Documentation of meteor data available at the IAU Meteor Data Center

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C O N T E N T

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Part. 1. Photographic orbits

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Introduction

The data available at the IAU Meteor Data Center consists of a collection of orbital and physical data on meteors obtained by photographic technique. This technique is the oldest and most precise observational method and it has therefore produced a vast amount of information. However, the early orbital computations were done with desk calculators or by hand. Hence computational errors may occur in the data. Some errors in the published lists have been corrected at the data center after correspondence with the original investigators. Later, the complete recalculation of the photographic orbits has been made at the data center.

The photographic data were originally stored on 80 column cards and were available on diskettes as 80 column data files, with two records for each meteor. Both orbital and trajectory information were available for all photographic orbits. The geophysical records could, however, in some case be incomplete.

The original identification code (meteor no.) for each meteor was assigned to the meteor by the original investigator (position in the datafile consisting of five characters). If the original meteor no. was a six digit no., only the five last digits were listed. For reference purposes the order of the orbit in the original catalogue was also given. This publication serial no. was listed together with a station or author code and a number of catalogue.

Most of the photographic orbits have been published elsewhere as detailed in the subsequent references, but some unpublished material is also included. In several cases the data were sent to the Lund data center as cards or tapes based on the original investigator's master file. The IAU orbital data may therefore contain more significant figures than is available in the published volume. The data center is indebted to the original investigators for kind permission to distribute this material.

Documentation on photographic orbits

1. Harvard small camera orbits

Harvard small camera double station meteors were observed from the Cambridge and Agassiz stations of the Harvard Observatory in the period 1936-1952. The stations were moved to New Mexico in 1952. Meteors with serial no. less than or equal to 1695 were photographed at the Massachusetts stations; meteors with no. greater than 1695 at the Harvard stations in New Mexico. (Time was not accurately known on meteors with nos. lower than 1695).

The orbits were reduced by Whipple and later re-reduced by Jacchia. The data are taken directly from Jacchia's card deck. In addition to the 144 orbits published by Whipple, Jacchia reduced an additional 27 small camera orbits. These orbits have not been published. They are listed below and have arbitrarily been assigned publ. numbers 145-171. Meteors 1722, 1865, and 1932 were partly reported in Harvard Tech. Rep. no. 10.

Unpublished Harvard small camera orbits New Mexico
Harvard ser no.

1722	2402	2625	2835
1865	2440	2633	2862
1932	2537	2645	2898
2068	2584	2664	2907
2171	2588	2803	2918
2390	2589	2806	3454
2394	2615	2809	

The following Harvard small camera double station meteors published by Whipple were not re-reduced by Jacchia because of incompleteness of data. The data are therefore taken from Whipple (1954).

Meteor no.	Publ.no.
1693	012W1
0670	062W1
2031	071W1
1863	089W1
2290	113W1

In total 166 of meteors reduced by Whipple and Jacchia is included in the appropriate IAU MDC catalogue (having the code W1).

2. Harvard Super Schmidt orbits

From Febr. 1952 to Jan. 1959 some 6000 meteors were photographed by the Harvard Super Schmidt cameras in New Mexico. The stations were located at Dona Ana and Soledad in the period March 1952-June 1954, and at Sacramento Peak and Mayhill in the period July 1954-1959. The following data sets have been published to date.

Dona Ana and Soledad/New Mexico stations

March 1952-July 1954. Jacchia and Whipple, 413 precisely reduced orbits (two of these were photographed already in Oct. 1951). This sample represents the longest trails of about 3500 doubly photographed meteors during this period. (The catalogue code is J1.)

Febr. 1952-July 1954. Hawkins and Southworth random sample. The catalogue contains 359 orbits, representing every tenth meteor photographed during the period Febr. 1952-July 1954. A total of 46 meteors are common to those of Jacchia's sample, therefore the rest of 313 meteors are included in the concerning IAU MDC catalogue (code H1).

Sacramento Peak and Mayhill, New Mexico stations

Oct. 1956-Jan. 1959. Posen and McCrosky. Automatic machine reduction of 357 orbits mainly from the periods Oct. 1956-Nov. 1957 and June 1958-Jan. 1959. Although it is stated in this text that 357 orbits were reduced, the actual number of orbits listed in the catalogue (code P1) is only 353.

1956-1959. McCrosky and Shao. Automatic machine reduction of 253 orbits 1956-59.

Wallops Island

1965-6. McCrosky and Shao. Automatic machine reduction of 61 orbits 1965-67. (These orbits are merged with those reduced by McCrosky and Shao in 1956-59 and contained in the IAU MDC catalogue with code S1.)

3. NASA-NMSU

From Nov. 1974 to Dec. 1977 some 45 meteors were doubly photographed by K24 aerial type cameras from two stations in New Mexico operated by the New Mexico State University. Four Maksutov f/1.5 cameras with blazed transmission gratings provided spectral information. The stations were located at Tortugas Mountain and Carralitos. The baseline between the stations was 33.7 km. For 25 doubly observed meteors exact timing information was available and precise orbits were deduced. (Catalogue code is G1.)

4. Prairie Network fireball orbits

In 1963-75 the Smithsonian Astrophysical Observatory operated the "Prairie network" of 16 stations in the mid-western USA to record, photographically, very bright meteors. More than 2700 meteors were recorded from two or more stations (excluding Perseids, Leonids and Geminids). A coded time shutter demanded a meteor duration of 1 sec or more. This restricted the observational data to fairly slow meteors. A sample of 336 orbits has been fully reduced (McCrosky and Posen, 1968; McCrosky, Shao and Posen 1976, 1977, 1978, 1979). 334 of them are included in the concerning IAU MDC catalogue (code F1).

5. MORP fireball orbits

The Meteorite Observation and Recovery Project (MORP) was operated by the Herzberg Institute of Astrophysics, National Research Council, Ottawa, Canada in the period 1971-84. For a description of the MORP network see Halliday, Blackwell and Griffin (1978, 1989). Orbital elements for 50 fireball orbits have been published by Halliday, Griffin and Blackwell (1983). Additional orbits are listed in Halliday, Blackwell and Griffin (1989) and in Halliday (1988). A preliminary sample of 218 MORP fireballs (all fireballs reduced up to Sept 1983) were made available prior to publication by Halliday. (Orbital elements of seven of these fireballs have later been revised in Halliday, Blackwell and Griffin (1988)). The preliminary sample included many fireballs reduced because their end heights were expected to be low enough to be possible candidates for meteorite falls.

The exact time of appearance is in general not known. Hence, there is an uncertainty in radiant right ascension and a corresponding uncertainty in the orbit. In all but one or two cases the orbits was computed assuming that the meteor appeared in the middle of the exposure interval. The resulting errors in the orbital elements are discussed in Halliday, Blackwell and Griffin (1988). The preliminary sample of 218 fireballs contained 37 meteors tentatively identified as shower members. In general, the shower meteors are fast and have very few trail segments with the slow MORP shutters (only four segments per sec). Some have only a single segment, in which case velocities and orbits are determined with less confidence than for the long trails of the slow fireballs. In two concerning IAU MDC catalogues (codes I1 and I2), the total of 259 orbits are included.

6. USSR small camera meteor orbits

Double station photographic observations have been carried out at Odessa, Dushanbe and Kiev. Observations obtained at Dushanbe in 1940-1955 have been summarized by Katasev (1964). For later observations at Dushanbe and Odessa see Babadzhanov and Kramer (1963, 1967), Babadzhanov et al. (1964, 1970, 1982, 1985), Kramer and Markina (1966, 1976, 1980), Kramer and Shestaka (1982), Kramer, Shestaka and Markina (1986). For observations in Kiev see Benyukh, Kruchinenko and Sherbaum (1980a, 1980b), Kramer et al. (1983) and Sherbaum et al. (1985).

Kiev and Odessa orbits are originally identified by a 3-digit meteor number, a publ. no., and a station code. Dushanbe orbits are identified in the original publications by a 6-digit number. Only the five last digits have been included on the 80-col. records and are retained also in the new version. The number of orbits and the station/IAU MDC catalogue code are listed below.

Station	code	Year	No.		Comments
Dushanbe	D1	1940-55	73		are not published for 24 hyperbolic orbits
	D2	1957-59	181		
	D3	1960-63	72		
	D4	1964	77		
	D5	1965-66	15	(18)	masses not published and semi-major axis are not available for 3 orbits
	D6	1968-77	44		
	D7	1966-67	20		
	D8	1975-83	154		
Odessa	O1	1957-59	133	(134)	ser. no. O064 (520O1) is removed
	O2	1960-61	22		
	O3	1960-61	70		
	O4	1961-65	122	(124)	meteors ser. no. 338 B and 388 removed (ser. no. 388 included in Odessa 4)
	O5	1965-72	50		
	O6	1965-83	62		masses not included
Kiev	K1	1957-66	100		
	K2	1967-76	70		beginning and end heights not included
	K3	1977-81	36	(43)	beginning and end heights only available for 11 meteors. Seven duplicate orbital solutions removed.

