# *THE HIPPARCOS INPUT CATALOGUE*

*A publication of the INCA Consortium*

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# Introduction

## The Hipparcos Input Catalogue

The Hipparcos Input Catalogue was constructed as the observing programme for the European Space Agency's Hipparcos astrometry mission. The requirements of the project in terms of completeness, sky coverage, astrometric and photometric accuracy, as well as the necessary optimisation of the scientific impact, resulted in an extended effort to compile and homogenize existing data, to clarify sources and identifications and, where needed, to collect new data matching the required accuracy.

This has resulted in an unprecedented catalogue of stellar data including up-to-date information on positions, proper motions, magnitudes and colours, and (whenever available) spectral types, radial velocities, multiplicity and variability information. The catalogue is complete to well-defined magnitude limits, and includes a substantial sampling of the most important stellar categories present in the solar neighbourhood beyond these limits. As explained below, the magnitude limits vary from 7.3 to 9 mag as a function of galactic latitude and spectral type, and there are no stars fainter than about $V = 13$ mag.

## The Hipparcos mission

Overviews of the European Space Agency's Hipparcos astrometry mission, its history, scientific objectives and observing programme, the payload design, and plans for the satellite operations and data reductions, have been given frequently before the satellite launch. The most comprehensive description of the satellite, observing programme, and methods foreseen for the data reduction are contained in a 3-volume ESA publication, ESA SP-1111 (Perryman *et al.* 1989). The project was accepted within ESA's mandatory scientific programme in 1980, with a planned operational lifetime of 2.5 years. The goal of the Hipparcos project was to measure the astrometric parameters of about 100 000 stars with an accuracy of some 2-4 milli-arcsec (depending on magnitude) for the main mission and, as subsequently incorporated during the design phase, the astrometric and two-colour photometric properties of a further minimum of some 400 000 or more stars with somewhat lower accuracy for the Tycho experiment. By placing the observing platform above the perturbing atmosphere, and exploiting the all-sky visibility and freedom from gravitational flexure and thermal fluctuations, differential angular measurements are built up over large angles, at many different orientations and at many different epochs. ¿From these measurements, relative positions, annual proper motions and absolute parallaxes, free from regional or systematic errors at the milli-arcsec level, can be derived.

The Hipparcos satellite was launched by Ariane 4, flight 33, on 8 August 1989. At the time of publication of this 'Hipparcos Input Catalogue', the satellite is more than two years into its measurement programme, the on-board instrumentation is functioning according to specification and, despite the necessary revisions to the mode of operation brought about by the non-nominal orbit, the target accuracies of the original mission should be attained.

# The INCA Consortium (Input Catalogue Consortium)

The observing programme, by the nature of the mission concept and the data reduction procedures outlined below, had to be pre-selected and finalised before launch. The INCA Consortium was established in 1981, and was assigned the responsibility, by the European Space Agency, of dealing with the definition of, and preparation of, all aspects of the Hipparcos observing programme. The final observing programme consists of more than 118 000 stars, mostly within our Galaxy but some within the Magellanic Clouds, one quasar (3C273) and, within our solar system, 48 minor planets and three satellites of major planets (Europa, Iapetus and Titan). These selected objects were based upon 214 scientific proposals submitted to ESA in 1982, by the world-wide astronomical community, in response to an Invitation for Proposals. The selection of objects to be retained for observation according to their scientific interest was made by an *ad hoc* 'Hipparcos Scientific Selection Committee'. Their recommendations, constrained by the satellite observing capabilities, were implemented by the INCA Consortium, in consultation with the original proposers and representatives of the data reduction and satellite project teams. During this work and with the agreement of the Hipparcos Scientific Selection Committee, additional proposals were defined by the INCA Consortium in order to optimise the scientific return expected for some specific topics, notably the introduction of the magnitude-limited survey, the selection of stars in the Magellanic Clouds and in galactic open clusters, and the introduction of stars associated with the improvement of the link to an extragalactic reference system.

# The Hipparcos observing programme

The final observing programme was selected from some 214 000 proposed candidates following a series of comprehensive numerical simulations of the satellite observations. Each iterative step of these simulations was followed by an in-depth analysis of the resulting provisional selection, its qualities and drawbacks with respect to the selection of stars from high-priority proposed programmes, to their observability by the satellite, and to the optimum use of the satellite's specific observing capabilities. The 48 minor planets and the three other solar system objects finally retained for observation were selected purely on the basis of their magnitudes and their observability by the satellite.

A variety of constraints on the contents of the Input Catalogue arise from the measurement principle of the Hipparcos satellite, which is designed to scan the celestial sphere systematically at a constant rate. With a field of view of about $0.9 \times 0.9$ degrees, a modulating grid of period 1.2 arcsec, and observations conducted by switching the 'instantaneous field of view' of the detector to those programme stars visible within the total field of view, the following broad conditions influence the global observing programme: (i) the number of stars per square degree contained in the observing programme is limited; (ii) there is, at the same time, a requirement on the minimum density of bright stars and their uniformity across the sky required for satellite attitude determination and the subsequent data reductions; (iii) the magnitude distribution of the retained stars must be consistent with the available observing time (the minimum acceptable, and target, observing times increase with the star magnitude, and this places limits on the density of faint stars acceptable within the programme); (iv) to point to each target object, and to observe it with an optimum distribution of the available observing time, requires adequate *a priori* knowledge of the candidate's position and magnitude; (v) the detector's instantaneous field of view profile places stringent constraints on the separation and magnitude difference of double and multiple systems that can be usefully observed by the satellite, as well as on the selection of stars in dense regions where the signal from nearby, bright stars could influence the measurements.

In addition to the selection of the precise satellite observing targets, the INCA Consortium also had the responsibility of compiling, and where appropriate improving, the data available for the proposed stars and minor planets in order to satisfy the conditions necessary for their observation with the Hipparcos satellite. Based upon the characteristics of the satellite detection system and measurement principle, specifications were set at ±1.5 arcsec on the *a priori* positional knowledge of each object at epoch 1990, and ±0.5 mag on the *a priori* knowledge of the $B$ or $V$ magnitudes for all programme stars. As a consequence, extensive compilations of astrometric and photometric data were undertaken by the INCA Consortium (Turon 1988), along with systematic tests of reliability and consistency of the collected data. Large preparatory ground-based observational programmes were subsequently organised in order to supplement the available information, and the resulting data finally included in the present Input Catalogue therefore comprise a substantial body of previously unpublished data: measurements were made of about 100 000 star positions from photographic plates, some 10 000 additional positions from automatic meridian circle observations, 10 000 star magnitudes and colours obtained from multi-colour photoelectric photometry, and more than 100 000 star colours computed from spectral types combined with a new model of galactic extinction. In addition, special programmes were undertaken to deal with particular objects, such as double and multiple stellar systems, variable stars, stars in galactic open clusters, and minor planets.

For the minor planets, a substantial number of new observations with the two automatic meridian circles of Bordeaux and La Palma, and with the astrographs of San Fernando and Barcelona, were necessary for improving the knowledge of the orbital elements to a standard suitable for the satellite observations. For the three satellites of the major planets, Europa, Iapetus and Titan, for which studies indicated that valuable astrometric information could be acquired from Hipparcos, the available ephemerides already satisfied the specified accuracy requirements.

## Contents of this publication

The Hipparcos Input Catalogue includes the best available data collected within the framework of the INCA Consortium. The magnetic tape version is composed of the main catalogue, including data for each stellar target of the satellite, and one annex containing more detailed data for individual components of double and multiple systems for which at least one component is included in the main Input Catalogue.

The printed version of the Catalogue is published as ESA SP-1136. It contains 7 volumes: Volumes 1-5 comprise the main Hipparcos Input Catalogue, Volume 6 contains Annex 1 (data for individual components of double and multiple systems), Volume 7 contains Annexes 2 to 4 (identification charts for the fainter Input Catalogue stars, identification charts for all Input Catalogue stars in galactic open clusters, identification charts for all Input Catalogue stars in the Large and Small Magellanic Clouds).

A CD-ROM version of the Hipparcos Input Catalogue is being prepared containing all data of the main catalogue and Annex 1, and all charts of Annexes 2 and 3, along with interrogating and mapping software.

In addition, the INCA Consortium structure and membership, the Hipparcos Scientific Selection Committee membership, and the list of all scientific programmes received by ESA for observation with Hipparcos, are given at the end of this introduction.

## References

A complete description of all aspects of the preparation of the Hipparcos Input Catalogue can be found in the proceedings of two Colloquia on 'Scientific Aspects of the Input Catalogue Preparation' (Aussois, June 1985, ESA-SP 234, Turon & Perryman eds; and Sitges, January 1988, Torra & Turon eds), in ESA-SP 1111, Volume II (The Hipparcos Mission: Pre-Launch Status, Perryman & Turon 1989), and in a series of papers in *Astronomy & Astrophysics* covering star selection (Turon *et al.*

1992a), astrometric aspects (Jahreiß *et al.* 1992), photometric aspects (Grenon *et al.* 1992), solar system objects (Bec-Borsenberger 1992a), long-period variable stars (Mennessier *et al.* 1992), the adopted galactic extinction model (Arenou *et al.* 1992), and the VLBI link to an extragalactic frame (Lestrade *et al.* 1992). The performances of the Input Catalogue, as tested by the first results from the satellite, are presented by Crifo *et al.* (1992) and Turon *et al.* (1992b). All aspects of the link of the Hipparcos reference frame to an extragalactic reference frame are described by Argue (1989) and Jahreiß *et al.* (1992). The data on double and multiple systems will be contained in the 'Catalogue of the Components of Double and Multiple Stars' (CCDM, Dommanget *et al.*, in preparation). Annex 1 is a subset of a preliminary version of this catalogue. The improved orbital elements of the relevant minor planets, along with predicted ephemerides for the years 1991 and 1992, have been given by Bec-Borsenberger (1990, 1992b).

# Star Selection

The 118 000 stars of the Hipparcos Input Catalogue were selected from some 214 000 distinct candidates, contained in the 214 observation programmes listed at the end of this introduction. The scientific proposals deal with a wide variety of astrophysical and astronomical subjects: solar system, stellar physics and evolution, galactic structure, kinematics, dynamics and evolution, cosmic distance scale, and reference systems. With the endorsement of the ESA Hipparcos Scientific Selection Committee, the INCA Consortium supplemented the proposed list of stars with others considered to be unrepresented in the original compilation. Most importantly, this included a basic list of bright stars, essentially complete to a well-defined limiting magnitude, and hence referred to as the 'survey'.

The original set of proposed stars was, not surprisingly, poorly suited to the observing capabilities of the Hipparcos experiment: the sky distribution of the 214 000 proposed stars showed a strong concentration towards the galactic plane, and especially towards the galactic centre, and their $V$ -magnitude distribution showed a predominance of faint stars. As a result of the work of the INCA Consortium in merging, optimising, and supplementing the original list, the final Hipparcos Input Catalogue of about 118 000 stars can broadly be considered as being composed of two parts:

- a basic list of 52 000 'bright' stars (the 'survey'), complete to a limiting magnitude which is a function of the star's spectral type and galactic latitude (Crifo *et al.* 1985; Turon & Crifo 1986; Turon *et al.* 1989a; Gómez *et al.* 1989), and defined by:

$$\begin{aligned} V_{\rm lim} &\leq 7.9 + 1.1 \sin|b| && \text{for spectral types earlier or equal to G5,} \\ V_{\rm lim} &\leq 7.3 + 1.1 \sin|b| && \text{for spectral types later than G5.} \end{aligned}$$

  If no spectral type was available, the break was taken at $B - V = 0.8$ mag. The original star selection for this survey was made from the SIMBAD data base (Egret *et al.* 1991).

- 66 000 'faint' additional stars selected from the proposed observing programmes according to the priorities allocated by the Hipparcos Scientific Selection Committee. The allocated priorities, reflecting the Committee's assessment of the scientific importance of the proposals, ranged from priority 1 (the highest) to priority 5 (the lowest).

Although the inclusion of the bright stars was partly motivated by reasons related to the satellite operations (attitude determination) and data reductions, the precise choice of stars was not in itself significant for these purposes. The only two basic requirements were to retain a reasonably regular stellar density of bright stars all over the sky, and to ensure that a large sub-sample of these stars would have sufficiently accurate *a priori* positions. Stars were therefore chosen such that any further statistical uses of the catalogue, for example in the domains of galactic physics, would be enhanced by this choice. The above survey definition satisfies all three requirements, while at the same time reducing the proportion of red giant stars in favour of A and F stars. The latter, being typically closer, will get a correspondingly more accurate determination of their distances and space motions.

As a result, the 118 000 selected stars, just 55 per cent of those originally proposed, actually represent 94 per cent of the 'priority 1' stars. Their distribution on the sky is much smoother than that of proposed stars, even though more (bright) stars are selected in the galactic plane than outside. Their $V$ -magnitude distribution shows a maximum between 7 and 10 mag, and very few stars fainter than 12 mag (these stars require a very large fraction of the available observing time). The final star selection (Turon 1989) was made following an iterative process, using numerical simulations of the mission (Crézé *et al.* 1989). These simulations progressively took into account all the astrometric and photometric data collected or newly obtained within the INCA Consortium, as well as all data coming from parallel work on double, multiple and variable stars. All these data are collected in a dedicated data base, the INCA data base, originally constructed as a sub-base of SIMBAD, with the data and cross-identifications from SIMBAD (Arenou & Morin 1988; Turon *et al.* 1991). The updating and interrogation software of this data base was an important asset in storing and managing all the data necessary for the construction of the Input Catalogue.

In the context of the Hipparcos Input Catalogue, and especially in discussions of the Input Catalogue's statistical properties, the word 'star' is frequently used when catalogue 'entry' would be more appropriate. An 'entry' refers to a satellite target: it may be a single star, a component of a double or multiple system, or a unique joint entry for a close double or multiple system. This is a specific feature of the Hipparcos Input Catalogue, reflecting the satellite's detection system. It should be stressed again that the Input Catalogue was compiled specifically for the Hipparcos programme. Its stellar and data contents reflect these fundamental requirements.

# MAIN CATALOGUE

# Main Catalogue Description

**Note: the field numbers of the Main Catalogue are not identical to those of the printed version (ESA SP-1136) as some additional information has been added: the correspondence between the two are given in the table describing the magnetic tape format. Field entries are blank if the corresponding data are not available.**

The description of the data given below follows the order of the columns of the Hipparcos Input Catalogue. Further explanations, along with relevant information on how the data were collected and selected, are included in smaller type. Full names and references of all catalogues are given at the end of this introduction (page 33). In general, the number of decimals retained provides an indication of the precision of the data.

# Fields 1-3: Hipparcos Input Catalogue (HIC) Identification

## Field 1: Hipparcos Input Catalogue (HIC) running number

The star entries are ordered by increasing HIC number. This numbering basically follows the order of the object's right ascension (equinox J2000.0), independent of declination. The catalogue epoch is J2000.0, although stars with unknown proper motion are referred to their original epoch of measurement. There is one entry in the main catalogue corresponding to each satellite *target*, irrespective of the possible multiplicity of the star. If the star is a component of a known double or multiple system, fields 2-3 provide further information.

Entries which have been suppressed from the observing programme after launch, and therefore result in HIC numbers no longer contained within the Input Catalogue, are listed in Table A1 (page 9).

The Hipparcos Input Catalogue running number was created in 1988, for the first preliminary version distributed to ESA, to ESOC (ESA's European Space Operations Centre), and to the Data Reduction Consortia. This first version was used for the development of the software for operating the satellite, and for reducing the Hipparcos data. One consequence of the Input Catalogue's development is that increasing HIC number does not always correspond precisely to the order of increasing right ascension (field 4) for two reasons:

- from the start of the Input Catalogue work, the star entries have been ordered and numbered for epoch J1990.0, corresponding to the mean epoch adopted for Hipparcos operational considerations, rather than for epoch J2000.0, the epoch adopted for the Input Catalogue publication;
- after the start of the satellite operations, and as a result of verifications made on the early observations, some stars were deleted from the programme, and some corrections to the catalogue entries were made. Where this resulted in a change in position of more than several arcsec, a new HIC running number was allocated to the star in order to provide a clear update at the operational level, and to avoid any possible confusion within the data reductions. These 24 recently-assigned numbers, unrelated to the right ascension of the affected entry, lie between 120 001 and 120 313.

As ordered by right ascension, 33 stars are out of sequence by 10 to 20 places, and 70 by 5 to 9 places. Stars for which the displacement would have been larger than 20 entries have been allocated a number larger than 120 000. The 137 'missing' HIC numbers, resulting from these reallocations or from suppression of the original target after launch, are given in Table A1 (page 9). The 24 'additional' HIC numbers, ordered by increasing running number with their right ascension, and by right ascension, are listed in Table A2/1 (page 10) and Table A2/2 (page 10) respectively.

Table A1: HIC numbers of objects suppressed from the Input Catalogue

| | | | | | |
|---|---|---|---|---|---|
| 672 | 28810 | 48831 | 63158 | 86909 | 106808 |
| 1569 | 31077 | 49190 | 64239 | 87011 | 108292 |
| 3814 | 31441 | 49361 | 65576 | 88138 | 110971 |
| 5200 | 31865 | 49550 | 66518 | 88168 | 111772 |
| 5791 | 31869 | 50224 | 67089 | 89395 | 112054 |
| 8402 | 32720 | 51431 | 67295 | 90057 | 112313 |
| 9584 | 33870 | 52081 | 67920 | 90682 | 112445 |
| 9626 | 33967 | 52754 | 67924 | 90688 | 114095 |
| 11119 | 34232 | 54637 | 68098 | 91787 | 114122 |
| 11916 | 34593 | 55419 | 69217 | 91835 | 115426 |
| 11961 | 35175 | 56283 | 74720 | 92357 | 116059 |
| 12388 | 35292 | 56288 | 76367 | 96513 | 116992 |
| 15088 | 36230 | 56804 | 78626 | 96578 | |
| 15417 | 36353 | 57147 | 78778 | 96685 | |
| 15502 | 37807 | 57354 | 81359 | 97453 | |
| 18193 | 38450 | 58156 | 82616 | 98686 | |
| 18200 | 38452 | 58209 | 82846 | 99630 | |
| 19006 | 39151 | 59097 | 82924 | 100410 | |
| 20461 | 39615 | 59304 | 83437 | 101609 | |
| 24045 | 40207 | 59860 | 83470 | 101775 | |
| 24908 | 41023 | 60606 | 84039 | 101872 | |
| 25384 | 43168 | 60656 | 85550 | 102008 | |
| 26911 | 45172 | 60898 | 85754 | 102079 | |
| 27274 | 47481 | 61056 | 86018 | 104519 | |
| 28058 | 47855 | 63146 | 86337 | 105516 | |

Table A2/1: Supplementary HIC numbers - ordered by running number

| HIC | RA | HIC | RA | HIC | RA |
|---|---|---|---|---|---|
| 120001 | 05 10 42.37 | 120047 | 07 15 18.694 | 120212 | 12 27 48.113 |
| 120002 | 05 59 25.16 | 120071 | 10 07 38.261 | 120229 | 21 58 41.732 |
| 120003 | 06 31 09.68 | 120082 | 11 39 49.882 | 120248 | 06 49 51.093 |
| 120004 | 08 25 48.528 | 120121 | 16 04 48.154 | 120250 | 21 10 01.778 |
| 120005 | 09 14 24.723 | 120132 | 18 00 10.084 | 120276 | 10 02 04.672 |
| 120006 | 14 53 20.95 | 120148 | 20 03 00.888 | 120290 | 16 57 40.942 |
| 120027 | 03 19 13.104 | 120155 | 20 21 31.78 | 120306 | 23 06 44.94 |
| 120046 | 07 03 52.545 | 120159 | 21 22 59.83 | 120313 | 13 45 35.65 |

Table A2/2: Supplementary HIC numbers - ordered by right ascension

| HIC | RA | HIC | RA | HIC | RA |
|---|---|---|---|---|---|
| 120027 | 03 19 13.104 | 120005 | 09 14 24.723 | 120290 | 16 57 40.942 |
| 120001 | 05 10 42.37 | 120276 | 10 02 04.672 | 120132 | 18 00 10.084 |
| 120002 | 05 59 25.16 | 120071 | 10 07 38.261 | 120148 | 20 03 00.888 |
| 120003 | 06 31 09.68 | 120082 | 11 39 49.882 | 120155 | 20 21 31.78 |
| 120248 | 06 49 51.093 | 120212 | 12 27 48.113 | 120250 | 21 10 01.778 |
| 120046 | 07 03 52.545 | 120313 | 13 45 35.65 | 120159 | 21 22 59.83 |
| 120047 | 07 15 18.694 | 120006 | 14 53 20.95 | 120229 | 21 58 41.732 |
| 120004 | 08 25 48.528 | 120121 | 16 04 48.154 | 120306 | 23 06 44.94 |

The following stars in NGC 2516, added to the Hipparcos observing list at a late stage of the measurement programme, are not included in the main catalogue (nor in the above table, nor in the finding chart for NGC 2516 given in Annex 3 of the printed version, where the reference to the adopted numbering system is given):

HIC 120401 = NGC 2516 12
HIC 120402 = NGC 2516 91
HIC 120403 = NGC 2516 11
HIC 120404 = NGC 2516 15

## Field 2: Component(s) considered

A letter (or letters) in this field indicates that the star is part of a known double or multiple system. In the case of a double system with well-separated components, for example, 'A' or 'B' indicates that the entry corresponds to that component. In the case of a 'joint' entry (see field 3) letters indicate which of the components of the system are considered (e.g. 'AB', 'AC', 'APB', etc.).

