Open Cluster Data Base

Version 2.0

(User's Guide)

J.-C. Mermilliod

Institut d'Astronomie de l'Université de Lausanne
CH - 1290 Chavannes-des-Bois / Switzerland

E-mail: `mermio@scsun.unige.ch`

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Abstract

The database for stars in galactic open clusters (BDA) has been developed since 1987 at the Institute for Astronomy (University of Lausanne). The extensive collection of observational data covers most significant domains and concerns about 100000 stars in some 500 NGC, IC and anonymous clusters. This includes measurements in most photometric systems in which cluster stars have been observed, spectroscopic observations, astrometric data, various kinds of useful information and extensive bibliography. Maps for about 180 clusters have been scanned and included in the database. The greatest effort has been spent in solving the identification problems raised by the definition of so many different numbering systems.

The database not only aims at storing data but also at offering a versatile working environment covering many aspects of the study of open clusters. It provides tools to compare the data and plot photometric diagrams. It is most suitable for use on a workstation. Independently of the application software proposed, the main utility of the database lies in the extensive data collection brought into uniform numbering systems. The BDA presents a clear report of the present status of observations.

The following document presents the general philosophy of the data organisation and retrieval. It explains with many examples how to use the database.

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Part I

DATABASE DESCRIPTION

Chapter 1

Introduction

1.1 History

About 1200 galactic open clusters are known and approximately half of them have been observed so far, in at least one photometric system. The number of stars per cluster goes from a few tens for the poorest objects, to several thousands for the most prominent clusters.

Modern observations of open clusters developed very rapidly after the definition of the UBV photoelectric system (Johnson & Morgan 1953). These observations produced a number of colour-magnitude (Hertzsprung-Russell) diagrams which made fundamental contributions to the understanding of stellar evolution. At the same time photographic photometry allowed to observe larger areas and reach fainter stars. Additional information, mostly spectroscopic, was gradually obtained, first for stars in the nearby clusters and later in more distant clusters, thanks to the existence of larger telescopes and more efficient detectors. Two-dimensional detectors are best adapted for the observations of star clusters and CCD observing is today becoming the preferred technique. It replaces both the photoelectric and photographic photometry.

Data compilations started already in 1972 at the Institute for Astronomy (University of Lausanne, Switzerland). Mermilliod (1976a) published a first catalogue of UBV photometry and MK spectral types in open clusters. The third version was announced ten years later (Mermilliod 1986a). The systematic determination of cross-references between the many numbering systems in a cluster was the basic work which made the realisation of the data collections possible. Several catalogues were distributed by the Strasbourg Data Center (CDS). The files remained on magnetic tapes until the installation of Unix workstations and large disks in our institute made it possible to keep the data on-line. These compilations were discontinued in their older form and the data were organised in a database designed in March 1987 (Mermilliod 1988a, 1988b).

1.2 Need for a database

The quantity and variety of observations accumulated on about 100000 stars in open clusters are quite impressive and sufficient to motivate the development of a specialised database. Data analysis in open clusters is quite complex and extensive information are often necessary, but are difficult to gather because of the multiple star designations created so far. The star identification problem, already discussed (Mermilliod 1972, 1973, 1976b, 1979a) is not specific to star clusters, but takes on a more accute form. The variety of stars identifications asks for an unavoidable amount of extra work to collect the data available for any star. The necessity to keep on-line track of the cross-references between various numbering systems may be one of the motivations for developing a database.

The database offers one solution to this problem and a coherent data storage and retrieval. The fact that data are kept under a stable format allows to develop tools more easily. It is also a deposit for unpublished data, although the development of anonymous ftp servers has reduced the interest of the database to preserve unpublished data.

1.3 Access mode

The database is maintained on a Sun Sparc worksation and its total size is about 35 MB for a total of about 6000 files. Due to the specific structure of the database, it is presently more convenient to have a copy of it on a workstation.The dissemination of various copies may raise the problem of the simultaneous existence of several revisions. However, this problem is solved by the transfer of the modified or new data files grouped in a tarfile over the Internet. Such a system is already used to maintain a copy of the database at the Meudon observatory in Paris on a DEC workstation, which offers additional possibilities for distribution to other machines. Access through the World Wide Web is being examined. Hypertext description is being written and some database consultation will be provided. There is also a project to access the database through the ADS facility.

1.4 User's guide overview

The first part presents a database overview and describes the concept of datatype and the organisation of the bibliography (Chapter 2), the database structure in directories and the file organisation (Chapter 3), the different query modes that have been considered for BDA (Chapter 4) and the graphics facilities (Chapter 5).

Chapter 6 discusses the detail of the database installation from tape and the various definition files.

The second part is divided in four chapters which explain how to use the basic commands and the various query modes: command, menu, prompt and graphical user interface.

The third part presents applications provided by the database and discusses the underlying philosophy. It also explains how to use them. The use of the graphic program which generates the photometric diagrams is explained here.

The Appendix presents a summary of the command and program names, option meaning, data types, file names, field names and aliases. It also describes the catalogue of red giants in open clusters.

Chapter 2

Database Overview

2.1 Basic concepts

2.1.1 Database concept

The database structure results from the history of data compilation, the constraints of existing application software and mostly reflects the way the research using the database is viewed.

The database has been built not only to query information for one or a few stars, but mainly to study, in a general sense, open clusters. This includes data comparaisons, data elaboration as well as evaluation of cluster properties. The latter analysis relies basically on membership determination.

Therefore clusters, rather than stars, form the basic unit of the database, and each cluster has its own directory and contains the relevant data. The various logical steps of the cluster study and the necessity of starting from the original data justify the adopted structure.

2.1.2 Data types

One important concept in BDA is that of datatype. A datatype designation has been attributed to each kind of data. This designation is generally similar to acronyms currently used, like, for example: **ubv, mk, uvby, jhk**, and so on. The datatype designation is described in Appendix C.

The knowledge of the datatype is important because it is always used for querying the database. The datatype may be an argument to commands, like in `list ubv`, but more generally, many command names are identical to the datatype designation. For example, the command to get the UBV data for some stars, let's say star # 1 2 3, will be simply: `ubv 1 2 3`.

This syntax and the fact that the data are collected in distinct files hide the name of the file that contains the desired data and the field names in each record.

2.1.3 The basic scheme

The analysis of photometric diagrams, and especially the colour-magnitude diagrams that can be built in several photometric systems, remains the key method to determine the cluster parameters (reddening, distance and age). The study of a cluster necessitates to have also easily available all complementary information, remarks and bibliography. This is why everything is organised in the cluster directories.

If the production of a colour-magnitude diagram seems rather easy, the real situation is unfortunately not simple and the data are not always of sufficient quality. Therefore a large amount of work is necessary to plot a reliable colour-magnitude diagram. The various steps involved are:

1. the census of the stars in the cluster field, to determine the completeness in terms of both limiting magnitude and surface coverage;

2. the comparison of the various sources of data;

3. the selection of cluster members. This is certainly the main problem and no straightforward solution has yet been found. The other data contained in the database, like spectral types, radial velocities, remarks, and so on, may help in assigning cluster membership;

4. with the best selected data, it is eventually possible to plot a nice colour-magnitude diagram and determine more accurate cluster distances and ages.

The database cross-reference tables and the collection of rectangular positions are useful to achieve the first step. Tools to perform the second step and compute mean values are also provided.

2.1.4 Star numbering

Star numbering is probably the most serious problem to solve to build a coherent database. The solution adopted is based on earlier work which was undertaken to include photometric data on star clusters into catalogues prepared for the Strasbourg Data Center (Mermilliod 1972, 1973, 1976b, 1979a).

One numbering system has been adopted for each cluster and it provides a unique identificator for each star which is used to register the various data. Therefore the data recorded under the numer #1 in each data file always belong to the same star, i.e. star #1. This identificator is the main key that will be used to access the data. This policy implies that star original numbers found in publications have often to be transformed into the system adopted in the database. Complete cross-references have been determined, either by comparing cluster charts or by using rectangular (x,y) positions and carefully kept in tables, one per cluster. These tables give, for each star, the different identification numbers that are existing in the various numbering systems. The first column of the cross-reference table defines the adopted numbering system.

The second column of the table contains the numbers from the basic source and the numbers adopted in BDA are therefore identical to it. But no numbering system contains all the stars present in the cluster field and the basic numbering systems have been extended.

Two solutions have been adopted to record additional stars. The first one consists in continuing the numering system with the new stars of the second reference, entered in increasing number order, then with the third system and so on. This works fine if the additional stars are not too numerous. The second solution is used when one numbering system contains many new stars, but it is not desirable to change the reference system. This happens, for example, when proper motion studies contain lots of stars outside the main cluster area. In these cases, a constant is added to the star numbers. Adding 1000, makes it easy to read back the original numbers.

2.1.5 Star membership

The membership of stars to open clusters is certainly the most difficult problem to solve as a preliminary to any study. However there are very few methods to used when proper motions probabilities are not available. Existing codes developed at several observatories are not yet publicly available.

An expert system, adapted from Jonathan (Frot 1988), has been implemented in the database with a number of rules that should help the user to determine if a given star is a cluster member or not. Rules have to be improved to resolve the ambiguities resulting from the curvature of the sequences in some photometric diagrams and to extend the number of data taken into consideration. Presently, the expert system looks in the database for the UBV data, spectral types, proper motion membership probability and radial velocity, and distance from the cluster center and makes inference on the membership. It does the work of extracting the data itself and proposes a decision according to the data it has found and the rules it knows to analyse the situation. This behaviour reproduces the way the same question is solved by a human user. It could of course use more information than it does now, speak English instead of French, the language in which it has been developed, and above all, have better rules. It would however be extremely useful to be able to sort out the member stars more or less automatically, on the basis of objective criteria.

2.2 Directory organisation

The database is not a traditional relational database management system, but rather an advanced file management system. Clusters, but not stars, form the basic unit of the database and the structure has been designed to provide a natural working environment. The whole data set for a cluster forms a special relational set, because one key, the star designation, is common to all files.