Table 1. References. USSR meteor orbits

Station	Code	Year	No.	Main reference
Dushanbe	D1	1940-55	73	Katasev, L.A., 1964, Photographic Methods in Meteor Astronomy, Jerusalem.
	D2	1957-59	181	Babadzhanov, P.B. and Kramer, E.N., Ionosphere and Meteors, Section V of IGY program, No. 12, Moscow 1963.
	D3	1960-63	72	Babadzhanov, P.B. and Kramer, E.N., 1967, Smithson. Contrib. Astrophys., 11, pp. 67-79.
	D4	1964	77	Babadzhanov, P.B., Getman, T.I., Zausayev, A.F. and Karaselnikova, S.A., 1969, Bull. Astrophys. Inst. Akad. Nauk Tadjikistan SSR, No. 49, pp. 3-12.
	D5	1965-66	15	Babadzhanov, P.B. and Getman, T.I., 1970, Bull. Astrophys. Inst. Akad. Nauk Tadjikistan, SSR, No. 53, pp. 3-6.
	D6	1968-77	44	Babadzhanov, P.B., Getman, T.I., Konovalova, N.A. and Obrubov, Y.V., 1982, Bull. Astrophys. Inst. Akad. Nauk Tadjikistan SSR, 73, pp. 22-30.
	D7	1966-67	20	Babadzhanov, P.B. and Getman, T.I., 1985, Bull. Astrophys. Inst. Akad. Nauk Tadjikistan SSR, 76, pp. 28-31.
	D8	1975-83	154	Babadzhanov, P.B. et al., 1998, Bull. Astrophys. Inst. Akad. Nauk Tadjikistan, 82, pp. 16-41.

Odessa	O1	1957-59	133	Babadzhanov, P.B. and Kramer, E.N., Ionosphere and Meteors, Section V of IGY program, No. 12, Moscow, 1963.
	O2	1960	22	Babadzhanov, P.B. and Kramer, E.N., 1967, Smithson. Contrib. Astrophys., 11, pp. 67-79.
	O3	1961	70	Babadzhanov, P.B. and Kramer, E.N., 1967, Smithson. Contrib. Astrophys., 11, pp. 67-79.
	O4	1961-65	122	Kramer, E.N. and Markina, A.K., 1980, Probl. of Cosm. Phys. 15, pp. 53-63.
	O5	1962-72	50	Kramer, E.N. and Markina, A.K., 1976, Probl. of Cosm. Phys. 11, pp. 51-56.
	O6	1957-83	62	Kramer, E.N., Shestaka, I.S. and Markina, A.K., Catalogue of Meteor Orbits, Materials of World Data Center B, Moscow 1986.
Kiev	K1	1957-66	100	Benyukh, V.V., Kruchinenko, V.G. and Sherbaum, L.M., 1980, Astronomiya i Astrofizika (Kiev), 41, pp. 68-81.
	K2	1967-76	70	Sherbaum, L.M. et al., 1985, Bull. Kiev Univ. Ser. Astron., 27, pp. 73-76.
				Bull. Kiev, Univ. Ser. Astron., 30, pp. 68-82.
	K3	1977-81	36	Konavalova, N.V., Zarubina, T.I. and Taranucha, Y.G., Bull. Kiev Univ. Ser. Astron., 30, pp. 58-61.

7. Ceplecha small camera orbits

Orbits obtained by the Czechoslovak camera network in the period 1955-1959 are reported in various numbers of Bull. Astron. Inst. Czechosl. and in SEAN Bull. (Smithson. short-lived Event Alert Network, Museum Nat. History, Washington D.C.). The main data catalogues are listed in the references below.

Four data sets totalling 346 orbits (plus geophysical data) are included in the IAU MDC file. The first set contains 109 small camera meteors photographed 1955-1959, the second set contains 176 fireballs observed 1947-1989 and the third set 13 meteors photographed in 1988-1990 - in all 298 meteors. Six meteors listed below, were later found to be common to the first two data sets. These duplicates (from data set no. 1: 070C1, 071C1, 074C1, 077C1, 080C1 and 096C1) have therefore been removed from the first data set (the first IAU MDC catalogue of the Czechoslovak network, code C1, thus contains 103 orbits). The number of independent orbits is thus 292. (The second part of these orbits, 189, is in E1 catalogue.)

The orbits obtained after 1990 (and some during the previous period but not included in the two first catalogues) have gradually been added to the IAU MDC data as three additional catalogues (codes E2, E3, and E4) containing 48, 98, and 34 orbits, respectively. The IAU data center is indebted to Z. Ceplecha and P. Spurný, Ondřejov Observatory, for supplying the data in the C1 and Es catalogues.

8. Nippon Meteor Society small camera orbits

In the 1950:s a two station observing program was started at the Tokyo Observatory but very few photographic meteor orbits were obtained (Hirose and Tomita, 1950, 1955a, 1955b). In the 1960:s several amateur groups in Japan started to make double station observations of meteors using 35 mm film and equatorially mounted cameras equipped with rotating shutters. Timing was accomplished by visual observers. The orbits were originally published in various reports of the Nippon Meteor Soc. (Ochiai 1984a, 1984b). A list of 325 radiants and orbits obtained in 1964-89 has been published in English (Koseki 1990, Koseki, Sekiguchi and Ohtsuka 1990). It should be observed that some of the orbits were calculated assuming a circular Earth orbit. These orbits have a digit 2 in quality class. For a discussion of these cases see Lindblad (1991). A new list of NMS orbits containing mainly minor shower members has been published (Ochiai, Ohtsuka and Sekiguchi 1989). This list contains revised orbits of meteors in the Koseki papers. It also includes several new orbits. The NMS orbits can be found in three IAU MDC catalogues (codes N1, N2, and U1) containing 95, 164, and 66 orbits.

A list of 30 orbits photographed by the Tokyo Meteor Network in 1983-89 has been published by Ohtsuka et al. (1991). Of these orbits 16 are rereduced orbits of meteors previously reported in Koseki (1990) and Koseki et al. (1990), while 14 are new orbits. These orbits with another sets included to the IAU MDC data later, represents three IAU MDC catalogues (codes T1, T2, and T3) containg altogether 85 orbits. For a short description of the Tokyo Meteor Network see Ohtsuka and Tomioka (1991) and Ohtsuka et al. (1992).

9. Dutch Meteor Society orbits

The IAU MDC database also includes three catalogues (codes B1, B2, and B3) of meteor orbits gained and published by H. Betlem et al. of the Dutch Meteor Society. The first catalogue was also included in the 3002 version and contains 359 orbits. The second catalogue contains 75 orbits determined within the campaign of the Leonids in 1998. Another 47 orbits publihed recently is included as the third catalogue.

10. Spanish meteor societes orbits

In the new version of the IAU MDC data 32 orbits determined from the observations conducted by the Spanish Meteor and Cometary Society (SOMYCE) and Spanish Photographic Meteor Network (SPMN) are included as a single catalogue (code R1). The data were published by Trigo-Rodríguez et al. in 1996-2005.

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Note. Most of the Japanese, Dutch, and Spanish orbits have been obtained by amateur groups under the auspices of the Nippon Meteor Society (NMS), the Dutch Meteor Society (DMS), the Spanish Meteor and Cometary Society (SOMYCE) and the Spanish Photographic Meteor Network (SPMN).

Inconsistencies in orbital elements

I. The inconsistencies found by B. A. Lindblad and additional corrections provided by the original authors within a private correspondence

The small camera meteor data have been checked for internal consistencies, e.g. between the published values of heliocentric velocity V_h and semi-major axis a, published values of q, a and e, etc. Numerous typographical errors and/or inconsistencies were noted. Those that have been corrected in the IAU file as of Nov. 1996 are listed in the following:

<u>Whipple small camera orbits</u>

The following Whipple small camera orbits were incorrectly listed in the original publication. Corrections have been made in the IAU file.

Ident. code	Variable	Published(1950)	Corrected(1950)
095W1	Ω	82.7	262.7
	π	216.7	136.7

<u>Hawkins and Southworth Super Schmidt orbits</u>

For meteors 08348 and 08528 wrong values of q and a were entered in the file. Corrections have been made as follows:

Ident. code	Variable	Published	Corrected
185H1	q	0.105	0.933
082H1	λ	–	
	V_∞	10.6	11.25
090H1	V_∞	11.0	11.30

<u>Dushanbe small camera orbits</u>

The following Dushanbe small camera orbits were incorrectly listed in the original publications. Corrections have been made in the IAU MDC data file.

Ident. code	Variable	Published	Corrected
– Dushanbe 2			
066D2	δ_R	$-1^o49'$	$2^o05'$
096D2	i	64.7	115.3
134D2	V_∞	72.2	63.3
137D2	α_R	$70^o29'$	$80^o29'$
– Dushanbe 4			
008D4	α_R	$77^o46'$	$-77^o06' =$ $= 282^o54'$
024D4	$sin\, P^*$	0.408	0.406
052D4	q	0.500	0.678
	a	−0.690	2.37
	e	1.724	0.714
	i	$6^o52'$	$1^o50'$
	K	−0.586	0.15
054D4	e	0.996	0.771
	i	$97^o08'$	$7^o57'$

—

Note that $sin\, P$ is entered on the orbital data file (in position 55-56). It is intended to be used as a quality code.

054D4	q	0.012	0.719
	Q	6.29	5.58
059D4	e	0.954	0.751
	i	$91^o59'$	$27^o05'$
	q	0.146	0.784
	Q	6.16	5.52
	ω	$318^o45'$	$240^o57'$
	π	$129^o30'$	$51^o42'$
	K	1.127	0.34
060D4	e	9.767	0.767
− Dushanbe 3 and 4			
057D3	M_{max}	"bolide"	-10.0^m
062D3	"	"	"
015D4	"	"	"
024D4	"	"	"
038D4	"	"	"
041D4	"	"	"
− Dushanbe 5			
015D5	day	17.916	16.916
− Dushanbe 6			
007D6	shower	−	sporadic
009D6	$sin\,P$	0.542	0.339
	α_R	$78^o48'$	$-78^o48' =$ $= 281^o12'$
011D6	K	1.23	1.53
014D6	$sin\,P$	0.909	0.257
017D6	e	0.24	0.824
031D6	$sin\,P$	0.543	0.118
035D6	$sin\,P$	0.235	0.063
039D6	$sin\,P$	0.956	0.335
041D6	$sin\,P$	0.258	0.352
042D6	$sin\,P$	0.884	0.147
043D6	$sin\,P$	0.707	0.932
044D6	M_{max}	−	-2.5^m
	m_∞	−	1.84
	shower	−	κ Cygn.

