	C
	7	7.150	1.568	Berdnikov & Turner (1995a)	C
	19	7.112	1.607	Barnes et al. (1997)	J
TT Aql	51	5.722	1.409	Coulson et al. (1985)	C
	16	5.759	1.468	Barnes et al. (1997)	J
	36	5.726	1.403	Moffett & Barnes (1984)	J
FF Aql	42	4.509	0.864	Moffett & Barnes (1984)	J
	10	4.515	0.853	Berdnikov & Turner (1995b)	C
FM Aql	35	6.765	1.506	Moffett & Barnes (1984)	J
	6	6.814	1.531	Berdnikov & Turner (1995a)	C
FN Aql	29	6.987	1.395	Moffett & Barnes (1984)	J
	7	6.970	1.389	Berdnikov & Turner (1995a)	C
	4	6.978	1.380	Dean (1977)	C
	18	6.987	1.392	Barnes et al. (1997)	J
V496 Aql	37	6.485	1.262	Gieren (1981)	C
	7	6.436	1.298	Berdnikov & Turner (1995a)	C
	30	6.473	1.278	Moffett & Barnes (1984)	J
V600 Aql	37	8.270	1.767	Moffett & Barnes (1984)	J
V1162 Aql	11	6.847	0.962	Berdnikov & Turner (1995b)	C
η Aql	46	3.028	0.870	Moffett & Barnes (1984)	J
	9	3.034	0.852	Shobbrook (1992)	C
	18	3.000	0.913	Barnes et al. (1997)	J
V340 Ara	7	8.522	1.626	Harris (1980)	W
RT Aur	30	4.764	0.683	Moffett & Barnes (1984)	J
	27	4.794	0.689	Barnes et al. (1997)	J
RX Aur	29	6.642	1.029	Moffett & Barnes (1984)	J
SY Aur	22	7.871	1.205	Moffett & Barnes (1984)	J
YZ Aur	5	8.820	1.513	Harris (1980)	W
AN Aur	13	9.057	1.409	Harris (1980)	W
RX Cam	45	6.263	1.419	Moffett & Barnes (1984)	J
RY CMa	54	7.131	0.978	Dean et al. (1977)	C
	28	7.133	0.971	Moffett & Barnes (1984)	J
RZ CMa	35	8.496	1.201	Moffett & Barnes (1984)	J
SS CMa	55	8.492	1.449	Coulson & Caldwell (1985)	C
TW CMa	25	8.441	1.120	Moffett & Barnes (1984)	J
VZ CMa	37	8.155	1.229	Stobie & Balona (1979)	C
	17	8.177	1.238	Berdnikov & Turner (1995b)	C
U Car	26	5.070	1.233	Coulson & Caldwell (1985)	C
	25	5.047	1.224	Berdnikov & Turner (1995b)	C
V Car	7	6.435	0.944	Dean (1977)	C
UX Car	29	7.546	0.735	Stobie & Balona (1979)	C
VY Car	23	6.279	1.183	Coulson & Caldwell (1985)	C
WZ Car	37	7.964	1.297	Coulson & Caldwell (1985)	C
	26	7.972	1.297	Berdnikov & Turner (1995b)	C
XX Car	67	8.119	1.210	Coulson et al. (1985)	C
XY Car	58	7.952	1.342	Coulson et al. (1985)	C
XZ Car	39	7.239	1.358	Coulson et al. (1985)	C
YZ Car	65	7.436	1.261	Coulson & Caldwell (1985)	C
AQ Car	63	7.869	0.982	Coulson et al. (1985)	C
ER Car	6	5.932	0.865	Dean (1977)	C
FR Car	29	8.430	1.242	Coulson & Caldwell (1985)	C
GH Car	28	8.057	1.105	Berdnikov & Turner (1995b)	C