The database structure uses the directory hierarchy supported by the Unix system. The main directory is the database itself. It contains several subdirectories: description of the database, help information, references, bibliography, programs, shell scripts. The clusters are collected in parent directories according to the source catalogues (NGC, IC or anon). Each cluster defines an independent directory identified by its name and containing the available data in distinct files, one for each data type. This structure allows easy inclusion of any new data type.

The present database structure is thought of as a first step in the organisation of cluster data and bibliography. When enough data analysis has been performed and only one set of data for each type will be available for each star, it may perhaps be more convenient to adopt another structure and collect all the data in one file for each cluster.

2.3 File organisation

The files are organised sequentially and compressed and, within the files, the entries are sorted by star number and source reference. Due to the small size of many files, there is no need for indexing or direct access.

The filenames reflect their content and are conserved throughout the data base. They are presented in Appendix D. The command names are usually identical to that of the data type they handle.

This file organisation offers several advantages: it allows the full use of UNIX file handling tools for searching and sorting and has enabled the straightforward implementation of graphics facilities. Compressing the files with the system function `compress` produces a reduction of disk storage by a factor of two. Many tasks can be performed without physically decompressing the files, by using the system function `zcat` to feed a pipe; it produces an output but leaves the files compressed. Finally, Unix editors are used to maintain the files, saving software development.

2.4 Record structure

Whenever possible, the records have the same structure: each record contains the star identification, the source and the data. White space are used as separators and no padding is used for missing data. The fields of each datatype are listed in Appendix E. The star identification is the main key to access the data, but it is also possible to use filters based on the data sources or astrophysical parameters.

Most data files are 1 to n relations because several sources of data may exist for each star. Files with mean or selected data are 1 to 1 relations. The first aim of the database and of the data analysis facilities developed is to pass from the 1 to n state to the 1 to 1 state. This means that at the end of the analysis process, only one value of each parameter will remain for each star.

2.5 Data sources

The database started with the installation of the data already collected and kept on magnetic tapes. Several catalogues had been announced and made available through the Strasbourg Data Center: UBV photometry and MK spectral types in open clusters (Mermilliod 1976a, 1986a), UBV photographic data (Mermilliod 1984a), individual radial velocities (Mermillliod 1979b, 1984b), cross-reference tables (Mermilliod 1979a), cross-identifications with astronomical catalogues (Mermilliod 1986b). Unpublished compilations made by me and containing CCD data, rotational velocities, membership probabilities and positions were used at the first installation of the database.

Aditional photoelectric photometric data were taken from the compilations made in our institute, and among them data in the following systems: uvby (Hauck & Mermilliod 1985), DDO (Mermilliod & Nitschelm 1989), Walraven (Nitschelm & Mermilliod 1990).

The files remained on magnetic tapes until the installation of Unix workstations and large disks in our institute made it possible to keep the data on-line. The data were organised in a database designed in March 1987 (Mermilliod 1988a, 1988b) and the compilations of cluster data were discontinued in their older form. New published data are entered regularly. A progress report on the introduction of recent data has been published in the CDS Bulletin (Mermilliod 1992a).

The bibliography from Alter et al. (1970) and the information from Lyngå's (1987) catalogue were taken from the files distributed by the Strasbourg Data Center.

2.6 Data content

The database tries to collect all published data for stars in open clusters that may be useful either to determine the star membership, or to study the stellar content and properties of the cluster. The data are usually recorded in their original form, with an indication of the source, but also as averaged values or selected data when relevant. The mean values for UBV (photoelectric, photographic or CCD) are not kept in the database, but can readily be computed. It presently contains:

- **astrometric** data: coordinates, rectangular positions, and some proper motions;
- **photometric** data in most systems in which cluster stars have been observed;
- **spectroscopic** data: spectral classification, radial- and rotational velocities;
- **bibliographic** information;

- **specific** information: (a) membership probabilities, (b) orbital elements of spectroscopic binaries, (c) remarks on peculiarity, variability, duplicity, (d) identifications of double star components, (e) cross-identifications with astronomical catalogues, (f) list of red giants in the cluster field and of non-member stars.

Table 2.1 gives an insight into the present content of the database; it lists for each kind of data the number of clusters involved, the number of measurements, and the number of stars concerned, except for the references and bibliography where the number of entries is indicated. The completeness of the data base should be rather high for many types of data, and is still improving.

Table 2.1: July 1994 database content

	Number of		
Subjects	Clusters	Meas.	Stars
Identifications	365		9876
Transit Table	190		68719
Coordinates	441	30621	27879
Positions	441		39424
Positions (x,y)	385		122819
Double stars	193	1662	1230
UBV photoelectric	413	30341	20632
UBV photographic	268	91458	71899
UBV CCD	69	30409	28322
UBV camera	3	194	194
UBV sit	3	284	284
UBV cmd	5		2867
UBV hrd	7		321
RGU (pg)	74	10191	10191
Geneva 7-colors	184		4306
uvby measures	155	5461	3897
uvby mean	155		3423
uvby Eggen	42	876	775
uvby CCD:	8	935	935
Hβ measures	216	5696	3821
Hβ mean	216		3312
Walraven	58	1432	1382
Vilnius	31	747	698
DDO	126	950	769
Washington	60	533	507
RI (Johnson)	2	405	350
RI (Kron)	4	1254	1111
RI (Eggen)	14	118	118
RI (Cousins)	23	869	847
RI (Cousins) CCD	8	3149	3112

Subjects	Number of Clusters	Meas.	Stars
JHK	33	776	774
uvgr (Thuan, Gunn)	4	144	144
Smith	5	103	103
MK types	272	7754	4645
MK types (selected)	162		3974
HD types	299		8584
Vsini	79	2222	1592
RV mean	63	1799	1612
RV individual	183	29712	3450
RV GPO	10	568	568
RV RFS	7		141
Orbits	35	199	175
Proper motion (abs)	1	2331	1164
Proper motion (rel)	4	3811	3811
Probability (μ)	59	21574	21574
Probability (RV)	2		87
Remarks	234	3703	3146
Periods	3	67	62
gK stars	231		3291
Am stars	36		109
NM	94		2645
Cluster maps	177		
Bibliography (Alter)	1200		
Bibliography (69-94)			3000
References			2500

A part from the published data found in the literature, the database contains also information that was accumulated in the past or prepared especially for it to enhance its capabilities:

- Cross-reference tables contain the basic cross-identifications between the various numbering systems in a cluster. A large part of the work has been done by the author.
- Rectangular (x, y) positions (usually in arbitrary units) have been collected from the literature or measured on published photographs with a digitizing tablet. A file collects the information relevant to the scale of the (x, y) positions and the sources of the data.
- Published photographs defining cluster numbering systems have been scanned and included in the database. About 180 maps have already been processed.

2.7 Access to the information

Thanks to the work on stellar identifications invested in the preparation of the catalogues used for building the database, the identification problem is greatly simplified; the various data for each star are collected under a unique designation, according to the numbering system adopted for the cluster. This identification is the main key for accessing the data of any star in any file. However, there are other possibilities for querying the database:

- One can recover the star number in the adopted numbering system (main key) starting with any identification existing in the cross-reference tables;
- One can access the data directly with HD, DM or other identifications;
- Data can be selected according to a source number;
- Samples can be formed according to astrophysical criteria.

Interesting clusters may be selected according to the number of available data of any type and the implementation of Lyngå's (1987) catalogue allows other types of selection, based on galactic position or cluster age for example.

2.8 Bibliography and references

The access to general or bibliographic information is considered as a very important facility that the database should offer. The catalogues already available in computer-readable form have been installed in the database and an additional bibliographic service covering the recent literature has been developed in another style to make the retrieval easier and more efficient. The various facets are provided by:

- the compilation of cluster parameters by Lyngå (1987), which provides the global information available on open clusters;
- the bibliography compiled by Alter et al. (1970) and its first supplement (Ruprecht et al. 1981), which collect the references from about 1900 or before up to 1973.
- the recent bibliography, covering the years 1969 to the present day, which has been developed for the database. This bibliography is based on chapter 153 of the Astronomy and Astrophysics Abstracts and the recent references are regularly entered in the computer. The bibliography search is based on keywords. The most obvious one is simply the cluster name, but many others can be used. Abstracts are not yet included in the database.
- the information on ongoing work, generally extracted from observatory reports and AAS abstracts is also available from the database.

The source of most data are indicated and the references can be obtained either one by one for any type of data or for any sample.

2.9 On-line help and information

On-line help and information are available at several levels. General descriptions of the database and applications are proposed through various menus. One can easily recover the names of the commands, the content of the files or the descriptions of the options. In addition, each command and function is (or will be) described in a manual file. A rapid help on the command syntax to use to obtain the desired results is available with an on-line menu which offers also many examples. Similar command description is also available in hypertext form and can be displayed with NCSA Mosaic.

2.10 Facilities offered by the database

The database offers several working facilities and some are described below. Three examples are discussed by Mermilliod (1992b).

- **Data comparaison:** Data comparaison is an important step before starting any study. Tools have been developed to compare data coming from different sources. This concerns essentially the UBV system because the UBV data represents a large fraction of the published photometric data. The other photometric systems seldom present two or more different sources of data.

- **Colour-magnitude diagram manipulation:** The main tool of the database allows to plot the various diagrams that can be built in the UBV and Geneva photometric systems. It offers a large spectrum of facilities, like fitting sequences or computing isochrones. Extensions have to be developed for other photometric systems (uvby, Walraven and others).

- **Technical data:** The technical information on instruments and data acquisition systems may also prove important to characterise the data contained in the database. Pioneering work has been done by van Leeuwen (1985) who collected the information on telescopes and plates related to proper motion studies in open clusters. This information is available in the database. The collection of similar information on telescopes and spectrographs used for radial velocity determination has been started. It would also be necessary to collect the same information for CCD photometry.

- **Miscellanous facilities:** To avoid remembering many commands and their options, a number of menus have been written which group most actions concerning a given subject. Those built up so far are generally related to the maintenance and development of the database, and were especially designed to facilitate the introduction of new data. In this category, one finds:

  1. the management of *coordinates:* it was made to determine coordinates of stars in open clusters starting from (x,y) positions in arbitrary units and include them in the database;

2. the management of *rectangular position:* (x,y) positions are now often published with CCD data. In addition many published charts have been measured and the results included in the database;
3. the management of *cross-references:* to maintain the principles of the database, it is necessary to determine the cross-references between any new numbering system and those already existing.