Odessa small camera orbits

The following orbits were originally listed in Kramer and Markina, 1980, Problems of Cosmical Physics, 15, pp. 53-63. Corrections later listed in Kramer, Shestaka and Markina, 1986 are given below. These have been included in the IAU data file.

Ident. code	Variable	Published	Corrected
039O2	day	11.827	11.887
055O3	day	12.044	13.044
079O4	day	00.894	31.894
124O4	q	0.900	0.990

Orbit 338B has been removed in the summary catalogue.
Orbit 388 has been removed, since it is also included in Odessa 4.

Kiev small camera orbits

The Kiev orbits listed below were incorrectly listed in Benyukh et al. 1980. Corrections as supplied by the investigators have been made in the IAU.

Ident. code	Variable	Published	Corrected
– Kiev 1			
033K1	π	383.0	283.0
055K1	π	$393^o15'$	$33^o15'$
057K1	q	0.556	0.956
076K1	date	21.915	10.915
079K1	$cos\,z_R$	0.820	0.542
083K1	α_R	$273^o03'$	$73^o03'$
– Kiev 2			
016K2	date	0.009	9.009
– Kiev 3			
008K3	date		4.979
027K3	e	0.320	0.920
	Q	16.04	23.34
033K3	q	0.090	0.950

Nippon Meteor Society orbits (Koseki et al.)

Ochiai, Ohtsuka, and Sekiguchi (1989)

Ident. code	Variable	Published	Corrected
003U1	V_h	33.10	13.10
006U1	a	7.219	0.722
041U1	date	Nov. 17 JST	$02^h54^m53^s$ JST = 17.74643 UT

Recalculated orbits by Ochiai et al. (1989)

The following Koseki orbits were recalculated in Ochiai et al. (1989). The recalculation was, however, again based on the assumption of a circular Earth orbit, i.e. R = 1. These orbits were therefore assigned a quality class 2 in col. 56.

Koseki no.	Ochiai no.
017	057
104	023
242	019

Note: Koseki meteor no. 084 (033N1) was later found to be identical to Ochiai meteor 074 (061U1). Koseki no. 084 was therefore deleted from the Koseki files.

II. The inconsistencies found on the basis of throughout recalculation of mutually dependent parameters by L. Neslušan, V. Porubčan, and J. Svoreň

Ident. Code	Variable	Published (1950)	Published (2000)	Corrected (1950)	Corrected (2000)
011W1	δ_R	29.0	29.2	−29.0	−28.7
051W1	α_R	238.2	238.2	230.2	230.3
068W1	λ	81.0		99.0	
130W1	Ω	38.2	38.8		38.3
137W1	i	34.9	34.9		28.1
137W1	λ	79.9		99.9	

153W1	α_R				8.1
153W1	δ_R				10.8
050J1	V_{infty}	20.36		21.94	
119J1	λ	76.6		69.7	
188J1	V_h	38.67		41.12	
272J1	Ω	147.1	145.9		146.9
372J1	Ω	224.7			235.6
394J1	ω	35.2	35.1	324.8	324.7
394J1	π	223.8	294.8		224.4
082H1	q	1.013		1.000	
196H1	q	0.040		0.440	
061P1	month(orb.)	11		12	
061P1	month(geo.)	11		12	
072P1	i	170.4	170.3	70.4	70.3
146P1	month(orb.)	1		2	
146P1	month(geo.)	1		2	
204P1	e	0.023		0.623	
205P1	λ	10.6		19.6	
149S1	λ	100.3		105.3	
149S1	V_g	18.98		16.98	
153S1	month(orb.)	8		9	
196S1	Ω	229.8			237.9
196S1	π	0.9	1.5		243.9
289S1	V_∞	11.0		11.3	
001G1	V_∞	40.4			
001G1	V_g			40.4	
002G1	V_∞	39.8			
002G1	V_g			39.8	
003G1	V_∞	40.5			
003G1	V_g			40.5	
004G1	V_∞	63.1			
004G1	V_g			63.1	
005G1	V_∞	12.5			
005G1	V_g			12.5	
006G1	V_∞	19.0			
006G1	V_g			19.0	
007G1	λ	126.5		78.4	
007G1	V_∞	11.1			
007G1	V_g			29.64	
008G1	V_∞	21.2			
008G1	V_g			21.2	
009G1	V_∞	59.6			
009G1	V_g			59.6	
010G1	V_∞	23.3			
010G1	V_g			23.3	
011G1	V_∞	25.5			
011G1	V_g			25.5	
012G1	V_∞	56.7			
012G1	V_g			56.7	
025F1	Ω	38.3	36.5		37.5
026F1	Ω	51.5	49.1		50.7

026F1	V_∞	10.8		11.18	
071F1	λ	91.9		89.0	
071F1	α_R	274.3	275.0	278.3	279.0
190F1	λ	178.6		175.6	
020I1	q	0.748		0.646	
020I1	e	0.646		0.748	
047I1	q	0.973		0.978	
047I1	ω	162.5	162.4	167.5	167.4
047I1	π	109.5	110.1		115.1
061I1	λ	99.3		105.3	
061I1	α_R	66.0	66.6	63.0	63.6
125I1	V_g	26.8		28.8	
125I1	V_∞	29.0		30.9	
006D1	month(orb.)	9		11	
006D1	month(geo.)	9		11	
009D1	Q	-4.31		-12.32	
009D1	λ	33.4		38.4	
010D1	Q	4.49		2.20	
010D1	λ	86.3		75.0	
012D1	q	0.770		0.727	
014D1	Q	1.24		5.45	
014D1	λ	81.5		142.1	
021D1	q	0.996		0.946	
022D1	q	0.971		0.951	
024D1	q	0.987		0.957	
031D1	δ_R	-13.1	-12.9	-16.1	-15.9
032D1	q	1.020		1.014	
041D1	q	1.020		1.010	
049D1	q	0.999		0.959	
049D1	λ	36.2		41.1	
057D1	q	0.962		0.942	
058D1	q	0.970		0.947	
062D1	q	0.981		0.951	
064D1	λ	65.7		69.7	
065D1	q	0.731		0.999	
067D1	q	0.968		0.928	
070D1	Q	2.41		1.78	
070D1	λ	77.4		67.4	
016D2	V_∞	25.7		27.29	
029D2	V_∞	19.7		17.14	
040D2	δ_R	9.0	9.2	-9.0	-8.7
068D2	δ_R	-11.0	-10.8	-14.0	-13.8
136D2	λ	62.2		59.6	
137D2	Q	2.08		1.68	
137D2	λ	92.0		82.0	
139D2	Q	1.97		2.64	
001D3	λ	90.1		93.1	
003D3	Q	2.00		3.00	
003D3	λ	63.5		68.5	
028D3	q	0.970		0.990	
044D3	i	41.0	40.9	4.1	4.0

044D3	ω	87.9	87.9	272.1	272.1
044D3	π	242.7	243.3		67.5
072D3	Ω	269.6	270.3		270.9
001D4	λ	90.0		67.5	
021D4	ω	282.2	282.2	257.8	257.8
021D4	π	59.3	59.9		35.5
022D4	q	1.000		1.008	
029D4	Q	165.86		120.42	
047D4	q	0.999		1.008	
049D4	λ	32.2		40.6	
055D4	Q	6.76		28.65	
055D4	λ	1.2		21.2	
057D4	q	1.000		1.006	
070D4	λ	90.0		77.3	
001D6	Ω	283.0	283.6		283.1
002D6	Ω	140.1	140.8		140.2
004D6	Ω	140.3	141.0		140.4
005D6	Ω	141.2	141.9		141.3
007D6	q	0.960		0.950	
007D6	ω	151.5	151.5		148.1
007D6	Ω	140.3	140.9		140.4
007D6	π	291.8	292.5		288.5
008D6	Ω	139.9	140.6		139.6
010D6	Ω	162.7	163.4		162.8
012D6	Ω	140.1	140.8		140.1
016D6	Ω	139.9	140.6		139.8
016D6	a	88.700		52.851	
017D6	Ω	139.9	140.6		139.8
018D6	Ω	140.0	140.7		139.9
019D6	Ω	140.8	141.4		140.7
020D6	Ω	129.0	129.6		128.9
020D6	δ_R	-5.8	-5.6	-8.8	-8.6
021D6	Ω	131.1	131.8		131.0
024D6	Ω	136.5	137.2		136.3
026D6	α_R	40.4	41.3	46.4	47.3
035D6	Ω	139.3	140.0		139.2
035D6	λ	30.5		40.5	
036D6	V_∞	37.2		38.84	
008D7	q	0.945		0.985	
008D7	Ω	235.0	235.6	55.0	55.7
013O1	day(orb.)	18.843		28.843	
013O1	day(geo.)	18.84		28.843	
013O1	i	85.6	85.5	89.6	89.5
032O1	λ	42.0		45.0	
059O1	Ω	139.4	140.1		139.5
071O1	month(orb.)	11		9	
071O1	month(geo.)	11		9	
071O1	α_R	255.6	255.9	225.6	226.0
082O1	V_g	37.5		33.5	
082O1	V_h	33.9		31.38	
082O1	V_∞	39.4		35.31	