Table 1. continued

Name	points	$< I >$	$< V > - < I >$	Reference	system
GI Car	36	7.475	0.847	Gieren (1985)	C
	28	7.484	0.848	Berdnikov & Turner (1995b)	C
IT Car	31	7.084	1.012	Gieren (1985)	C
l Car	25	2.557	1.177	Dean et al. (1977)+Dean (1981)	C
RW Cas	50	7.900	1.318	Moffett & Barnes (1984)	J
RY Cas	11	8.352	1.582	Harris (1980)	W
SU Cas	43	5.103	0.868	Moffett & Barnes (1984)	J
	23	5.086	0.860	Barnes et al. (1997)	J
SW Cas	39	8.421	1.283	Moffett & Barnes (1984)	J
SZ Cas	28	8.110	1.744	Moffett & Barnes (1984)	J
UZ Cas	9	10.051	1.268	Harris (1980)	W
VV Cas	19	9.412	1.340	Harris (1980)	W
VW Cas	15	9.361	1.383	Harris (1980)	W
CF Cas	32	9.731	1.405	Moffett & Barnes (1984)	J
CH Cas	14	8.987	1.988	Harris (1980)	W
CY Cas	9	9.604	2.004	Harris (1980)	W
DD Cas	28	8.543	1.336	Moffett & Barnes (1984)	J
DL Cas	34	7.611	1.357	Moffett & Barnes (1984)	J
FM Cas	29	8.003	1.125	Moffett & Barnes (1984)	J
V Cen	30	5.797	1.041	Berdnikov & Turner (1995b)	C
	35	5.803	1.017	Gieren (1981)	C
VW Cen	36	8.767	1.476	Coulson & Caldwell (1985)	C
XX Cen	65	6.735	1.082	Coulson et al. (1985)	C
AZ Cen	28	7.842	0.791	Berdnikov & Turner (1995b)	C
	20	7.853	0.776	Gieren (1981)	C
	31	7.812	0.794	Stobie & Balona (1979)	C
BB Cen	29	8.920	1.141	Stobie & Balona (1979)	C
	29	8.934	1.161	Berdnikov & Turner (1995b)	C
KK Cen	12	9.939	1.501	Berdnikov & Turner (1995a)	C
KN Cen	47	8.000	1.860	Coulson & Caldwell (1985)	C
	29	7.994	1.881	Berdnikov & Turner (1995b)	C
V339 Cen	35	7.392	1.314	Coulson & Caldwell (1985)	C
V378 Cen	28	7.273	1.193	Gieren (1985)	C
	27	7.263	1.221	Berdnikov & Turner (1995b)	C
V381 Cen	6	6.880	0.964	Dean (1977)	C
V419 Cen	27	7.340	0.850	Berdnikov & Turner (1995b)	C
CR Cep	37	7.991	1.663	Moffett & Barnes (1984)	J
δ Cep	50	3.209	0.747	Moffett & Barnes (1984)	J
	17	3.190	0.783	Barnes et al. (1997)	J
AX Cir	11	4.974	0.879	Shobbrook (1992)	C
	9	4.979	0.912	Dean (1977)	C
BP Cir	5	6.639	0.892	Balona (1981)	C
R Cru	27	5.909	0.873	Dean et al. (1977)	C
S Cru	42	5.751	0.846	Gieren (1981)	C
T Cru	31	5.613	0.958	Dean et al. (1977)	C
BG Cru	27	4.762	0.712	Berdnikov & Turner (1995b)	C
	31	4.753	0.710	Stobie & Balona (1979)	C
X Cyg	130	5.248	1.143	Moffett & Barnes (1984)	J
	17	5.290	1.183	Barnes et al. (1997)	J
SU Cyg	47	6.188	0.673	Moffett & Barnes (1984)	J
SZ Cyg	26	7.812	1.617	Moffett & Barnes (1984)	J
TX Cyg	45	7.261	2.253	Moffett & Barnes (1984)	J
VX Cyg	14	8.123	1.898	Harris (1980)	W
VY Cyg	35	8.122	1.470	Moffett & Barnes (1984)	J
VZ Cyg	33	7.956	1.002	Moffett & Barnes (1984)	J
	18	7.932	1.007	Barnes et al. (1997)	J