2.11 Graphics

The SM (2.3.1) graphics package written by Robert Lupton and Patricia Monger is extensively used to produce graphical output and hardcopy. It is often used in its interpreter mode for two reasons: firstly, macros take less disk space than compiled Fortran or C programs and are much easier to write, and secondly, the interaction with the user is extremely efficient; values of various parameters (plot size, title, symbols) can be changed interactively and the final plot printed. The dialogs are driven by menus.

2.12 Correction and updating

A program proposing pull down menus drives the updating processes through a number of shell scripts. Correction and updating is done either by editing the files when only a few data are to be added or corrected, or by shell handling file commands when more data are to be added.

2.13 User's profile

Even if the proposed software is not used, the utility of the database lies in the extensive collections of data brought into a uniform numbering system. The database can therefore be useful not only to astronomers working in the field of open star clusters, but also to students for a variety of work, because of the easy access to the data and facility for implementing users' programs.

Copies of the database have been sent to several colleagues in various countries. Other colleagues and several students working on their Ph.D. have also asked for specific data or bibliographic information by E-mail.

2.14 Scientific use

The realisation of a new atlas of colour-magnitude diagrams based on improved and homogeneous cluster parameters was the first scientific use of the database foreseen and the motivation of its development. The way to achieve this goal is however quite long, but it remains a major project. When reliable parameters have been determined for a number of clusters, it becomes possible to do some astrophysical research.

The information collected in the database may be used to study the clusters' stellar content and properties. In spite of the limitations due to the lower precision of some data, or their limited number, the database is the best starting point for many astrophysical studies involving open clusters. Nowhere are complete data collections to be found and one merit of the database is to give a clear report of the present observation status.

The database facilities have been used by Meynet et al. (1993) to compare new theoretical isochrones with the colour-magnitude diagrams of 30 clusters. In the spring of 1994, the database was successfully used to cross-identify the stars detected by the Tycho experiment on board the Hipparcos satellite.

2.15 Future plans

The challenge for the future lies in the management of the rapidly growing number of new data coming from CCD photometry and extensive observations of faint stars in nearby clusters and covering a wide range of groundbased and space techniques.

Due to the increasing quantity of available data, any study will become more and more time-consuming. One has therefore to think to more automated methods that rely not only on extensive data collections, but also on the transfer of knowledge to the computer, to let it do much of the work. Therefore, aside from continuing to collect and install new data and take other data types into consideration, the main development should consist of implementing more analysis facilities and calibrations.

Another important point would be to include in the database the knowledge contained not only in the data or procedures themselves, but in the article and review texts. Some could of course be recovered by searching the bibliography, but it may take a long time because the number of papers written every year on open clusters is increasing regularly and reaches the level of 200 papers for the best years. Therefore new results or exciting hypothesis should be extracted from the papers and stored in the database. This is actually possible thanks to the hypertext facility offered by NCSA Mosaic or the WAIS text indexing and search facilities.

Chapter 3

Database structure

The numerous files are located in a directory hierarchy based on a two or three level structure. The root directory is bda, the database itself and the data, programs, bibliography and documentation are contained in subdirectories. The following describes the database organisation and the content of the numerous directories

3.0.1 Clusters

Each cluster forms a directory identified by its name (like: 2287, 2516 for NGC clusters, 2391, 2602 for IC clusters or cr228, tr16 for anonymous clusters). The clusters are members of parent directories named ngc, ic, and anon depending on the catalogue source. Anon clusters should represent a two level structure author's name / cluster number, but this would have destroyed the general symetry and be a source of difficulty.
Therefore the path to the clusters NGC 2287, IC 2391 and anon tr16 are respectively:

- bda/ngc/2287
- bda/ic/2391
- bda/anon/cr228

Each cluster directory contains a working subdirectory, .T/, which is used to copy data or write temporary files.

3.0.2 Programs

Different programming languages are used to build the database software. The programs and shell scripts are grouped in directories according to their characteristics. The path to the executable programs and shells contained in these directories are set by the command `source .bdarc` which should be normally included in the alias bda.

- bda/bin groups shell commands, options and functions;
- bda/progf contains the Fortran sources and executables, corresponding mostly to application software;
- bda/progc contains the codes written in the C language, mostly system programs using Unix libraries;
- bda/progs groups the graphic programs that use the SM C library;
- bda/progx groups the elements related to the development of the graphical interface;
- bda/graphic contains the many routines of the program developed to plot photometric diagrams. This is a temporary implementation to facilitate the development;
- bda/smacro contains the SM default file (user's macros) and its two variants (one for each language) *default_fr* and *default_eng*;
- bda/src has a small numbers of sources of external routines;
- bda/lib will contain libraries of BDA routines.

3.0.3 Description and documentation

The documentation of the database, and on-line help of the various query modes are localized in several directories. The distribution is not really exclusive and will be improved when the query programs will be more definite.

- bda/introduction contains the user's guide and installation pages;
- bda/descri contains documentation files used by the `dsc` and `doc` menus;
- bda/html contains the hypertext version of the user's guide and the command description for use with NCSA Mosaic;
- bda/emploi contains the command description for line mode;
- bda/man contains man pages for BDA commands and menus which can be displayed with the Unix command `man`. This directory is subdivided in two subdirectories: `man1` and `man3`;
- bda/manuel contains the French manual files corresponding to the command `mnl`;
- bda/help contains help information for various programs;
- bda/xhelp contains the text of the on-line help provided with graphical user interface

- **bda/dictionnaire** contains files that describes the record structure of the data file;
- **bda/information** contains files with technical information on the data;
- **bda/contenu** contains the files collecting the database content summary for each datatype.

3.0.4 Bibliography and references

The files containing the bibliographic references to the literature published from 1969 to the present day are located in the directory bda/bibliographie. There is one file for the bibliography and one file for the keyword for each year.

The files containing the references of the data sources are located in the directory bda/references. There is one reference file for each datatype.

The files with the Alter et al. bibliography (1900 to 1973) and those from the catalogue of Lyngå (1987) are normally distributed in the cluster directories. The files for the clusters which do not have yet their own directory are collected in the following directories bda/catalogue/budapest and bda/catalogue/lynga respectively.

Finally, the original UBV photographic data from Moffat and Vogt (1972) are kept in bda/catalogue/bochum.

3.0.5 Miscellanous

There are more directories depending on bda.

- **bda/hipad** contains the (x,y) positions measured on a digitizing tablet and awaiting their installation in the database;
- **bda/newdata** new data generally received by E-mail and awaiting their inclusion in the database;
- **bda/resultat** results from data comparisons, and other files;
- **bda/format** templates for datafile format;
- **bda/entete** column headers for each datatype;
- **bda/sequence** reference sequences (ZAMS) for photometric diagrams, and evolutionary models for computing isochrones;
- **bda/isochrone** isochrones computed on the fly. This directory should be cleaned regularly;
- **bda/modeles** data on stellar inertia to compute binary system evolution
- **bda/regles** rules for the expert systems;
- **bda/tmp** temporary files used by commands and programs;

- **bda/gestion** miscellanous files, related to the distribution of BDA and especially the file named *journal* which collects the names of the files modified or added and the date of the change;
- **bda/sauve** backup copies of data or program files made before an important change;
- **bda/oldata** cluster data, saved temporarily before doing a major change, like a numbering system change;
- **bda/menus** French and English texts of the various menus;
- **bda/poste** a place to put files to be sent by E-mail;
- **bda/tarfile** the last tarfiles to update distributed copies of the database;
- **bda/labo** a working directory.

Chapter 4

Query modes

4.1 Introduction

It is not so easy to design a query method that remains simple and avoids the use of an extended idiom and complex syntax. The idea was to avoid something like SQL because it is not be necessary to know the file- and field names to use the database. Therefore the query modes have been designed to hide as much as possible the database details.

In BDA four different approaches have been tried in an effort to minimize the learning and keep the typing at a low level. These four modes can be schematized as:

1. The command mode
2. The menu mode
3. The prompt mode
4. The graphical interface mode

4.2 The command mode

4.2.1 General principles

The historically first query mode developed is the command mode. Commands are issued at the Unix shell prompt and the user can benefit of the shell facilities, including command history, command editing and pipe or output redirection. Unix-style commands with several options have been written. These options provide most methods needed to extract information from the database, compare data and plot diagrams. For sake of simplicity, the commands that work on a specific datatype have the same name as the datatype designation. For example the command `ubv` deals with the UBV pe data and the `mk` command, with the MK spectral types. Command names are listed in Appendix A and option meanings, in Appendix B. The file names and content are described in

Appendix D, while the various fields of each data file are described in Appendix E.

The file organisation and their small size (a few hundred records), make the consultation very rapid with UNIX tools: the `grep` family and `awk`. The programming of the Bourne shell, together with specific Fortran or C language codes, offers interesting possibilities for coding elegant and efficient functions and commands.

Commands working on data are organised in the same way:

- Without parameter, the command provides a listing of the entire corresponding file, page by page;
- Given one or several star numbers as argument, the command returns the desired data;
- With a keyword, an option and one or several parameters, the command performs a selection according to the specification given, which may be a limiting value refering to the data or a reference;
- Options performing specific tasks have also been developed.

Commands relating to general information (manual, references, bibliography, help, statistics, and so on) can be called from anywhere in the database. However, most commands relating to data retrieval are active in a cluster directory only. Consequently, one first has to place oneself in a cluster directory, which is simply reached by giving its path: `ngc 2287`. Owing to the fact that the file names are conserved from cluster to cluster there is no need to tell a command which file it applies to: it knows it automatically. Because there is no a priori necessity to display a part of a record only instead of the whole line, it is not useful to know the detailed structure of the record for each datatype. A simple function called `nof` for "name of file" is used to get the corresponding filename. Try `nof ubv` just to see.

4.2.2 Command and function shell scripts

The command lines may have three possible structures:

1. `command star-number-list`: extract information for a number of stars. The datatype is implied by the command name, as for example: `ric 5 21 37`.
2. `command option values`: make a specific action driven by the option chosen. The values may be a list of stars or cutoff parameters, as for example: `ubv -a 1 2 3` or `mk -d 5`.
3. `command parameter comparator values`: perform a selection according to the chosen parameter and limits given by values, as for example: `ubv b-v -gt 1.5` or `mk ref -eq 999`.