Due to the nature of the Hipparcos detection system (the diameter of the instantaneous field of view of the primary detection system is about 38 arcsec), two stars or components within 10 arcsec are observed by the satellite as a unique target. If the component separation is larger than 10 arcsec, the number of discrete entries in the main catalogue will correspond to the number of separate observing targets defined within the observing programme. The number of such entries will not necessarily correspond to the number of known components of the double or multiple system, for example in those cases where the fainter component(s) have not been retained for the satellite observations.

## Field 3: Satellite target in case of a joint entry

While the location of the 'satellite target' (the part of the sky on which the detector is centred for the particular observation) is well defined for single stars, being the best estimate of the star's position at the epoch of the satellite observation, the situation is not so straightforward for double or multiple systems. For such systems, the choice of the target position may be:

- the brighter component (designated by the corresponding letter);
- the geometric centre, i.e. the mid-point between two components (designated by $g$);
- the photocentre (designated by $j$).

The nature of the target for the satellite observation depends upon the separation and difference of magnitudes between the components, and has been dictated by considerations of the observation and data reduction procedures (Turon *et al.* 1989b). The brighter component is chosen when the signal perturbation due to the other component(s) can be neglected ($\Delta m \geq 1.2$ mag). For $\Delta m < 1.2$ mag, there are two possibilities according to the geometry of the system and the availability of data for the components. The geometric centre has been selected when the positions and magnitudes of each component are known. A 'geometric centre' may also have been adopted for some multiple systems when the two brightest components dominate the other components. The photocentre has been selected if the separation is such that only one position or magnitude has been obtained for the system as a whole, or in the case of multiple systems. When the component separation is smaller than 3 arcsec, the entry is considered as a photocentre irrespective of the difference of magnitude between the components.

# Fields 4-11: Position (Equinox J2000.0)

The position given here is the position of the satellite target.

## Field 4: Right ascension (hours, minutes, and seconds, equinox J2000.0)

The right ascension, $\alpha$, is given for equinox J2000.0 in the FK5 system (Fricke *et al.* 1988), in hours, minutes, and seconds. The epoch is J2000.0, except when no proper motion is available. The epoch corresponding to the published right ascension is given in field 6.

## Field 5: Declination (degrees, minutes, and seconds, equinox J2000.0)

The declination, $\delta$, is given for equinox J2000.0 in the FK5 system (Fricke *et al.* 1988), in degrees, minutes, and seconds. The epoch is J2000.0, except when no proper motion is available. The epoch corresponding to the published declination is given in field 6.

## Field 6: Epoch for the position

The epoch is for the position given in fields 4-5 and 10-15.

Epoch J2000.0 was chosen for the Input Catalogue publication, corresponding to the 'standard' epoch common to all recently-published catalogues, even though the epoch for the version used for satellite operations was 1990.

If the epoch is different from 2000.0, this indicates that only a single epoch position is available, and therefore no proper motion can be derived. Where relevant, the stated epoch refers to the average of the epochs for $\alpha$ and $\delta$.

## Field 7: Mean error of the right ascension

The mean error of the right ascension, $15 \cos \delta \times$ m.e. in $\alpha$, is given in field 7, expressed in units of arcsec.

## Field 8: Mean error of the declination

The mean error of the declination is given in field 8, expressed in units of arcsec.

## Field 9: Source of position

The positions contained in the Hipparcos Input Catalogue are derived from a wide variety of sources. The correspondence between the letters used in field 9 and the source of the positions, along with the number of stars whose position was taken from the source, is given in Table B1.

As far as possible, all positions and proper motions were initially reduced to the FK4 system for equinox and epoch B1950.0. Subsequently, all data were transformed to the FK5 system and to equinox and epoch J2000.0, i.e. the old standard was replaced by the IAU (1976) system, and the systematic corrections FK5-FK4 were applied as given in Fricke *et al.* (1988). A recent discussion of such transformations can be found in Smith *et al.* (1989).

The above procedure applies also to the new meridian circle measurements, which were performed differentially with respect to the FK5 system for equinox J2000.0. However, for the basic FK5 (Fricke *et al.* 1988) and the FK5 extension (Fricke *et al.* 1991) stars, the J2000.0 data were taken directly from the respective catalogues. Their B1950.0 data (fields 16-19) were then obtained by transforming the J2000.0 FK5 data to equinox and epoch B1950.0 and eliminating all systematic corrections applied in the transition from FK4 to FK5. Therefore, the B1950.0 data of the basic FK5 and FK4 Supplement stars are not identical to those given in the FK4 and FK4 Supplement catalogues since the individual corrections FK5-FK4 are still included.

The data given in fields 4-9 are the result of extensive compilations of previously-available data (Bastian & Lederle 1985; Jahreiß 1988, 1989; Jahreiß *et al.* 1992), and new observations and measurements (Réquième 1982, 1985, 1986, 1988a, 1988b, 1989; Muiños *et al.* 1988; Le Poole *et al.* 1988; Morrison & Gibbs 1985; Turon & Réquième 1984) performed by the INCA Consortium. The new observations were necessary since many of the stars of high astrophysical interest were not contained in the major astrometric catalogues.

The compilation of existing 'astrometric data', i.e. position and proper motion data of good quality, was performed at the Astronomisches Rechen-Institut at Heidelberg, and collected within the CDA (Catalogue des Données Astrométriques, Bastian & Lederle 1985; Jahreiß 1988, 1989). Data were taken from the FK5, FK5 extension, FK4 Sup, PPM, AGK3RN, SRS, NPZT74, N30, 2CP50, GC, AGK3, SSSC, CPC2, SAO, CPC (the given order corresponding roughly to decreasing order of positional accuracy). FK5 data were not used for the faint stars of the FK5 Extension for schedule reasons.

Table B1: Source of positions and proper motions

| Source Code | Source | Abbreviation | No. of Stars Positions | Motions |
|---|---|---|---|---|
| B | General Catalogue (Boss) | GC | 140 | 2 577 |
| C | Cape Photographic Catalogue for 1950.0 | CPC | 18 | 4 738 |
| D | Catalogue of Components of Double and Multiple Stars* | CCDM | 7 596 | 5 867 |
| F | FK5 and FK5 extension ** | FK5/FK5 Ext | 2 523 | 2 526 |
| G | Guide Star Catalog | GSC | 618 | - |
| K | FK4 Supplement | FK4 Sup | 994 | 995 |
| M | Bordeaux and/or Carlsberg automatic meridian circles*** | - / CAMC | 8 221 | 6 075 |
| N | New plate measurements or new proper motions | - | 14 480 | 27 |
| P | Catalogue of Positions and Proper Motions* | PPM | 49 936 | 50 464 |
| R | International Reference Stars (AGK3RN, SRS*) | IRS | 14 695 | 8 918 |
| S | Smithsonian Astrophysical Observatory Star Catalogue | SAO | 163 | 14 341 |
| T | Cape Catalogue of Faint Stars | CF | - | 889 |
| X | Miscellaneous | - | 114 | 3 524 |
| Y | Sydney Southern Star Catalogue | SSSC | 4 786 | 4 260 |
| 2 | Second Cape Photographic Catalogue**** | CPC2 | 12 900 | 7 259 |
| 3 | Catalogue of Standard Stars Based on the N30 System | N30 | 277 | 381 |
| 5 | Second Cape Photographic Catalogue for 1950.0 | 2CP50 | 748 | 1 416 |
| | [Entry without corresponding information] | [ - ] | [ - ] | [3 952] |

* provisional version
** faint stars of the FK5 Extension were not included for schedule reasons
*** of these two sources, only the Carlsberg Meridian Catalogues give proper motions
**** preliminary version (courtesy W. Nicholson & C. de Vegt)

In addition to this compilation work, and once the list of stars requiring new positional data was established, extensive campaigns of new observations and measurements were initiated and organised according to the capabilities of the European institutes involved in the INCA Consortium. From south to north, in equatorial coordinates, contributions were made as follows:

- for $-90° < \delta < -17°.5$: measurements for this zone were performed on glass copies of the ESO Quick Blue and ESO/SERC J Sky Survey Schmidt plates. The measurements were shared by the Bordeaux, Royal Greenwich, Marseille, and Leiden Observatories, which measured respectively some 100 000, 5 400, 15 000, and 5 000 (Input Catalogue and 'reference') stars;
- for $-25° < \delta < 0°$: observations of about 2500 'non-astrometric stars' with the Carlsberg Automatic Meridian Circle at La Palma;
- for $-5° < \delta < +81°$: observations of about 5500 stars with the Bordeaux Observatory automatic meridian circle;
- for $+80° < \delta < +90°$: measurements on plates taken with an astrograph at the Hamburg Observatory.

In addition, 950 SAO stars with poor positions in the zone $-40° < \delta < 0°$ were observed with the Carlsberg Automatic Meridian Circle.

All collected data, compiled and newly obtained from ground-based observations or measurements, were then processed in a global and homogeneous way (Jahreiß 1989). The selection of the best data for each star was made following their expected positional accuracy at epoch 1990, the adopted mean observing epoch of Hipparcos. This choice strongly depends on the errors of the available proper motions. Only for a very small number of catalogues (FK5, PPM, AGK3RN, GC, and the new meridian circle observations) are the positional error estimates given individually for each star. For other catalogues and for plate measurements, the central epoch (when individual epochs are not available), the mean error at that epoch, and the proper motion error (when a proper motion is available) had to be evaluated. For regions south of -17°.5, plate measurements were made for all proposed stars, yielding a significant overlap with the CDA. This allowed further comparisons and checks between the different sources of data. At the end of the campaigns of new observations and measurements, a few hundred stars remained without reliable positions. Positions (and in a few cases magnitudes) were taken from the Guide Star Catalog (Lasker *et al.* 1990).

In parallel with the global observing and measuring campaigns, specific measurement programmes were devoted to stars in galactic open clusters, for which careful attention had to be given to the problems of star identification, and to stars in double and multiple systems. Stars in galactic open clusters were measured on plates taken with an astrograph at Hamburg Observatory for the northern hemisphere, and at the Münster University Astronomy Department for the southern hemisphere (Tucholke 1988, 1989). An additional verification was made for stars south of $-17^\circ.5$ by the comparison of the identifications and positions obtained respectively on astrograph and on Schmidt plates (from measurements made at Bordeaux).

For stars in double and multiple systems, the situation was more problematical than for single stars for two main reasons. First, it was not straightforward to cross-identify their components with the stars in large astrometric catalogues. Second, in many cases discrepancies exist between the individual positions given in these catalogues for each component, and the relative positions given in catalogues of double and multiple systems. As a consequence, an extensive programme of compilation and analysis of the existing data was required, before defining the necessary measuring programmes (Dommanget 1985, 1988, 1989). The work was organised by the team of the Observatoire Royal de Belgique at Brussels, and the collected and newly obtained data were incorporated into the CCDM (Catalogue of Components of Double and Multiple stars, Dommanget *et al.*, in preparation). The construction of this catalogue was undertaken in Brussels starting from 1981 (Dommanget 1983) and subsequently improved with newly compiled and observed data. CCDM positions are the result of a compilation from a large number of other sources: CDA positions were used when there was no doubt about component identification. Many other sources were compiled and new measurements obtained within the framework of the Double and Multiple Star Working Group of the INCA Consortium. This work has been presented in detail by Dommanget (1989), and is also summarised in the introduction to Annex 1. Depending on the characteristics of the stellar system (separation and difference of magnitude between components) the positional and proper motion data were processed differently: systems with separation smaller than 3 arcsec, and the bright components of systems where the expected Hipparcos signal perturbation due to the presence of secondaries was negligible, were processed as single stars. In most other cases, all data were taken from a preliminary version of the CCDM. A few hundred systems with very poor positions were processed individually, in a collaboration between Meudon and Brussels using new ground-based measurements, meridian circle observations and, in some cases, the GSC.

## Field 10: Right ascension (decimal degrees, equinox J2000.0)

The right ascension, $\alpha$, is given for equinox J2000.0 in the FK5 system (Fricke *et al.* 1988), in decimal degrees. The epoch is J2000.0, except when no proper motion is available. The epoch corresponding to the published right ascension is given in field 6.

## Field 11: Declination (decimal degrees, equinox J2000.0)

The declination, $\delta$, is given for equinox J2000.0 in the FK5 system (Fricke *et al.* 1988), in decimal degrees. The epoch is J2000.0, except when no proper motion is available. The epoch corresponding to the published declination is given in field 6.

# Fields 12-15: Other coordinates

## Field 12: Galactic longitude

The galactic longitude is given in decimal degrees.

## Field 13: Galactic latitude

The galactic latitude is given in decimal degrees.

## Field 14: Ecliptic longitude

The ecliptic longitude is given in decimal degrees.

### Field 15: Ecliptic latitude

The ecliptic latitude is given in decimal degrees.

## Fields 16-19: Position (Equinox B1950.0)

### Field 16: Right ascension (equinox B1950.0, hours, minutes, seconds)

The right ascension in field 16 is given in the FK4 system for equinox B1950.0, in hours, minutes, and seconds. The epoch is 1950.0 except when no proper motion is available. In this case, the epoch is given in field 6. See fields 4-9 for further explanation.

### Field 17: Declination (equinox B1950.0, degrees, minutes, seconds)

The declination in field 17 is given in the FK4 system for equinox B1950.0, in degrees, minutes, and seconds. The epoch is 1950.0 except when no proper motion is available. In this case, the epoch is given in field 6. See fields 4-9 for further explanation.

### Field 18: Right ascension (equinox B1950.0, decimal degrees)

The right ascension in field 18 is given in the FK4 system for equinox B1950.0, in decimal degrees. The epoch is 1950.0 except when no proper motion is available. In this case, the epoch is given in field 6. See fields 4-9 for further explanation.

### Field 19: Declination (equinox B1950.0, decimal degrees)

The declination in field 19 is given in the FK4 system for equinox B1950.0, in decimal degrees. The epoch is 1950.0 except when no proper motion is available. In this case, the epoch is given in field 6. See fields 4-9 for further explanation.

## Fields 20-24: Proper Motion

### Field 20: Proper motion in right ascension (equinox J2000.0)

The proper motion in right ascension, $15\mu_\alpha \cos\delta$, is expressed in units of arcsec per year. The equinox is J2000.0. The proper motion is given in the system of the FK5 whenever the necessary information was available.

### Field 21: Proper motion in declination (equinox J2000.0)

The proper motion in declination, $\mu_\delta$, is expressed in units of arcsec per year. The equinox is J2000.0. The proper motion is given in the system of the FK5 whenever the necessary information was available.

### Field 22: Mean error of the proper motion in right ascension

The mean error of the proper motion in right ascension $(15\mu_\alpha cos\delta)$ is given in field 22. It is expressed in units of milli-arcsec per year.

## Field 23: Mean error of the proper motion in declination

The mean error of the proper motion in declination ($\mu_\delta$) is given in field 23. It is expressed in units of milli-arcsec per year.

## Field 24: Source of proper motion

The proper motions in the Hipparcos Input Catalogue are derived from a wide variety of sources. The correspondence between the letters used in field 24 and the source of the proper motions, along with the number of stars whose proper motion was taken from this source, is given in Table B1 (page 13).

For most stars the source of the proper motions and positions is identical. In addition, data were taken from high proper motion surveys, in particular from the Luyten (LHS, NLTT, L, and LP) and Giclas surveys, either via the SIMBAD data base or through data newly included in the INCA data base. These proper motions have relatively large errors, of the order of 0.02 arcsec per year. However, if they are used for stars whose positions were newly obtained either by plate measurements (mean epoch around 1976) or by meridian circle observations (mean epoch 1986), the final accuracy obtained at epoch 1990 for the input to the Hipparcos observations (Jahreiß 1989) was still within the margin tolerated by the satellite operation requirements.

Consistency checks were performed when independent machine-readable positions were available for epochs sufficiently well separated in time, and some new proper motions were individually computed using first epoch positions from the Astrographic Catalogue (AC, see van Biesbroeck 1963). About 4 000 entries of the Hipparcos Input Catalogue remain without known proper motions.

# Fields 25-31: Photometry

## Field 25: Magnitude in the Hipparcos photometric system, $H_\mathrm{P}$

The 'Hipparcos magnitude', designated as $H_\mathrm{P}$, is defined by the pass-band of the Hipparcos main detection chain, which ranges from 340 to 850 nm. This broad-band system yields magnitudes close to the visual $V$ magnitude, but shows residuals with respect to $V$ especially for red stars. For the prediction of the $H_\mathrm{P}$ magnitude with the specified accuracy (necessary for the optimum allocation of satellite observing time, which varies strongly with magnitude especially towards the fainter stars), it was necessary to obtain both a magnitude and a colour index for each programme star. Transformation formulae were established to obtain $H_\mathrm{P}$ from the magnitudes and colours available or newly observed in various photoelectric systems (Grenon 1988b). $H_\mathrm{P}$ magnitudes given in the Input Catalogue have been derived using on-ground calibration of the detection chain and preliminary transformation formulae (which will be refined for the derivation of the $H_\mathrm{P}$ magnitudes from the satellite data). An approximate relation valid for O-F stars and G-K giants in terms of the Johnson $V$ magnitude and $B-V$ colour index is:

$$H_\mathrm{P} = V + 0.408(B-V) - 0.130(B-V)^2$$

For variable stars, further information is given in field 26, and in fields 39-44.

## Field 26, 1st character: Variability code

The variability code provides information on known or suspected variable stars. Table V1 lists the possible values (all amplitudes are in $H_\mathrm{P}$):

Details of the treatment of variable stars within the Hipparcos programme have been given by Mennessier & Figueras (1989) and Mennessier *et al.* (1992).