091O1	Ω	228.7	229.4		48.3
091O1	π	351.4	352.0		170.9
013O2	λ	111.3		101.3	
013O2	α_R	370.2	10.8	270.2	270.5
042O2	q	0.951		0.974	
042O2	α_R	48.4	49.3	42.4	43.3
049O2	q	0.563		0.963	
087O2	λ	87.1		92.9	
004O3	Q	26.34		7.30	
004O3	q	1.004		0.961	
004O3	a	13.670		4.134	
004O3	e	0.927		0.767	
004O3	i	6.2	6.1		2.8
004O3	ω	177.8	177.7		25.5
004O3	π	24.3	24.9		232.7
004O3	λ	158.5		136.2	
014O3	Q	-10.01		-3.33	
014O3	q	0.372		0.518	
014O3	a	-4.820		-1.406	
014O3	e	1.077		1.368	
014O3	i	31.9	31.8		24.7
014O3	ω	77.2	77.2		261.1
014O3	π	206.4	207.0		30.9
014O3	λ	79.3		90.6	
014O3	V_h	44.0		48.77	
031O3	Ω	137.0	137.7	138.0	138.7
036O3	δ_R	-11.3	-11.0	11.3	11.5
040O3	i	119.1	119.0	113.1	113.0
053O3	δ_R	56.0	56.1	58.0	58.1
001O4	λ	80.5		86.5	
005O4	V_g	35.6		33.60	
005O4	V_∞	37.3		35.41	
006O4	Q	-710.71		3.12	
006O4	q	0.698		0.159	
006O4	a	-355.000		1.644	
006O4	e	1.002		0.903	
006O4	i	45.5	45.4		9.2
006O4	ω	67.4	67.3		140.7
006O4	π	292.2	292.8		6.2
006O4	λ	82.0		65.9	
018O4	δ_R	7.6	7.8	17.6	17.8
026O4	λ	71.3		113.1	
032O4	α_R	42.2	43.1	48.2	49.1
051O4	Q	-3.33		-6.52	
051O4	a	-1.170		-2.767	
051O4	e	1.850		1.350	
051O4	V_h	50.1		45.51	
051O4	V_∞	69.8		64.67	
087O4	λ	29.6		25.6	
095O4	λ	50.9		40.9	
098O4	ω	253.4	253.4	235.4	235.4

098O4	π	355.9	356.6		338.5
099O4	Q	5.49		3.49	
099O4	a	2.970		1.877	
099O4	i	8.8	8.8	3.8	3.8
099O4	ω	244.2	244.1		121.8
099O4	Ω	296.8	297.5		294.6
099O4	π	181.0	181.6		56.4
105O4	λ	68.6		88.6	
115O4	Ω	137.0	137.7		136.6
117O4	δ_R	50.3	50.4	56.3	56.4
010O5	Ω	161.1	161.8		162.4
014O5	Q	0.18		3.91	
016O5	λ	32.7		82.7	
016O5	α_R	249.6	249.8		290.5
021O5	Q	2.24		3.49	
021O5	q	0.447		0.509	
021O5	a	1.344		2.002	
021O5	e	0.668		0.745	
021O5	i	18.5	18.4		1.3
021O5	ω	66.8	66.8		99.2
021O5	π	215.0	215.6		248.0
021O5	λ	77.2		86.4	
021O5	V_h	33.09		36.20	
023O5	λ	24.1		30.2	
028O5	Q	2.74		4.25	
029O5	Q	1.23		2.23	
029O5	λ	81.3		118.1	
029O5	V_h	29.38		34.36	
032O5	Ω	137.2	137.9		137.2
041O5	Ω	168.4	169.0		169.9
049O5	Q	-0.96		-67.23	
050O5	Q	-0.92		-22.06	
404O6	Q	-1.22		-11.70	
405O6	V_g	54.70		56.70	
405O6	V_∞	55.68		57.79	
406O6	λ	81.0		100.2	
406O6	α_R	111.6	112.4		67.6
408O6	Ω	75.2	75.8	76.2	76.8
408O6	λ	62.1		118.5	
415O6	Q	-0.48		-8.70	
416O6	Q	5.70		-1.59	
416O6	q	0.410		0.869	
416O6	a	5.220		-0.361	
416O6	e	0.092		3.404	
416O6	i	107.7	107.7		23.2
416O6	ω	103.6	103.5		145.4
416O6	Ω	347.4	348.0		168.0
416O6	π	91.0	91.6		313.4
416O6	λ	61.6		121.4	
416O6	V_h	39.92		64.91	
417O6	q	1.014		0.990	

419O6	q	1.013		0.979	
421O6	q	0.999		0.989	
424O6	λ	62.9		68.9	
427O6	Ω	260.7	261.4		261.3
433O6	λ	76.8		89.1	
445O6	α_R	56.5	57.4	52.5	53.4
456O6	day(orb.)	14.972		19.972	
456O6	day(geo.)	14.97		19.972	
004K1	q	1.010		1.006	
006K1	Q	-5.27		-410.21	
006K1	a	-2.63		-204.603	
025K1	λ	110.4		24.2	
025K1	α_R	18.4	19.0	118.4	119.1
031K1	Ω	161.9	162.5		198.8
031K1	π	264.5	265.1		301.4
042K1	ω	177.8	177.8	182.2	182.2
042K1	π	288.9	289.5		293.9
043K1	Q	2.31		5.23	
043K1	q	1.012		0.983	
043K1	a	1.660		3.110	
043K1	e	0.391		0.683	
043K1	i	19.5	19.4		11.6
043K1	ω	175.6	175.6		201.8
043K1	π	313.5	314.1		340.3
043K1	λ	106.7		129.0	
043K1	V_h	34.9		38.28	
046K1	ω	256.3	256.2	103.7	103.6
046K1	π	94.8	95.3		302.7
047K1	ω	44.2	44.2		315.8
047K1	π	62.7	63.3		334.9
056K1	ω	88.7	88.7		271.3
056K1	π	220.7	221.3		43.9
057K1	Ω	138.7	139.4		140.2
060K1	ω	190.5	190.5	198.5	198.5
061K1	Ω	190.2	190.8	191.2	191.8
062K1	ω	57.5	57.4	302.5	302.4
062K1	π	276.2	276.8		161.8
068K1	month(orb.)	7		6	
068K1	month(geo.)	7		6	
071K1	i	99.3	99.2		112.4
071K1	ω	128.3	128.3	158.3	158.3
071K1	π	265.5	266.2		296.1
084K1	month(orb.)	11		9	
084K1	month(geo.)	11		9	
089K1	Q	-1.10		-1.40	
089K1	e	1.181		1.811	
095K1	V_∞	35.7		37.5	
099K1	q	0.994		1.005	
099K1	α_R	109.8	110.9	250.2	250.2
002K2	q	0.923		0.913	
010K2	ω	347.6	347.6	247.6	247.6

017K2	month(orb.)	6		7	
017K2	month(geo.)	6		7	
019K2	ω	311.8	311.8	48.2	48.2
019K2	π	84.2	84.7		181.1
026K2	α_R	13.3	14.0	43.3	44.1
031K2	δ_R	46.6	46.3	43.6	43.3
040K2	Q	−1.25		−1.43	
040K2	a	−0.202		−0.289	
040K2	e	5.180		3.951	
040K2	i	36.3	36.2		41.4
040K2	λ	116.2		106.2	
040K2	V_h	78.4		69.37	
043K2	α_R	37.1	37.7	322.9	323.5
048K2	λ	77.8		52.4	
055K2	α_R	69.2	70.2	290.8	291.0
061K2	V_g	59.9		61.90	
065K2	q	1.020		1.015	
066K2	month(orb.)	7		1	
066K2	month(geo.)	7		1	
066K2	day(orb.)	25.90		23.899	
066K2	day(geo.)	25.90		23.899	
066K2	Q	3.81		6.31	
066K2	q	0.528		0.598	
066K2	a	2.170		3.456	
066K2	λ	87.2		93.3	
066K2	V_h	36.6		39.31	
067K2	day(orb.)	26.88		30.884	
067K2	day(geo.)	26.88		30.884	
019C1	Q	999.99		−44.41	
019C1	a	999.999		−21.705	
022C1	Q	999.99		−24.27	
022C1	a	999.999		−11.630	
031C1	Q	999.99		−70.19	
031C1	a	999.999		−34.622	
031C1	e	1.000		1.027	
037C1	Q	999.99		−148.42	
037C1	a	999.999		−73.730	
037C1	e	1.000		1.013	
041C1	Q	999.99		−237.16	
041C1	a	999.999		−118.105	
041C1	e	1.000		1.008	
042C1	q	0.967		0.937	
048C1	Q	999.99		−393.46	
048C1	a	999.999		−196.273	
050C1	Q	999.99		−18.92	
050C1	a	999.999		−9.207	
062C1	Q	999.99		−104.33	
062C1	a	999.999		−51.688	
062C1	e	1.000		1.018	
064C1	Q	999.99		−162.69	
064C1	a	999.999		−80.869	

064C1	e	1.000			1.011
065C1	Q	999.99			332.47
076C1	Q	999.99			−18.09
076C1	a	999.999			−8.752
084C1	Q	999.99			−501.66
084C1	a	999.999			−250.329
084C1	e	1.000			1.004
085C1	q	0.094			0.941
085C1	a	0.378			3.780
085C1	e	0.075			0.751
085C1	i	104.4	104.3	44.0	43.9
remark: there was a format shift at meteor 085C1 (one error)					
087C1	Q	999.99			−28.12
087C1	a	999.999			−13.572
087C1	e	1.000			1.072
092C1	Q	999.99			−57.78
092C1	a	999.999			−28.411
092C1	e	1.000			1.033
093C1	Q	999.99			−25.32
093C1	a	999.999			−12.187
093C1	e	1.000			1.077
007E1	Q	999.99			−9.49
007E1	a	999.999			−4.452
010E1	Q	999.99			228.45
019E1	Q	999.99			128.53
025E1	V_h	35.52			32.52
049E1	Q	999.99			−28.50
049E1	a	999.999			−13.776
049E1	e	1.000			1.069
050E1	Q	999.99			−37.98
050E1	a	999.999			−18.511
050E1	e	1.000			1.051
051E1	Q	999.99			−4.89
051E1	a	999.999			−2.000
052E1	Q	999.99			−13.66
052E1	a	999.999			−6.432
070E1	Q	999.99			−20.40
070E1	a	999.999			−9.712
071E1	Q	999.99			−18.74
071E1	a	999.999			−8.898
072E1	Q	999.99			−14.62
072E1	a	999.999			−6.830
072E1	e	1.000			1.140
073E1	Q	999.99			−524.76
073E1	a	999.999			−261.899
073E1	e	1.000			1.003
080E1	Q	999.99			−49.50
080E1	a	999.999			−24.286
080E1	e	1.000			1.038
082E1	δ_R	20.4	20.2	−20.4	−20.5
083E1	Ω	56.1	56.7	55.1	55.7