Five comparators are used for making selections:

- "greater than" (-gt),
- "less than" (-lt),
- in an interval (-i),
- "equal to" (-eq),
- "nonequal to" (-ne).

The basic principle of the command software is the following:

1. the command parses the command line and calls the appropriate option,
2. the option function collects the necessary elements (column headers, data file, calls a awk function and displays the output,
3. the awk function does the real selection work.

The options have been grouped in a small number of scripts. Their names begin with opt_ and end with the options they contain, as for example `opt_pgine`. The names of older functions are formed simply by concatenation of "op" and the option name, as for example `op-d`. These options often call functions written in the awk language. With this structure and task distribution, any new option added to the system is immediately available for all commands without further modifications.

Figure 4.1 gives the listing of the `ubv` command which handles the UBV data through some 15 options. It has been chosen as an example because nearly all commands working on photometric data are simply links to the `ubv` command. This script first places the command name in the variable TY and writes it in a temporary file, and sets the variable FS to the name of the corresponding data file given by the function `nof` (name of file). Then it tests the number of arguments on the command line. If this number is equal to zero it displays the headers of the columns and lists the whole file. If there are one or more arguments on the command line, the script first tests if the first argument is numerical. If it is, it is assumed that the arguments are stars numbers and it calls the function `opt_noet` and passes to it the source filename, the datatype and all arguments.

If the first argument is not numerical, the script tests if it is a known option, and calls the respective function if the answer is positive. Finally, the command line may contain parameters for a selection and the option is then the second argument, which is tested. The position of the field used to do the selection is searched in the *pos.dic* file located in the directory bda/dictionnaire and is then passed to the function `opt_pgine`.

Figure 4.2 shows the code of this central function that performs the selections on star numbers, references, and parameters. It first puts in the variable

Figure 4.1: Example of a command: ubv

```
TY=`basename $0`
FS=`nof $TY`
typ $TY

case $# in

0) (cat $ENT/$TY.ent ; zex $FS) | page ;;

*) if numeric $1
   then
     opt_noet $FS $TY $*
   else

   case $1 in
     -a) op-a $FS $TY $2 ;;
     -y) op-y $FS $TY ;;
   -plt) diag $TY ;;
  -r|-u|-f|-sort) opt_star $1 $FS $TY $2 $3 ;;
  -d|-h|-t|-dr|-nb) opt_drnbt $1 $FS $TY ${2-1} ;;
   esac

   case $2 in
     -gt|-lt|-i|-eq|-ne)
          pos=`grep $TY  $DIC/pos.dic | \
             awk ' $1 == cle {print $2,$3} ' cle=$1`
          opt_pgine $2 $FS $TY $pos $3 $4 ;;
     -id) opt_star $2 $FS $TY $1 $3 ;;
   esac

   fi ;;
esac
echo ' '
```

Figure 4.2: Example of a function: opt_pgine

```
opt=$1
shift

case $opt in
-lt) (cat $ENT/$2.ent ; zex $1 | awkp $3 $4 $5 |\
        tee $SRT )| more ;;
-gt) (cat $ENT/$2.ent ; zex $1 | awkg $3 $4 $5 |\
        tee $SRT )| more ;;
 -i) (cat $ENT/$2.ent ; zex $1 | awkg $3 $4 $5 |\
        awkp $3 $4 $6 | tee $SRT )| more ;;
-eq) (cat $ENT/$2.ent ; zex $1 | awke $3 $4 $5 |\
        tee $SRT )| more ;;
-ne) (cat $ENT/$2.ent ; zex $1 | awkn $3 $4 $5 |\
        tee $SRT )| more ;;
esac

awk ' { print $1 } ' $SRT | sort -nu > $BTP/liste.noet
echo ' '
case $LNG in
  fr) echo " Etoiles selectionnees:
        `grep -c '^.' $BTP/liste.noet`" ;;
 eng) echo " Selected stars:
        `grep -c '^.' $BTP/liste.noet`" ;;
esac
```

opt the option, passed as the first argument and tests its value. In all five cases the structure of the code is similar: the whole action is put in a sub-shell so that the pagination made by `more` or `page` will leave the headers apparent on the top of the first page. The first part sends the appropriate column headers; the second feeds a pipe with a data file and the data are filtered by the corresponding awk function. The result is displayed on the standard output, but a copy is sent for further use to a temporary file *sortie.out* located in the directory `bda/tmp`, which is recorded as the environment variable **SRT**. When the action is finished, the file *sortie.out* is read to count the number of stars and display a message like: "Selected stars: 10". The command `zex` contains a simple `if` test. If the file is compressed, use `zcat`, else use `cat`.

The following figure 4.3 shows a typical example of the awk functions used to perform the real work. The preamble BEGIN is used to recover the arguments of the command line. The information on the data field passed to the function are the column number (pos) of the beginning of the field, its length in character (lon) and the cutoff value (lim). The substring is extracted and compared to the limit. If the test is positive, the line is printed. The other awk functions used in opt_pgine differs by the comparaison made in the function.

Figure 4.3: Example of a awk function: awkg

```
awk '
BEGIN {
pos='$1'
lon='$2'
lim='$3'+0
}
{
n=substr($0,pos,lon)+0
if( n >= lim )
  printf "%s\n",$0
} '
```

4.2.3 A complementary approach

A different solution was searched for in another approach. New commands with shorter and more direct scripts were written. Their names are evocative of the action they do, like `meas` or `list`. They effectively run a little faster and take usually less than one second, but the price to pay is an extension of typing. A example of the complete syntax would be `meas ubv 1`. The chain `meas` may be ascribed to a function key (F2 to F10) to save typing. Because these short scripts produce a shorter response time, a reverse policy has been adopted for the most common actions. It concerns the extraction of measurements, listing of a data file on the screen, display of the detailed content of a file and data comparaison.

A number of commands have no equivalent in command option syntax, like `carte, ximage, post`, and so on. See the Appendix A for a list and the second part of this guide for a description of their use and actions.

4.3 Menu mode

Because a lot of actions have been coded, it becomes difficult to remember all commands, options and requested parameters. Therefore menus have been designed that group actions related to the same subject, like `xy` or `sbs` do, or to the same working environment, like `ttr`. The text should allow to recognize easily the purpose of the items and the item order follows the logical order in which the work is usually done. An initial menu `go` is the starting point of BDA menu mode. It offers a possibility to get basic information and perform various tasks without knowing any of the command names.

The main menu usually presents a second one, more typical of the possibilities offered to solve the problem, and a third level menu may appear before the task is really done. In the menu cascade, the completion of an action with a menu brings back to the previous one.

Basic database query is possible with the main menu `go` and it is possible to obtain information without knowing anything about the database commands, which fills the schedule of conditions. It is however difficult to provide all facilities with menus, because it will lead to asking too many questions and need too much typing. The present menu `go` is not the best solution for querying data and making subtle selections. The command or prompt modes are better in this case. However, the menu mode offers an easy access to sub-menus that would be called anyway, to use calibrations, to study spectroscopic binaries or work on cross-references. This menu mode is the best way to access them and forget about command names and details of the processes.

Working in the menu mode is described in part II, chapter 8.

4.4 The prompt mode

In another attempt to diminish the typing for repetitive actions and make some functions easier, a prompt mode has been designed. The fact that most commands querying data offer the same options and have many similar functionalities, makes it a little absurd to have so many command names. This was also the reason to develop the three level structure using options and functions.

The reverse philosophy is faster but needs more typing. The prompt mode is an attempt to combine fast answer time and low typing. An attempt has been done to keep the number of files to a minimum. The program `dbms` is a large Bourne shell script. When run, it presents a prompt `bda>` to which commands are issued. The prompt is then modified and contains the command name. An agent has been called, in some similarity with Simbad vocabulary. To the agent prompt, one can enter star numbers, options and parameters, a datatype, depending on the context. One can enter `help` at any prompt to get a list of the valid answers. The agent `help` entered at the bda prompt opens a new window which allows to keep it in parallel. The help presents a list of all agents, datatypes and information on each.

At a certain level of complexity, it becomes again difficult to present a simple syntax and easy methods to execute tasks which requires complex selections, with several verbs and a variable number of parameters. Therefore, in this first version of `dbms` the command mode syntax is used for performing selection, because it is finally the more compact. However the `select` agent allows to use a syntax like `measure ubv> v < 7.5` to select stars with V magnitudes less than 7.5 from the UBV data file.

The complexity is also in the parsing program that analyse the entry line. The shell has been restricted to some standard style. Maybe that writing the program with Perl would bring more facility to do complex entry line parsing.

4.5 The user graphical interface mode

Finally the only way to avoid much typing is to use a graphical interface. A user graphical interface is being developed with the really fantastic tool called OpenWindows Developer's Guide 3.0, which allows to build windows, locate the widgets (choice panel, buttons, menus and so on), and create links with actions. The first version has been made for Open Look with SUN's Xview library. It offers a query mode based on the use of choice settings, command buttons and menus. It would however be useful to have a version of this interface done with the X Intrinsics Toolkit to port the interface to workstations using the Motif widgets.

The basic concept of the window presentation is to have a selection panel for choosing datatypes and command buttons or menus to perform the actions. The command part is a pile of five panels called: Interrogation, Selection, Application, Documentation and Development. The first command panel only has been completed and it allows to query measurements, list files, query the bibliography and references. Short on-line help explaining how to use the interface and each button has been prepared. It is activated in the standard manner, i.e. by setting the mouse pointer on the button and pressing the keyboard key <help>. Parts of the other panels have been realised to date.

Chapter 5

Installing BDA

5.1 From tape to disk

Copies of the database are available for SUN and DEC Unix worksations.

The tape has been created on SUN with the command `tar cfb /dev/rst1 126 .`. The information is thus blocked with a blocksize of 126.