Table V1: Variability code

| | |
|---|---|
| blank | the star is not a known or suspected variable |
| 1 | suspected variable, with a suspected amplitude variation smaller than 2 mag |
| 2 | suspected variable, with a suspected amplitude variation larger than 2 mag |
| 3 | known variable, with an amplitude variation larger than 0.2 mag |
| 4 | known variable, with large amplitude (> 2 mag) for which an ephemeris was necessary |
| 5 | known variable, with an amplitude variation smaller than 0.2 mag |

A blank field (not a known or suspected variable) does not mean that the star is *not* variable. The only stars known to be not variable at the level of about 0.02 mag are those with a flag C as photometric standard stars, as described by the second character of field 26. Some stars were suspected variable by some observers, while subsequent observations have suggested that they are very stable. For such stars, their variability code may not be blank even though they are classified as photoelectric standard stars.

Code '3': stars in this category have been assigned a unique magnitude for the purposes of the Hipparcos observations, despite their (possibly large) amplitude variation. The definition of this unique magnitude depends on the type of variability (it may correspond to the maximum or minimum, or to a mean or weighted magnitude) and is specified by the second character of field 44.

Code '4': for these large-amplitude variable stars, the use of an ephemeris was necessary for specifying the observing time to be allocated to the Hipparcos observations. In this case, a weighted magnitude is given in field 25. As specified by the second character of field 44, the weighted magnitude used for stars in this category corresponds to:

$$[0.33\times \text{ magnitude at maximum luminosity } + 0.67\times \text{ magnitude at minimum luminosity}].$$

Code '5': these stars, for which the amplitude of variation is smaller than 0.2 mag, are processed in the same way as non-variable stars.

## Field 26, 2nd character: Photoelectric standard stars

Two categories of photoelectric standards are distinguished:

- **C**: the star is a photoelectric standard with confirmed long-term stability (with three or more independent measurements over several years);
- **S**: the star is a secondary photoelectric standard star (based on two independent measurements).

The photometric accuracies required for a programme star to be considered as a photometric standard range from 0.020 to 0.026 mag (standard error depending on the $H_{\rm P}$ magnitude, Grenon 1989b). The photoelectric standard stars are used to calibrate the magnitudes derived from the detection chains of the main mission (Hipparcos magnitude, $H_{\rm P}$) and of the Tycho experiment ($B_{\rm T}$ and $B_{\rm T}$ magnitudes), and for monitoring the detector responses (including their colour dependence), the linearity of these responses, and their evolution throughout the mission (Grenon 1985b, 1989b). In the final version of the Hipparcos Input Catalogue, there are 10 822 C stars and 3 068 S stars.

### Field 27: $V$ magnitude

### Field 28: Error of $V$ magnitude

### Field 29: $B - V$

### Field 30: Error of $B - V$

### Field 31: Source of photometry

The photometric data given in the Hipparcos Input Catalogue are derived from a wide variety of sources. The correspondence between the letters used in field 31 and the source of the photometry, along with the number of stars whose photometry was taken from this source, is given in Table B2.

Table B2: Source of photometry

| Source Code | Source | No. of Stars |
|---|---|---|
| A | Photographic $B$ or $V$ from SIMBAD or proposers; colour from spectral type | 45 445 |
| C | $V$ magnitude derived from CAMC; colour estimated from spectral type | 13 315 |
| D | Joint systems (double or multiple) with combined or joint magnitude and colour | 8 009 |
| P | Photoelectric photometry from GCPD, new measurements or proposers | 44 634 |
| V | Variable stars (amplitude larger than 0.2 mag) | 2 165 |
| X | Miscellaneous | 4 641 |

Stars were proposed for Hipparcos observation on the grounds of their scientific interest, irrespective of the accuracy of available data on position or photometry. The photometric data given by the proposers were taken either from the SIMBAD data base or from various sources of very heterogeneous quality. Of the 214 000 proposed stars, $UBV$ photoelectric photometry was available for about 26 000 stars, while approximate photographic photometry was available for about 32 000 other stars. In addition, it was possible to derive acceptable $B$ and $V$ magnitudes from the available estimates of blue and visual magnitudes for some 139 000 stars. For the remaining 17 000 stars, the photometric information was not reliable. These stars belonged primarily to the faint end of the proposed programmes. The observational effort was concentrated on stars having a high probability of being finally retained in the Input Catalogue considering the results of the successive numerical simulations of the mission. The observing lists were updated after each simulation.

As for positional data, the data given in fields 25-31 are the result of extensive compilations (Mermilliod & Mermilliod 1985; Egret 1985; Grenon 1989a), and new observations (Grenon 1985a, 1988a, 1988b; Torra *et al.* 1988). The photometric contents of the INCA data base, initially identical to those of SIMBAD, were updated in successive steps:

- compilation of photoelectric multi-colour photometry. This work was prepared in Lausanne and Geneva (Mermilliod & Mermilliod 1985; Grenon 1989a) within the framework of the updating of the General Catalogue of Photometric Data (GCPD, Hauck *et al.* 1990). $B$ and $V$ magnitudes (Johnson system) and the $H_P$ magnitudes were computed from the data collected in the GCPD for various multi-colour photometric systems after a determination of the transformation formulae from these systems to the Johnson and Hipparcos systems (Grenon 1985b). Identifiers used in the GCPD were incorporated into the INCA data base, facilitating the inclusion of the $B$, $V$ and $H_P$ magnitudes;

- new observations in photoelectric multi-colour photometry. This work was organised in Geneva (Grenon 1985a, 1988a, 1988b, 1989a) in order to obtain a Hipparcos magnitude and a colour for all stars for which the available data were not reliable, and in order to perform ground-based observations as far as possible complementary to the outputs expected from Hipparcos and Tycho. The observations were made using multi-colour photometry, with the system selected according to the spectral type in order to be able to derive some basic physical parameters (such as $T_{\rm eff}$, $\log g$, [M/H]) in addition to the magnitudes. The selection was made as follows (Grenon 1985a):

```
Spectral type:   O     B5    AF    G2    G5    K0    K5    M     RNC
               |   UBV    |                  |   UBV    |
                   |     Strömgren       |
                   |  Walraven   |               |        VRI         |
                   |            Geneva          |
```

  All observations were published separately, and only the resulting $H_{\rm P}$, $V$ and $B-V$ magnitudes are given here. They represent the result of the combined effort of astronomers from Belgium, Denmark, France, Germany, The Netherlands, Spain and Switzerland (Grenon 1989a). The data were introduced into the INCA data base following the same procedure as for the compiled photoelectric data described above. Among these new observations, special mention should be made of the visual magnitudes obtained by the Carlsberg Automatic Meridian Circle at La Palma: it provides magnitudes in a band similar to the Johnson $V$ and with an accuracy only slightly lower than that achieved with classical photometric techniques. The magnitudes published in the Carlsberg Catalogues Vols 1-3 (1985, 1986, 1987) were reduced to Johnson $V$ using a colour term derived from the spectral type, and were retained when no other photoelectric data were available;

- improvement of non-photoelectric data. For the remaining stars, data from the SIMBAD data base or from the original programmes proposed for Hipparcos observation were used as a basis. The magnitudes available in SIMBAD are the result of a hierarchy of catalogue sources and of a unification of systems performed by Ochsenbein (1974). When the sources available for both $B$ and $V$ magnitudes were not identical, the more reliable magnitude was retained, and the colour of the stars was computed from the spectral type and a newly-derived extinction model (Arenou *et al.* 1992);

- for components of double and multiple systems, the photometric data were derived as described above when the components are processed as single stars (i.e. systems with separation smaller than 3 arcsec or systems with secondary components that have a negligible impact on the quality of the Hipparcos observations). In the other cases, new compilations (Oblak & Mermilliod 1988) and new observations (Oblak 1988, Argue & Irwin 1988) were performed. Some magnitudes were taken from the GSC (Lasker *et al.* 1990). In the absence of additional data, the magnitudes were taken from the preliminary version of the CCDM, which were, in turn, taken from the Index Catalogue of Visual Double Stars (IDS, Jeffers *et al.* 1963). Most often the CCDM magnitudes are visual estimates but, especially for the faintest systems, they may be photographic. The 'magnitude difference' given in field 49 was computed from the CCDM, and may not be consistent with data given in field 27 for the separate components.

# Fields 32-33: Spectral Type

## Field 32: Spectral type and luminosity class

Spectral types were taken either from SIMBAD or from other miscellaneous sources, and thus follow various classification systems (MK, HD, etc). In the case of the MK classification system of Morgan *et al.* (1943), the spectral type, luminosity class, and peculiarity code are given with the following designations:

- O, B, A, F, G, K, M plus sub-type (0, 1, etc), and sometimes intermediate sub-type (for example F7.2, F7.5, F7.7) for the spectral types of 'normal stars';
- R, S, N, C for carbon stars;
- DB, DA, DF, DG for white dwarfs;
- WR, WN, WC for Wolf-Rayet stars;

For luminosity class, the following designations are used: Ia0, Ia, Iab, Ib for supergiants, II for bright giants, III for giants, IV for sub-giants, V for dwarfs. The sub-dwarfs are either noted **sd** followed by the spectral type, or class VI.

Peculiarities of the spectra are noted in lower case letters (**e** for emission lines, **m** for enhanced metallic lines, **n** for nebulous lines, **nn** for very nebulous, **p** for peculiarity in the chemical composition, **s** for sharp lines, **sh** for the existence of a shell, **v** for variations in the spectrum, **w** for weak lines, etc). **CN** indicates stars with an anomaly in the cyanogen abundance.

The following signs are also used:

| | |
|---|---|
| **:** | indicates some doubt about the determination of the spectral type or luminosity class; |
| / | between two spectral types or luminosity classes indicates Survey; |
| **-** | between two spectral types or luminosity classes indicates that the parameter is intermediate between those given; |
| +... | indicates composite spectra (the second spectrum is no given); |
| ... | indicates truncated spectra (the source catalogue gives more details on the spectra, such as peculiarities). |

In the INCA data base, the spectral types were initially taken from the SIMBAD data base or from the original proposal when the data were not available in SIMBAD. The spectral types available in SIMBAD in 1985, at the time of creation of the INCA data base, were mainly taken from the Michigan Spectral Survey (Houk & Cowley 1975; Houk 1978, 1982). Volume 4 of the MSS (Houk & Smith-Moore 1988) was made available to the INCA Consortium in advance of publication by courtesy of N. Houk, and integrated into the INCA data base in 1988. For variable stars, many spectral types were taken from the Fourth Edition of the General Catalogue of Variable Stars (GCVS, Kholopov 1985, 1987). Furthermore, many additions and corrections were made from the various programmes proposed for Hipparcos observation, or from individual searches in the literature. Confidence tests were performed from a correspondence between the spectral types and the colour index when both $B$ and $V$ magnitudes were considered reliable, and many resulting corrections were made either to the spectral types or to the photometric data.

The above description does not cover all MK designations which may be found in field 32. A more complete description, with the criteria used for classification, can be found in the introduction to the Michigan Spectral Survey.

## Field 33: Source of the spectral type data

The spectral type and luminosity class information in the Hipparcos Input Catalogue is derived from a variety of sources. The correspondence between the letters used in field 33 and the source of the data, along with the number of stars whose data was taken from this source, is given in Table B3.

Table B3: Source of spectral types

| Source Code | Source | No. of Stars |
|---|---|---|
| 1 | Michigan Spectral Survey, Vol. 1 (Houk & Cowley 1975) | 12 348 |
| 2 | Michigan Spectral Survey, Vol. 2 (Houk 1978) | 9 375 |
| 3 | Michigan Spectral Survey, Vol. 3 (Houk 1982) | 11 232 |
| 4 | Michigan Spectral Survey, Vol. 4 (Houk & Smith-Moore 1988) | 10 304 |
| K | Fourth Edition of the General Catalogue of Variable Stars (GCVS) | 929 |
| S | SIMBAD | 57 081 |
| X | Miscellaneous | 13 993 |
| | [Entry without corresponding information] | [2 947] |

# Fields 34-36: Parallax

## Field 34: Parallax

The parallax is expressed in units of milli-arcsec.

## Field 35: Probable error of parallax

The probable error of the (trigonometric) parallaxes is expressed in units of milli-arcsec. No errors are quoted for the dynamical parallaxes.

## Field 36: Type of parallax

The following abbreviations are used: 'T' for trigonometric, 'D' for dynamical.

There are 5 485 trigonometric parallaxes in the Input Catalogue, which were taken, via SIMBAD, from the General Catalogue of Trigonometric Parallaxes (Jenkins 1952) and its supplement (Jenkins 1963). There are also 389 dynamical parallaxes, taken from Dommanget (1967) and Dommanget & Nys (1982). Since the New General Catalogue of Trigonometric Parallaxes (van Altena *et al.*, in preparation) was not available at the time of publication of the Input Catalogue, no more recent parallaxes are given here.

# Fields 37-38: Radial Velocity

## Field 37: Radial velocity

The radial velocity is expressed in units of km/s (with positive values indicating recession).

## Field 38, 1st character: Quality of radial velocity

The 'quality' given in this field is derived from information in the GCRV (Wilson 1953) and the catalogue of Evans (1978), according to which the estimated mean probable errors are '*based upon three factors: the number of observations, the dispersion of the spectrograph used, and the interagreement of separate determinations*'. The radial velocities are characterised by five such values:

- **a**: 0.5 km/s
- **b**: 1.2 km/s
- **c**: 2.5 km/s
- **d**: 5 km/s
- **e**: not given

## Field 38, 2nd character: Source of radial velocity

There are three principal sources of radial velocity data used in the present compilation: the General Catalogue of Stellar Radial Velocities (Wilson 1953) and the catalogue of Evans (1978), both accessed via the SIMBAD data base, and the catalogue of Barbier-Brossat (1989) which was later included in the INCA data base. The correspondence between the letters used in this field and the source of the data, along with the number of stars whose radial velocity was taken from this source, is given in Table B4.

Table B4: Source of radial velocities

| Source Code | Source | No. of Stars |
|---|---|---|
| B | Barbier-Brossat (1989) | 4 094 |
| E | Evans (1978) | 4 866 |
| W | GCRV (Wilson 1953) | 9 616 |
| X | Miscellaneous | 899 |

The data given here are very incomplete as they do not include most radial velocities obtained by cross-correlation methods (not yet published or published in small lists). Furthermore, they do not include the results of the ongoing observations organised in parallel with the work of preparation of the Hipparcos Input Catalogue. In the northern hemisphere, a radial velocity programme for early-type stars brighter than $m_{\rm pg} = 9.0$ mag has been in progress since mid-1982 using objective-prism techniques and a slit spectrograph (Fehrenbach & Burnage 1985; Grenier 1988; Burnage *et al.* 1988). In the southern hemisphere, three ESO key-programmes have been in progress since the end of 1988, two for early-type stars (one for stars nearer than 100pc, one for stars in OB and early-A associations), and one for late-type stars using the Coravel spectrometer (one measurement has already been obtained for each of the 20 000 or so stars on the observing programme). These three programmes are described by Gerbaldi *et al.* (1990), Hensberge *et al.* (1990), and Mayor *et al.* (1990).

# Fields 39-44: Variability

Variable stars, especially those with large amplitude, raise specific problems for the Hipparcos observations. The optimum 'target observing time' is determined from the Hipparcos magnitude, and this observing time varies strongly as a function of magnitude. The allocation of excessive observing time to a star is inefficient, while allocating too short an observing time would result in less accurate astrometric parameters at the end of the mission (Mennessier & Baglin 1988). Ephemerides are therefore used for large-amplitude variable stars, while a unique magnitude is chosen for the others (Mennessier 1985). The limiting amplitude for requiring the use of ephemerides was taken as $\Delta H_{\rm P} = 2$ mag. For stars with a smaller amplitude, a unique magnitude was chosen according to the type of variability. The choice is indicated as a code in the second character of field 44.

## Field 39: Variable star name

The names of the variable stars are taken from the Fourth Edition of the General Catalogue of Variable Stars (GCVS, Kholopov 1985, 1987) or, where the NSV number is given, from the New Catalogue of Suspected Variable Stars (Kholopov 1982). The names were included in the INCA data base from SIMBAD, and some cross-identifications were corrected.

## Field 40: Type of variability

The data on variability type are taken from the GCVS and NSV Catalogues (see field 39). The abbreviations given in Table V2 follow the main classes of variability (eruptive, pulsating, rotating, cataclysmic, eclipsing, and X-ray variable stars). If the 3-letter code used here is an abbreviation of the type of variability given in the two source catalogues, the complete designation is given in Table V2 (page 23) between brackets.

Table V2: Types of variability

| Code | Description | Class of Variability |
|---|---|---|
| ACV | $\alpha^2$ Canum Venaticorum variables | rotating variable |
| ACY | $\alpha$ Cygni variables (ACYG) | pulsating variable |
| BCE | $\beta$ Cephei variables (BCEP) | pulsating variable |
| BY | BY Draconis variables | rotating variable |
| CEP | Cepheids | pulsating variable |
| CST | constant stars (formally believed variable by some observer) | |
| CW | W Virginis variables | pulsating variable |
| CWA | W Virginis variables (periods $>$ 8 days) | pulsating variable |
| CWB | W Virginis variables (periods $<$ 8 days) | pulsating variable |
| DCE | $\delta$ Cephei variables (DCEP and DCEPS) | pulsating variable |
| DSC | $\delta$ Scuti variables (DSCT and DSCTC) | pulsating variable |
| E | (E+, E/ ..) | eclipsing binary |
| EA | Algol type (EA+, EA/ ..) | eclipsing binary |
| EB | $\beta$ Lyrae type (EB/ ..) | eclipsing binary |
| ELL | rotating ellipsoidal variables (ELL+.. or /..) | rotating variable |
| EW | W Ursae Majoris type (EW/ ..) | eclipsing binary |
| FKC | FK Comae Berenices variables (FKCOM) | rotating variable |
| GCA | $\gamma$ Cassiopeiae variables (GCAS) | eruptive variable |
| I | irregular variables (I, IA, In, InT, Is) | eruptive variable |
| IN | irregular variables (INA, INAT, INB, INSA, INSB, INST, INT) | eruptive variable |
| IS | irregular variables (ISA, ISB) | eruptive variable |
| L | slow irregular variables (L, LB, LC) | pulsating variable |
| M | Mira Ceti variables | pulsating variable |
| NA | fast novae | cataclysmic variable |
| NB | slow novae | cataclysmic variable |
| NC | slow novae | cataclysmic variable |
| NL | nova-like variables | cataclysmic variable |
| NR | recurrent novae | cataclysmic variable |
| PVT | PV Telescopii type (PVTEL) | pulsating variable |
| RCB | R Coronae Borealis type | eruptive variable |
| RR | RR Lyrae type (RR, RRAB, RRC) | pulsating variable |
| RS | RS Canum Venaticorum type | eclipsing binary |
| RV | RV Tauri type (RV, RVA, RVB) | pulsating variable |
| SDO | S Doradus type (SDOR) | eruptive variable |
| SR | semi-regular variables (also SRA, SRB, SRC, SRD) | pulsating variable |
| SXA | SX Arietis type (SXARI) | rotating variable |
| SXP | SX Phœnicis type | pulsating variable |
| UGS | SS Cygni type (UGSS) | cataclysmic variable |
| UV | UV Ceti type | eruptive variable |
| WR | Wolf-Rayet variables | eruptive variable |
| XNG | X-ray nova-like system | X-ray binary |
| XP | X-ray pulsar | X-ray binary |
| ZAN | Z Andromedae type (ZAND) | cataclysmic variable |
| ZZA | Hydrogen ZZ Ceti type | pulsating variable |

## Field 41: Period of variation

The period of variation is expressed in days.