084E1	Q	999.99	−14.24
084E1	a	999.999	−6.623
091E1	Q	999.99	−7.76
091E1	a	999.999	−3.399
091E1	e	1.000	1.283
092E1	Q	999.99	−54.51
092E1	a	999.999	−26.778
092E1	e	1.000	1.035
093E1	Q	999.99	−21.78
093E1	a	999.999	−10.405
095E1	Q	999.99	−9.04
095E1	a	999.999	−4.060
095E1	e	1.000	1.227
100E1	Q	999.99	−5.28
100E1	a	999.999	−2.150
100E1	e	1.000	1.458
103E1	Ω	210.5 211.2	210.2
114E1	Q	999.99	−10.15
114E1	q	0.953	0.973
114E1	a	999.999	−4.590
114E1	e	1.000	1.212
114E1	Ω	301.2 301.8	331.2 331.8
121E1	e	0.5 2	0.502
121E1	i	54.0 53.9	0.2
136E1	Q	999.99	−36.27
136E1	a	999.999	−18.038
136E1	e	1.000	1.010
149E1	λ	113.8	103.8
151E1	Q	999.99	−11.11
151E1	a	999.999	−5.049
153E1	Q	999.99	−2.19
153E1	a	999.999	−0.709
153E1	e	1.000	2.096
174E1	V_h	33.20	35.20
181E1	λ	121.1	131.1
183E1	a	999.990	999.999
183E1	λ	49.7	69.7
061N1	q	0.981	0.991
003N2	q	0.995	0.978
006N2	q	0.990	0.973
007N2	q	0.993	0.976
026N2	q	0.994	0.980
048N2	q	0.994	0.977
049N2	q	0.998	0.981
100N2	q	0.995	0.975
101N2	q	0.986	0.969
103N2	q	0.996	0.979
115N2	q	0.975	0.958
171N2	q	0.992	0.974
002U1	Q	2.94	3.94
002U1	e	0.674	0.764

002U1	λ	83.4		88.4	
002U1	V_h	36.0		37.55	
003U1	λ	65.6		24.8	
006U1	Q	11.61		1.16	
006U1	i	27.1	27.0		33.5
012U1	ω	239.0	239.0		242.4
012U1	π	5.6	6.2		9.6
012U1	λ	109.3		106.3	
014U1	q	0.970		1.014	
022U1	λ	109.1		139.1	
022U1	V_g	13.9		8.9	
024U1	month(orb.)	8		2	
024U1	month(geo.)	8		2	
024U1	day(orb.)	12.68818		8.68818	
024U1	day(geo.)	12.69		8.68818	
024U1	λ	112.8		109.2	
025U1	α_R	320.2	320.8		318.4
043U1	q	0.990		0.980	
052U1	λ	87.3		92.7	
052U1	V_g	27.9		25.9	
055U1	e	0.830		0.890	
055U1	λ	80.9		84.9	
065U1	δ_R	68.9	68.8	58.9	58.8
068U1	Ω	276.0	276.6		271.0
068U1	π	239.4	240.0		234.3
031T2	e	0.981		0.891	
006B1	δ_R	−1.1	−0.9		−9.1
007B1	δ_R	−1.1	−0.9		−8.9
059B1	α_R	28.6	29.2	25.6	26.2
061B1	δ_R	53.7	53.7	56.7	56.7
095B1	δ_R	0.5	0.3		−38.2
108B1	δ_R	0.1	0.2		37.5
126B1	δ_R	−0.9	−0.7		−6.9
163B1	δ_R	−1.1	−0.9		−9.0
166B1	δ_R	−1.0	−0.8		−8.7
170B1	δ_R	−0.1	−0.1		−1.7
172B1	λ	44.2		47.2	
172B1	V_g	55.19		53.19	
175B1	Ω	259.8	260.9		259.8
175B1	π	82.8	83.4		82.3
175B1	λ	168.1		172.6	
201B1	δ_R	−1.0	−0.9		−9.3
288B1	Q	39.66		6.53	
288B1	a	20.112		3.538	
288B1	e	0.972		0.846	
288B1	i	140.1	140.1		157.5
288B1	ω	8.5	8.4		90.6
288B1	π	323.9	324.5		46.7
288B1	λ	32.8		26.2	
288B1	V_h	41.30		38.71	
328B1	δ_R	−0.9	−0.7		−7.0

331B1	δ_R	−0.6	−0.3		−3.8
332B1	δ_R	−0.9	−0.7		−7.7
339B1	V_g	58.97		56.97	
339B1	V_∞	60.15		58.05	
340B1	λ	23.7		28.7	
340B1	V_g	65.21		63.21	
340B1	V_∞	66.30		64.19	
358B1	δ_R	−1.1	−0.9		−8.7
061D8	Ω	138.8	139.5		140.6
064D8	λ	49.8		39.8	
130D8	q	1.025		1.015	
150D8	α_R	58.3	59.2	38.3	39.1
151D8	λ	44.1		26.7	
154D8	month(orb.)	8		12	
154D8	month(geo.)	8		12	
154D8	day(orb.)	11.881		7.881	
154D8	day(geo.)	11.88		7.881	
014K3	α_R	39.2	40.1	29.2	30.0
032K3	α_R	214.7	215.0	241.7	241.9
039K3	Ω	133.0	133.7		132.7
004I2	year−1900(geo.)	80		79	
004I2	month(geo.)	8		12	
004I2	day(geo.)	6.28		26.275	
022I2	day(orb.)	10.382		15.382	
022I2	day(geo.)	10.38		15.382	
022I2	q	0.294		0.394	
022I2	λ	53.6		56.6	
028I2	i	1.9	1.8	161.9	161.8
049I2	λ	82.1		79.4	
054I2	λ	76.5		80.6	
032E2	e	1.000		1.016	
037E2	e	1.110		1.107	
042E2	ω	9.2	9.2	80.8	80.8
042E2	Ω	32.3	32.9		32.3
042E2	π	41.5	42.1		113.1
046E2	Ω	294.7	295.4		296.0
048E2	e	1.040		1.035	
003T3	ω		27.95		81.5
003T3	Ω		81.5		27.95

The IAU MDC database is regarded as the database of meteor orbits. For the full characterization of the given orbit, five orbital elements are necessary. The elements can be calculated from radiant coordinates and geocentric velocity for the time of meteor detection. All the mentioned quantities (orbital elements q, e, i, ω, and Ω, radiant coordinates α_R and δ_R as well as geocentric and heliocentric velocities, V_g) and V_h, are, hereinafter, categorized as "basic parameters" in the database.

Some basic parameters were not published by the original authors. In three catalogues (C1, E2, and, few times, E2), the hyperbolic eccentricity was rounded to 1.000. The list of these parameters as supplied into the data in the IAU MDC follows:

Ident. Code	Variable	Published	(Re)calculated (2000)
145W1	α_R		323.1
145W1	δ_R		−13.4
146W1	α_R		113.7
146W1	δ_R		32.1
147W1	α_R		90.0
147W1	δ_R		15.9
148W1	α_R		289.3
148W1	δ_R		55.8
149W1	α_R		5.0
149W1	δ_R		−1.0
150W1	α_R		113.9
150W1	δ_R		32.0
151W1	α_R		113.9
151W1	δ_R		32.7
152W1	α_R		113.7
152W1	δ_R		32.1
153W1	α_R		8.1
153W1	δ_R		10.8
154W1	α_R		113.9
154W1	δ_R		32.2
155W1	α_R		113.5
155W1	δ_R		32.2
156W1	α_R		113.9
156W1	δ_R		31.8
157W1	α_R		114.2
157W1	δ_R		32.2
158W1	α_R		59.7
158W1	δ_R		23.3
159W1	α_R		52.2
159W1	δ_R		15.1
160W1	α_R		93.2
160W1	δ_R		15.5
161W1	α_R		299.6
161W1	δ_R		42.8
162W1	α_R		93.9
162W1	δ_R		15.6
167W1	α_R		222.1
167W1	δ_R		24.3
168W1	α_R		158.4
168W1	δ_R		−12.0
169W1	α_R		157.0
169W1	δ_R		10.5
170W1	α_R		195.3
170W1	δ_R		−4.0
171W1	α_R		204.0
171W1	δ_R		−9.1
019C1	e	1.000	1.046
022C1	e	1.000	1.086
031C1	e	1.000	1.026