Table 1. continued

Name	points	$< I >$	$< V > - < I >$	Reference	system
CD Cyg	35	7.492	1.454	Moffett & Barnes (1984)	J
DT Cyg	56	5.171	0.602	Moffett & Barnes (1984)	J
MW Cyg	33	7.926	1.563	Moffett & Barnes (1984)	J
V386 Cyg	31	7.819	1.815	Moffett & Barnes (1984)	J
V402 Cyg	31	8.695	1.178	Moffett & Barnes (1984)	J
V459 Cyg	31	8.902	1.697	Moffett & Barnes (1984)	J
V532 Cyg	35	7.845	1.241	Moffett & Barnes (1984)	J
V924 Cyg	26	9.734	0.976	Moffett & Barnes (1984)	J
β Dor	27	2.943	0.809	Dean et al. (1977)+Dean (1981)	C
	17	2.943	0.807	Shobbrook (1992)	C
W Gem	30	5.917	1.036	Moffett & Barnes (1984)	J
RZ Gem	39	8.696	1.320	Moffett & Barnes (1984)	J
AA Gem	38	8.556	1.169	Moffett & Barnes (1984)	J
AD Gem	38	9.043	0.811	Moffett & Barnes (1984)	J
	26	9.057	0.812	Barnes et al. (1997)	J
DX Gem	19	9.586	1.149	Berdnikov & Turner (1995b)	C
	35	9.596	1.146	Moffett & Barnes (1984)	J
ζ Gem	34	3.082	0.834	Moffett & Barnes (1984)	J
	10	3.096	0.797	Shobbrook (1992)	C
V Lac	54	7.884	1.053	Moffett & Barnes (1984)	J
X Lac	52	7.341	1.064	Moffett & Barnes (1984)	J
	16	7.325	1.078	Barnes et al. (1997)	J
Y Lac	35	8.289	0.856	Moffett & Barnes (1984)	J
	18	8.275	0.867	Barnes et al. (1997)	J
Z Lac	38	7.179	1.236	Moffett & Barnes (1984)	J
	16	7.172	1.248	Barnes et al. (1997)	J
RR Lac	40	7.793	1.052	Moffett & Barnes (1984)	J
BG Lac	32	7.806	1.076	Moffett & Barnes (1984)	J
	18	7.802	1.079	Barnes et al. (1997)	J
GH Lup	50	6.375	1.259	Coulson & Caldwell (1985)	C
V473 Lyr	13	5.409	0.710	Berdnikov & Turner (1995a,c)	C
T Mon	28	4.969	1.162	Coulson & Caldwell (1985)	C
	23	4.992	1.139	Moffett & Barnes (1984)	J
	25	4.982	1.152	Berdnikov & Turner (1995b)	C
SV Mon	37	7.137	1.119	Coulson & Caldwell (1985)	C
	25	7.146	1.118	Moffett & Barnes (1984)	J
TX Mon	23	9.629	1.328	Berdnikov & Turner (1995b)	C
	38	9.644	1.317	Moffett & Barnes (1984)	J
TZ Mon	21	9.468	1.323	Berdnikov & Turner (1995b)	C
AC Mon	19	8.706	1.393	Berdnikov & Turner (1995b)	C
CV Mon	23	8.647	1.644	Berdnikov & Turner (1995b)	C
	30	8.674	1.624	Moffett & Barnes (1984)	J
EK Mon	21	9.608	1.451	Berdnikov & Turner (1995b)	C
V465 Mon	20	9.473	0.895	Berdnikov & Turner (1995b)	C
V508 Mon	24	9.460	1.039	Berdnikov & Turner (1995b)	C
V526 Mon	24	7.899	0.730	Berdnikov & Turner (1995b)	C
R Mus	7	5.499	0.825	Dean et al. (1977)	C
S Mus	7	5.129	0.912	Dean (1977)	C
RT Mus	35	7.967	1.029	Stobie & Balona (1979)	C
UU Mus	35	8.485	1.294	Coulson & Caldwell (1985)	C
S Nor	32	5.427	1.001	Dean et al. (1977)+Dean (1981)	C
U Nor	40	7.351	1.874	Coulson & Caldwell (1985)	C
GU Nor	5	8.793	1.529	Harris (1980)	W
Y Oph	29	4.559	1.592	Coulson & Caldwell (1985)	C
	39	4.564	1.606	Moffett & Barnes (1984)	J
BF Oph	34	6.363	0.969	Gieren (1981)	C
	38	6.382	0.958	Moffett & Barnes (1984)	J