The data are taken from the GCVS and NSV Catalogues (see field 39). In the GCVS, the dates of the last observed maxima or minima are also given for most stars.

## Field 42: $V$ magnitude at maximum luminosity

## Field 43: $V$ magnitude at minimum luminosity

For observations with Hipparcos, and for the preparatory numerical simulations of the mission, $H_{\rm P}$ magnitudes at maximum and minimum luminosities were computed from the available luminosity curves (Mennessier & Figueras 1989). However, it was considered more useful to the future user to give here the $V$ magnitudes at maximum and minimum luminosities, rather than the $H_{\rm P}$ magnitudes. These magnitudes are those of the GCVS except for some stars for which more precise observations were available, and for the Mira stars. Indeed the GCVS gives the maximum and minimum magnitudes observed for each star. Due to the significant variability of Miras from one cycle to another one, it was considered more appropriate to give here the mean magnitudes of the luminosity extrema. A comparison of GCVS magnitudes with the mean magnitudes of the luminosity extrema, obtained from 30 years of observation for about 200 Miras by Campbell (1955), gives the following statistical relations (where $P$ is the period, and $V_{\rm GCVS(max)}$ and $V_{\rm GCVS(min)}$ are the magnitudes at maximum and minimum luminosities given in the GCVS respectively):

$$\begin{aligned} V_{\rm mean\ at\ maximum} &= V_{\rm GCVS(max)} + 0.32 + 0.11\frac{P}{100} \\ V_{\rm mean\ at\ minimum} &= V_{\rm GCVS(max)} - 0.6 \end{aligned}$$

## Field 44, 1st character: Coded error of $V$ magnitude at maximum/minimum luminosity

This code gives an estimation of the accuracy of the $V$ magnitudes at maximum and minimum luminosity given in fields 42 and 43. This estimate includes the errors of individual measurements and the possible variability of the maxima and minima. This information is given for stars with a variability code of 3 or 4 (as specified by the first character of field 26), whenever the necessary information on the luminosity curve was available. The code can take the values given in Table V3.

Table V3: Coded error of the $V$ magnitudes

| | |
|---|---|
| 1 | $\leq 0.2$ mag |
| 2 | $0.2 - 0.5$ mag |
| 3 | $0.5 - 1.0$ mag |
| 4 | $\geq 1.0$ mag |

## Field 44, 2nd character: Code specifying the magnitudes and colour given in fields 25, 27, 29

The choice of the unique magnitude used for the determination of the target observing time with Hipparcos depends on the shape of the luminosity curve of each type of variable star. It can be the magnitude at minimum or maximum luminosity, a mean, or a weighted magnitude (Mennessier & Figueras 1989). This information is given for stars with a variability code of 3 or 4 (as specified by the first character of field 26), whenever the necessary information on the luminosity curve was available. It is coded as given in Table V4.

Table V4: Magnitudes and colours given in fields 25, 27, 29

| Code | magnitude used |
|---|---|
| 1 | magnitude at minimum luminosity |
| 2 | magnitude at maximum luminosity |
| 3 | mean magnitude |
| 4 | weighted magnitude (0.33 max + 0.67 min) for most pulsating stars |
| 5 | weighted magnitude (0.85 max + 0.15 min) for eclipsing systems |

# Fields 45-50: Multiplicity

For double or multiple systems for which one or more components are contained in the Hipparcos observing programme (see fields 2-3), fields 45-50 provide concise information (position angle, separation and magnitude difference, when available) describing the system.

The values given in fields 47-49 refer to the two components specified in field 46. If the entry is a primary component, fields 46 to 49 are blank.

The CCDM and HIC numbers provide the link between the main catalogue and Annex 1. More comprehensive explanations and data on the relevant double and multiple systems, and details of the data contained in these fields, are given in Annex 1.

The data given in fields 45-50 are taken from a provisional version of the 'Catalogue of the Components of Doubles and Multiple Stars' (CCDM, Dommanget *et al.*, in preparation).

## Field 45: CCDM number

## Field 46: Components considered

The first letter corresponds to the 'reference' component, with respect to which the separation and difference of magnitude are computed.

## Field 47: Position angle (degrees) between the components considered

Letters such as 'NF', 'SP' may be used.

## Field 48: Separation (arcsec) between the components considered

## Field 49: Magnitude difference between the components considered

The 'magnitude difference' given in this field is computed from the available provisional version of the CCDM. It may not be consistent with data given in field 27 for separate components. If the 'reference' component is fainter than the second one, this difference is negative.

### Field 50: Information on orbital systems

The characters in this field have the following meaning:

- **O**: the orbit of the system is known.
- **A**: the star is a known astrometric binary.
- *****: the astrometric binary is also a member of an orbital system (details are given in Annex 1).

## Fields 51-60: Identifications

During the preparation of the Hipparcos Input Catalogue, numerous cross-identifications and systematic checks of these identifications were carried out, resulting in many individual corrections being included in the INCA data base. The basic initial material was taken from the SIMBAD data base. Some of the most important identifiers are given here. The order adopted for the choice of identifications reflects the nature of the stars included in the Hipparcos observing programme (e.g. catalogues of nearby stars, of high proper motion stars, etc.).

In the following format descriptions, NNN... denotes a running number; HH, DD, and MM (and MM.m) denote hours, degrees and minutes respectively; LLL and BB denote galactic longitude and latitude respectively; VV (and VV.v) denote 'volume'; ZZ indicates the declination zone; FFF... denotes a 'field' number; and A indicates a component.

In case of joint entry, the identifier with the 'smaller' running number is given, irrespective of the brightness of the components (e.g. BD +50 222 is given, not BD +50 223; Mel 22 800 is given, not Mel 22 801; GL NNNA is given, not GL NNNB).

### Field 51: BD number

The format is ± ZZ NNNNa. The last character of this field is used for additional BD stars, i.e. stars with suffix 'a' or 'b' (these stars were added to the BD Catalogue after the original numbering was made). Such identifications do not imply that the entry is a component of a double or multiple system.

### Field 52: CD number

The format is ± ZZ NNNNN

### Field 53: CPD number

The format is ± ZZ NNNNN

Reliability tests were performed to check the coherence between the zones of the DM (BD, CD, and CPD) numbers and the declination at the epoch of the catalogue (1855 for BD, 1875 for CD and CPD), and also to check that the numbers increased with increasing right ascension at the epoch of the catalogue. Resulting corrections (from typing errors in the numbers or in the coordinates, originating from the source catalogue themselves or from an intermediate transcription, or confusion between the CD and CPD identifiers) have been included in the Hipparcos Input Catalogue.

### Field 54: HD/HDE number

Cross-identifications are given to stars in the HD Catalogue (Cannon & Pickering 1918-24, with numbers in the range 1-225 300), and its two extensions: HDE numbers in the range 225 301-272 150 (Cannon 1925-36) and 272 151-359 083 (Cannon & Walton Mayall 1949) respectively.

As for the DM identification numbers, reliability tests were performed to check that the HD numbers increased with increasing right ascension at the epoch of the catalogue (1900). Resulting corrections have been included in the Hipparcos Input Catalogue. The format is NNNNNN.

## Field 55: FK5/FK5 Ext/FK4 Sup, or IRS (AGK3R/SRS) number

Cross-identifications are given to stars in the Fifth Fundamental Catalogue (FK5, Fricke *et al.* 1988), its extension (FK5 Ext, Fricke *et al.* 1991), the FK4 Supplement (FK4 Sup, Fricke 1963), and to the International Reference Stars (IRS), which comprises the AGK3R (Smith 1980) and SRS (Smith *et al.* 1990) Catalogues. Abbreviation, format, range, number of identifiers in the Hipparcos Input Catalogue are given for each catalogue, in Table I1.

Table I1: FK4-FK5, IRS catalogues

| Abbreviation | Catalogue | Format | Range | No. of stars |
|---|---|---|---|---|
| A | AGK3R | NNNNN | 1-21 499 | 19 777 |
| F | FK5 | NNNN | 1- 1 670 | 1 535 |
| F | FK5 Ext | NNNN | 2 001- 6 125 | 3 103 |
| K | FK4 Sup | NNNN | 2 001- 3 997 | 995 |
| S | SRS | NNNNN | 1-20 495 | 15 472 |

Cross-identifications are included according to the following hierarchy: FK5, FK5 Ext, FK4 Sup, AGK3R, SRS (e.g. if the star appears in both the AGK3R and SRS catalogues, only the AGK3R number is given). Note that the FK5 stars are identical to the FK4 stars. Stars with FK4 Sup numbers are not contained in the FK5 extension.

## Field 56: AGK3/CPC number

Cross-identifications are given to stars in the AGK3 Catalogue for $\delta > -2.5°$ (Dieckvoss *et al.* 1975), and otherwise to stars in the CPC Catalogue (Jackson & Stoy 1954-68). The format of each catalogue is given in Table I2.

Table I2: AGK3-CPC catalogues

| Catalogue | | Format | |
|---|---|---|---|
| AGK3 | $\pm$ | DD | NNNN |
| CPC | | VV | NNNNN |
| | or | VV.v | NNNNN |
| Other* | | 0 | NNNNN |

* Note that the CPC Catalogue does not cover the declination zone $-40° > \delta > -52°$. Cross-identifications for stars in this interval are given following the system adopted within the SIMBAD data base: a zero (0) is adopted in place of the volume number (in contrast to $\pm 00$ for stars from the AGK3 with zero declination) with cross-identifications made to stars from this zone from the older Cape Zone Catalogue (Gill & Hough 1923). These numbers, in the range 1 - 20843, correspond to those also used by the Yale Photographic Catalogues (known as the 'Yale Zone' Catalogue, YZ) in the zone $-40° > \delta > -50°$ (YZ does not cover the declination zone $-50° > \delta > -60°$).

## Field 57: SAO number

Cross-identifications are given to stars in the SAO Catalogue (Smithsonian Institute 1966). The format is: NNNNNN.

## Field 58-59: Other principal identifiers

These fields provide up to two of the identifiers: GL, GJ, G, LHS, LTT, LP, L, BPM, CF, McC (according to this hierarchy). Abbreviation, reference and format are given, for each catalogue, in Table I3.

Table I3: Abbreviations and format of catalogues used in fields 58 and 59

| Abbreviation | Catalogue | Reference | Format |
|---|---|---|---|
| BPM | Bruce Proper Motion Survey | Luyten (1963) | NNNNN |
| CF | Cape Faint Stars | Spencer-Jones & Jackson (1939) | NNNNN |
| G | Lowell Proper Motion Survey | Giclas *et al.* (1959-78) | FFF-NNN |
| GL | Catalogue of Nearby Stars | Gliese (1969) | NNNA or NNN.NA |
| GJ | " extensions | Gliese & Jahreiß (1979) | NNNNA |
| L | Luyten Catalogue | Luyten (1942) | FFFF-NNNN |
| LHS | Luyten Half-Second Catalogue | Luyten (1979) | NNNN |
| LP | Luyten Palomar Survey | Luyten (1963-87) | FFFF-NNN |
| LTT | Luyten Two-Tenths Catalogue | Luyten (1957) | NNNNN |
| McC | McCormick Observatory | Vyssotsky (1943-58) | NNN |

## Field 60: Other identifiers

Cross-identifications are given for stars in galactic open clusters, in the Large and Small Magellanic Clouds, or in the following catalogues: C*, IRC, PK, and WD.

Table B5 (page 30) gives the list of galactic open clusters names and abbreviations for which at least one star is included in the Input Catalogue. The reference of the adopted numbering system in each cluster is given under each chart (see Annex 3 of the printed version). Usual names for some clusters are given hereafter: $\alpha$ Persei (Melotte 20), Coma Berenices (Melotte 111), h Persei (NGC 869), $\chi$ Persei (NGC 884), Hyades (Melotte 25), Pleiades (Melotte 22), Praesepe (NGC 2632), $\zeta$ Sculptoris (Blanco 1).

Identifications in the Large and Small Magellanic Clouds are given in Table I4.

Table I4: Identifiers in the Magellanic Clouds

| Abbreviation | Catalogue | Reference | Format |
|---|---|---|---|
| Sk | Large Magellanic Cloud | Sanduleak (1969a) | - DD NNN |
| Sk | Small Magellanic Cloud | Sanduleak (1968, 1969b) | NNN |

Other possible cross-identifications are given in Table I5.

Table I5: Others identifiers

| Abbreviation | Catalogue | Reference | Format |
|---|---|---|---|
| C* | Cool Carbon stars | Stephensen (1973) | NNNN |
| IRC | Caltech $2\mu$ Survey | Neugebauer *et al.* (1969) | ±DDNNN |
| PK | Planetary Nebulae | Perek & Kohoutek (1967) | LLL±BB NN |
| WD | White Dwarfs | McCook & Sion (1977) | HHMM±DD |

# Fields 61: Miscellaneous Information

## Field 61, 1st character: Survey star and identification chart

The letters in this field have the following meaning:

- **S**: the star is a 'survey' star
- **C**: an identification chart is provided within the faint star Atlas (Annex 2, Volume 7 of the printed version)
- **T**: the star is a 'survey' star, and an identification chart is provided within the faint star Atlas

The survey is the basic list of bright stars added to and merged with the total list of proposed stars (see 'Star Selection', page 5). Its limiting magnitude is a function of the star's spectral type and galactic latitude, and is defined by:

$$\begin{aligned} V_{\rm lim} &\leq 7.9 + 1.1 \sin|b| \quad && \text{for spectral types earlier or equal to G5,} \\ V_{\rm lim} &\leq 7.3 + 1.1 \sin|b| \quad && \text{for spectral types later than G5.} \end{aligned}$$

(if no spectral type was available, the break was taken at $B - V = 0.8$ mag).

Where there was considered to be some possible doubt as to the identification of the star (e.g. for faint stars, for crowded zones, or for components of double or multiple systems), charts were constructed from the Guide Star Catalog (Lasker *et al.* 1990).

Table B5: Galactic open clusters: names and abbreviations

| Abbrev. | Cluster Name | Clusters with Stars in the Hipparcos Input Catalogue | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| NGC | New General | 129 | 188 | 225 | 457 | 581 | 654 | 659 | 663 | 744 | 752 | 869 |
| | Catalogue | 884 | 957 | 1027 | 1039 | 1245 | 1342 | 1444 | 1502 | 1528 | 1545 | 1647 |
| | | 1662 | 1750 | 1778 | 1807 | 1857 | 1893 | 1901 | 1907 | 1912 | 1960 | 1977 |
| | | 2099 | 2129 | 2168 | 2169 | 2204 | 2232 | 2244 | 2251 | 2264 | 2281 | 2286 |
| | | 2287 | 2301 | 2323 | 2335 | 2343 | 2353 | 2354 | 2360 | 2362 | 2383 | 2395 |
| | | 2414 | 2422 | 2423 | 2437 | 2439 | 2447 | 2451 | 2467 | 2477 | 2482 | 2483 |
| | | 2489 | 2516 | 2527 | 2533 | 2539 | 2546 | 2547 | 2548 | 2567 | 2571 | 2579 |
| | | 2632 | 2669 | 2670 | 2682 | 2925 | 3033 | 3114 | 3228 | 3293 | 3324 | 3496 |
| | | 3532 | 3572 | 3603 | 3680 | 3766 | 4103 | 4337 | 4349 | 4439 | 4463 | 4609 |
| | | 4755 | 5138 | 5281 | 5316 | 5460 | 5606 | 5617 | 5662 | 5749 | 5822 | 5823 |
| | | 6025 | 6067 | 6087 | 6124 | 6167 | 6169 | 6178 | 6193 | 6204 | 6208 | 6231 |
| | | 6242 | 6249 | 6250 | 6281 | 6322 | 6383 | 6405 | 6425 | 6475 | 6494 | 6514 |
| | | 6530 | 6531 | 6546 | 6604 | 6611 | 6613 | 6618 | 6633 | 6664 | 6694 | 6709 |
| | | 6716 | 6755 | 6811 | 6823 | 6830 | 6834 | 6866 | 6871 | 6882 | 6883 | 6910 |
| | | 6913 | 6940 | 7039 | 7062 | 7063 | 7086 | 7092 | 7128 | 7142 | 7160 | 7209 |
| | | 7235 | 7243 | 7261 | 7380 | 7510 | 7654 | 7686 | 7788 | 7789 | 7790 | 7822 |
| Ber | Berkeley | 87 | | | | | | | | | | |
| Biu | Biurakan | 2 | | | | | | | | | | |
| Bla | Blanco | 1 | | | | | | | | | | |
| Boc | Bochum | 4 | 13 | | | | | | | | | |
| Col | Collinder | 96 | 121 | 132 | 140 | 185 | 197 | (205*) | 228 | 258 | 463 | |
| Hog | Hogg | 14 | 15 | (16**) | 17 | 18 | | | | | | |
| IC | Index Catalogue | 348 | 1795 | 1805 | 1848 | 2391 | 2395 | 2581 | 2602 | 2944 | 4651 | 4665 |
| | | 4725 | 4756 | 4996 | 5146 | | | | | | | |
| Kin | King | 19 | | | | | | | | | | |
| Lyn | Lyngå | 2 | | | | | | | | | | |
| Mrk | Markarian | (6***) | 18 | 50 | | | | | | | | |
| Mel | Melotte | 20 | 22 | 25 | 111 | 227 | | | | | | |
| Pis | Pismis | 4 | 12 | 16 | 20 | | | | | | | |
| Rup | Ruprecht | 44 | 98 | 108 | | | | | | | | |
| Sto | Stock | 2 | 7 | 14 | | | | | | | | |
| Tru | Trumpler | 1 | 2 | 9 | 10 | 15 | 16 | 17 | 18 | 27 | 33 | 37 |
| Upg | Upgren | 1 | | | | | | | | | | |

* Collinder 205 = Markarian 18
** Hogg 16 is also called Basel 19
*** Markarian 6 = Stock 7

### Field 61, 2nd character: Notes

The letter ‘N’ in this field indicates that a note is given in this file.

