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Extragalactic Cepheid database

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We present in this paper an exhaustive compilation of all published data of extragalactic Cepheids. We have checked every light curve in order to characterize the different types of Cepheid and detect potential overtone pulsators, or to estimate the quality of the data. This compilation of about 3000 photometric measurements will constitute a very useful tool for astronomers involved for instance in the extragalactic distance scale.

Key words: Database - Cepheids: extragalactic

1. Introduction

It is well known that Cepheid pulsating stars constitute, through the Period-Luminosity (PL) relation, the one primary calibrator for extragalactic distance scale. Photometric data of extragalactic Cepheids are then the raw material of its calibration, and, thus, it is of greater importance to have as much data as possible.

With the aim of computing new distances based on our direct calibration of the PL relation (Lanoix et al. 1999a) while taking into account the PL relation incompleteness bias (Lanoix et al. 1999b) first, and subsequently calibrating secondary distance calibrators such as Tully-Fisher relation, luminosity peak brightness of SNe Ia (Lanoix 1998) or Faber-Jackson relation for globular clusters (Di Nella-Courtois et al. 1999), we have looked for photometric data of extragalactic Cepheids. We found that Madore published in 1985 a compilation of all data available at this time. However, this compilation actually put data from 10 galaxies together, and to our knowledge, no updated version of this paper exists, whereas data from more than 30 galaxies is now available.

We have therefore updated this compilation for our own work while putting quality flags to every light curve, and have now decided to put this useful tool at the astronomical community's disposal.

2. Data

We collect 3031 photometric measurements of 1061 Cepheids located in 33 galaxies (without including SMC and LMC). Table 1 gives the complete list and the main characteristic of those galaxies according to the LEDA database (http://www-obs.univ-lyon1.fr/leda/home_leda.html). Our bibliography is as exhaustive as possible, and is complete until November 1998, while new publications are still arriving.

One can note that some old photographic data has been rejected. For instance, concerning NGC 224 (M31), we exclude data from Gaposchkin (1962) and Baade & Swope (1963, 1964) from our base. Moreover, we also exclude measurements of that galaxy taken in very crowded fields, such as part of Welch et al. (1986) ones. However finding charts or light curves may be found in these papers.

Actually, the compilation can be divided into two subclasses: ground based data and *Hubble Space Telescope* (HST) data. The first class appears very heterogeneous in many aspects (methods, limit magnitudes, bandpasses, time coverage, quality) since it's made of observations from many different telescopes. Moreover almost all those Cepheids were observed during a single observation campaign too, so that they cannot be compared to any other campaign. On the other hand, the spatial observations of the HST are highly homogeneous and are composed of Cepheids from 17 galaxies at present. However, concerning papers from the HST Key Project group (see Freedman et al. 1994), we have chosen to keep only data from ALLFRAME software package, while two sets of photometry may be available. We have checked every light curve (except for NGC 3368, NGC 4725 and NGC 224) in order to allocate a flag to them, and then to characterize the type of the corresponding Cepheid, or to give an idea of the

Table 1: List of the 33 galaxies of the database

Name	PGC/LEDA number	RA 2000	DEC 2000	Morph. type	Lum. class code	Total B-magnitude	HST
DDO 155	PGC 44491	12.97775	14.21618	Irr	9.000	14.715	n
DDO 216	PGC 71538	23.47614	14.74660	Irr	9.000	12.789	n
DDO 50	PGC 23324	8.31831	70.71419	Irr	8.279	11.092	n
DDO 69	PGC 28868	9.98995	30.74495	Irr	9.000	12.956	n
IC 10	PGC 01305	.34016	59.29171	Irr	9.000	12.197	n
IC 1613	PGC 03844	1.08172	2.13330	Irr	9.230	9.933	n
IC 4182	PGC 45314	13.09704	37.60582	Sm	8.338	12.409	y
NGC 1365	PGC 13179	3.56016	-36.13807	SBb	1.371	10.350	y
NGC 2090	PGC 17819	5.78398	-34.25145	Sc	3.931	11.767	y
NGC 224	PGC 02557	.71232	41.26897	Sb	2.000	4.170	n
NGC 2366	PGC 21102	7.48175	69.21442	Irr	8.722	11.430	n
NGC 2403	PGC 21396	7.61513	65.59957	SBc	5.000	8.824	n
NGC 2541	PGC 23110	8.24451	49.06227	SBc	6.696	12.043	y
NGC 300	PGC 03238	.91493	-37.68250	Scd	5.969	8.785	n
NGC 3031	PGC 28630	9.92597	69.06665	Sb	2.000	7.687	y
NGC 3109	PGC 29128	10.05185	-26.15890	SBm	7.924	10.347	n
NGC 3351	PGC 32007	10.73278	11.70408	SBb	3.000	10.382	y
NGC 3368	PGC 32192	10.77922	11.82098	SBab	3.000	9.916	y
NGC 3621	PGC 34554	11.30466	-32.81352	SBcd	5.849	10.077	y
NGC 4321	PGC 40153	12.38200	15.82293	SBbc	1.000	9.992	y
NGC 4414	PGC 40692	12.44097	31.22479	Sc	3.576	10.923	y
NGC 4496A	PGC 41471	12.52771	3.93911	SBd	5.600	12.116	y
NGC 4536	PGC 41823	12.57414	2.18848	SBbc	2.824	11.012	y
NGC 4725	PGC 43451	12.84079	25.50030	SBab	1.689	9.955	y
NGC 5253	PGC 48334	13.66551	-31.64477	S?	/	10.765	y
NGC 5457	PGC 50063	14.05356	54.35075	SBc	1.000	8.197	y
NGC 598	PGC 05818	1.56414	30.66017	Sc	4.000	6.193	n
NGC 6822	PGC 63616	19.74940	-14.80306	Irr	8.493	9.322	n
NGC 7331	PGC 69327	22.61809	34.41949	Sbc	2.000	10.165	y
NGC 925	PGC 09332	2.45467	33.57817	SBcd	4.000	10.583	y
SEXTANS A	PGC 29653	10.18369	-4.71346	Irr	9.704	11.745	n
SEXTANS B	PGC 28913	9.99996	5.33256	Irr	8.117	11.834	n
WLM	PGC 00143	.03246	-15.45032	Irr	8.258	11.113	n