Table 1. continued

Name	points	$<I>$	$<V>-<I>$	Reference	system
RS Ori	49	7.277	1.129	Moffett & Barnes (1984)	J
GQ Ori	49	7.881	1.082	Moffett & Barnes (1984)	J
SV Per	32	7.761	1.224	Moffett & Barnes (1984)	J
SX Per	12	9.822	1.346	Harris (1980)	W
VX Per	31	7.953	1.350	Moffett & Barnes (1984)	J
AS Per	44	8.144	1.575	Moffett & Barnes (1984)	J
AW Per	35	6.227	1.261	Moffett & Barnes (1984)	J
X Pup	19	7.134	1.314	Moffett & Barnes (1984)	J
	23	7.171	1.365	Berdnikov & Turner (1995b)	C
RS Pup	25	5.489	1.531	Berdnikov & Turner (1995b)	C
	21	5.485	1.514	Moffett & Barnes (1984)	J
VZ Pup	39	8.304	1.336	Coulson & Caldwell (1985)	C
	22	8.293	1.350	Berdnikov & Turner (1995b)	C
WX Pup	24	7.958	1.101	Moffett & Barnes (1984)	J
WZ Pup	23	9.419	0.917	Moffett & Barnes (1984)	J
AD Pup	22	8.709	1.187	Berdnikov & Turner 1995b)	C
AP Pup	7	6.466	0.939	Dean (1977)	C
AQ Pup	20	7.150	1.526	Coulson & Caldwell (1985)	C
	24	7.140	1.546	Berdnikov & Turner (1995b)	C
	30	7.191	1.600	Moffett & Barnes (1984)	J
AT Pup	32	7.067	0.905	Gieren (1985)	C
BN Pup	34	8.551	1.334	Coulson & Caldwell (1985)	C
EK Pup	22	9.630	1.034	Berdnikov & Turner (1995b)	C
LS Pup	40	9.091	1.378	Coulson & Caldwell (1985)	C
	25	9.072	1.391	Berdnikov & Turner (1995b)	C
MY Pup	31	4.908	0.758	Stobie & Balona (1979)	C
	23	4.900	0.763	Berdnikov & Turner (1995b)	C
S Sge	43	4.784	0.839	Moffett & Barnes (1984)	J
	8	4.801	0.847	Berdnikov & Turner (1995b)	C
	17	4.770	0.847	Barnes et al. (1997)	J
U Sgr	46	5.449	1.238	Gieren (1981)	C
	11	5.438	1.271	Berdnikov & Turner (1995b)	C
	12	5.412	1.268	Berdnikov & Turner (1995a)	C
	36	5.465	1.230	Moffett & Barnes (1984)	J
W Sgr	39	3.868	0.804	Moffett & Barnes (1984)	J
	7	3.855	0.819	Dean (1977)	C
	9	3.843	0.798	Shobbrook (1992)	C
X Sgr	44	3.663	0.899	Moffett & Barnes (1984)	J
	7	3.653	0.892	Dean (1977)	C
	10	3.659	0.878	Shobbrook (1992)	C
Y Sgr	38	4.821	0.925	Moffett & Barnes (1984)	J
	8	4.781	0.948	Dean (1977)	C
WZ Sgr	37	6.586	1.449	Coulson & Caldwell (1985)	C
	37	6.544	1.483	Moffett & Barnes (1984)	J
XX Sgr	34	7.504	1.350	Moffett & Barnes (1984)	J
YZ Sgr	20	6.217	1.128	Moffett & Barnes (1984)	J
	12	6.217	1.125	Berdnikov & Turner (1995b)	C
AP Sgr	35	6.038	0.905	Gieren (1981)	C
	13	6.049	0.930	Berdnikov & Turner (1995b)	C
	38	6.052	0.898	Moffett & Barnes (1984)	J
AY Sgr	7	8.683	1.785	Harris (1980)	W
BB Sgr	45	5.829	1.106	Gieren (1981)	C
	14	5.841	1.108	Berdnikov & Turner (1995b)	C
	27	5.838	1.108	Moffett & Barnes (1984)	J
	28	5.805	1.139	Berdnikov & Turner (1995a)	C
V350 Sgr	34	6.421	1.041	Gieren (1981)	C
	16	6.430	1.049	Berdnikov & Turner (1995b)	C
	23	6.430	1.052	Moffett & Barnes (1984)	J