Table A3: Solar system objects observed by Hipparcos

(a) Minor planets

| No. | Name | No. | Name | No. | Name |
|---|---|---|---|---|---|
| 1 | Ceres | 18 | Melpomene | 63 | Ausonia |
| 2 | Pallas | 19 | Fortuna | 88 | Thisbe |
| 3 | Juno | 20 | Massalia | 115 | Thyra |
| 4 | Vesta | 22 | Kalliope | 129 | Antigone |
| 5 | Astraea | 23 | Thalia | 192 | Nausikaa |
| 6 | Hebe | 27 | Euterpe | 196 | Philomela |
| 7 | Iris | 28 | Bellona | 216 | Kleopatra |
| 8 | Flora | 29 | Amphitrite | 230 | Athamentis |
| 9 | Metis | 30 | Urania | 324 | Bamberga |
| 10 | Hygiea | 31 | Euphrosyne | 349 | Dembowska |
| 11 | Parthenope | 37 | Fides | 354 | Eleonora |
| 12 | Victoria | 39 | Laetitia | 451 | Patientia |
| 13 | Egeria | 40 | Harmonia | 471 | Papagena |
| 14 | Irene | 42 | Isis | 511 | Davida |
| 15 | Eunomia | 44 | Nysa | 532 | Herculina |
| 16 | Psyche | 51 | Nemausa | 704 | Interamnia |

(b) Other solar system objects

Satellite of Jupiter: Europa
Satellites of Saturn: Iapetus and Titan

(Note that additional solar system objects, in particular Uranus and Neptune, are observed by the Hipparcos satellite's 'star mapper' as part of the Tycho experiment)

# Catalogue Abbreviations

| | |
|---|---|
| AC | Astrographic Catalogue, see van Biesbroeck (1963) |
| ADS | New General Catalogue of Double Stars within 120° of the North Pole, Aitken (1932) |
| AGK3 | Catalogue of Positions and Proper Motions North of $-2°.5$, Vols 1-8, Dieckvoss *et al.* (1975) |
| AGK3R | Catalogue of Reference Stars for the AGK3, Smith (1980) |
| AGK3RN | Unpublished version of AGK3R, supplied with proper motions by T.E. Corbin |
| BD | Bonner Durchmusterung, Schönfeld (1886), Argelander (1903) |
| BPM | Bruce Proper Motion Survey, Luyten (1963) |
| CAMC | Carlsberg Meridian Catalogues Vols 1-4 (1985-87) |
| CCDM | Catalogue of Components of Double and Multiple Stars, Dommanget *et al.* (in preparation) |
| CD | Cordoba Durchmusterung, Thome (1892, 1894, 1900, 1914); Perrine (1932) |
| CDA | Catalogue des Données Astrométriques, see Bastian & Lederle (1985) |
| CF | Cape Catalogue of Faint Stars, Spencer-Jones & Jackson (1939) |
| CPC | The Cape Photographic Catalogue for 1950.0, Jackson & Stoy (1954-68) |
| CPC2 | Second Cape Photographic Catalogue, see Nicholson *et al.* (1984) |
| 2CP50 | Second Cape Catalogue for 1950.0, Stoy (1968) |
| CPD | Cape Photographic Durchmusterung, Gill (1903) |
| CSI | Catalogue of Stellar Identifications, Ochsenbein (1978) |
| C* | Cool Carbon Stars Catalogue, Stephensen (1973) |
| DM | Durchmusterung (BD, CD or CPD) |
| FK4 | Fourth Fundamental Catalogue, Fricke *et al.* (1963) |
| FK4 Sup | Preliminary Supplement to FK4, Fricke (1963) |
| FK5 | Fifth Fundamental Catalogue, Fricke *et al.* (1988) |
| FK5 Ext | The FK5 extension. New Fundamental Stars, Fricke *et al.* (1991) |
| G | Lowell Proper Motion Survey, Giclas *et al.* (1959-78) |
| GC | General Catalogue of 33342 Stars for the Epoch 1950, Boss *et al.* (1937) |
| GCPD | General Catalogue of Photometric Data, Hauck *et al.* (1990) |
| GCRV | General Catalogue of Radial Velocities, Wilson (1953) |
| GCVS | General Catalogue of Variable Stars, Kholopov ed. (1985) |
| GJ | Extension to the Catalogue of Nearby Stars, Gliese & Jahreiß (1979) |
| GL | Catalogue of Nearby Stars, Gliese (1969) |
| GSC | Guide Star Catalog of the Space Telescope Science Institute, Lasker *et al.* (1990) |
| HD | Henry Draper Catalogue, Cannon & Pickering (1918-49) |
| HDE | Henry Draper Extensions, Cannon (1925-36), Cannon & Walton Mayall (1949) |
| HIC | Hipparcos Input Catalogue, ESA-SP1136 (1992) |
| IDS | Index of Double Stars, Jeffers *et al.* (1963) |
| IRC | Caltech 2m Survey, Neugebauer *et al.* (1969) |
| IRS | International Reference Stars, comprises AGK3R and SRS Catalogues |
| L | Luyten Catalogue, Luyten (1942) |
| LHS | Luyten Half-Second Catalogue, Luyten (1979) |
| LP | Luyten Palomar Catalogue (proper motion survey with the 48-inch Schmidt), Luyten (1963-87) |
| LTT | Luyten Two-Tenth Catalogue, Luyten (1957) (see also NLTT) |
| McC | McCormick Observatory, Vyssotsky (1943-58) |
| MSS | Michigan Spectral Survey Vols 1-4, Houk *et al.* (1975, 1978, 1982, 1988) |
| NLTT | New Luyten Two-Tenth Catalogue Vols I-IV, Luyten (1979-80) |
| NPZT74 | Northern PZT Stars Catalog, Yasuda *et al.* (1982) |
| NSV | New Catalogue of Suspected Variable Stars, Kholopov ed. (1982) |
| N30 | Catalogue of 5268 Standard Stars, 1950.0, based on the Normal System N30, Morgan (1952) |
| Perth 70 | A Catalogue of Positions of 24900 Stars, Høg *et al.* (1976) |
| PK | Planetary Nebulae, Perek & Kohoutek (1967) |
| PPM | Positions and Proper Motions: Stars north of -2°.5 declination, Röser & Bastian (1991) |
| SAO | Smithsonian Astrophysical Observatory Star Catalogue (1966) |
| SIMBAD | Data base of the Centre de Données Astronomiques de Strasbourg, Egret *et al.* (1991) |
| Sk | Stars in the Large & Small Magellanic Clouds (Sanduleak 1968, 1969a,b) |
| SRS | Southern Reference System Catalogue, Smith *et al.* (1990) |
| SSSC | Sydney Southern Star Catalogue, King & Lomb (1983) |
| WD | Catalogue of White Dwarfs, McCook & Sion (1977) |
| WDS | Washington Catalog of Visual Double Stars 1984.0, Worley & Douglass (1984) |
| Woolley | Catalogue of Stars within 25pc of the Sun, Woolley *et al.* (1970) |
| YZ | Yale Photographic Catalogues, Trans. Astron. Obs. Yale University, Vols 3-32 (1926-83) |

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# Notes

These notes include:

- references to erroneous data or incorrect identifications found in the literature;
- information for double or multiple systems not contained in the CCDM;
- other identifications, where appropriate;
- any inconsistencies noted from early results of the satellite data processing.

| | |
|---|---|
| 40 | joint system: NGC 7822 11 (A)/ 12 (B) |
| 183 | although bright, this star is not in SAO |
| 223 | component B = NSV 3 |
| 350 | erroneously identified with CPD -57° 10423 and CPD -58° 8130 in the literature |
| 592 | central star of a reflection nebula |
| 755 | erroneous value for proper motion in right ascension in GC and SAO |
| 1021 | central star of a reflection nebula |
| 1158 | component A = AD Cet |
| 1501 | component B is variable |
| 1543 | component A = V377 Cas |
| 1860 | other identification: LHS 1065. LHS 1066 (also G 242-52, V=14 mag) is at 11arcsec |
| 1902 | globular cluster 47 Tucanae |
| 2242 | double system: $\theta = 215°$, $\rho = 36$ arcsec, $\Delta V = 3.2$ mag |
| 2355 | component A = GN And |
| 3243 | erroneously identified with GJ 1017 in the literature |
| 3856 | error in HIC identification: LHS 124 is about 20 arcsec NNE of the target |
| 4189 | double system with LP 990-139: $\theta = 202°$, $\rho = 5$ arcsec, $\Delta V = 0.9$ mag |
| 4427 | component A = gam Cas |
| 4655 | component A = WW Psc |
| 4831 | double system: $\theta = 170°$, $\rho = 61$ arcsec, $\Delta V = 1$ mag. Component B = CD -48° 249 |
| 5348 | component A = zet Phe |
| 5745 | erroneously identified with CPD -51° 179 in the literature |
| 7024 | component A = SY Phe |
| 7410 | double system: $\theta = 120°$, $\rho = 90$ arcsec, $\Delta V = 1.5$ mag |
| 8832 | component A = gam Ari |
| 8924 | not LP 528-136 (error in HIC identification). Proper motion from ESO plates and AC |
| 9230 | component A = CI Eri |
| 9258 | component A = AA Cet |
| 9383 | component A = X Tri |
| 9711 | not detected by the satellite at the expected position or with the expected intensity |
| 9786 | erroneously identified with SAO 167562 in the literature |
| 9879 | erroneously identified with G 274-149 and LTT 1101 in the literature |
| 10280 | component A = TZ Tri |
| 10704 | component A = V438 Per |
| 10826 | component A = omi Cet; component P = VZ Cet |
| 11174 | component A = V440 Per |
| 11317 | other identification: Woolley 9081 |
| 11569 | component A = iot Cas |
| 11604 | other identification: Markarian 6 28 |
| 11607 | other identification: Markarian 6 23 |
| 11612 | other identification: Markarian 6 18 |
| 11769 | component A = V425 Per |
| 12035 | double system: $\theta = 30°$, $\rho = 38$ arcsec, $\Delta V = 0.9$ mag |
| 12097 | erroneously identified with BD +19° 381 in the literature |
| 12101 | erroneously identified with CD -48° 698 and CPD -49° 132 in the literature |
| 12495 | component A = V482 Cas |
| 12981 | component A = CU Eri |
| 13112 | uncertain magnitude |
| 13215 | this star is SW of LHS 1452, proper motion close to zero |
| 13218 | erroneously quoted as a double system in the literature |
| 13290 | erroneously identified with V500 Cas in the literature |

| | |
|---|---|
| 14879 | component B = NSV 1074 |
| 15087 | erroneously identified with AGK +52° 334 in the literature |
| 15286 | erroneous proper motion in SAO, correct in NLTT |
| 15474 | component A = tau 04 Eri |
| 15803 | double system: $\theta = 215°$, $\rho = 21$ arcsec, $\Delta B = 1.1$ mag |
| 16490 | double system on Palomar plates, $\theta = 100°$, $\rho = 20$ arcsec, $\Delta B = 2$ mag |
| 16713 | component A = IX Per |
| 16846 | component A = V711 Tau |
| 17448 | component A = omi Per |
| 17465 | joint system: IC 348 14/20 |
| 17572 | joint system: Melotte 22 800 (B)/ 801 (A) |
| 17600 | component A = S For |
| 17923 | joint system: Melotte 22 2500 (C)/ 2503 (B)/ 2507 (A) |
| 18322 | erroneously identified with BD +12° 530 in the literature |
| 18377 | not detected by the satellite at the expected position or with the expected intensity |
| 18972 | component A = RW Tau |
| 19201 | component A = AG Per |
| 19261 | joint system: Melotte 25 11 (A)/ 12 (B) |
| 19272 | joint system: NGC 1502 1 (A)/ 4 (C) |
| 19424 | component A = U Men |
| 19849 | erroneously identified with DY Eri in the literature |
| 20338 | companion of HIC 20342, $\theta = 330°$, $\rho = 61$ arcsec |
| 20342 | companion of HIC 20338 |
| 20632 | double system: $\theta = 2°$, $\rho = 28$ arcsec, $\Delta V = 2.1$ mag |
| 20648 | component A = V776 Tau |
| 20990 | component A = UX Tau |
| 21185 | not LHS 193 (error in HIC identification) |
| 21222 | triple system: AB: $\theta = 320°$, $\rho = 34$ arcsec, $\Delta B = 1.1$ mag<br>AC: $\theta = 170°$, $\rho = 27$ arcsec, $\Delta B = 1.2$ mag |
| 21256 | erroneously identified with McC 744 or G 8-23 in the literature |
| 21278 | component A = EH Eri |
| 21492 | not detected by the satellite at the expected position or with the expected intensity |
| 21763 | component A = DM Eri |
| 21986 | component B = DW Eri |
| 22105 | other identification: Melotte 25 8067 |
| 22176 | other identification: Melotte 25 164 |
| 22260 | component A = XZ Men |
| 23873 | component A = RW Aur |
| 24575 | component A = AE Aur |
| 25050 | component A = UV Aur |
| 25281 | component A = eta Ori |
| 25473 | component A = psi Ori |
| 25733 | component A = LY Aur |
| 25921 | not detected by the satellite at the expected position or with the expected intensity |
| 25966 | double system: $\theta = 55°$, $\rho = 25$ arcsec, $\Delta m = 0.6$ mag |
| 26220 | joint system: NGC 1977 587 (B = V1016 Ori)/ 595 (D = BM Ori)/ 584 (H) |
| 26950 | not detected by the satellite at the expected position or with the expected intensity |
| 27656 | erroneously identified with CD -41° 2185 in the literature |
| 27989 | component A = alf Ori |
| 28380 | component A = tet Aur |
| 28436 | erroneously identified with CPD -65° 633 in the literature |
| 29055 | probably fainter than indicated: 11.22 < V < 12.11 according to GCVS |
| 29100 | not detected by the satellite at the expected position or with the expected intensity |
| 29170 | component B = NSV 2849 |
| 29385 | optical pair with CD -35° 2745 (satellite target is the faint component at the NW) |
| 29401 | component A = V638 Mon |
| 29655 | component A = eta Gem |
| 30214 | component A = FR CMa |
| 30920 | component B = V577 Mon |
| 31070 | not detected by the satellite at the expected position or with the expected intensity |
| 31153 | error in HIC identification (BD +14° 1330 is at $\alpha = 06\ 32\ 12.0$, $\delta = +14\ 27\ 50$) |

| | |
|---|---|
| 31292 | physical pair with HIC 31293, $\rho = 23$ arcsec, $\theta = 215°$, $\Delta B = 1.0$ mag |
| 31293 | physical pair with HIC 31292 |
| 31349 | erroneous proper motion in AGK3 |
| 31437 | not detected by the satellite at the expected position or with the expected intensity |
| 32270 | erroneous position in NLTT |
| 32349 | Sirius. The adopted proper motion is the combination of the proper motion of the centre of gravity of the system and of the orbital motion. The adopted value is valid for the mean epoch of the Hipparcos mission. An ephemeris is given in the introduction to Annex 1 (field 5) |
| 32504 | other identification: Collinder 121 37 |
| 33324 | erroneously identified with CPD -56° 1692 in the literature |
| 34117 | not detected by the satellite at the expected position or with the expected intensity |
| 34234 | component A = V569 Mon |
| 34299 | erroneously identified with BD -04° 1825 in the literature |
| 34301 | component A = FN CMa |
| 35381 | double system: $\theta = 180°$, $\rho = 12$ arcsec (this entry is the northern component) |
| 35793 | component A = VY CMa |
| 36188 | component A = bet CMi |
| 36347 | double system from ESO plate measurements, $\Delta B = 3$ mag |
| 36649 | not detected by the satellite at the expected position or with the expected intensity |
| 37279 | Procyon. The adopted proper motion is the combination of the proper motion of the centre of gravity of the system and of the orbital motion. The adopted value is valid for the mean epoch of the Hipparcos mission. An ephemeris is given in the introduction to Annex 1 (field 5) |
| 38014 | not detected by the satellite at the expected position or with the expected intensity |
| 38256 | not detected by the satellite at the expected position or with the expected intensity |
| 38398 | not detected by the satellite at the expected position or with the expected intensity |
| 38575 | erroneously identified with SAO 116086 in the literature |
| 38692 | joint system: Trumpler 9 62/63 |
| 38957 | component A = V Pup |
| 38966 | joint system: NGC 2516 130 (A)/ 210 (B) |
| 39329 | component A = QQ Pup |
| 39652 | erroneously identified with CD -39° 3991 in the literature |
| 39656 | erroneously identified with CD -39° 3987 in the literature |
| 39826 | erroneous proper motion in AGK3 |
| 39840 | erroneously identified with BD -16° 231 in the literature |
| 40831 | double on ESO plates, $\rho = 23$ arcsec |
| 40935 | not detected by the satellite at the expected position or with the expected intensity |
| 40977 | component A = V Cnc |
| 41361 | component A = NO Pup |
| 41979 | erroneously identified with BD +20° 2113 and AGK +20° 985 in the literature |
| 42366 | erroneously identified with CD -50° 1691 in the literature |
| 42712 | component A = HX Vel |
| 42988 | other identification: IC 2391 46 |
| 43071 | other identification: IC 2391 49 |
| 43406 | error in HIC identification (LHS 2056 is about 30 arcsec SW of the target) |
| 43851 | erroneously identified with NSV 4310 in the literature |
| 44232 | other identification: Collinder 205 2 |
| 44243 | other identification: Collinder 205 1 |
| 45170 | component P = GL 337B |
| 45792 | not detected by the satellite at the expected position or with the expected intensity |
| 45908 | erroneously identified with CPD -59° 2351 in the literature |
| 45954 | erroneous position in NLTT |
| 46586 | not detected by the satellite at the expected position or with the expected intensity |
| 46806 | component A = R Car |
| 46899 | erroneously identified with BD -10° 2681 in the literature |
| 47145 | component A = IM Vel |
| 47480 | erroneously identified with LHS 2169 (which is at 66 arcsec, $\theta = 220°$) in the literature |
| 47694 | component A = IP Vel |
| 47727 | component A = W UMa |
| 48218 | component B = DG Leo |
| 49616 | erroneously identified with GL 385 in the literature |