To install the database, create a directory called bda (`mkdir bda`), move to it (`cd bda`) and tar the tape (`tar xbf /dev/unit 126 .`)

bda is the top directory which contains all the sub-directories. It also contains also a file named *.bdarc* (the dot is important!) which collects the environment variables and path. In particular, one has to write in the first line of this file the path to bda. The present one is /home/vaud/mermio/bda. /home/vaud/mermio/ has to be replaced by the new path.

5.2 The environment

The file *.bdarc* in the directory bda contains environment variables which have to be adapted according to your configuration. You have to edit this file and replace the parameters with those corresponding to your configuration.

5.2.1 Definition of environment variables

- setenv BDA /home/vaud/mermio/bda
- setenv SRC 7
- setenv OCL 8
- setenv CUT 25
- setenv RSRC 5
- setenv ROCL 6
- setenv LCUT 25

- setenv LNG eng
- setenv DEFTYPE ubv
- setenv EDT vi
- setenv PLOT sm
- setenv DEVICE "X11 -geometry 640x600+500+270 -bg white -fg black"
- setenv PRINT "postland sp2"
- setenv HELPPATH $BDA/xhelp
- setenv MANPATH $MANPATH:$BDA/man

5.2.2 Meaning of environment variables

- **BDA** is the access path to the root directory of the database bda/
- **SRC** is the number of elements of that path to ngc, ic or anon
- **OCL** is the number of elements to the cluster name
- **CUT** is the number of characters of the path until bda/.

  The data for NGC 2287 are located in the directory: bda/ngc/2287. Therefore, depending on the access path to bda, the variable **SRC**, **OCL** and **CUT** have to be adapted.
- **RSRC ROCL** and **LCUT** represent the same things, but are used by C programmes. They are presently different, this depends on the actual installation of each machine and the links between disks and directories.
- **LNG** is the language used. The two possible values are **eng** and **fr**. By setting **LNG** to **eng**, most dialogs will be in english, instead of french. Sorry for the remaining French.
- **DEFTYPE** sets the default datatype when entering a command that needs a datatype without argument.
- **EDT** contains the editor to use when the work or a menu item propose the edition of a file.
- **DEVICE** is the kind of device used for the graphics output on the screen
- **PRINT** contains the name of the printer device. Both variables are used by macros and C programs.
- **HELPPATH** is the path to the on-line help related to the graphical user interface
- **MANPATH** this line adds the path to BDA man pages to the usual MANPATH.

5.2.3 Checking the installation parameters

A shell program has been prepared to test that the values have been correctly assigned. To use it, move to the directory of NGC 2287 (from `bda: cd ngc/2287`) and enter `testenv`. Each option displays the current value of the parameter, the expected chain and that obtained.

Once you have set the path for BDA, most shell scripts and programs use this path as $BDA or are recovered by the function `getenv()`.

5.2.4 The file *.bdarc*

The file *.bdarc* contains also the path to directories with executable programs or commands:

- set path = ($path $BDA/bin)
- set path = ($path $BDA/progf)
- set path = ($path $BDA/progc)
- set path = ($path $BDA/progs)
- set path = ($path $BDA/progx)
- set path = ($path $BDA/graphic)

5.2.5 The file .alias.bda

The file *.alias.bda* contains some aliases that are used to move more easily within the database. Appendix G lists the most useful. Any other alias may be added in this file.

5.3 Other settings

5.3.1 The file *.cshrc*

The simplest way to go to bda is to add in the *.cshrc* file of each user an alias like:
`alias bda 'cd /"path"/bda ; source .bdarc ; source .alias.bda'`
`cd` will move you to the basic directory `bda`, `source .bdarc` will initialise the environment variables, `source .alias.bda`, useful aliases.

The *.cshrc* file should also contain the following instructions:

```
set lpath = ()
set lcd = ()
set cdpath = (..  ../..)
```

Figure 5.1: Menu items

```
"Database"           MENU
"Command mode"       DEFAULT       chdir $BDA ;
        exec $OPENWINHOME/bin/xview/shelltool tcsh
          -WI $BDA/bda.icon -WL "BDA Comm"
          -Wl "Open Cluster Database Command"
"Menu mode"
        exec $OPENWINHOME/bin/xview/shelltool go
          -WI $BDA/bda.icon -WL "BDA Menu"
          -Wl "Open Cluster Database Menu"
"Prompt mode"                      chdir $BDA/ngc/0103 ;
        exec $OPENWINHOME/bin/xview/shelltool dbms
          -WI $BDA/bda.icon -WL "BDA Prompt"
          -Wl "Open Cluster Database DBMS"
"GUI mode"               chdir $BDA/ngc/0103 ; exec xbda
"Mosaic"                 xmosaic $BDA/html/bda.html
"Database"            END
```

5.3.2 The .login file

The *.login* file should contain the terminal code according to the Termcap database if different from "sun".

To access BDA man pages, the path should be added:

`setenv MANPATH ${MANPATH}:${PATH}/bda/man`

5.3.3 The .logout file

The *.logout* file should contain the command `recompress` located in bda/bin which compresses at the end of session the files that have been uncompressed for various reasons.

5.3.4 The .openwin-menu file

It may appear convenient to start the various query modes with a choice in the main menu. If the group shown in Figure 5.1 is included in the *.openwin-menu* the menu item "Database" will appear in the main menu and a submenu will offer the five choices: Command mode, Menu mode, Prompt mode, GUI mode and NCSA Mosaic BDA front page.

Of course the action should be put on a single line, which is not possible here.

5.4 Compilation of the C or Fortran programs

The code sources are distributed in several directories:

- bda/progf Fortran codes and executables;
- bda/progc C codes;
- bda/progs programs using the SM library;
- bda/progx graphical interface C source;
- bda/graphic source and exectuable of the program diag.

A file called *Makefile* has been prepared and is to be found in each one of these directories. Most programs are simply compiled like:

`f77 -o astrom astrom.f` or `cc -o ajzero ajzero.c`

The name of the executable is identical to the programme name, without the suffix .f or .c.

A few of them need either a routine or a library. See the *Makefile* files for more information.

5.5 Graphics package (SM 2.3)

The SM package has a *.sm* initialisation file. There is an example of such a *.sm* file (but it is not used) in the main directory bda. The line starting with **macro2** defines the path to the user's default file containing the user's macros.

Part of the database graphics is done with SM macros and these are located in the file *default* in the directory bda/smacro. To use the database graphics you have to indicate the right path in macro2, or to add the content of BDA *default* file to yours.

5.6 Tutorial of the database

The present introduction is located in the file *manuel.tex* located in the directory bda/introduction. The file *manuel.ps* is ready for printing on a postscript printer. A hypertext version is available under NCSA mosaic and can be reached from BDA front page.

5.7 References

The database has been described in two issues of the Information Bulletin of the Strasbourg Data Center.

Mermilliod J.-C. 1988, Bull. Inform. CDS 35, 77
Mermilliod J.-C. 1992, Bull. Inform. CDS 40, 115

5.8 Language of the database

EWhenthe language is set to English (**eng**) you shoud not find remaining dialogs in French. The English version has not yet been reviewed by English speaking persons, so you may find awkward phrasing or bad translation. Please send me your comments to improve it, and remarks on this user's guide, for unclear explanations, other things you would like to find in it, and so on.

The number of on-line help texts displayed by the command `emploi` translated in English is growing. If some yet non-existing file would be very useful to you, pleased drop me a mail, I'll do my best to prepare it.

5.9 Comments and questions

I am open to any comments, questions, suggestions, criticism, to improve the portability (I had a number of change to do to accomodate to DEC Unix), make the installation more easy and versatile to take into account various situations, and to add more application software to make the database more useful.

My E-mail address is: mermio@scsun.unige.ch

I wish you much pleasure in using BDA.

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Part II

HOW TO USE BDA

Chapter 6

The command mode

6.1 Basic Commands

The following description provides many examples of the command usage and some comments.

6.1.1 Content of BDA

To know which NGC clusters exist in BDA move to bda and enter:
> ngc
> ls
This will produce a list of all NGC clusters appearing as subdirectories in the bda/ngc directory. Similarily, enter:
> ic
> ls
or
> anon
> ls
to look at the ic and anon directories respectively.

6.1.2 Moving within BDA

To move to a cluster directory, simply enter:
> ngc 2287
when you are in bda

> ic 1805	will put you in the cluster IC 1805
> anon mel022	will transport you to the Pleiades directory.

These motions are possible if cdpath has been set to ../.. as explains in 6.3.1. A few aliases have been created (see Appendix G) to reach the directory of nearby clusters, and you can create more.

6.1.3 List of data files

When in a cluster directory, you can look at the data file:
> `ls` or `ls -l`
Do not forget that the files are compressed, so they have the suffix ".Z". You can uncompress them with the `uncompress` system command or with `testfZ` which uncompresses the file and writes its name and path in the file *fich_compr* located in bda/gestion/. At the end of the work session the files are automatically recompressed if the command `recompress` has been added in the *.logout* file.

> `testfZ mkk.don`

6.1.4 Looking at the file content

Several commands have been prepared to handle compressed files. The syntax is simply:
> command *filename*

> `scl`	display a scale and the first ten lines of a file
> `zp`	list a compressed file, one page at a time
> `zhd`	list the first 15 lines of a file
> `ztl`	list the last 15 lines of a file
> `zpr`	print a file with `lpr`
> `wz`	count the number of lines
> `vz`	uncompress a file and call the vi editor

Note that the suffix ".Z" should not be present. Adding it will produce an error.

6.2 Manual and help

6.2.1 Manual

The command man Man pages have been written for many commands, and are accessible with the system command `man`, provided the **MANPATH** has been correctly set. You may consult the manual information interactively from anywhere in the data base. The manual files are located in the directory bda/man/man1. Use `man -t command-name` to print the man pages.

`man bda` produces a list of the commnads for which man pages are available.

The command mnl You may consult the manual information interactively from anywhere in the data base. The manual files are located in the directory bda/manuel. They all have the suffix ".mnl". After displaying the manual information, the shell script asks you if you want to see the source code of the command or function. These description are in French.

Interactive form for the command `mnl`:

> `mnl ubv`

```
Do you want a listing of the code (y/n) ? y
```

6.2.2 Documentation

A number of texts describe the database and they can be reached by entering `dsc` which will display a menu. A shorter way is to enter directly `doc` or `help`.