Table 1. continued

Name	points	$< I >$	$< V > - < I >$	Reference	system
RV Sco	32	5.897	1.129	Gieren (1981)	C
	23	5.921	1.122	Moffett & Barnes (1984)	J
RY Sco	28	6.278	1.738	Coulson & Caldwell (1985)	C
	29	6.306	1.706	Moffett & Barnes (1984)	J
KQ Sco	56	7.659	2.150	Coulson & Caldwell (1985)	C
V482 Sco	46	6.850	1.125	Gieren (1981)	C
	24	6.848	1.116	Moffett & Barnes (1984)	J
V500 Sco	25	7.234	1.504	Moffett & Barnes (1984)	J
V636 Sco	7	5.645	1.012	Dean (1977)	C
V950 Sco	26	6.404	0.906	Berdnikov & Turner (1995b)	C
X Sct	8	8.560	1.452	Harris (1980)	W
Y Sct	46	7.825	1.801	Moffett & Barnes (1984)	J
Z Sct	50	8.103	1.481	Moffett & Barnes (1984)	J
RU Sct	31	7.467	2.006	Moffett & Barnes (1984)	J
SS Sct	42	7.116	1.086	Gieren (1981)	C
	29	7.116	1.094	Moffett & Barnes (1984)	J
TY Sct	7	8.749	2.005	Harris (1980)	W
CK Sct	9	8.715	1.840	Harris (1980)	W
CM Sct	27	9.458	1.648	Moffett & Barnes (1984)	J
EV Sct	33	8.667	1.470	Moffett & Barnes (1984)	J
	10	8.677	1.471	Berdnikov & Turner (1995b)	C
CR Ser	12	8.893	1.968	Berdnikov & Turner (1995b)	C
ST Tau	55	7.157	1.061	Moffett & Barnes (1984)	J
	32	7.241	1.125	Barnes et al. (1997)	J
SZ Tau	35	5.539	0.992	Moffett & Barnes (1984)	J
	42	5.523	1.001	Barnes et al. (1997)	J
EU Tau	213	7.296	0.797	Gieren et al. (1989)	J
R Tra	43	5.846	0.808	Gieren (1981)	C
	11	5.842	0.822	Dean (1981)	C
S Tra	33	5.588	0.796	Gieren (1981)	C
α UMi	10	1.370	0.609	Arellano Ferro (1983)	J
T Vel	32	6.983	1.044	Gieren (1985)	C
V Vel	36	6.724	0.862	Gieren (1985)	C
RY Vel	42	6.833	1.532	Coulson & Caldwell (1985)	C
	26	6.827	1.550	Berdnikov & Turner (1995b)	C
RZ Vel	27	5.880	1.208	Coulson & Caldwell (1985)	C
	26	5.860	1.231	Berdnikov & Turner (1995b)	C
SV Vel	26	7.328	1.255	Berdnikov & Turner (1995b)	C
SW Vel	27	6.845	1.272	Coulson & Caldwell (1985)	C
	26	6.846	1.283	Berdnikov & Turner (1995b)	C
SX Vel	5	7.248	0.996	Dean (1977)	C
AH Vel	23	5.051	0.658	Berdnikov & Turner (1995b)	C
BG Vel	7	6.350	1.323	Dean (1977)	C
DR Vel	32	7.829	1.687	Coulson & Caldwell (1985)	C
T Vul	57	5.052	0.701	Moffett & Barnes (1984)	J
	17	5.054	0.695	Barnes et al. (1997)	J
U Vul	33	5.595	1.532	Moffett & Barnes (1984)	J
	18	5.575	1.522	Barnes et al. (1997)	J
X Vul	36	7.199	1.650	Moffett & Barnes (1984)	J
SV Vul	34	5.721	1.507	Moffett & Barnes (1984)	J
	17	5.678	1.486	Barnes et al. (1997)	J

in any system when no Cousins photometry exists, except datasets which contain very few (of order 5 or less) data points. When more than one entry exists for a star, the first one may be considered the "best" one, which is a subjective balance between the original photometric system (Cousins being preferred over other photometric systems to avoid possible systematic effects due to the transformation) and the number of points in the light curve.

From this dataset I find that the difference magnitude-mean minus intensity-mean is 0.0070 $\pm$ 0.034 in the I-band taking all datasets; 0.0048 $\pm$ 0.033 taking the 193 datasets which contain $\geq$ 20 data points in the light curve and -0.0025 ± 0.036 taking the 41 datasets which contain $\geq$ 40 points in the light curve. The correction value of 0.03 used by Gieren et al. (1998) is therefore not confirmed.