50640 not detected by the satellite at the expected position or with the expected intensity
50829 component B = NSV 4836
51612 companion at $\rho = 25$ arcsec, $\Delta m = 2$ mag
51802 component A = TX Leo
52526 component A = QZ Car
54131 not detected by the satellite at the expected position or with the expected intensity
54299 not detected by the satellite at the expected position or with the expected intensity
54360 component A = V815 Cen
54365 not detected by the satellite at the expected position or with the expected intensity
54724 erroneous proper motion in SAO
55052 double on ESO plates, $\theta = 75°$, $\rho = 12.4$ arcsec, $\Delta B > 2$ mag
55106 component A = SV Crt
56327 erroneously identified with BD -11° 3122 in the literature
56518 component A = V763 Cen
56991 component A = UZ Cen
57936 component A = bet Hya
59219 erroneously identified with BD +22° 233 in the literature
59683 component A = AH Vir
60197 joint system: Melotte 111 72 (B)/ 73 (A)
60417 erroneously identified with CPD -66° 1212 in the literature
60500 component A = FK Vir
60557 joint system: NGC 4337 17 (A)/ 18 (B)
60878 this component B is at 1196.3 arcsec from A
60936 3C 273
61826 erroneously identified with BD -15° 3342 in the literature
62038 not detected by the satellite at the expected position or with the expected intensity
62967 not detected by the satellite at the expected position or with the expected intensity
63494 component B = NSV 6053
64094 component A = tet Mus
65182 not detected by the satellite at the expected position or with the expected intensity
65977 component A = V701 Cen
66187 not detected by the satellite at the expected position or with the expected intensity
66307 erroneous proper motion in CPC2
66747 not detected by the satellite at the expected position or with the expected intensity
66934 erroneous proper motion in SAO
67090 optical double system
67261 component A = V766 Cen
67487 erroneous position in CPC2
68264 erroneously identified with CPD -40° 4376 in the literature
68702 component A = bet Cen
69454 erroneously identified with CPD -56° 5362 and IDS 14064 S 5617 B in the literature
69972 erroneously identified with CPD -58° 5564 in the literature
70958 not detected by the satellite at the expected position or with the expected intensity
70890 Proxima Centauri
71681-71683 = $\alpha$ Centauri. The adopted proper motion is the combination of the proper motion of the centre of gravity of the system and of the orbital motion. The adopted value is valid for the mean epoch of the Hipparcos mission. An ephemeris is given in the introduction to Annex 1 (field 5)
71766 not detected by the satellite at the expected position or with the expected intensity
71876 component A = DL Dra
72436 erroneous right ascension in NLTT
72659 component A = ksi Boo
73695 component A = 44 Boo; component B = i Boo (variable component)
74192 component A = T TrA
74332 double system: $\theta = 50°$, $\rho = 25$ arcsec, $\Delta V = 3.6$ mag
74386 component A = FL Ser
74838 double system: $\theta = 165°$, $\rho = 21$ arcsec, $\Delta V = 1.4$ mag
75695 component A = bet CrB
75727 component A = GO Lup
76196 component A = TW Dra
76276 component A = del Ser

| | |
|---|---|
| 76334 | not detected by the satellite at the expected position or with the expected intensity |
| 76377 | component A = R Nor |
| 76952 | component A = gam CrB |
| 77157 | not detected by the satellite at the expected position or with the expected intensity |
| 77895 | double system: $\theta = 100°$, $\rho = 25$ arcsec, $\Delta V = 3.0$ mag |
| 78233 | double system: $\theta = 25°$, $\rho = 20$ arcsec, $\Delta V = 3.5$ mag |
| 78528 | not detected by the satellite at the expected position or with the expected intensity |
| 78999 | erroneously identified with BD -05° 4242 in the literature |
| 79080 | C component = V856 Sco |
| 79126 | proper motion derived from the position in the GSC and in AC |
| 79212 | component A = EQ TrA |
| 79607 | component A = TZ CrB |
| 79734 | double system: $\theta = 185°$, $\rho = 15$ arcsec, $\Delta V = 3.5$ mag |
| 79844 | not detected by the satellite at the expected position or with the expected intensity |
| 80463 | component A = ome Her |
| 80509 | double system: $\theta = 205°$, $\rho = 24$ arcsec, $\Delta V = 3.0$ mag |
| 80706 | not detected by the satellite at the expected position or with the expected intensity |
| 80763 | component A = alf Sco |
| 80851 | double system: $\theta = 35°$, $\rho = 26$ arcsec, $\Delta V = 0.9$ mag |
| 81455 | CD -29° 12698, not CD -29° 12689 (error in YZ and SAO) |
| 81490 | not detected by the satellite at the expected position or with the expected intensity |
| 81519 | component A = WW Dra |
| 81538 | error in HIC position: target is 25 arcsec from BD+52 1986 ($\alpha = 16\ 39\ 73.88$, $\delta = +52\ 37\ 37.7$) |
| 81582 | double system: $\theta = 25°$, $\rho = 28$ arcsec, $\Delta V = 2.5$ mag |
| 81589 | component A = R Ara |
| 81960 | double system: $\theta = 50°$, $\rho = 30$ arcsec, $\Delta V = 0.2$ mag |
| 82321 | component A = V637 Her |
| 83059 | component A = RV Sco |
| 83070 | double system: $\theta = 225°$, $\rho = 15$ arcsec, $\Delta V = 3.6$ mag |
| 84289 | component A = V655 Her |
| 84293 | component A = AK Her |
| 84345 | component A = alf Her |
| 84573 | component A = u Her |
| 84708 | double system: $\theta = 360°$, $\rho = 16$ arcsec, $\Delta B = 0.3$ mag |
| 85302 | component A = V640 Her |
| 85467 | component A = V750 Ara |
| 85622 | component B = NSV 8918 |
| 86062 | erroneous proper motion in SAO |
| 86101 | error on BD number in YZ |
| 86789 | double system: $\theta = 300°$, $\rho = 11$ arcsec, $\Delta V = 2.6$ mag |
| 86873 | component A = SZ Sgr |
| 86892 | double system: $\theta = 10°$, $\rho = 23$ arcsec, $\Delta V = 2.9$ mag |
| 87345 | component A = RY Sco |
| 87482 | double system: $\theta = 205°$, $\rho = 10$ arcsec, $\Delta V = 3.8$ mag |
| 87616 | component A = V906 Sco |
| 87937 | Barnard's star |
| 88069 | component A = V1647 Sgr |
| 88438 | not detected by the satellite at the expected position or with the expected intensity |
| 88495 | satellite target is CPC 21.1 4198 = CPD -64° 3774, probably not L 157-110 |
| 88643 | double system: $\theta = 190°$, $\rho = 11$ arcsec, $\Delta V = 3.0$ mag |
| 88827 | erroneously identified with BD +01° 3597 in the literature |
| 89057 | double system: $\theta = 135°$, $\rho = 25$ arcsec, $\Delta V = 4.2$ mag |
| 89156 | component B = NSV 10363 |
| 89163 | double system: $\theta = 20°$, $\rho = 10$ arcsec, $\Delta V = 2.4$ mag |
| 89299 | companion of AGK +49° 1397 = SAO 47320, $\rho = 14$ arcsec |
| 89642 | component A = eta Sgr |
| 89908 | component A = phi Dra |
| 90008 | this star is CD -47° 12228, not CD -47° 12218 |
| 90048 | triple system: AB: $\theta = 40°$, $\rho = 20$ arcsec, $\Delta V > 3$ mag |

| | |
|---|---|
| | AC: $\theta = 315°$, $\rho = 28$ arcsec, $\Delta V = 1.8$ mag |
| 90441 | component A = d Ser |
| 90474 | probably fainter than expected |
| 90539 | double system: $\rho < 5$ arcsec from Palomar plates |
| 90959 | variability and photoelectric data are not coherent |
| 91256 | double system: $\rho = 9$ arcsec from ESO plates |
| 91389 | component A = X Oph |
| 91924 | not detected by the satellite at the expected position or with the expected intensity |
| 92221 | double system: $\theta = 305°$, $\rho = 12$ arcsec, $\Delta V = 0.3$ mag |
| 92414 | component A = AD Her |
| 92499 | erroneous proper motion in SAO, correct in CPC |
| 92536 | not detected by the satellite at the expected position or with the expected intensity |
| 93124 | component A = FF Aql |
| 93605 | component A = SU Sgr |
| 94155 | double system: $\theta = 320°$, $\rho = 20$ arcsec, $\Delta V = 3.9$ mag |
| 94197 | not detected by the satellite at the expected position or with the expected intensity |
| 94368 | erroneously identified with CPD -56° 7638 in the literature |
| 94827 | component A = ES Vul |
| 94982 | component A = V1208 Aql |
| 95024 | component A = U Lyr |
| 95198 | not detected by the satellite at the expected position or with the expected intensity |
| 95672 | double system: $\theta = 0°$, $\rho = 13$ arcsec; component B $< 11$ mag |
| 95676 | probably fainter than expected |
| 95820 | component A = U Aql |
| 96007 | component A = V822 Aql |
| 96108 | not detected by the satellite at the expected position or with the expected intensity |
| 96480 | component A = V1744 Cyg |
| 96515 | double system: $\theta = 200°$, $\rho = 8$ arcsec, $\Delta V < 2$ mag |
| 96840 | component A = QS Aql |
| 97091 | component A = PS Vul |
| 97241 | double system: $\theta = 330°$, $\rho = 15$ arcsec, $\Delta V = 0.9$ mag |
| 98237 | double system: $\theta = 320°$, $\rho = 8$ arcsec |
| 99002 | component A = V1676 Cyg |
| 99085 | component B = RY Cap |
| 99283 | joint system: Biurakan 2 130 (B)/ 131 (A) |
| 99397 | not detected by the satellite at the expected position or with the expected intensity |
| 99629 | double system: $\theta = 305°$, $\rho = 40$ arcsec, $\Delta V = 1.4$ mag |
| 99675 | component A = V695 Cyg |
| 100048 | erroneous proper motion in AGK3 |
| 100227 | component A = V478 Cyg |
| 100287 | component A = V1687 Cyg |
| 100383 | not detected by the satellite at the expected position or with the expected intensity |
| 100515 | component B = NSV 13053 |
| 100695 | double system: $\rho = 32$ arcsec, $\Delta V = 1.1$ mag |
| 101341 | component A = V729 Cyg |
| 101750 | component A = VW Cep |
| 101972 | erroneous proper motion in GC and SAO |
| 102352 | not detected by the satellite at the expected position or with the expected intensity |
| 102571 | component A = T Cyg |
| 102817 | physical pair with LP 928-63 at 23 arcsec, $\theta = 270°$ |
| 103542 | component A = KZ Pav |
| 103766 | other identification: Woolley 9715 |
| 104371 | component A = V389 Cyg |
| 104521 | component A = gam Equ |
| 104887 | component A = tau Cyg |
| 105539 | erroneous proper motion in AGK3 |
| 105638 | probably fainter than expected |
| 106161 | erroneously identified with G 26-8 = BD -02° 5557 in the literature |
| 106774 | other identification: IC 1396 452 |
| 106843 | other identification: IC 1396 171 |
| 106998 | not LHS 3700 (G 213-9). Error in HIC identification |

107156 not SS Cyg. Error in HIC identification. Good coordinates (J2000) for SS Cyg:
$\alpha = 21\ 42\ 42.6$ $\delta = +43\ 35\ 09$, at $\theta = 75$ °, $\rho = 252$ arcsec
from star indicated on the chart
107164 other identification: IC 1396 750
107259 other identification: IC 1396 1319
107594 component A = AP Cap
108426 component A = IR Cep
108797 component A = DX Aqr
109930 not detected by the satellite at the expected position or with the expected intensity
110478 component A = pi.01 Gru
110892 erroneous proper motion in SAO
110893 Krüger 60 (component A = NSV 14168; component B = DO Cep). The proper motion, taken from AGK3, is given for the centre of gravity of the system. The orbital motion produces a small deviation from this value.
111293 error in HIC position: target is 80 arcsec from LHS 525
($\alpha = 22\ 32\ 54.22$ $\delta = +53\ 47\ 39.2$)
111363 double system: $\theta = 5°$, $\rho = 22$ arcsec, $\Delta V = 2.4$ mag
111400 component A = V362 Lac
111692 CD -29° 18408, not CD -29° 18404 (error in YZ and SAO)
111858 not detected by the satellite at the expected position or with the expected intensity
111932 double system: $\theta = 295°$, $\rho = 19$ arcsec, $\Delta V = 0.6$ mag
113017 component A = IL Cep
113652 erroneously identified with HD 215173 in the literature
113738 component A = NN Cep
113802 component A = LN And
114092 erroneously identified with AGK +61° 1415 in the literature
114107 erroneously identified with AGK +61° 1413 in the literature
114669 component B = NSV 14460
114994 optical pair, see Giclas chart. The faint component is LHS 3923, G 190-17.
The bright component is BD +37° 4803 and has a very small proper motion. Separation estimation from Palomar plates (epoch 1953.8): 24 arcsec (10 arcsec in 1990)
115344 CPD -37° 9332, not CPD -37° 9232 (error in the literature)
115715 erroneous proper motion in GC and SAO; correct in NLTT and Giclas
115990 component A = AR Cas
115993 not detected by the satellite at the expected position or with the expected intensity
116214 doubtful magnitudes
116389 component A = iot Phe
116430 the large proper motion from SAO and NLTT seems questionable, and is not retained
117011 erroneous proper motion in LTT, correct in NLTT
117114 CD -62° 1460, not CD -62° 1464 (error in NLTT)
117154 other identification: V405 Cas
117595 double system: $\theta = 330°$, $\rho = 29$ arcsec, $\Delta V = 3.1$ mag
117779 double system: $\theta = 310°$, $\rho = 22$ arcsec, $\Delta V = 1.3$ mag
117987 central star of a reflection nebula
118209 component B = NSV 14785
120159 there is a faint optical companion at $\rho = 13$ arcsec, $\theta = 170°$, $\Delta m = 1$ mag
120212 erroneously identified with AGK +01° 1462 in the literature
120229 not detected by the satellite at the expected position or with the expected intensity
120248 erroneously identified with BD +66° 466 and AGK +66° 355 in the literature

# ANNEX 1

# Components of Double and Multiple Systems

# Introduction

## Annex 1

The Hipparcos measurement system is not optimum for the observation and detection of all categories of double and multiple stars. If the components of such systems are sufficiently well separated, and sufficiently bright, each component may be observed separately, and may be included in the main catalogue according to its astrophysical or astrometric interest. However, for closer systems, or systems with fainter components, the instantaneous field of view of the Hipparcos observations may be centred on only one of the components, or on the geometric centre, or on the photocentre, depending on the precise geometric and photometric configuration of the system.

Annex 1 gives information and data for all known individual components of around fourteen thousand double and multiple systems for which at least one component is identified in the main Hipparcos Input Catalogue, i.e. when at least one component of the system is observed by the Hipparcos satellite. Because of their astronomical interest, all known components of double or multiple systems involved in the Hipparcos observations have been collected together in Annex 1, even though they may be completely negligible, in the context of the Hipparcos observations, because of their faint magnitude or distance from the primary component.

Annex 1 was constructed from a subset of a preliminary version of the Catalogue of Components of Double and Multiple Stars (CCDM, Dommanget at al., in preparation). A complete description of the information contained in the CCDM will be given in its first edition. This subset was supplemented by 452 stars (candidates for observation with Hipparcos) discovered as double systems by M. Rousseau when measuring ESO Survey Schmidt plates within the preparatory programme of ground-based measurements.

The INCA data base (the source of the main catalogue), and the preliminary version of CCDM (the source of Annex 1), have necessarily evolved separately during the course of the Input Catalogue preparation. However, systematic comparisons were made regularly between them in order to improve their agreement. In some cases, in the construction of Annex 1, data from the INCA data base have been preferred (for example, in the case of magnitudes or some proper motions), while in other cases, data from the CCDM were retained (for example, positions of components of the same system when they originate from the same source catalogue). This choice has been necessary in order to preserve the *internal* consistency of the (relative) data on the various components of a system, whilst at the same time preserving the 'absolute' positional information required for the Hipparcos observations. As a result, there are discrepancies between the details of such systems in the main catalogue and in Annex 1.

The systems are ordered by increasing CCDM numbers (constructed from equatorial coordinates at equinox and epoch J2000.0). For a same right ascension, the systems are ordered from the North to the South Pole. Each system is distinguished from the next one by a blank line. The CCDM and HIC numbers provide the link between the main catalogue and this annex.

## Catalogue of Components of Double and Multiple Stars

At the beginning of the INCA Consortium work in 1982, no specific general *astrometric* catalogue of double and multiple stars was available, and the construction of such a catalogue was therefore undertaken. This project is being carried out at the Observatoire Royal de Belgique (Dommanget 1983, 1989), under the name of the 'Catalogue of Components of Double and Multiple Stars' (CCDM). The original basis of this catalogue is the Index Catalogue of Visual Double Stars (Jeffers *et al.* 1963) augmented by a number of measurements collected at the US Naval Observatory by C.E. Worley and transmitted to the Meudon (later to the Nice) and Royal Greenwich Observatories until 1976. For logistical reasons, the WDS (Washington Visual Double Star Catalog, Worley & Douglass 1984) was not used. The CCDM has been complemented during the years 1982-91 by more than 40 000 accurate positions and proper motions for individual components, compiled at the Astronomisches Rechen-Institut at Heidelberg (CDA, Bastian & Lederle 1985) or observed within the framework of the INCA Consortium Working Group on Double Stars.

The CCDM includes about 63 000 systems, and aims to provide (for each component) accurate positions (better than one arcsec), proper motions, and cross-identifications with the most important reference and fundamental catalogues.

# Annex 1 description

## Annex 1, Fields 1-3: Component Identification

### Field 1: CCDM number

The CCDM number is constructed from a mean (approximate) position of the system ( $\alpha$ to a precision of 0.1 min, $\delta$ to a precision of 1 arcmin) referred to equinox and epoch J2000.0 (or equinox J2000.0 and the epoch of the original measurement if no proper motion is available).

### Field 2, 1st character: Reference component when different from A

This field specifies the component with respect to which the position angle and separation of the secondary component(s) are given in fields 8 and 9. A blank indicates that the reference component is the 'A' component of the system.

### Field 2, 2nd character: Component considered

This field specifies the component considered (letters A, B, C..., P, Q...), taken from the CCDM.

### Field 3: Hipparcos Input Catalogue (HIC) running number

This running number is that of the corresponding entry in the main Hipparcos Input Catalogue.

## Annex 1, Fields 4-5: Position (Equinox J2000.0)

### Field 4: Right ascension (equinox J2000.0)

The right ascension is given for equinox J2000.0. The epoch is J2000.0, or that of the original measurement if no proper motion is available. The epoch is not given in Annex 1.

### Field 5: Declination (equinox J2000.0)

The declination is given for equinox J2000.0. The epoch is J2000.0, or that of the original measurement if no proper motion is available. The epoch is not given in Annex 1.

The positions in Annex 1 are taken from the CCDM (see Introduction), and are not necessarily identical to those given in the Main Catalogue. The 'absolute' positions in the CCDM are themselves taken from various sources, but primarily from the CDA (Catalogue des Données Astrométriques, Bastian & Lederle 1985; Jahreiß 1989). In addition, specific astrometric observations were organised within the framework of a dedicated Working Group of the INCA Consortium. Numerous institutes participated in these observations: Observatoire Royal de Belgique, Bonn, Bordeaux, Brera, and Turin Observatories, Cambridge, La Plata, Leningrad, Lille and München Universities with observations also made at ESO and at La Palma. New data have been included, first into the CCDM, and then into the INCA data base, after systematic checks of their internal consistency. Some positions are also taken from the Guide Star Catalog (Lasker *et al.* 1990). Further details of the INCA Consortium's preparatory work on double and multiple stars are given by Dommanget (1983, 1985, 1988, 1989).

Preference has always been given to source catalogues or new observations giving positions for the largest number of components, so as to maximise the internal consistency of the data on the system. This explains some of the discrepancies with the main catalogue where updated data (related to the components observed by Hipparcos) have been included, even though these were available for only some of the components of a system.

For systems closer than 3 arcsec, the same position and proper motion are adopted for all components, unless separate data have been explicitly published. For larger separations, when no absolute position was available for the secondary component(s), these have been computed from the absolute position of the primary and the relative position of the secondary. In the case of orbital pairs, the same proper motion is also adopted for all components, even for separations larger than 3 arcsec, except for a few cases with large separations but slow relative motions. Ephemerides are given below for three exceptional cases. The values of $\Delta\alpha$ and $\Delta\delta$ have been obtained from the orbital elements given by van den Bos (1960) for Sirius, by Strand (1951) for Procyon, and by Heintz (1960) for $\alpha$ Centauri.