037C1	e	1.000	1.012
041C1	e	1.000	1.008
048C1	e	1.000	1.004
050C1	e	1.000	1.054
062C1	e	1.000	1.018
064C1	e	1.000	1.010
076C1	e	1.000	1.066
084C1	e	1.000	1.004
087C1	e	1.000	1.072
092C1	e	1.000	1.032
093C1	e	1.000	1.076
007E1	e	1.000	1.133
049E1	e	1.000	1.068
050E1	e	1.000	1.050
051E1	e	1.000	1.447
052E1	e	1.000	1.124
070E1	e	1.000	1.102
071E1	e	1.000	1.106
072E1	e	1.000	1.139
073E1	e	1.000	1.002
080E1	e	1.000	1.038
084E1	e	1.000	1.149
091E1	e	1.000	1.282
092E1	e	1.000	1.034
093E1	e	1.000	1.092
095E1	e	1.000	1.227
100E1	e	1.000	1.457
114E1	e	1.000	1.211
136E1	e	1.000	1.010
151E1	e	1.000	1.199
153E1	e	1.000	2.096
027E2	Q		-80.3
027E2	a		-3.732
027E2	e	1.000	1.151
032E2	e	1.000	1.016
002E3	α_R		134.6
002E3	δ_R		59.3
002E3	V_g		11.67
002E3	V_h		23.39
020E3	V_h		42.53
021E3	V_h		41.41
022E3	V_h		42.04
023E3	V_h		42.29
024E3	V_h		43.31
025E3	V_h		41.49
026E3	V_h		41.48
027E3	V_h		41.48
028E3	V_h		42.45
029E3	V_h		42.23
030E3	V_h		42.23
031E3	V_h		43.53

032E3	V_h	41.58
033E3	V_h	41.88
034E3	V_h	42.78
035E3	V_h	42.09
036E3	V_h	40.07
037E3	V_h	44.59
038E3	V_h	42.33
039E3	V_h	42.34
040E3	V_h	42.76
041E3	V_h	39.69
042E3	V_h	41.24
043E3	V_h	42.05
044E3	V_h	41.20
045E3	V_h	41.80
046E3	V_h	41.78
047E3	V_h	37.20
048E3	V_h	41.67
049E3	V_h	33.38
050E3	V_h	38.03
051E3	V_h	36.35
052E3	V_h	37.46
053E3	V_h	36.47
054E3	V_h	37.09
055E3	V_h	37.62
056E3	V_h	37.51
057E3	V_h	37.59
058E3	V_h	39.84
059E3	V_h	37.31
060E3	V_h	33.54
061E3	V_h	41.66
062E3	V_h	37.75
063E3	V_h	36.90
064E3	V_h	37.70
065E3	V_h	30.58
066E3	V_h	32.75
067E3	V_h	37.79
068E3	V_h	37.10
069E3	V_h	41.77
070E3	V_h	38.38
071E3	V_h	34.50
072E3	V_h	23.99
073E3	V_h	38.37
074E3	V_h	39.51
075E3	V_h	35.76
076E3	V_h	35.12
077E3	V_h	35.32
078E3	V_h	38.99
079E3	V_h	37.15
080E3	V_h	37.56
081E3	V_h	36.85
082E3	V_h	38.72

083E3	V_h	37.60
084E3	V_h	36.58
085E3	V_h	37.06
086E3	V_h	37.64
087E3	V_h	37.85
088E3	V_h	36.18
089E3	V_h	36.99
090E3	V_h	33.69
091E3	V_h	37.84
092E3	V_h	39.00
093E3	V_h	37.46
094E3	V_h	38.48
095E3	V_h	37.77
096E3	V_h	37.82
097E3	V_h	35.74
098E3	V_h	41.59
020E3	e	1.062
021E3	e	0.961
022E3	e	1.018
023E3	e	1.041
024E3	e	1.136
025E3	e	0.968
026E3	e	0.967
027E3	e	0.967
028E3	e	1.055
029E3	e	1.035
030E3	e	1.035
031E3	e	1.154
032E3	e	0.976
033E3	e	1.003
034E3	e	1.085
035E3	e	1.022
036E3	e	0.844
037E3	e	1.258
038E3	e	1.044
039E3	e	1.045
040E3	e	1.083
041E3	e	0.813
042E3	e	0.946
043E3	e	1.018
044E3	e	0.943
045E3	e	0.996
046E3	e	0.994
001E4	V_h	42.14
002E4	V_h	41.05
003E4	V_h	40.80
004E4	V_h	40.91
005E4	V_h	41.08
006E4	V_h	41.15
007E4	V_h	40.83
008E4	V_h	40.97

009E4	V_h	40.96
010E4	V_h	40.07
011E4	V_h	41.15
012E4	V_h	40.86
013E4	V_h	40.85
014E4	V_h	40.70
015E4	V_h	41.17
016E4	V_h	42.02
017E4	V_h	41.62
018E4	V_h	41.08
019E4	V_h	41.48
020E4	V_h	41.24
021E4	V_h	41.08
022E4	V_h	41.24
023E4	V_h	41.28
024E4	V_h	40.54
025E4	V_h	40.87
026E4	V_h	40.96
027E4	V_h	41.43
028E4	V_h	41.07
029E4	V_h	41.40
030E4	V_h	41.66
031E4	V_h	39.94
032E4	V_h	40.99
033E4	V_h	41.29
034E4	V_h	41.18
001R1	V_g	58.86
002R1	V_g	58.85
003R1	V_g	58.96
004R1	V_g	57.93
001R1	V_h	41.65
002R1	V_h	40.32
003R1	V_h	40.21
004R1	V_h	41.65
008R1	V_h	37.41

Availability

A complete set of all the photographic orbits available can be obtained through the IAU MDC web-site:

http://www.astro.sk/IAUMDC/Ph2013/

In the site, the following data or documentation files can be found

– the compressed (using ZIP) data for the download:
db2013full.zip - complete database (0.6 MB)
db2013in1line.zip - basic parameters of all meteors; the record about each meteor is given in a single line (0.4 MB)
db2013inF2003.zip - complete database in the format of previous, 2003 version (0.55 MB)

– each catalogue with the complete set of parameters as a single datafile; specifically, the following 41 datafiles are available: **B1.d13, B2.d13, B3.d13, C1.d13, D1.d13, D2.d13, D3.d13, D4.d13, D5.d13, D6.d13, D7.d13, D8.d13, E1.d13, E2.d13, E3.d13, E4.d13, F1.d13, G1.d13, H1.d13, I1.d13, I2.d13, J1.d13, K1.d13, K2.d13, K3.d13, N1.d13, N2.d13, O1.d13, O2.d13, O3.d13, O4.d13, O5.d13, O6.d13, P1.d13, R1.d13, S1.d13, T1.d13, T2.d13, T3.d13, U1.d13, W1.d13**

– each catalogue with the set of basic parameters as a single datafile; the record of every meteor is given in a single line of the datafile; specifically, the following 41 datafiles are available: **B1.1l, B2.1l, B3.1l, C1.1l, D1.1l, D2.1l, D3.1l, D4.1l, D5.1l, D6.1l, D7.1l, D8.1l, E1.1l, E2.1l, E3.1l, E4.1l, F1.1l, G1.1l, H1.1l, I1.1l, I2.1l, J1.1l, K1.1l, K2.1l, K3.1l, N1.1l, N2.1l, O1.1l, O2.1l, O3.1l, O4.1l, O5.1l, O6.1l, P1.1l, R1.1l, S1.1l, T1.1l, T2.1l, T3.1l, U1.1l, W1.1l**

– all catalogs in the single-line format merged and meteors arranged by their date of detection during year (from January 1-st to December 31-st): **all2013.1l** (this datafile is an alternative form of the data contained in files "*.1l")

– some specific lists (extracts):

supplem.lst -	list of meteors with some basic parameters completed in the IAU MDC (these parameters were not published by the original authors)
correct.lst -	list of meteors corrected in a single basic parameter
twocorr.lst -	list of meteors reliably corrected in two basic parameters
reject.lst -	list of meteors, where two or more corrections were necessary the data became mutually consistent, whereby the correctness still cannot be guaranted; the meteors are recommended to be rejected from the data in a proper usage
hyperb.dat -	list of extremly hyperbolic meteors (with heliocentric velocity beyond the Gaussian dispersion of this parameter)
document.pdf -	this documentation (PDF file)

Content of the data

The database is compilation of 41 catalogues by 17 investigators or observational stations. The list of the catalogues included is given in Table 2. Known meteor station coordinates are given in Table 3.

The 2013-version of the database contains, altogether, the characteristics on 4873 meteors.

Table 2. The content of the IAU MDC database of photographic meteors, version 2013. The catalogues are listed in the alphabetical order of their code.

Catalogue code and number	Number of precisely reduced orbits	Investigator or station
B1	359	Betlem, Dutch Meteor Society
B2	75	Betlem et al., Dutch Meteor Society
B3	47	– ” –
C1	103	Ceplecha (small camera)
D1	73	Babadzhanov et al., Dushanbe (small camera)
D2	181	– ” –
D3	72	– ” –
D4	77	– ” –
D5	15	– ” –
D6	44	– ” –
D7	20	– ” –
D8	154	– ” –
E1	189	Ceplecha and Spurný, European Network
E2	48	– ” –
E3	98	Ceplecha, Spurný et al., European Network
E4	34	Spurný et al., European Network
F1	334	McCrosky, Prairie Network
G1	25	Gale Harvey, New Mexico State University
H1	313	Hawkins and Southworth (Super-Schmidt)
I1	136	Halliday et al., MORP Network
I2	123	– ” –
J1	413	Jacchia (Super-Schmidt)
K1	100	Kiev (small camera)
K2	70	– ” –
K3	36	– ” –
N1	95	Koseki, Nippon Meteor Society
N2	164	– ” –
O1	133	Shestaka et al., Odessa (small camera)
O2	22	– ” –
O3	70	– ” –
O4	122	– ” –
O5	50	– ” –
O6	62	– ” –
P1	353	Posen and McCrosky (Super-Schmodt)
R1	32	Trigo-Rodríguez et al., Spanish Meteor Society
S1	314	McCrosky and Shao (Super-Schmodt)
T1	31	Ohtsuka, Tokyo Meteor Network
T2	48	Ohtsuka et al., Tokyo Meteor Network
T3	6	– ” –
U1	66	Ochai et al., Nippon Meteor Society
W1	166	Whipple (small camera)