Most of these texts are still in french. Thus, they have to be translated, and also improved to give better information. The texts may be revised to take into account your experience and the problems you may face.

A hypertext description of the database and commands is being developed. The front page of the database is displayed with the command `xhelp bda`. The user's guide is also accesible in hypertext form from the front page.

If the command `xhelp` does not work correctly, check the way NCSA mosaic is called. Move to the directory `bda/bin` and edit the file *xhelp*.

6.3 Command names, options and filenames

6.3.1 Command names

The command `ncm` display directly the small menu which drives the information on command names:

> `ncm`	display a menu arranged by datatypes
> `ncm ddo`	display directly the information on `ddo`

The command names are listed in Appendix A.

6.3.2 Command capabilities

The description obtained with the command `emploi` offers the best way to determine which syntax should be used to get the desired results:

> `emploi ubv`	display a small menu

```
which item?               4
back to the menu (y/n)?   y
which item?               7
back to the menu (y/n)?   n
```

The same menu may be displayed with the option -h: `ubv -h`. A hypertext version is available with NCSA Mosaic: the command name is `xhelp` and it takes a command name as argument, like in `xhelp ubv`.

6.3.3 Option meaning

The command "option" informs you about the option meaning:

> `option`	display the list of options
> `option -d`	provide information on "-d" only

6.3.4 File names

The command `fichier` behaves like the previous one:

> `fichier`	display the list of filenames
> `fichier wal.mes`	tell the content of that file

6.3.5 File fields

The command `field` informs on the field names used as parameters for selection or sorting.

> `field ubv`	display the data field in the file *ubv.peo*. It gives the field designation, the position of the beginning and its length
> `field ubv v`	display the information for v only

6.3.6 Datatypes

The command `dtype` explains which are the data concerned by a given datatype.

> `dtype ubv`	display an explanation line concerning the ubv datatype

This command may also be used to search for the datatype cooresponding to some kind of data.

> `dtype UBV`	display the various datatypes that correspond to UBV and related data
> `dtype CCD`	display the various datatypes that correspond to CCD data

6.4 Bibliography and References

6.4.1 The modern bibliography

The command `bib` handles the bibliography from 1969 to the present day created from the Astronomy and Astrophysics Abstracts. The following example presents a typical interactive session; it corresponds also to the interrogation started from the main menu.

> `bib`

`which year?`	`88`
`which subject?`	`lithium`
`another year?`	`87`
`another subject?`	<return>
`another year?`	<return>
`another subject?`	`Coma_Ber`
`another year?`	`0` (or n or fin)

The first request searches the 1988 bibliography for references concerning the lithium, the second one searches the 1987 bibliography for the same topics, and the third one explores the bibliography of 1987 again, but for references about the Coma Ber cluster.

This interrogation allows you to handle only one year and one subject at a time, which is limiting. Therefore, several options have been introduced to improve the efficiency. The option "-eq" permits to select one year and up to three different subjects simultaneously while the options "-i -lt -gt" allow to work within two limiting years. They also accept up to three keywords.

> `bib -i 84 88 Hyades Pleiades lithium`
display all references concerning the problem of lithium abundances in the Hyades and the Pleiades clusters published from 1984 to 1988.

> `bib -eq 86 752 lithium`	displays the references relating to the lithium abundance in NGC 752 published in the year 1986.
> `bib -gt 86 752 lithium`	display the references published in 1986 and later
> `bib -lt 75 Tr16`	display the references published between 1969 and 1975 for Trumpler 16
> `bib -n Claria -eq 88`	list the references published in 1988 by Clariá.
> `bib -k`	display the keywords which may be used. Cluster names are not listed in this file, but you can include all NGC and IC numbers as keywords. Generally "NGC" and IC" are not necessary. The names of anon clusters are spelled as in the `anon` directory, with the difference that the first character is upper case and there is no left padding with zeros.
> `bib -km cluster`	display a list of the keywords which contains the string "cluster" (many keywords are composite).
> `bib -ki stellar`	list all keywords beginning with the word "stellar".
> `bib -ke mass`	list all keywords ending with "mass".
> `bib -t 93`	count the number of references for the year 1993
> `bib -c 93`	give access to the keyword list of the references listed by the previous search. This command should therefore be issued after a successful search only

6.4.2 The Budapest bibliography

Information from the Catalogue of Star Clusters and Associations (Alter et al. 1970) and its first supplement (Ruprecht et al. 1981), available on tape, has been included for NGC, IC and anon clusters. The catalogue has been separated into smaller files, one for each cluster, which bears the name *bdp.cat*.

The command `bdp` offers a few options to select information from the Budapest bibliographic catalogue for one or several consecutive years with the options -eq, -gt -lt and -i, according to an author's name or a given topic (option -s). The abbreviating system is complex within this catalogue. The abbreviations for the subjects, the journals and publications are described in the hypertext presentation of he bibliography.

> `ngc 0129`	move to NGC 129. Notice the leading 0
> `bdp`	list the complete file
> `bdp tr16`	lists the bibliography for the cluster Trumpler 16. Can be called from anywhere in the database, for any cluster, even for those which do not have their own directory.
> `bdp -eq 1970`	Select the references for 1970
> `bdp -gt 1960`	produce a listing of all references published later than 1960
> `bdp -i 1950 1960`	list the references for the interval given.

The option -s is used to make selections on:

> `bdp -s Trumpler`	a name (case is not important)
> `bdp -s cepheids`	a subject

6.4.3 The information from Lyngå's catalogue

The information and global parameters from Lyngå's (1987) catalogue are recorded in each cluster directory. The output format is similar to that of the edition on microfiche. In addition, it is possible to retrieve specific information according to the option used with the command `lyn`.

> `ngc 2287`	move to the cluster NGC 2287
> `lyn`	display the information for NGC 2287
> `lyn 2516`	same, but for NGC 2516
> `lyn -p`	summarize the parameters of NGC 2287: distance, reddening and age
> `lyn -c`	give the equatorial and galactic coordinates
> `lyn -d`	display information on the diameter

The syntax `lyn cluster-name` is used to get the information for clusters which do not have their own directory.

6.4.4 The references

The references may be obtained in several different ways with the command `ref` which starts an interactive program. The references are written in distinct and uncompressed files located in the directory bda/references. The filename are like "data type.ref", e.g. *ubv.ref* or *vsini.ref*.

> `ref`

```
For which kind of data?       vsn
Give the reference number:      1
Another reference?             10
Another reference?             -1
Precise your choice:          orb
Give the reference number:      5
Another reference?              0
```

The answer "-1" displays the list of data types for which references are available. It also permit to change the data type for further query.

> `ref -h`	display information on the command capabilities.
> `ref -n Hoag ubv`	display the references containing the name of Hoag among the authors' names in the UBV references.

The next options work only with cluster data file, so you need to move to a cluster directory:

> `ngc 2287`	
> `ref -t ubv`	list all references relating to the UBV photoelectric data

The option -m is used to get the references after a data query or a selection:

> `mk 103`	select the MK data for star # 103
> `ref -m`	list the corresponding references
> `vsn V -gt 280`	select large Vsini
> `ref -m`	list the references

6.4.5 Cluster numbering system

The reference for the numbering system adopted in the database is obtained with `sysno`.

> `sysno`	display the reference of the numbering system for the current cluster
> `sysno 2516`	display the reference of the numbering system for NGC 2516 from anywhere in the database

6.4.6 Ongoing observations

The command `baas` simply displays the *baas.dat* file which contains information on ongoing work and observations. It does not have any option.

6.5 Remarks

The command `rem` is used to query the remarks. It is most often used with star numbers and has only one option "-k", used to search for a string of characters in the remark file.

> `ngc 2516`

> `rem`	list the file
> `rem 10 27 29`	search for the stars number 10 27 and 29
> `rem -k Delta Scuti`	list the stars classified as Delta Scuti variables.

6.6 Cross-Identifications

6.6.1 The cross-reference tables

BDA contains cross-reference tables which provide the cross-identifications between many numbering systems. Information may be retrieved in both senses: either from the original numbering systems to that adopted in BDA or from BDA's system to any other one.

If you are not in the directory of NGC 129, enter:

> `ngc 0129`

> `tab -r`	list the references of the numbering systems included in the cross-reference table.
> `tab`	list the cross-reference table.
> `tab 16 20 30`	display the line for stars 16 20 and 30.
> `tab -r 4`	remind you of the reference corresponding to column 4.
> `tab -l 3`	select the entries corresponding to column 3.
> `tab -s 3`	extract couples of cross-identifications: BDA number - column 3 number, sorted by column order.
> `tab -i`	print the references and the cross-reference table.
> `tab -c`	start a cross-identification program in the reverse sense: from any column to the adopted system.

```
Give the reference number:   0

        (0 displays the reference list, when you need it.)

Give the reference number:   2
Which star?                  5
Another star?               10
Another star?               -1
Give the reference number:   3
Which star?                 20
Another star?                0
```

The entry "-1" allows to change the reference searched, here one moves from reference 2 to 3.

> `tab -s`	produce an output sorted according to the selected column. May be redirected to any file.

```
sort on which column? 2
```

Special numbering systems may also be interrogated:

> `ngc 0457`	
> `tab -k 22- 75`	look for ”22- 75” in the table

6.6.2 The cross-identifications

Information on cross-identifications with astronomical catalogues may be obtained with the command `idm`. The cross-IDs are split into two files. The first one contains the common identifications (HR, HD, DM, NLS, SLS, GCVS), and the second one the IDS, ADS, SAO, and miscellanous IDs.

If you are not in the directory of NGC 129, enter

> `ngc 0129`	
> `idm1`	list the first file.
> `idm2`	list the second file.
> `idm 164 170`	display the content of both files for both stars.
> `idm1 164 170`	display the content of the first file only.
> `idm -sort hd`	list the entries sorted by HD numbers. Arguments are: hd dm hr/bs sao ids ads lss nls
> `idm 170 236429 113`	identifications can be mixed: star number HD or BS

6.6.3 The identification of double star components

Systematic cross-referencing has been done for the identification of double star components of the IDS (1984.0) catalogue and cluster stars. This information may be reached with the command `ids`.