Ephemerides for three orbital pairs

| | HIC 32349<br>Sirius<br>CCDM 06451-1643 A&B | | | | HIC 37279<br>Procyon<br>CCDM 07393+0514 A&B | | | | HIC 71683 - HIC 71681<br>$\alpha$ Centauri<br>CCDM 14396-6050 A&B | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | A - centre of gravity | | A - centre of gravity | | A - centre of gravity | | A - centre of gravity | | A - centre of gravity | | A - centre of gravity | |
| Date | $\Delta\alpha$ (s) | $\Delta\delta$ ($''$) | $\Delta\alpha$ (s) | $\Delta\delta$ ($''$) | $\Delta\alpha$ (s) | $\Delta\delta$ ($''$) | $\Delta\alpha$ (s) | $\Delta\delta$ ($''$) | $\Delta\alpha$ (s) | $\Delta\delta$ ($''$) | $\Delta\alpha$ (s) | $\Delta\delta$ ($''$) |
| 1990 | - 0.01 | - 1.5 | +0.02 | +3.0 | - 0.03 | - 1.3 | +0.09 | +3.5 | +0.67 | +7.2 | - 0.86 | - 9.1 |
| 1991 | +0.01 | - 1.2 | - 0.03 | +2.4 | - 0.04 | - 1.2 | +0.11 | +3.4 | +0.67 | +7.0 | - 0.85 | - 8.8 |
| 1992 | +0.04 | - 0.8 | - 0.07 | +1.7 | - 0.05 | - 1.2 | +0.13 | +3.2 | +0.66 | +6.8 | - 0.84 | - 8.6 |
| 1993 | +0.05 | - 0.3 | - 0.11 | +0.7 | - 0.06 | - 1.1 | +0.15 | +3.0 | +0.66 | +6.5 | - 0.83 | - 8.3 |
| 1994 | +0.06 | +0.2 | - 0.12 | - 0.3 | - 0.06 | - 1.0 | +0.17 | +2.8 | +0.65 | +6.3 | - 0.82 | - 8.0 |
| 1995 | +0.06 | +0.6 | - 0.12 | - 1.3 | - 0.07 | - 0.9 | +0.18 | +2.5 | +0.64 | +6.0 | - 0.81 | - 7.7 |
| 1996 | +0.04 | +1.0 | - 0.08 | - 2.0 | - 0.07 | - 0.8 | +0.20 | +2.2 | +0.63 | +5.8 | - 0.80 | - 7.3 |
| 1997 | +0.02 | +1.2 | - 0.04 | - 2.5 | - 0.08 | - 0.7 | +0.21 | +1.9 | +0.62 | +5.5 | - 0.78 | - 7.0 |
| 1998 | - 0.01 | +1.3 | +0.01 | - 2.7 | - 0.08 | - 0.6 | +0.22 | +1.6 | +0.60 | +5.2 | - 0.77 | - 6.6 |
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| 2000 | - 0.05 | +1.3 | +0.11 | - 2.7 | - 0.08 | - 0.3 | +0.22 | +0.8 | +0.58 | +4.6 | - 0.73 | - 5.9 |

# Annex 1, Field 6: Photometry

## Field 6: Magnitude

The magnitude given in this field is taken from the CCDM. It is generally the original magnitude from the IDS (Index Catalogue of Visual Double Stars, Jeffers *et al.* 1963, updated, up to 1976, at Meudon, Nice and Brussels Observatories from new measurements collected by C.E. Worley). In most cases it is a $V$ magnitude, since many of these magnitudes are visual estimates. For the faintest systems, it can be a photographic magnitude if the system has been discovered photographically. However, the type of magnitude is not specified in the IDS, and is therefore not given here.

# Annex 1, Fields 7-10: System Geometry

## Field 7: Date of observation of the relative position (for separations smaller than 10 arcsec)

The field is blank for separations larger than 10 arcsec. In this case, the relative position is obtained from the position of each component as given in fields 4 and 5, and it refers to the epochs of these data.

## Field 8: Position angle in degrees (when available)

The position angle is defined with the origin at North, and increasing through increasing right ascension.

For some stars, only a rough indication of the position angle is given and not a value in degrees: F (Following), P (Preceding), N (North), S (South), or a combination of these letters.

## Field 9: Separation in arcsec (when available)

Fields 7-9 provide details of the position of the secondary component(s) with respect to the position of the reference component identified by the first character of field 2, and thus provide a concise summary of the geometry of the system. For separations smaller than 10 arcsec, these *relative* positions are taken from the CCDM and thus from the IDS. For separations larger than 10 arcsec, the position angle and separation were deduced from the data on each component (for these systems, the relative positions are thus consistent with the absolute positions of the components).

For several thousand double systems, the relative position and proper motion of the secondary components were computed (Brosche & Sinachopoulos 1986, 1988a, 1988b), using all available observations communicated by C.E. Worley from the USNO double star data base.

### Field 10, 1st character: O = system with known orbit

### Field 10, 2nd character: A = astrometric binary

# Annex 1, Fields 11-12: Proper Motion

## Field 11: Proper motion in right ascension

Proper motion in right ascension, $15\mu_\alpha \cos\delta$, in arcsec per year.

## Field 12: Proper motion in declination

Proper motion in declination, $\mu_\delta$, in arcsec per year.

The proper motions are generally taken from the CCDM. The sources are generally the same as for positions (see explanations given under fields 4 and 5, and under fields 7 to 10). As for positions, there may be differences between the proper motions given in Annex 1 and in the main catalogue. The equinox of the proper motion is that of the source catalogue (this information is not given in Annex 1).

# Annex 1, Fields 13-19: Cross-Identifications

For joint systems, some additional identifications, especially for variable and cluster stars, are given in the notes of the main Catalogue.

## Field 13: DM number

DM identification numbers for stars in the Bonner Durchmusterung, the Cordoba Durchmusterung, and the Cape Photographic Durchmusterung (BD, CD or CPD respectively) are given following the HD convention, i.e.

- when the zone of the DM number is between $+90°$ and $-22°$, the BD number is used;
- when the zone of the DM number is between $-23°$ and $-51°$, the CD number is used;
- when the zone of the DM number is between $-52°$ and $-90°$, the CPD number is used.

The format is ± ZZ NNNNN, with ZZ indicating the declination zone, and NNNNN denoting a running number.

The BD, CD and CPD catalogues overlap, and in the overlapping regions their stellar content is not identical. It may thus happen, for example, that some stars in the zone $-23° > \delta > -51°$ only appear in the CPD catalogue. In such a case, where the HD convention cannot be followed, the available number is given, followed by $*$ in the last character of this field. The last character of this field is also used for additional BD stars, i.e. stars with suffix *a* or *b* (these stars were added to the BD Catalogue after the original numbering was made). Such identifications do not imply that the entry is a component of a double or multiple system.

## Field 14: HD/HDE number

Cross-identifications are given to stars in the HD Catalogue (Cannon & Pickering 1918-24, with numbers in the range 1-225300), and its two extensions: HDE numbers in the range 225301-272150 (Cannon 1925-36) and 272151-359083 (Cannon & Walton Mayall 1949) respectively. The format is NNNNNN.

## Field 15: AGK3 or SAO number

Cross-identifications are given to stars in the AGK3 and SAO Catalogues (the AGK3 number is given preferentially).

| Catalogue | Reference | Format |
|---|---|---|
| AGK3 | Dieckvoss *et al.* (1975) | ± DD NNNN |
| SAO | Smithsonian Institution (1966) | NNNNNN |

## Field 16: IDS number

Cross-identifications are given to (double or multiple) stars in the IDS Catalogue (Jeffers *et al.* 1963). The IDS number is constructed from approximate positions at equinox B1900.0, with component indication. The format is HHMMm X DDMM A (where X = N or S).

## Field 17: ADS number

Cross-identifications are given to (double or multiple) stars in the ADS Catalogue (Aitken 1932). The format is NNNNN.

# Acknowledgements

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# Executive and Steering Committees of the INCA Consortium

## The Executive Committee

The work of the Input Catalogue Consortium is supervised and managed by the Team Leader, Dr Catherine Turon, of the Observatoire de Paris, Meudon. The work has been divided into six main tasks, the leaders and description of which are as follows:

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| Crézé, M. | Besançon | Mission simulations |
| Egret, D. | Strasbourg | Collection, analysis and homogenisation of astrophysical data |
| Gómez, A. | Meudon | Management of proposals and versions of the Input Catalogue |
| Grenon, M. | Genève | New ground-based photometric observations and calibrations |
| Jahreiß , H.[1] | Heidelberg | Astrometric data collection, analysis and reduction to FK5 |
| Réquième, Y. | Bordeaux | New ground-based astrometric observations and measurements |

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In addition, four INCA Working Groups were established to coordinate the work performed in particular subject areas, and two astronomers undertook the selection of stars to be observed by Hipparcos in particularly dense areas of the sky:

| | | |
|---|---|---|
| Argue, A.N. | Cambridge | Linking to an extragalactic frame |
| Bec-Borsenberger, A. | Paris | Minor planets and satellites |
| Dommanget, J. | Bruxelles | Double and multiple stars |
| Mennessier, M.O. | Montpellier | Variable stars |
| Mermilliod, J.C. | Lausanne | Stars in selected galactic clusters |
| Prévot, L. | Marseille | Stars in the Magellanic Clouds |

These task and working group leaders constitute the Executive Committee of the INCA Consortium.

## The Steering Committee

The activities of the Input Catalogue Consortium are monitored by the INCA Steering Committee, comprising representatives of the participating countries, originally composed (1982 – 88) as follows:

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| Germany | W. Fricke (Chairman), Heidelberg |
| Netherlands | R.S. Le Poole, Leiden |
| Spain | J.J. de Orús, Barcelona |
| Switzerland | F. Rufener, Genève |
| United Kingdom | C.A. Murray, (formerly) Herstmonceux |

¿From 1988, the Steering Committee was re-organised as follows:

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| Orlov, V.V. | | Leningrad University |
| Pannunzio, R. | | Osservatorio di Pino Torinese |
| Perdomo, R. | | Universidad de La Plata |
| Scardia, M. | | Merate Observatory |
| Schmeidler, E. | | Institut für Astronomie, Universität München |
| Sinachopoulos, D. | | Observatoire Royal de Belgique, Bruxelles |
| Soulié, G. | | Observatoire de Bordeaux |
| Worley, C.E. | | U.S. Naval Observatory, Washington D.C. |

**(h) Variable stars:**

| | | |
|---|---|---|
| Mennessier, M.O. | Coordinator | Equipe d'Astrophysique, Montpellier |
| Baglin, A. | | Observatoire de Paris, Meudon |
| Barthès, D. | | Equipe d'Astrophysique, Montpellier |
| Coll, R. | | Equipe d'Astrophysique, Montpellier |
| Cordoni, J.P. | | Equipe d'Astrophysique, Montpellier |
| Figueras, F. | | Universitat de Barcelona |
| Mattei, J. | | AAVSO, USA |

**(i) Linking the Hipparcos frame to an extragalactic frame:**

| | | |
|---|---|---|
| Argue, A.N. | Coordinator | Cambridge University, Cambridge |
| Brosche, P. | | Universitäts-Sternwarte Bonn, Daun |
| Duncombe, R.L. | | University of Texas, Austin |
| Estalella, R. | | Universidad de Barcelona |
| Florkowski, D.R. | | U.S. Naval Observatory, Washington D.C. |
| Geffert, M. | | Universität Bonn |
| Hemenway, P.D. | | University of Texas, Austin |
| Jauncey, D.L. | | CSIRO, Epping |
| Johnston, K.J. | | U.S. Naval Research Laboratory, Washington D.C. |
| Klemola, A.R. | | Lick Observatory |

| | |
|---|---|
| Kovalevsky, J. | CERGA, Observatoire de la Côte d'Azur, Grasse |
| Lestrade, J.F. | Bureau des Longitudes, Paris |
| Ma, C. | Goddard Space Flight Center |
| Morrison, L.V. | Royal Greenwich Observatory, Cambridge |
| Murray, C.A. | (formerly) Royal Greenwich Observatory, Herstmonceux |
| Paredes, J. | Universitat de Barcelona |
| Réquième, Y. | Observatoire de Bordeaux |
| Ruben, G. | Sternwarte Babelsberg, Postdam |
| Sinachopoulos, D. | Observatoire Royal de Belgique |
| Vegt, C. de | Hamburger Sternwarte, Hamburg |
| Walter, H.G. | Astronomisches Rechen-Institut, Heidelberg |
| White, G.L. | CSIRO, Epping |

### (j) Minor planets and satellites:

| | | |
|---|---|---|
| Bec-Borsenberger, A. | Coordinator | Bureau des Longitudes, Paris |
| Arlot, J.E. | | Bureau des Longitudes, Paris |
| Baron, N. | | Bureau des Longitudes, Paris |
| Calaf, J. | | Universitat de Barcelona |
| Català, M.A. | | Universitat de Barcelona |
| Chareton, M. | | Observatoire de Besançon |
| Jordi, C. | | Universitat de Barcelona |
| Morrison, L.V. | | Royal Greenwich Observatory, Cambridge |
| Muiños, J.-L. | | Observatorio de Marina, San Fernando |
| Núñez, J. | | Universitat de Barcelona |
| Quijano, L. | | Observatorio de Marina, San Fernando |
| Rapaport, M. | | Observatoire de Bordeaux |
| Réquième, Y. | | Observatoire de Bordeaux |
| Rosselló, G. | | Universitat de Barcelona |
| Ruatti, C. | | Bureau des Longitudes, Paris |
| Sala, F. | | Universitat de Barcelona |
| Schmadel, L. | | Astronomisches Rechen-Institut, Heidelberg |
| Scholl, H. | | Observatoire de la Côte d'Azur, Nice |
| Torra, J. | | Universitat de Barcelona |

### (k) Stars in selected galactic clusters:

| | | |
|---|---|---|
| Mermilliod, J.C. | Coordinator | Institut d'Astronomie, Lausanne |
| Crézé, M. | | Observatoire de Besançon |
| Delhaye, J. | | Observatoire de Paris, Meudon |
| Dettbarn, C. | | Astronomisches Rechen-Institut, Heidelberg |
| Fehlberg, H.J. | | Hamburger Sternwarte, Hamburg |
| Saltel, M. | | Observatoire de Paris, Meudon |
| Sellier, A. | | Observatoire de Paris, Meudon |
| Tucholke, H.-J. | | Astronomisches Institut, Universität Münster |
| Turon, C. | | Observatoire de Paris, Meudon |
| Vegt, C. de | | Hamburger Sternwarte, Hamburg |
| Wielen, R. | | Astronomisches Rechen-Institut, Heidelberg |
| Zacharias, N. | | Hamburger Sternwarte, Hamburg |

**(l) Stars in the Magellanic Clouds:**

| | | |
|---|---|---|
| Prévot, L. | Coordinator | Observatoire de Marseille |
| Figon, P. | | Observatoire de Marseille |
| Peyrin, Y. | | Observatoire de Marseille |
| Rebeirot, E. | | Observatoire de Marseille |
| Robin, A. | | Observatoire de Marseille |

The activities on double and multiple stars included the participation of the Commission des Etoiles Doubles (Société Astronomique de France) and of a German group of amateur astronomers (Heidelberg).

The variable star work included the participation of the AAVSO staff (USA), AFOEV, CRIM and INRIA (France).

# The ESA Hipparcos Scientific Selection Committee

The proposals submitted by the scientific community were reviewed by a peer committee, established under the guidance of the ESA Astronomy Working Group. The composition was as follows:

| | | |
|---|---|---|
| Prof. A. Blaauw | (*Chairman*) | Groningen |
| Dr J. Dommanget | | Bruxelles |
| Dr W. Gliese | | Heidelberg |
| Prof. M. Hack | | Trieste |
| Prof. E.P.J. van den Heuvel | | Amsterdam |
| Prof. C. Jaschek | | Strasbourg |
| Prof. J. Lequeux | | Paris |
| Prof. P.O. Lindblad | | Stockholm |
| Prof. A. Maeder | | Genève |
| Dr P.E. Nissen | | Aarhus |
| Prof. B.E.J. Pagel | | Herstmonceux |
| Dr A. Renzini | | Bologna |
| Prof. C. de Vegt | | Hamburg |
| Prof. P.A. Wayman | | Dunsink |
| Prof. R. Wielen | | Heidelberg |

This Scientific Selection Committee met on three occasions. At the first meeting, general priorities were assigned to proposals or subsets of the proposals.

At the second meeting, after the results of the first round of simulations had been made by the INCA Consortium, and after proposers had been invited to comment on the general recommendations of the Committee, the preliminary recommendations were reviewed. Members of the INCA Consortium presented the simulation results, and the Selection Committee recommended topics for further study.

At the third meeting of the Selection Committee, the INCA Consortium made a detailed presentation of the results of the selection process, showing the extent to which various proposals and categories of proposals had been included in the Input Catalogue.

The various meetings of the Selection Committee were also attended by the leaders of the Hipparcos Data Reduction Consortia, who were able to provide advice on technical aspects of the data analysis which might impact on considerations of the Input Catalogue compilation.

In June 1988, the INCA Consortium distributed, to each of the proposal Principal Investigators, a listing of the stars from the original proposal finally contained in the Input Catalogue. A second opportunity was provided for comments on the listing. In this way, since the observing programme for the Hipparcos satellite would not be changed throughout the mission, proposers were given the opportunity to comment on the selection, achieved amongst the stars they had proposed, until just a few months before the satellite's launch.

# Scientific Proposals received by ESA

The following table lists the proposals received by the European Space Agency as a result of the Invitation for Proposals issued in 1982. For each proposal, the Principal Investigator, institute, and title of the proposed investigation are listed.