Table 3. Known meteor station coordinates. (Photographic programs)

Station	Long.	Lat. (N)	LT-UT (hrs)	LT-UT (days)
Dushanbe (Gissar)	68.782 E	38.562	4.5855	0.19106
Odessa	30.90 E	46.80	2.060	0.0850
Kiev (Pilipovichi)	29.92 E	50.58	1.995	0.08313
Kiev (Lesniki)	30.5304 E	50.2971	2.0354	0.08481
Kiev (Tripolye)	30.7548 E	50.1271	2.0503	0.08543
Ondrejov	14.7836 E	49.9106	0.9856	0.04107
Cambridge	71.130 W	42.382	−4.74200	−0.19758
Agassiz	71.558 W	42.506	−4.77053	−0.19877
Soledad	106.612 W	32.304	−7.10947	−0.29614
NMSU (Tortugas)	106.6973 W	32.2921	−7.11315	−0.29638
Dona Ana	106.799 W	32.506	−7.11993	−0.29666
NMSU (Corralitos)	107.0408 W	32.3809	−7.13605	−0.29734

LT = Local time
UT = Universal time
NMSU = New Mexico Southern University

Station coordinates are taken from the original publications or from the Astronomical Ephemeris. Station coordinates for Odessa are approximate.

Formats of the data

The format of the IAU MDC data has evolved with a gradual improvement of computer technique. The original format from the beginning of the collection of photographic data was designed only for the Fortran-formated integer parameters of meteors. The subsets of geophysical and orbital data of a meteor were constrained to a single, 80-character line of the datafile. Individual values were not separated by spaces and decimal points were omitted. It was, therefore, necessary to establish a more comfortable format which appeared in the 2003 version of the database. All data on a meteor were concentrated to 4 lines, separated by a blank line, of a single datafile.

In the last period, a lot of parameters started to be published together with the determined errors. In addition, the new data occur with mutually different precision, therefore the 2003-version format, which assumes the fixed Fortran writing again, has also become obsolete, meanwhile, and we are forced to establish a new, flexible format, applied to the 2013 version. Eventually, the data in this version are attempted to be recorded in a universal way independent of any specific computer-language or web-interacting-database (like, e.g., My-SQL). So, the purpose of the new format of the data is defining the list of parameters intended to be considered by the IAU MDC (not only at the photographical data) rather than to define a computer-language-writing format. With the help of the list, the IAU MDC specifies its request for the particular data.

The ordinary (full) format for the 2013 version is not very transparent when a user needs visually consult some data. Because of this reason, the data center provides a reduced alternative set, only consisting of the basic parameters, where the record on each meteor is given in a single line. Eventually, the old format for the 2003 version is still kept as the third alternative.

Full format of the version 2013

The list of the considered meteor-data parameters is given in the following table:

Table 4. The list of parameters included in the new 2013 version of IAU MDC database. No.P. is the serial number of the parameter in the list and C.P. is the code of the parameter. The positional parameters are referred to the equinox 2000.0.

No.P.	C.P.	explanation
1	#IC:	IAU MDC identification code
2	ANo:	number/code assigned to the meteor by author
3	Yr :	year of the detection
4	Mn :	month of the detection
5	Day:	day and fraction of day of the detection (UT)
6	LS :	solar longitude corresponding to the date of the detection [deg]
7	mv :	magnitude of maximum photographic brightness of meteor
8	HB :	height of beginning of meteor trail [km]
9	HM :	height of maximum brightness [km]
10	HE :	height of end of meteor trail [km]
11	RA :	right ascension of geocentric radiant [deg]
12	DEC:	declination of geocentric radiant [deg]
13	Vi :	extra-atmospheric velocity [$\mathrm{km\,s^{-1}}$]
14	Vg :	geocentric velocity [$\mathrm{km\,s^{-1}}$]
15	Vh :	heliocentric velocity [$\mathrm{km\,s^{-1}}$]
16	cZ :	cosine of the angular distance of geocentric radiant from the zenith
17	Qm :	quality code
18	q :	perihelion distance [AU]
19	e :	numerical eccentricity of orbit
20	1/a:	reciprocal semi-major axis [$\mathrm{AU^{-1}}$]
21	a :	semi-major axis [AU]
22	Q :	aphelion distance [AU]
23	i :	inclination of orbit to the ecliptic [deg]
24	arg:	argument of perihelion [deg]
25	nod:	longitude of ascending node [deg]
26	pi :	longitude of perihelion [deg]
27	Sh :	shower number
28	Mas:	pre-atmospheric photometric mass [g]
29	lgM:	decadic logarithm of the mass
30	cor:	remark on correction (if appears)
31	crh:	remark on extreme hyperbolicity

At the moment, the list consists of 31 parameters. It is supposed that, if needed, it can be extended by another items. Basically, a unique 5-character identification code, consisting of a 3-digit serial number of the meteor in a given partial catalogue and a 2-character code of this partial catalogue, is assigned to every meteor included into the IAU MDC database. The original designation, under which the meteor was published by the author(s), is also listed.

Each parameter is given in two lines of the datafile. In the first line, the code of the parameter and two binary values are written. If the first value is "1" and the second value is "0", then only the value of the parameter without the determination error is presented in the second line. If both values are "1", then the second line contains the value of the parameter together with the determination error. (The place for the parameter can be reserved with its code, binary values both equal to "0", and blank second line. Such a record is identical to the omission of the parameter.) The number of decimal digits of the value of any parameter and its determination error is arbitrary, usually depending on the precision of its determination.

The record about a given meteor begins with the meteor identification code and is terminated with the line containing 3 spaces and character &. It is not necessary to list all 31 parameters in a particular record. Only the identification code is mandatory. The order of parameters within each record is optional, except for the code. An example of the data in the full 2013-version format is shown in Appendix I.

Single-line format of version 2013

This format is designed for a visual work with the database. The record on each meteor consists of only basic parameters, in this format, and is written in a single line. The values of coresponding parameters are algned, in a single column, therefore the precision of the listed parameters is formally unified. An example of the single-line data format is shown in Appendix II.

The basic parameters are:

IC – identification code,
yr, mn, day – date of the meteor detection,
q – perihelion distance of meteor orbit [AU],
e – eccentricity,
i – inclination [deg],
arg – argument of perihelion [deg],
nod – longitude of ascending node [deg],
RA – right ascension of gecentric radiant of meteor [deg],
DEC – declination of geocentric radiant [deg],
Vg – geocentric velocity [$\mathrm{km\,s^{-1}}$],
Vh – heliocentric velocity of meteor [$\mathrm{km\,s^{-1}}$].

Format of version 2003

Since the users may wish to utilize their old computer programs that read the data in the old format, we also provide the data in the old format of the version 2003. The specific structure of these data is described in the table below.

Table 5. Format for data in files "??.d03" (format of the previous version of database). All the data are stored as 4 line records separated by blank line. The individual values within one record are arranged in the following way:

Pos.	Variable	Format	Unit
	*** 1-st line ***		
1– 5	Identif. code	aaaaa	
10–14	Meteor no.	aaaaa	
17–18	Quality	various codes	
21	correction remark	code letter	
22	extreme hyperbolicity	code letter	
28–30	Stream no. - omitted in the new version		
33–34	Assoc. no. - omitted in the new version		
37–38	Shower no.	aa	

	*** 2-nd line ***		
2− 3	month	xx	
5−12	day	xx.xxxxx	
14−17	year	xxxx	
19−23	longitude of the Sun	xxx.x	[^{o}]
26−30	α_R	xxx.x	[^{o}]
32−36	δ_R	xxx.x	[^{o}]
39−43	λ - omitted in the new version		
46−50	V_g	xx.xx	[km/s]
52−56	V_h	xx.xx	[km/s]
58−62	V_∞	xx.xx	[km/s]
	*** 3-rd line ***		
2− 6	q	x.xxx	[AU]
8−15	a	xxxx.xxx	[AU]
17−23	Q	xxxx.xx	[AU]
25−29	e	x.xxx	
32−36	i	xxx.x	[^{o}]
38−42	ω	xxx.x	[^{o}]
44−48	Ω	xxx.x	[^{o}]
51−55	π ($\pi = \omega + \Omega$)	xxx.x	[^{o}]
	*** 4-th line ***		
1− 5	M_{ph}	xxx.x	
8−13	$cos(z_R)$	xx.xxx	
16−20	HB	xxx.x	[km]
23−27	HMax	xxx.x	[km]
30−34	HE	xxx.x	[km]
38−43	$\log_{10}$(mass [g])	xx.xxx	
46−54	Mass	xxx.xxxxx	[g]
60−64	K - omitted in the new version		
67−71	CW - omitted in the new version		

Parameters in the appropriate Fortran-format command:

FORMAT(A5,4X,A5,2X,A2,2X,A1,A1,5X,A3,2X,A2,2X,A2,2X,A2)
FORMAT(I3,F9.5,I5,F6.1,F7.1,F6.1,F7.1,F7.2,F6.2,F6.2)
FORMAT(F6.3,F9.3,F8.2,F6.3,F7.1,F6.1,F6.1,F7.1)
FORMAT(F5.1,2X,F6.3,2X,F5.1,2X,F5.1,2X,F5.1,3X,F6.3,2X,F9.5,5X,F5.2,2X,F5.2)
FORMAT(A1)

All orbits are referred to the 2000.0 equinox. An example of the data in this format is shown in Appendix III.