> `ngc 2422`	
> `ids`	list the file.
> `ids 45`	list all components associated with star no 45.
> `ids ads -eq 6216`	list the lines containing the ADS number 6216.
> `ids sep -lt 10`	select the systems having a separation smaller than 10 ”arc. Options ”-gt” and -i” can also be used.
> `ids mult -eq AB`	select the entries for AB components.

6.7 Data queries

Most commands that query data use the same syntax. Without argument, the command lists the datafile; with one argument, it returns the star data if the argument is numeric or execute the appropriate option. To make a selection, enter the command followed by the parameter name on which the selection is made, the comparator and the value:

```
command parameter comparator value
```

The definition of the parameters for each datafile is given in Appendix E. It may be obtained simply with the command **`field`** described above. The discussion of the command `ubv` will illustrate this syntax, which is the same for all selections.

6.7.1 General case: the command ubv

Start by going to the directory of the cluster NGC 129

`> ngc 0129`	
`> ubv`	all commands entered without argument produce a listing of the entire file, one page at a time.

Query by star number:

`> ubv 200`	list the UBV data of star 200 (DL Cas)
`> ref -m`	display the references of these data.
`> ubv -r 200`	equivalent to the preceding two commands.
`> ubv 164 170 200`	list the UBV data of the three stars.
`> ubv -u 1341 200`	select the data for star 200 from reference 1341.
`> ubv -a 200`	compute the mean value.
`> ubv hd -id 236429`	query by HD number.
`> ubv -f no.lst`	search for the UBV data for a list of stars contained in a file, here *no.lst*.

Selection on UBV parameters or reference:

`> ubv v -lt 9.0`	select the stars with V < 9.0.
`> ubv b-v -gt 1.8`	select stars with B-V > 1.8.
`> ubv no -lt 10`	list the stars with numbers less than 10
`> ubv ref -eq 1341`	select data from the reference 1341.
`> ubv ref -ne 1341`	select data from any reference except 1341.

Options common to most data commands:

`> ubv -d 10`	give the list of sources that have 10 stars or more and the number of stars.
`> ubv -dr 10`	produce the same output as "ubv -d", but list also the corresponding references.
`> ubv -nb 3`	list the stars with at least three sources.
`> ubv -sort v`	produce an output sorted by V mag.
`> ubv -t`	count the number of measurements and stars.
`> ubv -h`	display the description of the command.

Option specific to the `ubv` command:

`> ubv -y`	give the results of the UBV data comparaison.
`> ubv -plt`	plot photometric diagram.

Most other commands handling photometric data (see Appendix A, table A.1)) behave similarily. This is especially true for the commands that handle UBV type data `pgh ccd sit cam`. The options -d, -dr, -nb, -t and -h are common to commands handling referenced data.

6.7.2 The commands ubvm and cmd

The commands `ubvm` and `cmd` have the special keyword "ns" which means number of sources, because the data source is replaced by the number of sources used in the computation of the mean.

> `cmd ns -gt 3`	list the mean values based on 3 sources or more.

6.7.3 The command hrd

The datafile for the type hrd contains in addition to the dereddened UBV colours a column indicating the individual colour excesses. It is possible to select the stars according to E(B-V).

> `hrd ebv -gt .65`	select the stars with E(B-V) > 0.65.

6.7.4 The commands mk, mks and spt

The parameter "ts" is specific to the command `mk`, `mks` and `spt` and the options -eq, -lt, -gt and -i have their standard meaning. The parameters no and ref can also be used to perform selections.

> `ngc 2516`	
> `mk ts -eq B8 V`	select the stars with a spectral type like B8 V
> `mk ts -lt B5`	select the stars earlier than B5
> `mk ts -gt K0`	select the stars later than K0
> `mk ts -i B8 A2`	select the stars with types between B8 and A2
> `mk ref -eq 999`	select the classifications from reference 999

6.7.5 The commands coo and pos

The commands `coo` and `pos` handle the coordinates. The option "-eq" changes the equinox from 1950 to any other one, and has the meaning of "equinox" only for these two commands. The syntax is the same for both:

> `ngc 0129`	
> `coo -eq 2000 200`	precess the coordinates to 2000
> `pos -eq 1975 200`	precess the coordinates to 1975

It should not be confused with

> `coo ref -eq 128`	Select coordinates from source 128 (GSC).

It is possible to look for the stars which are in a given radius around a center specified by its right ascension and declination.

`coo R -lt 1.5 6 44 30 -20 40 00`

	list the stars within 1.5 'arc around the position RA = 6^h 44^m 30^s, DEC = -20° 40' 00"
> `coo -k 0 27 1`	search the stars having a coordinate between 0h 27m 10s and 0h 27m 19s. The same can be done in declination.

The option -k searches for strings of characters, even if they contain white space.

> `coo -info 10` list information on reference 10

6.7.6 The commands apm and rpm

These commands manipulate the absolute and relative proper motions. These data are not yet very numerous, but their importance will grow with the results of Hipparcos. The option -info is interesting: it displays the information collected by van Leeuwen on proper motion studies. The argument can be a reference number or a cluster name.

> `apm -info 180` display the information for reference 180

> `apm -info NGC 2682` display the information for NGC 2682

6.7.7 The command irv

The command `irv` has a few specific options to select and plot radial velocities in function of observation time or Julian date. The option -dn was made to look at the observations of each night to check visually the stability of the radial velocity system. The option -v is used to plot the radial velocities of a star in function of the Julian date and -bin is used to extract the observations of one star and start the program to determine an orbit. These actions are grouped in the menu `sbs`. The program is described in part III.

> `ngc 2516`

> `irv -dn` produce a list of the observing nights, ordered by increasing Julian dates, with a minimum of 5 observations. These nights are numbered for display and plotting facilities.

```
Which night number?             5
Do you want to plot the RVs?    y

What do you want to do?         m
Give the mean cluster RV:      15

What do you want to do?         f

Which night number?             0
```

The level of selection may be modified by entering the new limit:

> `irv -dn 10`

The rest of the process is the same as the one described just above.

> `irv -v 5` select the observations relating to star 5 and plots the data versus the Julian dates.

```
Do you want to plot the RVs?    y
```

```
What do you want to do?          m
Give the mean cluster RV:       15

What do you want to do?          f
```

> `irv 5 | page`	pipe with `page` or `more` for long output
> `irv jd -eq 40191`	select and display the observations made on JD 24440191.
> `irv -bin 25`	select the measurements of star 25 and run the program to compute the binary orbit, for a SB1
> `irv -bin2 34`	select the measurements of star 34 and run the program to compute the binary orbit, for a SB2

6.7.8 The command prob

The command `prob` allows to make selections on the membership probabilities.

> `prob p -gt .75`	select stars with a membership probability larger than 75%

The options -i and -lt are also valid, as are selection on the star numbers "no" and the reference "ref".

6.7.9 The command hpd

The command name is from the Hipad Plus^{TM} the name of the Houston Instruments digitizing tablet used to measure the rectangular positions on cluster photographs. The positions were put in the *hipad.xy* file, as a distinct source with respect to author's names when the data were taken from the literature.

The command `hpd` has a specific option -info. It displays the entry for the given cluster in the file *info.hpd* located in the directory bda/information/ containing the scale of the xy positions and the source of the data. The cluster name has to be indicated on the command line.

> `hpd -info 2287`	extract the line relating to NGC 2287
> `hpd -c`	display the number of the central star (0,0)

Selection can be made on the x or y or both parameters (xy).

> `hpd xy -lt 20`	select the stars within a box of 20 units in size
> `hpd r -lt 20`	select the stars within a circle of radius 20

A cluster chart may be built from the (x,y) positions and the magnitudes contained in the file *hipad.xy*. The same action may be obtained with `carte`.

> `hpd -plt`	plot a chart from (x,y) positions

6.7.10 The command gk and red giant data

The command `gk` displays the file containing the information on the cluster red giants. These files are part of an unpublished catalogue of about 3200 red giants in open clusters. The description of the record content is given in Appendix I.

> `ngc 0129`	move to NGC 129.
> `gk`	list the file.
> `gk 164`	display one star.
> `gk ph -eq ubv`	select the stars with UBV data.
> `gk ph -ne ddo`	select the stars without DDO data.

Arguments for the keyword ph (photometry) are: ubv pgh gen ddo cmt ri egg iyz wing.

A tentative classification (ABCD) has been developed to indicate the evolutionary state of the red giants. (See Appendix I for further comments. A selection can be performed on the classification with the keyword "cl".

> `gk cl -eq C`	list clump red giants
> `gk cl -eq A`	list AGB giants
> `gk cl -eq F`	list the field stars
> `gk cl -eq sb`	list the spectroscopic binaries

6.7.11 Obtaining further information: aud

The command `aud` (for "autre donnees" = other data) obtains other kinds of data for a sample created with a data handling command, like `ubv, mk, vsn` and so on. Let us first move to the NGC 2516 directory.

> `ngc 2516`	
> `vsn V -gt 270`	form a sample with stars having a rotational velocity larger than 270 km/s.
> `aud mk`	list the spectral types for that sample
> `aud prob`	list the membership probabilities.
> `aud -s rem`	list the remarks, but the sample has been redefined by the output of the preceding command. This is useful whenever data are not found for all stars.
> `rem -k SB`	search for the spectroscopic binaries.
> `aud vsn`	list the Vsini for the binaries.
> `mk ts -eq B8 V`	select the B8 V stars.
> `aud betam`	display the mean Hβ values.

The command `aud` is also used to extract data for a predefined list of stars, or stars contained in a BDA file.

> `aud -f gK ddo`	display the DDO data for the red giants contained in the file *gK*. Even if the file is normally compressed, do not add the .Z suffix
> `aud -v gK ddo`	list the red giants which do not have DDO data
> `aud -t cmd coo`	display the coordinates for the stars that have mean UBV data.
> `aud -v cmd coo`	list the stars that have mean UBV data, but no coordinates. The argument to -v is a data type.

6.7.12 Obtaining several kinds of data at a time: multi

One can obtain several kinds of data for one star in a simple way by using the command `multi`:

> `ngc 0129`	
> `multi 200 ubv mk pos`	list the UBV data, spectral types and coordinates for star 200.