| No. | Proposer | Institute | Title |
|---|---|---|---|
| 143 | Acker, A. | Strasbourg | Calibration of the distance scale of planetary nebulae |
| 35 | Adelman, S.J. | Charleston, USA | The Ursa Major stream |
| 22 | Alksnis, A. | Latvia | Luminosity calibration of carbon stars |
| 10 | Antonello, E. | Milan | Luminosity and related parameters of variable A and F stars ($\delta$ Scuti stars) |
| 127 | Ardeberg, A. | Lund | Physical parameters and kinematics of late-type stars and the history of the Galaxy |
| 26 | Argue, A.N. | Cambridge | Super-priority radio stars[1] |
| 56 | Argue, A.N. | Cambridge | Link to extragalactic reference frame (via Space Telescope): the southern sky |
| 210 | Argue, A.N. | Cambridge | Radio stars (master list) |
| 221 | Argue, A.N. | Cambridge | Super-high priority 'link' stars |
| 50 | Arlot, J.E. | Paris | Determination of precise positions of faint stars in the ecliptic zone |
| 223 | Arlot, J.E. | Paris | Observations of Europa and Titan |
| 52 | Aslan, Z. | Ankara, Turkey | Kinematics of RS CVn-type binary stars |
| 66 | Auvergne, M. | Meudon | Dwarf and subgiant A stars |
| 166 | Barbieri, C. | Padova | Search for sub-stellar and planetary masses accompanying the nearest stars |
| 57 | Bartkevicius, A. | Vilnius,Lithuania | The HR diagram and kinematic properties of F-M field stars with metal deficiency |
| 103 | Bastian, U. | Heidelberg | Parallaxes and proper motions of Herbig-Ae/Be stars |
| 104 | Bastian, U. | Heidelberg | Observations of Magellanic Cloud OB supergiants |
| 105 | Bastian, U. | Heidelberg | Distances of T Tauri stars |
| 76 | Baudry, A. | Bordeaux | Observations of late-type stars coinciding with radio line masers and of 3C 273B |
| 43 | Benacchio, L. | Padova | Astrometry of the planet Pluto |
| 179 | Bergeat, J. | Lyon | Carbon stars and stellar evolution |
| 168 | Bernacca, P.L. | Asiago | Astrodynamics of trapezia systems from space and ground |
| 88 | Bien, R. | Heidelberg | Observations of the fundamental stars of FK4 and of new fundamental stars |
| 197 | Bonneau, D. | Grasse | Linear geometry of stellar atmospheres |
| 140 | Brand, J. | Leiden | Proper motions of Herbig-Haro objects[2] |
| 171 | Briot, D. | Paris | Absolute magnitudes and comparative kinematical studies of B and Be stars |
| 38 | Brosche, P. | Bonn | Extragalactic calibration of the Hipparcos proper motion system |
| 42 | Brosche, P. | Bonn | Absolute proper motions of thirteen globular clusters |
| 63 | Buarque, J.A. | Rio de Janeiro | Stellar orbits in the solar neighbourhood |
| 32 | Caprioli, G. | Rome | Improved earth's rotation and polar motion since 1968 |
| 209 | Carquillat, J.M. | Toulouse | Contribution à l'étude des étoiles à spectre composite |
| 71 | Catchpole, R.M. | SAAO, S. Africa | Astrometric orbit of the spectroscopic binary HD 1273 |
| 153 | Cayrel, R. | Paris | Kinematics of halo subdwarfs: the clue to early galactic evolution |
| 160 | Cayrel de Strobel,G | Meudon | The HR diagram of the Hyades, Pleiades, Coma Berenices & Ursa Major clusters |
| 157 | Chevalier, C | OHP | Kinematical studies of galactic X-ray sources |
| 69 | Clube, S.V.M. | Oxford, UK | Kinematics of early-type stars |
| 60 | Cottrell, P.L. | Canterbury, NZ | RCrB and He-rich B stars: are they evolutionary partners? |
| 100 | Couteau, P. | Nice | Masses of faint visual binary systems |
| 164 | Cramer, N. | Genève | Internal dynamics and ages of Scorpius-Centaurus $\zeta$ Persei and I Lac associations |
| 172 | Cramer, N. | Genève | Magnetic Ap stars detected by Geneva photometry |
| 189 | Crézé, M. | Besançon | Kinematics of distant red giants in the Galactic plane |
| 158 | Delhaye, J. | Meudon | Kinematics, age and chemical composition of F, G & K stars in the Fe/H catalogue |
| 159 | Delhaye, J. | Meudon | The escape velocity in the vicinity of the sun |
| 146 | Divan, L. | Paris | Calibration in absolute magnitudes of the BCD spectral classification |
| 196 | Dolan, J.F. | NASA GSFC, USA | Parallaxes of galactic X-ray sources |
| 23 | Dommanget, J. | Bruxelles | Les masses stellaires et l'évolution des binaires |
| 24 | Dommanget, J. | Bruxelles | Les caracteristiques physiques, l'origine et l'évolution des binaires spectroscopiques |
| 25 | Dommanget, J. | Bruxelles | Duplicités découvertes pour certaines étoiles lors de leurs occultations par la lune |
| 54 | Dommanget, J. | Bruxelles | Recherches statistiques sur les étoiles doubles et multiples proches |
| 204 | Dommanget, J. | Bruxelles | Recherches statistiques sur les étoiles multiples de toutes catégories |
| 48 | Dravins, D. | Lund | Convection in stellar atmospheres |
| 82 | Dürbeck, H.W. | Bonn | W UMa-type contact binaries: luminosities, masses, motions and evolution |
| 193 | Dunham, D.W. | Silver Spring,USA | Lunar occultation stars: (1) stars from the Zodiacal Catalogue |
| 194 | Dunham, D.W. | Silver Spring,USA | Lunar occultation stars: (2) stars not in the Zodiacal Catalogue |
| 195 | Dunham, D.W. | Silver Spring,USA | Lunar occultation stars: (3) stars from the USNO C-Catalogue observed during 1982 |
| 161 | Duncombe, R.L. | Austin, USA | Dynamical reference for the Hipparcos instrumental system |
| 163 | Duncombe, R.L. | Austin, USA | Extragalactic reference for the Hipparcos instrumental system |
| 137 | Egret, D. | Strasbourg | Luminosity of G5-M3 stars near the giant branch |
| 114 | Estalella, R. | Barcelona | Connection of the Hipparcos and extra-galactic reference frame using radio stars |
| 185 | Feast, M.W. | SAAO, S. Africa | Parallaxes and proper motions of Mira variables |
| 186 | Feast, M.W. | SAAO, S. Africa | Parallaxes and proper motions of Cepheid variables |
| 79 | Feissel, M. | Paris | Earth rotation and continental drift |
| 80 | Feitzinger, J. | Bochum | Proper motion and parallaxes of the Magellanic Cloud stars |
| 217 | Florkowski, D.R. | Washington, USA | Radio stars |
| 6 | Fracassini, M. | Milan | Absolute radii of stars from the CADARS |
| 7 | Fresneau, A. | Strasbourg | The internal velocities of PER OB III cluster members |
| 150 | Fringant, A.M. | Paris | Faibles étoiles bleues à haute latitude galactique |
| 149 | Friedjung, M. | Paris | Distances of cataclysmic variables |
| 120 | Gass, H. | Heidelberg | Search for low-luminosity carbon stars |
| 77 | Geyer, E.H. | Bonn | Common proper motion investigations of young to medium age stellar troops |

| No. | Proposer | Institute | Title |
|---|---|---|---|
| 119 | Gilmore, G. | Cambridge | Kinematic properties of the galactic spheroid |
| 108 | Gómez, A. | Meudon | Estimation of the gradients of the velocity dispersions |
| 147 | Gómez, A. | Meudon | The stellar luminosity function and quantitative HR diagram[2] |
| 29 | Goossens, M. | Leuven | Faint early-type stars at high galactic latitudes |
| 122 | Grenier, S. | Meudon | Determination of masses for G and K giants |
| 139 | Grenon, M. | Genève | Physical and kinematical properties of halo, old disc and nearby stars from NLTT |
| 107 | Grosbøl, P. | ESO, Garching | Birthplaces of nearby early-type stars |
| 182 | Guibert, J. | Paris | Interstellar reddening and distribution of B stars in the solar neighbourhood |
| 98 | Habing, H.J. | Leiden | Mira variables |
| 68 | Harrington, R.S. | Washington, USA | Comparison of Hipparcos and USNO trigonometric parallaxes |
| 55 | Hauck, B. | Lausanne | Fundamental data for B and A chemically-peculiar stars |
| 61 | Hearnshaw, J.B. | Canterbury, NZ | Eggen's moving groups: fact or fiction? |
| 62 | Hearnshaw, J.B. | Canterbury, NZ | Ages and kinematics of the oldest disk stars |
| 28 | Heck, A. | Strasbourg | Statistical parallaxes of field RR Lyrae stars |
| 162 | Hemenway, P.D. | Austin, USA | Galactic distribution and motions of A5-F5 stars |
| 85 | Hering, R. | Heidelberg | Observation of early-type stars for investigations of galactic structure |
| 81 | Hidajat, B. | Java, Indonesia | Astrophysical research on particular visual binaries |
| 83 | Hilditch, R.W. | St. Andrews | Studies of O to F8 stars at the galactic poles |
| 19 | Hobbs, L.M. | Yerkes, USA | Interstellar gas and young stars in the galactic halo |
| 128 | Houziaux, L. | Liège | Peculiar objects: their positions in the HR diagram |
| 30 | Hucht,K.A.van der | Utrecht | A proper motion study of evolved massive candidate runaway stars |
| 198 | Hughes, J.A. | Washington, USA | Astrometric parameters of the NPZT stars |
| 199 | Hughes, J.A. | Washington, USA | Astrometric parameters of the supplement list to the AGK3R and SRS(IRS) lists |
| 200 | Hughes, J.A. | Washington, USA | Astrometric parameters of the AGK3R stars |
| 201 | Hughes, J.A. | Washington, USA | Astrometric parameters of the SRS list |
| 44 | Høg, E. | Copenhagen | Nature of $\delta$ Scuti variables |
| 64 | Ishida, K. | Tokyo, Japan | Kinematical analysis of C- and M-type stars in the solar neighbourhood |
| 72 | Jahreiß , H. | Heidelberg | Parallaxes for Smethells' red dwarf stars |
| 73 | Jahreiß , H. | Heidelberg | Parallaxes of NLTT stars[2] |
| 89 | Jahreiß , H. | Heidelberg | Nearby stars |
| 90 | Jahreiß , H. | Heidelberg | K and M dwarfs at low galactic latitudes |
| 91 | Jahreiß , H. | Heidelberg | High-velocity stars |
| 92 | Jahreiß , H. | Heidelberg | McCormick K and M dwarfs |
| 93 | Jahreiß , H. | Heidelberg | Southern K and M dwarfs |
| 212 | Jahreiß , H. | Heidelberg | M dwarf stars (Robertson list) |
| 169 | Jaschek, C. | Strasbourg | Luminosities and kinematics of spectroscopically-peculiar groups |
| 220 | Jauncey, D.L. | Epping, Australia | Stars around quasars, $\delta < 40°$ |
| 208 | Kharchenko, N. | Kiev, Ukrania | Studies of the galactic main meridional section |
| 15 | Kilkenny, D. | SAAO, S. Africa | Parallaxes and proper motions of OB stars at high galactic latitudes |
| 21 | Kilkenny, D. | SAAO, S. Africa | Parallaxes and proper motions of hot subdwarfs |
| 167 | Klare, G. | Heidelberg | Kinematics of young stars within 3 kpc |
| 75 | Klemola, A.R. | Lick, USA | Comparison of Lick proper motion and Hipparcos reference frames[2] |
| 205 | Klemola, A.R. | Santa Cruz, USA | Subset of the Lick comparison programme (AGK3 stars) |
| 206 | Klemola, A.R. | Santa Cruz, USA | Lick proper motion catalogue (part)[2] |
| 170 | Kovalesky, J. | Grasse | Stars occulted by Uranus and Neptune |
| 207 | Kovalevsky, J. | Grasse | RS CVn systems in the southern hemisphere |
| 156 | Krautter, J. | Heidelberg | Evolutionary status of low and medium mass pre-main-sequence stars |
| 125 | Kristensen, L.K. | Aarhus | Catalogue rotation using (51) Nemausa |
| 37 | Lacy, J.H. | Austin, USA | Reference stars near the galactic centre |
| 59 | Laval, A. | Marseille | Expansion of the association Sco OB1 |
| 86 | Lederle, T. | Heidelberg | Determination of proper motions for the IRS and NPZT stars |
| 129 | Lequeux, J. | Meudon | Direct distance calibration for stars closer than 500 pc[2] |
| 130 | Lequeux, J. | Meudon | Distances and proper motions of runaway O-B stars and supergiants |
| 40 | Lestrade, J.F. | Paris | Stars around millisecond pulsars [1] |
| 41 | Lodén, K. | Stockholm | Kinematics of the local Gould's Belt system of early-type stars |
| 78 | Lortet, M.C. | Meudon | Wolf-Rayet runaways |
| 65 | Lundström, I. | Lund | Proper motions in the region of the open cluster Collinder 121 |
| 117 | Lutz, T.E. | Pullman, USA | Proper motions of central stars of planetary nebulae |
| 152 | Lutz, T.E. | Pullman, USA | Parallax standard stars |
| 13 | Lynden-Bell, D. | Cambridge | Proper motion of the Magellanic Clouds |
| 47 | Lyngå, G. | Lund | Cluster membership of the cepheids S Nor and U Sgr |
| 133 | Malyuto, V. | Tartu, Estonia | Determination of absolute magnitudes for spectral classification standard stars |
| 131 | Mayor, M. | Genève | F stars of all ages as tracers of galactic chemical and dynamical evolution |
| 190 | Mayor, M. | Genève | Propriétés dynamiques et chimiques du halo galactique par le biais des sous-naines |
| 99 | Mennessier, M.O. | Montpellier | Young stars: irregularities of the velocity field and spiral structures |
| 148 | Mennessier, M.O. | Montpellier | Mira stars and stellar evolution |
| 214 | Mermilliod, J.C. | Lausanne | Selected absolute proper motions of stars in galactic open clusters |
| 215 | Mermilliod, J.C. | Lausanne | Stars in NGC 188 (HST calibration field) |
| 97 | Mirzoyan, L.V. | Byurakan,Armenia | Nearby OB associations and trapezium-type multiple systems |
| 39 | Miyamoto, M. | Japan | Kinematics of RR Lyrae stars: where is the galactic mass? |
| 3 | Monnet, G. | Lyon | Determination of the 'local' rotational angular velocity in our Galaxy |

| No. | Proposer | Institute | Title |
|---|---|---|---|
| 184 | Murray, C.A. | Herstmonceux | Candidate stars within 100 pc |
| 113 | Nicolet, B. | Genève | Evolution stage of the Am stars |
| 101 | Núñez, J. | Barcelona | Towards an inertial reference frame through observations of minor planets |
| 177 | Oblak, E. | Besançon | Etoiles doubles à éclipse |
| 178 | Oblak, E. | Besançon | Etoiles doubles visuelles |
| 135 | Oja, T. | Uppsala | kinematics at the north galactic pole |
| 95 | Olsen, E.H. | Copenhagen | HD stars (A5 to G0) brighter than $m = 8.3$ mag[2] |
| 96 | Olsen, E.H. | Copenhagen | HD stars (G5) brighter than $m = 8.6$ mag[2] |
| 115 | Orús, J.J. de | Barcelona | Study of the local stellar velocity distribution |
| 183 | Pagel, B.E.J. | Herstmonceux | Astrometry of nearby stars of halo population |
| 9 | Pasinetti, L.E. | Milan | Solar standards: the search for groups of solar spectral analogues |
| 2 | Paturel, G. | Lyon | The extragalactic distance scale from Cepheids |
| 211 | Pedoussaut, A. | Toulouse | Contribution à l'étude des étoiles binaires spectroscopiques |
| 123 | Penston, M.V. | Cambridge | Distances of T associations |
| 132 | Perrin, M.N. | Paris | Precise trigonometric parallaxes of non-evolved G- and K-type dwarfs and subdwarfs |
| 84 | Pettersen, B.R. | Oslo | The absolute luminosities of flare stars and their variability |
| 8 | Popper, D.M. | Los Angeles, USA | Absolute fluxes from nearby eclipsing binaries |
| 31 | Popper, D.M. | Los Angeles, USA | Parallaxes of visual binaries with reliable orbits |
| 106 | Pottasch, S.R. | Groningen | Distances to planetary nebulae |
| 74 | Praderie, F. | Meudon | Physical parameters for programme stars in the satellite project |
| 213 | Prévot, L. | Marseille | Selection of stars in the Magellanic Clouds |
| 118 | Reid, I.N. | Pasadena, USA | Astrometry of low-lumimosity stars |
| 102 | Rosselló, G. | Barcelona | Analysis of 7296 lunar occultations observed by photoelectric methods |
| 124 | Ruben, G. | Potsdam | Establishment of a reference system with a Schmidt telescope |
| 203 | Ruben, G. | Potsdam | Link to the extragalactic reference frame in three fields of the northern hemisphere |
| 40 | Schmidt, M. | Pasadena, USA | Extragalactic reference frame based on bright quasars[2] |
| 126 | Schmidt-Kaler, T. | Bochum | Proper motions of O-type runaway stars |
| 154 | Schmidt-Kaler, T. | Bochum | Parallaxes and proper motions of solar-type stars (solar twins) |
| 155 | Schmidt-Kaler, T. | Bochum | Be stars in open clusters |
| 188 | Schober, H.J. | Graz | Search for binary asteroids |
| 11 | Scholl, H. | Nice | Observations of minor planets for determination of the dynamical reference system |
| 12 | Scholl, H. | Nice | Determination of the masses of asteroids (20) Massalia and (44) Nysa |
| 121 | Schutz, B.F. | Cardiff | Search for a solar companion[2] |
| 87 | Schwan, H. | Heidelberg | Determination of improved proper motions for the GC stars |
| 151 | Schwarzenberg,A. | Brighton | Critical mass-transfer rate for stable accretion disks in cataclysmic variables |
| 94 | Schwerdtfeger, M. | Heidelberg | Positions and motions of pulsating variables |
| 138 | Shipman, H.L. | Delaware, USA | Distances and luminosities of highly-evolved stars |
| 216 | Smith, C. | Washington, USA | FK5 candidate stars |
| 173 | Snow, T.P. | Boulder, USA | The interstellar medium in three dimensions |
| 33 | Soderblom, D.R. | Baltimore, USA | Luminosities of solar-type stars |
| 34 | Soderblom, D.R. | Baltimore, USA | Positions of stars associated with nebulosity |
| 45 | Söderhjelm, S. | Lund | Minor planets for a dynamical reference frame |
| 142 | Spite, F. | Meudon | Kinematics and age of population I stars with observed lithium abundances |
| 144 | Squeren,A.M. Le | Meudon | Study of intrinsic parameters of OH Mira stars |
| 49 | Stenholm, B. | Lund | Proper motions of Wolf-Rayet stars |
| 36 | Sutton, E.C. | Berkeley, USA | Determination of the IR reference frame |
| 14 | Szabados, L. | Budapest,Hung. | Calibration of the Cepheid distance scale |
| 145 | Taylor, G.E. | Herstmonceux | Occultations of stars by planets and satellites |
| 70 | Thé, P.S. | Amsterdam | Location of pre-main sequence Herbig Ae/Be stars in the HR diagram |
| 116 | Thé, P.S. | Amsterdam | The absolute magnitude of M-type giants of various spectral types |
| 187 | Tobin, W. | Canterbury, NZ | Kinematic study of high-latitude OB stars |
| 27 | Trefzger, C. | Binningen | Parallaxes and absolute magnitudes of population II dwarf stars |
| 58 | Trimble, V. | Irvine, USA | Parallaxes and proper motions of astrophysically-puzzling classes of stars |
| 176 | Turon, C. | Meudon | Local mass density through the kinematical study of F-stars in the meridian plane |
| 180 | Turon, C. | Meudon | Density and velocity distribution of M dwarfs |
| 181 | Turon, C. | Meudon | Evolution of late dwarf stars |
| 191 | Upgren, A. | Van Vleck, USA | Dwarf K and M stars found spectro scopically without bias toward high velocity |
| 192 | Upgren, A. | Van Vleck, USA | Space densities and location in t he HR diagram of common types of stars |
| 165 | Vauclair, G. | Toulouse | Parallaxes of bright white dwarf stars |
| 109 | Vegt, C. de | Hamburg | Selected radio stars for an extragalactic reference link using the VLA |
| 110 | Vegt, C. de | Hamburg | Transformation of the Hipparcos stellar frame to an extragalactic reference frame |
| 111 | Vegt, C. de | Hamburg | Investigations of systematic errors and improvement of ground-based catalogues[2] |
| 112 | Vegt, C. de | Hamburg | Proper motions and space velocities of open clusters in the northern hemisphere[2] |
| 218 | Vegt, C. de | Hamburg | Optical & radio positions of radio * for a link to the extragalactic reference frame |
| 174 | Viotti, R. | Frascati | Observations of hot subdwarf stars |
| 175 | Viotti, R. | Frascati | Observations of VV Cephei and symbiotic stars |
| 67 | Vogt, N. | Santiago, Chile | Astrometry of cataclysmic variables |
| 20 | Walter, H.G. | Heidelberg | Astrometric parameters of selected radio stars |
| 26 | Walter, H.G. | Heidelberg | Positions and proper motions of stars in the fields of extragalactic radio sources[2] |
| 1 | Weiss, W. | Vienna | Parallaxes of Ap and Am stars in the field and in clusters |
| 134 | Westerlund, B.E. | Uppsala | The $\zeta$ Sculptoris cluster: its members, distance, space motion and evolution |

| No. | Proposer | Institute | Title |
|---|---|---|---|
| 121 | White, G. | Epping, Australia | Radio stars[1] |
| 202 | White, N.E. | Noordwijk | Properties of X-ray sources discovered by Einstein, Exosat and Rosat[2] |
| 16 | Wielen, R. | Heidelberg | Proper motions of open star clusters |
| 17 | Wielen, R. | Heidelberg | Parallaxes of LHS stars |
| 18 | Wielen, R. | Heidelberg | Proper motions of pulsating variable stars |
| 136 | Wing, R.F. | Columbus, USA | Absolute magnitudes of Mira variables and carbon stars |
| 4 | Xu Tong-Qi | Shanghai, China | Rotation of the Earth since 1957 |
| 5 | Xu Tong-Qi | Shanghai, China | Comparison between the optical and radio positions of radio stars |
| 53 | Yasuda, H. | Tokyo, Japan | Confirmation of a fundamental system in the fainter magnitude ranges |
| 46 | Yoshii, Y. | Tokyo, Japan | Kinematics of extremely metal-deficient red giants |
| 51 | Zappalà, V. | Torino | Physical observations of asteroids |
| 141 | Zeeuw, P.T. de | Princeton, USA | Structure and evolution of OB associations |

[1] Original proposal withdrawn and replaced by this proposal

[2] Proposal deleted (no data)

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