Notes to Tables 4-5

Identification code. [#IC:] The unique (not confusing) identification of each meteor is possible through its "identification code", which consists of three components:

– *Publication serial no.* Photographic orbits are listed in the order they appeared in the original publications. This order is normally chronological, but sometimes the meteors have been catalogued by day, month and year. (The Odessa 2 geo-data were listed in different order in two different catalogues.) For unpublished data the publ.ser.no. represents the order in which the data were listed when received at the data center.

– *Author o station code.* A code letter is used to denote the station or investigator. (For investigator or station code see Table 2.) For example, a Dushanbe meteor with a publication no. 151D recorded on July 27.717 UT, 1959 is the 151st meteor listed in Table V of Babadzhanov and Kramer (1963). Unfortunately, the publ.ser.no. with autor/station code is still not a unique designation since some groups have published several catalogues. For example the Dushanbe team has published 8 catalogues.

– *Catalogue no.* In both 2003 and 2013 versions of the database, the catalogue no. is added to distinguish among several catalogues by the same author group.

Meteor no. [code: ANo:] − original serial number. Various investigators have used different schemes to define an identification number (serial no.) for each meteor. An investigator may choose to give each meteor observed a unique serial no. This is, for example, the case with all the Harvard Super Schmidt data. Other investigators may choose to introduce a plate number. (In some cases this plate no. is the modified Julian Day number.) If several meteors are recorded on the same plate these are denoted A, B, C etc. in order of time. Since the old IAU data format only allowed a five digit number (which is transmitted to the new version for a large part of the data), it has been necessary to remove some letters from the original serial number. In some data samples (Dushanbe) the ser.no. is a six or eight digit number, where the first two digits represent the year of observation (year−1900). In these cases only the last five digits are included.

year−1900, month, day [Yr :], [MN :], [Day:] − time of meteor detection. Time is given as day and fraction of day (UT). Fraction of day varies in different data sets from two to five significant figures.

Longitude of the Sun. [LS :] The value for the date of meteor detection is given. This quantity is often used instead of date.

Magnitude (M_{ph}) [mv] − photographic magnitude.

HB, HMax, HE [HB :], [HM :], [HE :] − height of beginning, maximum brightness, and end of meteor trail.

α_R, δ_R [RA :], [DEC:] − right ascension and declination of geocentric radiant. Both the coordinates are corrected for zenithal attraction.

V_{infty}, V_g, V_h [Vi :], [Vg :], [Vh :] − extra-atmospheric, geocentric, and heliocentric velocity of the meteor.

$cos(z_R)$ [cZ :] − cosinus of angular distance of geocentric radiant from the zenith.

Quality code. [Qm :] No attempt has been made at the data center to assess the precision or quality of data obtained at a particular station or by a particular investigator. Some investigators (Whipple, Jacchia) have included in their catalogues a measure of the relative accuracy of their orbits. This measure is listed in the data as the quality code. When no index of relative accuracy is given, other measures of orbital accuracy have been introduced, e.g. sin P (where P is the angle between the apparent great circles of meteor motion as seen from the two observing stations) or the no. of shutter brakes on the photographic image. For a discussion see Lindblad (1971c). In some cases (mainly amateur data and some radio orbits), the orbit computation has been made assuming R = 1 AU, i.e. a circular Earth orbit. For a discussion of these cases see Lindblad (1991).

q, e, $1/a$, a, Q, i, ω, Ω, π [q :], [e :], [1/a:], [a :], [Q :], [i :], [arg:], [nod:], [pi :] − orbital elements of meteor orbit in order of perihelion distance, eccentricity, reciprocal semi-major axis, semi-major axis, aphelion distance, inclination, argument of perihelion, longitude of ascending node, and longitude of perihelion. Note that for hyperbolic meteors the negative sign on semi-major axis, a (as wel as on $1/a$ and Q) is not included.

Shower no. [Sh :] − shower no. The shower Harvard classification as given by original investigator is listed as a two digit number. A non-existence of any number indicates that the original investigator either classified the meteor as a sporadic or did not published any shower classification. (The Harvard classification for the photographic meteors is still kept in the 2013 version, because its conversion to the new, universal, IAU MDC classification is not always unique.)

Table 6. Harvard code no:s for identifying shower meteors.

1	α-Capricornids
2	Southern Taurids
3	ι-Aquarids (southern branch)
4	Geminids
5	δ-Aquarids (southern branch)
6	Lyrids
7	Perseids
8	Orionids
9	Draconids
10	Quadrantids
11	Virginids
12	κ-Cygnids
13	Leonids
14	χ-Orionids
15	Ursids
16	σ-Hydrids
17	Northern Taurids
18	Southern Arietids
19	Monocerotids
20	Coma Berenicieds
21	α-Virginids
22	Leo Minorids (October)
23	ε-Geminids
24	μ-Pegasids
25	δ-Arietids
26	δ-Aquarids (northern branch)
27	κ-Serpentids
28	Andromedids
29	σ-Leonids (northern branch)
30	Piscids (northern branch)
31	η-Aquarids
32	Leo Minorids (December)
33	ι-Aquarids (northern branch)

Mass. [Mas:] The mass is the pre-atmospheric photometric mass derived from integration of the luminosity equation. It is important to note that various investigators may have adopted slightly different values/equations for the luminous efficiency tau and its dependence on velocity.

$\log_{10}$(mass) [lgM:] − decadic logarithm of mass (given in grams). The mass is the pre-atmospheric photometric mass derived from integration of the luminosity equation. It is important to note that various investigators may have adopted slightly different values/equations for the luminous efficiency τ and its dependence on velocity.

Correction remark. [cor:] A code letter is given if the basic parameter(s) characterizing the meteor is corrected. Specifically,
c - one basic datum is corrected;
m - two basic data are reliably corrected;
r - two or more basic data are corrected; meteor is recommended to be rejected from the data

Extreme hyperbolicity. [crh:] If the meteor is in an extremly hyperbolic orbit, which cannot be explained by the Gaussian dispersion of corresponding heliocentric velocity, letter ,,h" appears in this parameter of meteor record (otherwise the parameter is not listed).

References to the discussion of formats:

1−17	Jacchia, L.G. and Whipple, F.L., 1961, Smithson. Contrib. Astrophys., 4, 97.
20−25,27,32	McCrosky, R.E. and Posen, A., 1959, Astron. J., 64, 25.
28	Hawkins, G.S., Southworth, R.B. and Stienon, F., 1959, Astron. J., 64, 183.
22,32	Cook, A.F. et al., 1971, Smithson. Contrib. Astrophys., 15, 1-5.

* * *

APPENDIX I
Full format of 2013 version

An example of the data format in 2013 version for 2 meteors:

#IC: 1 0
001B2
ANo: 1 0
98001
Yr : 1 0
1998
Mn : 1 0
11
Day: 1 0
16.68186
mv : 1 0
0.
HB : 1 0
116.6
HM : 0 0

HE : 1 0
103.9
RA : 1 1
153.32 0.28
DEC: 1 1
22.23 0.26
Vi : 1 1
71.2 0.9
Vg : 1 0
70.0
Vh : 1 0
40.8
cZ : 1 0
0.20
Qm : 1 0
46.2
q : 1 1
0.9817 0.0015
1/a: 1 1
0.1451 0.0830
i : 1 1
161.59 0.48
arg: 1 1
169.79 1.18
nod: 1 1
234.12721 0.00000
Sh : 0 0

&
#IC: 1 0
002B2

ANo: 1 0
98002
Yr : 1 0
1998
Mn : 1 0
11
Day: 1 0
16.69212
mv : 1 0
-3.
HB : 1 0
128.9
HM : 1 0
104.8
HE : 1 0
102.8
RA : 1 1
152.98   0.03
DEC: 1 1
22.33   0.02
Vi : 1 1
71.8   0.0
Vg : 1 0
70.6
Vh : 1 0
41.4
cZ : 1 0
0.22
Qm : 1 0
31.0
q : 1 1
0.9834   0.0001
1/a: 1 1
0.0933   0.0033
i : 1 1
161.92   0.04
arg: 1 1
171.25   0.11
nod: 1 1
234.13763   0.00001
&

The codes of the individual parameters are listed in Table 4. The set of parameters for a given meteor is separated from the set of parameters of the next meteor by the line containing only character &.

APPENDIX II

Single-line format of 2013 version

An example of the single-line data format for 3 meteors:

IC	yr	mn	day	q	e	i	arg	nod	RA	DEC	Vg	Vh
001B2	1998	11	16.68186	0.982	0.858	161.6	169.8	234.1	153.3	22.2	70.00	40.80
002B2	1998	11	16.69212	0.983	0.908	161.9	171.3	234.1	153.0	22.3	70.60	41.40
003B2	1998	11	16.69326	0.983	0.849	162.5	170.6	234.1	152.9	21.9	70.00	40.70

APPENDIX III

Format of 2003 version

An example of the data format in 2003 version for 3 meteors:

```
001B2   98001       46
11  16.68186  1998   0.0   153.3   22.2    0.0   70.00  40.80  71.20
0.982    0.000     0.00  0.000   161.6  169.8  234.1     43.9
0.0   0.200  116.6    0.0  103.9    0.000     0.00000     0.00   0.00

002B2   98002       31
11  16.69212  1998   0.0   153.0   22.3    0.0   70.60  41.40  71.80
0.983    0.000     0.00  0.000   161.9  171.3  234.1     45.4
-3.0   0.220  128.9  104.8  102.8    0.000     0.00000     0.00   0.00

003B2   98003       18
11  16.69326  1998   0.0   152.9   21.9    0.0   70.00  40.70  71.20
0.983    0.000     0.00  0.000   162.5  170.6  234.1     44.8
-3.0   0.250  126.9  101.4   88.1    0.000     0.00000     0.00   0.00
```

The missing parameters, in the given catalogue, are substituted by zeroes.