The ground-based measurements are divided up among 11 different bandpasses, from B (440 nm) to K (2200 nm), whereas HST observed only in V and I bands. Table 2 gives the relation between notations and wavelengths.

Our base contains several types of magnitude corresponding to the calculation method that is described in table 4. In some cases the sign ":" may follow magnitudes or periods : it means that these magnitudes are doubtful and that these periods are just estimates or lower bounds of the real values (according to the original authors).

The reference codes and the corresponding authors are given in table 5. They can allow the interested reader to look at the finding charts as well as the light curves.

Finally, the Cepheid names are those chosen by the authors, except in the case of several stars in NGC 224 (Freedman & Madore 1990, field IV) and NGC 3368 (Tanvir 1995), where we obtain data right from their figures and called them FRE – – and TAN – –, respectively.

3. Table structure

Data is presented as a table of more than 5000 lines according to the structure described below for each Cepheid :

- First line: Host galaxy, Cepheid name, number of following data lines for that Cepheid
- Second line: pointer = 1, logarithm of the period in days, light curve flag
- Next lines: pointer = 2, magnitude, type, band, reference

This database is available as an ASCII table on request by sending an e-mail to Lanoix@obs.univ-lyon1.fr .

Table 2: Bandpasses

Band	λ_{eff} (nm)	Band	λ_{eff} (nm)
B	440	IV	1050
V	550	J	1250
r	650	H	1650
R	700	K	2200
i	820	g	500
I	900		

Table 3: Description of light curves flags

Flag	Light curve description
N	Normal
S	Symetrical (but high amplitude)
B	Bumpy
B+	Scattered or very bumpy
O	Overtone
O-	Low amplitude (but asymmetrical or with high period)
P	Peculiar
/	No curve

Table 6: Extract of the ASCII file for the Cepheid V1 of galaxy IC1613.

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IC1613  V1            9
       1    .748     N
       2   21.36     mea       B   Fr88a
       2   20.79     mea       V   Fr88a
       2   20.36     mea       R   Fr88a
       2   20.14     mea       I   Fr88a
       2   20.50     max       B   Sa88a
       2   22.03     min       B   Sa88a
       2   21.27     ave       B   Sa88a
       2   21.39     mea       B   Sa88a
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Table 4: Magnitudes description

Flag	Description
mea	Intensity averaged (based on curve area)
max	Maximum
min	Minimum
ave	Average of minimum and maximum
/	Single measurement

Table 5: References

Reference code	Corresponding authors	Reference code	Corresponding authors
Ala83	Mc Alary et al. 1983	Mad87	Madore et al. 1987
Ala84	Mc Alary et al. 1984	McA84	Mc Alary & Madore 1984
Alv95	Alves & Cook 1995	Mou87	Mould 1987
Car90	Carlson & Sandage 1990	Mus98	Musella et al. 1997
Cap92	Capaccioli et al. 1992	Pio94	Piotto et al. 1994
Chr87	Christian & Schommer 1987	Phe98	Phelps et al. 1998
Coo86	Cook & Aaronson 1986	Raw97	Rawson et al. 1997
Fer96	Ferrarese et al. 1996	Sah94	Saha et al. 1994
Fer98	Ferrarese et al. 1998	Sah95	Saha et al. 1995
Fr88a	Freedman 1988	Sa85a	Sandage & Carlson 1985a
Fr88b	Freedman & Madore 1988	Sa85b	Sandage & Carlson 1985b
Fre90	Freedman & Madore 1990	Sa88a	Sandage 1988
Fre91	Freedman et al. 1991	Sa88b	Sandage & Carlson 1988
Fre92	Freedman et al. 1992	Sh96a	Saha et al. 1996a
Fre94	Freedman et al. 1994	Sh96b	Saha et al. 1996b
Gal96	Gallart et al. 1996	Sh96c	Saha et al. 1996c
Gib98	Gibson et al. 1998	Sil96	Silbermann et al. 1996
Gra97	Graham et al. 1997	Sil98	Silbermann et al. 1998
Hoe90	Hoessel et al. 1990	Tam68	Tamman & Sandage 1968
Hoe94	Hoessel et al. 1994	Tan95	Tanvir et al. 1995
Hoe98	Hoessel et al. 1998	To95a	Tolstoy et al. 1995a
Hug98	Hughes et al. 1998	To95b	Tolstoy et al. 1995b
Kay67	Kayser 1967	Tur98	Turner et al. 1998
Kel96	Kelson et al. 1996	Vis89	Visvanathan 1989
Kin87	Kinman et al. 1987	Wal88	Walker 1988
Mad85	Madore et al. 1985	Wel86	Welch et al. 1986

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