One can ask the question if there are any systematic differences between the datasets. For example, there are 26 stars for which both original datasets in the Johnson and Cousins system are available, and with $\geq$ 10 points in the light curve. The difference between the "transformed Johnson" - "Cousins" datasets is -0.007 ± 0.019 in $< I >$, and -0.004 ± 0.026 in $< V > - < I >$. There are 24 stars with (at least) 2 datasets in the Cousins system, and $\geq$ 10 points in the light curve. The difference "first dataset - second dataset" is 0.0009 ± 0.0120 in $< I >$ and -0.008 ± 0.014 in $< V > - < I >$. This suggests that there are no systematic differences due to the transformation from the Johnson to the Cousins system, and among the different observations in the Cousins system themselves, and that the spread in $< I >$ and $< V > - < I >$ are consistent with the typical error quoted in a single observation which is of order 0.01 magnitude.

The intensity-mean $< V >$ (only the "best" dataset in the case of more than one entry) was also compared to the corresponding value listed in the Fernie et al. database. In 23 cases the difference was more than 0.03 mag. However, in 9 of those cases there are fewer than 10 points in the light curve and this difference is probably due to the poor sampling of the light curve. Since the $< V >$ and $< I >$ have been calculated from the same dataset, the $< V > - < I >$ magnitude should still be reliable. In 13 other cases the difference in magnitude is between 0.03 and 0.052, which seems large but still acceptable. There is one odd case, and that is RW Cas where the difference in $< V >$ is 0.101 mag and in $< B > - < V >$ 0.1 magnitude. The Welch (1997) database indicates that the dataset of Moffett & Barnes (1984) is the largest single dataset for this star, and it was used by me, as it also is the only dataset containing I-data. From this datset I find $< V > = 9.218$, and $< B > - < V > = 1.196$. The Fernie et al. database lists $< V > = 9.117$ and $< B > - < V > = 1.096$. From the combined data set of Berdnikov (1992, 1993) with 63 points in the light curve I obtain $< V > = 9.229$ and $< B > - < V > = 1.243$, in agreement with the magnitudes from the Moffett & Barnes (1984) data. This leaves little doubt that the data used in the Fernie et al. database is in fact from Moffett & Barnes (1984), however listed with an off-set of 0.1 mag in $< V >$ and $< B > - < V >$, possibly a typographical error.

Table 2. Cepheids without intensity-mean I-band data

Name	V	I	$V-I$	Reference
V336 Aql			1.522	Caldwell & Coulson (1987)
SX Car			1.136	Caldwell & Coulson (1987)
UW Car			1.205	Caldwell & Coulson (1987)
UZ Car			0.988	Caldwell & Coulson (1987)
WW Car			1.097	Caldwell & Coulson (1987)
GX Car			1.221	Caldwell & Coulson (1987)
AY Cen			1.142	Caldwell & Coulson (1987)
V496 Cen			1.397	Caldwell & Coulson (1987)
V1334 Cyg	5.885	5.275		Arellano Ferro (1984)
IQ Nor			1.627	Caldwell & Coulson (1987)
V440 Per	6.247	5.273		Arellano Ferro (1984)
WY Pup			0.882	Caldwell & Coulson (1987)
ST Vel			1.388	Caldwell & Coulson (1987)
AE Vel			1.565	Caldwell & Coulson (1987)

Table 3. Cepheids without I-band data

V493 Aql	Y Aur	BK Aur	CK Cam	RW CMa
TV CMa	CN Car	CY Car	EY Car	FN Car
HW Car	RS Cas	SY Cas	XY Cas	BP Cas
BY Cas	CD Cas	DF Cas	DW Cas	V636 Cas
V659 Cen	V737 Cen	V898 Cen	AK Cep	CP Cep
IR Cep	AV Cir	AD Cru	GH Cyg	V495 Cyg
V520 Cyg	V538 Cyg	V1154 Cyg	V411 Lac	BE Mon
RS Nor	CS Ori	VW Pup	WW Pup	HL Pup
LX Pup	XX Vel	DK Vel	FN Vel	BR Vul

Table 2 contains data for which I-band data exists but no intensity-mean values could be derived. Two stars come from Arellano Ferro (1984) who does not list the original individual observations. The values listed are in the Cousins system transformed from the original Johnson photometry. All the other stars are listed in CC but the original data could not be traced. Very likely there are in unpublished material quoted by CC. The values listed are magnitude-means on the Cousins system.

Table 3 lists the Type I HIPPARCOS Cepheids without I-band data.

4. Near-infrared data

The single largest database with NIR data on Cepheids is Laney & Stobie (1992) who provide data for 51 Cepheids on the Carter system. Intensity-mean magnitudes have been calculated by me following the recipe outlined above, and agree exactly or within one unit in the last decimal with the number published by them.

The other two datasets used are Welch et al. (1984) and Barnes et al. (1997). Both provide magnitudes in the

CIT system and these have been converted to the Carter system using the formula in Table 3 of Laney & Stobie (1993). From Welch et al., only stars with ≥ 8 points in the light curve have been considered. This leaves out as many as about 40 stars, but with 2-5 points in the light curve no sufficiently accurate (that is at a level of 0.01 mag) intensity-mean (or magnitude-mean) can be determined.

Data from the following sources is not considered: Lloyd Evans (1980) because of large error in individual measurements (> 0.06 mag); McGonegal et al. (1983) and Schechter et al. (1992), because they observed only few points in the light curve; Fernley et al. (1989) because of the photometric system.

The intensity-mean JHK magnitudes are listed in Table 4. It contains 89 determinations for 69 stars. When more than one dataset exists, they are listed in the following order: Laney & Stobie (1992), Barnes et al. (1997), Welch et al. (1984). This can be thought of as an order of preference, prefering the largest single dataset in the Carter system over the other two sources of photometry which had to be transformed from the CIT to the Carter system, and then prefering Barnes et al. (1997) over Welch et al. (1984) because their light curves contain more data points.

In about a dozen cases there is photometry available from 2 or more sources. Comparing the datasets suggests consistency at a level of 0.01 magnitudes, although larger differences (up to 0.04 mag) exist.

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Table 4. Intensity-mean JHK data

Name	points	$<J>$	$<H>$	$<K>$	Reference
U Aql	21	4.484	4.005	3.893	Welch et al. (1984)
SZ Aql	37	5.953	5.346	5.159	Laney & Stobie (1992)
	30	5.994	5.359	5.181	Barnes et al. (1997)
	25	5.971	5.377	5.200	Welch et al. (1984)
TT Aql	34	4.783	4.202	4.053	Barnes et al. (1997)
	22	4.761	4.202	4.053	Welch et al. (1984)
FF Aql	21	3.929	3.575	3.489	Welch et al. (1984)
FM Aql	34	5.794	5.215	5.060	Barnes et al. (1997)
	20	5.776	5.233	5.071	Welch et al. (1984)
FN Aql	32	6.077	5.499	5.355	Barnes et al. (1997)
	20	6.057	5.502	5.361	Welch et al. (1984)
V496 Aql	22	5.649	5.142	5.037	Welch et al. (1984)
η Aql	26	2.471	2.053	1.977	Barnes et al. (1997)
	23	2.453	2.063	1.985	Welch et al. (1984)
RT Aur	12	4.254	3.961	3.904	Barnes et al. (1997)
U Car	33	4.193	3.669	3.521	Laney & Stobie (1992)
V Car	26	5.805	5.388	5.285	Laney & Stobie (1992)
VY Car	44	5.463	4.945	4.806	Laney & Stobie (1992)
WZ Car	48	7.008	6.456	6.290	Laney & Stobie (1992)
l Car	31	1.765	1.210	1.091	Laney & Stobie (1992)
SU Cas	31	4.531	4.197	4.127	Barnes et al. (1997)
V Cen	30	5.073	4.628	4.509	Laney & Stobie (1992)
VW Cen	41	7.655	7.015	6.819	Laney & Stobie (1992)
XX Cen	36	5.992	5.531	5.407	Laney & Stobie (1992)
KN Cen	42	6.515	5.754	5.489	Laney & Stobie (1992)
δ Cep	27	2.748	2.382	2.321	Barnes et al. (1997)
X Cyg	29	4.478	3.957	3.831	Barnes et al. (1997)
	20	4.444	3.950	3.835	Welch et al. (1984)
SU Cyg	21	5.713	5.383	5.332	Welch et al. (1984)
VZ Cyg	30	7.290	6.860	6.750	Barnes et al. (1997)
	12	7.261	6.865	6.762	Welch et al. (1984)
CD Cyg	19	6.451	5.880	5.712	Welch et al. (1984)
DT Cyg	20	4.749	4.469	4.430	Welch et al. (1984)
β Dor	42	2.438	2.029	1.959	Laney & Stobie (1992)
AD Gem	17	8.525	8.133	8.060	Barnes et al. (1997)
X Lac	26	6.607	6.149	6.042	Barnes et al. (1997)
Y Lac	28	7.706	7.307	7.222	Barnes et al. (1997)
Z Lac	28	6.344	5.819	5.688	Barnes et al. (1997)
BG Lac	31	7.112	6.650	6.539	Barnes et al. (1997)
GH Lup	26	5.492	4.960	4.813	Laney & Stobie (1992)
T Mon	29	4.185	3.653	3.525	Laney & Stobie (1992)
CV Mon	26	7.404	6.792	6.576	Laney & Stobie (1992)
S Mus	26	4.553	4.125	4.015	Laney & Stobie (1992)
UU Mus	47	7.529	6.990	6.828	Laney & Stobie (1992)
S Nor	31	4.729	4.275	4.162	Laney & Stobie (1992)
	8	4.753	4.306	4.198	Welch et al. (1984)
U Nor	40	5.930	5.236	4.990	Laney & Stobie (1992)
Y Oph	22	3.437	2.869	2.682	Laney & Stobie (1992)
	30	3.445	2.881	2.715	Welch et al. (1984)
BF Oph	20	5.700	5.285	5.178	Laney & Stobie (1992)
X Pup	31	6.180	5.600	5.431	Laney & Stobie (1992)
RS Pup	30	4.432	3.815	3.634	Laney & Stobie (1992)
	9	4.434	3.867	3.688	Welch et al. (1984)
VZ Pup	33	7.371	6.829	6.669	Laney & Stobie (1992)
AQ Pup	40	6.098	5.481	5.298	Laney & Stobie (1992)
BN Pup	46	7.624	7.076	6.922	Laney & Stobie (1992)
LS Pup	45	8.094	7.517	7.354	Laney & Stobie (1992)
S Sge	31	4.233	3.833	3.758	Barnes et al. (1997)
	22	4.225	3.845	3.773	Welch et al. (1984)

Table 4. continued

Name	points	$< J >$	$< H >$	$< K >$	Reference
RY Sco	29	4.999	4.365	4.143	Laney & Stobie (1992)
KQ Sco	27	6.024	5.216	4.946	Laney & Stobie (1992)
RU Sct	40	6.018	5.312	5.068	Laney & Stobie (1992)
SS Sct	22	6.382	5.943	5.845	Welch et al. (1984)
EV Sct	12	7.664	7.171	7.029	Laney & Stobie (1992)
	8	7.662	7.151	6.972	Welch et al. (1984)
U Sgr	30	4.586	4.092	3.953	Laney & Stobie (1992)
	29	4.602	4.089	3.990	Welch et al. (1984)
Y Sgr	26	4.137	3.695	3.612	Welch et al. (1984)
XX Sgr	21	6.496	5.959	5.834	Welch et al. (1984)
YZ Sgr	26	5.471	4.994	4.898	Welch et al. (1984)
BB Sgr	19	5.099	4.639	4.511	Laney & Stobie (1992)
	27	5.113	4.634	4.542	Welch et al. (1984)
AP Sgr	27	5.417	4.975	4.893	Welch et al. (1984)
V350 Sgr	26	5.709	5.243	5.158	Welch et al. (1984)
ST Tau	10	6.401	5.956	5.838	Barnes et al. (1997)
SZ Tau	17	4.831	4.408	4.311	Laney & Stobie (1992)
	19	4.837	4.430	4.330	Barnes et al. (1997)
T Vel	37	6.225	5.768	5.641	Laney & Stobie (1992)
RY Vel	33	5.703	5.122	4.928	Laney & Stobie (1992)
RZ Vel	40	4.979	4.461	4.309	Laney & Stobie (1992)
SW Vel	36	5.933	5.393	5.234	Laney & Stobie (1992)
SX Vel	27	6.554	6.120	6.001	Laney & Stobie (1992)
T Vul	35	4.604	4.259	4.198	Barnes et al. (1997)
	19	4.598	4.263	4.215	Welch et al. (1984)
U Vul	27	4.630	4.093	3.953	Barnes et al. (1997)
SV Vul	27	4.668	4.077	3.921	Laney & Stobie (1992)
	26	4.662	4.104	3.936	Welch et al. (1984)
	30	4.682	4.074	3.917	Barnes et al. (1997)