6.8 Cluster map and chart

Cluster maps have been scanned and installed in the database. The maps scanned (output file in the tiff format) have been displayed with `xv`, captured with `xwd` and compressed with `gzip`. The result is that they occupy about 10 kB on the disk instead of some 300kB in the tiff format. They are uncompress on the fly and displayed with `xwud`. The command `ximage` is doing the display business. It needs the map author's name as argument.

> `ngc 3572`	
> `ximage moffat`	display Moffat's map
> `ximage steppe`	display Steppe's map

The image may be moved only, but the size cannot be changed. A single click on the mouse left button, when the pointer is located within the map will make it disappear. It is of course possible to keep two maps on the screen.

> `xprimage moffat`	make a hardcopy of Moffat's map

As discussed under command `hpd`, the command `carte` plots a cluster chart from the (x,y) rectangular positions and magnitude. By default, `carte` looks for the file *hipad.xy*. If none is existing you can enter any other —.xy filename.

Maps and charts can be displayed simultaneously on the screen.

6.9 Cluster Selection

6.9.1 The command `slm`

It is sometimes useful to have a list of those clusters which have many stars observed in one kind of data, or to know which clusters lack data. The command `slm` allows this kind of queries. The `bda` directory contains a sub-directory `contenu` which collects files (one per data type) containing the name of the cluster, the number of stars and the number of measurements available. The selection is made only on the number of stars. This command may be run from anywhere in the database. It always needs at least one argument, i.e. the data type.

> `slm ubv`	lists the whole file.
> `slm ubv -gt 200`	select the clusters having more than 200 stars observed in UBV.
> `slm gpo`	list the file containing the information on radial velocities from objective prism spectra.

> `slm map`	list the cluster for which a scanned map is available
> `slm ubv -histo`	display the UBV database content in a histogram.
> `slm ubv 2287`	display the information for NGC 2287.

It is also possible to answer the question: "Which are the clusters that have at the same time red giants and DDO data" with the option -int and the indication of both datatypes.

> `slm gk -int ddo`	list cluster with red giants and DDO data
> `slm gk -int ddo ngc`	restrict the output to NGC clusters

One can refine the intersection by setting a condition to the first datatype, by asking, for example that te number of red giants must be larger than ten.

> `slm -gt 10 gk -int ddo`	list cluster with at least 10 red giants and DDO data. No selection is made on the DDO data
> `slm -gt 10 gk -int ddo ngc`	restrict the output to NGC clusters

Finally, constraints can be placed on both selections to avoid selecting clusters with many data in one datatype and few in the second one.

> `slm -gt 10 gk -int ddo -gt 10`	list cluster with at least 10 red giants and DDO data for at least 10 stars.

6.9.2 The command `ocl`

BDA offers also the possibility of performing selections on cluster parameters such as distance, reddening, age, diameter and equatorial or galactic coordinates, on the basis of the results catalogued by Lyngå. The command name is `ocl`. The output is sorted by increasing order of the selected parameters.

> `ocl`	list the whole file, page by page.
> `ocl Berkeley`	list the Berkeley clusters
> `ocl d -lt 500`	select clusters nearer than 500 pc, and displays a list sorted by increasing distance.
> `ocl l -i 0 90`	select clusters with galactic coordinates between 0^o and 90^o degrees.
> `ocl lb -i 0 30 -5 5`	select clusters according to the conditions: $0^o < l < 30^o$, $-5^o < b < +5^o$
> `ocl -t d`	list the whole catalogue, sorted by increasing distance

The permitted options are: -gt -lt -i, arguments are from the following list:

`alf dec ad`	right ascension and declination, or both.
`l b lb`	galactic coordinates or both,
`z`	distance from the galactic plane,
`d`	distance in pc,
`m-M`	distance modulus,
`ebv`	colour excess E(B-V),
`t`	log of the age,

`D`	cluster apparent diameter

Try also `emploi ocl` for further explanations and examples.

6.10 Statistics

One can get statistical information on several topics.

For each data file, one can obtain the number of stars observed for each reference, using the option -d:

> `ngc 0129`	
> `ubv -d`	detailed content
> `ubv -d 10`	detailed content, sources with more than 10 stars
> `ubv -dr`	detailed content and references

One can also obtain the number of data sources per star, and fix some cutoff level if necessary:

> `ubv -nb`	
> `ubv -nb 3`	select only those stars which have more than three UBV sources.

One can also get global information on the database content:

> `stcn ubv`	display the number of stars and UBV measurements.
> `stcn bda`	display a complete table of the database content.

6.11 Further commands

6.11.1 The command post

The command `post` has been designed to prepare data from the database before sending them by mail. `post` takes datatypes as arguments and produce a file called *f.exp* written in the directory `.T`.

`post lyn tab ubv mk vsn`
prepare a file containing a header and the required data, with the references when relevant.

6.11.2 The command moyen

The command `moyen` is used to compute mean values for the UBV data because no avera data are kept in the database. It takes a datatype as argument.

> `moyen ubv`	compute mean ubv data

The command first displays the detailed content of the file and asks if weights are desired. If yes it presents each reference and ask for the weight. It computes the mean values and displays a table showing the number of stars with 1 or more data sources.

6.11.3 The command olps

The command `olps` (one line per star) is designed to reduce the data to one line per star by a selection on the data sources. This command is used for example to keep one position only (datatype pos) or to prepare the file *mkk.sel*.

> `olps mk`

The program first presents the detailed content and references and asks for a list of references to consider. They should be entered by order of decreasing importance. It finally asks for the output filename.

6.12 Alternative commands

Other forms of some commands are also available which in principle shortens the answer delay. They require an indication of the type of data to be processed. No options are available. They are:

`meas list detail detref extrf compar slct`

> `meas ubv 1 2`	display the UBV data of star 1 and 2; (identical to `ubv 1 2`).
> `list doo`	list the ddo data file; (identical to `ddo`).
> `detail mk`	give the number of stars per reference; (identical to `mk -d`).
> `detref vsn`	list in addition the relevant references; (identical to `vsn -dr`).
> `extrf ubv 1341`	select the data from reference 1341 (identical to `ubv ref -eq 1341`).
> `compar ubv pgh`	start the program for comparing the UBV pe data with the pg ones; (identical to `ubv -c pgh`).
> `slct ubv v -lt 7.5`	select star with $V < 7.5$; (identical to `ubv v -lt 7.5`).

Chapter 7

The menu mode

7.1 Introduction

The menu mode is more indicated when one wants to perform an action which is driven by a menu. Instead of remembering all menu names, it is easier to look at the desired option. A second menu is often presented, and even as third one may appear.

When the end of the action, a triple choice is sometimes presented: `continue (y/n/f)?`. If the answer is `yes` the same menu is proposed again. If `no` is prefered, then the previous menu is presented again, and finally the answer `fin` made you quit the whole process.

In a cascade of menu, as for example the sequence `go`, with selection `dsc` and `doc`, when entering `fin` to put an end to the work with the menu, the previous menu appears again. Thus entering `fin` to the menu "doc" will come back to the calling menu "dsc". `fin` to "dsc" will finally bring the user back to the starting point "go".

7.2 The menu go

One possibility is to start with the main menu which offers a simple way to interrogate the database.
To display the main menu, enter:
> `go`

A number of preliminary texts describe the database and they can be reached by answering "dsc" to the main menu choice > `dsc`
displays the general menu

```
Which subject?                    doc
     Which subject?                 f
     Other information (y/n/f)?     y
     Which subject?                 n
          Which subject?            1
```

Figure 7.1: Listing of the menu "go"

```
Welcome to the Open Cluster Data Base

What do you want to do today?

Look at the documentation on BDA  ........ dsc
Query BDA interactively ................. bda
Query BDA with a program ................ int
Query the bibliography .................. bib
Query the references .................... ref
Query Alter's bibliography .............. bdp
Look at the man pages ................... man
Look at the french manual ............... mnl
Analyse the data ........................ ana
Investigate a cluster ................... atp
Plot photometric diagrams ............... pho
Work on co-ordinates .................... trc
Update the Data Base .................... maj
Come back to the UNIX shell ............. sh
Look at the menu system information ...... hlp
End of interrogation .................... fin
```

```
          Autre information?       y
          Which subject?           2
          Autre information?       n
     Which subject?              end
```

The command `bdp` may be started from the main menu: the action then corresponds to the syntax `bdp` and one only gets a listing of the file.

\> `go`

```
Express your wish:     bdp
For which cluster:     ngc/0457
suite (y/n)?           y
For which cluster?     ngc/0581
suite (y/n)?           n
Express your choice:   fin
```

`lyn` can be called from the main menu "go". In this case one should give the complete name of the cluster, as for example: ngc/2516 or anon/tr16.

The main menu "go" offers a simple interactive interrogation for `ref`.

7.3 Other menus

Chapter 8

The prompt mode

8.1 Starting and ending

Enter `dbms` to initiate the prompt mode. The program will display the prompt bda¿ with the cluster name inside the prompt. It is ready to work. An on-line help is offered each time a new prompt is presented to tell you about the allowed agents or parameters. What you enter at the bda¿ prompt is not really a command, although the text is similar, but what I called an agent. It does not execute the job, but the agent comes behind the prompt and you can enter further information to perform the action.

`dbms` offers the option -v (verbose). If it is set, a comment line is displayed at any new prompt to inform the user about the kind of entry that is expected.

The agent prompt is left by `bye`, you should come back to bda¿. If there are any parameter or star number you need to enter ¡return¿ or 0. To end with the program, enter ¡return¿ or `bye` at the prompt bda¿.

When an agent is waiting for a cluster name, the default value is the current cluster name. It is presented in square brackets. To get the information for another cluster, enter another cluster name.

8.2 On-line help

A help is provided at every level. If you enter `help` (or simply h) at the promp bda¿, it will open a new window and you get the prompt help¿ [dbms], dbms being the default value. It displays information about the program, and suggests to continue reading the text on bda, which in turn proposes yo to continue with agent, to discover the allowed agents.

If you for example chose `meas`, your prompt is now measure¿. Typing `help` will display a list of the datatypes for which you can get data. After you selected a datatype, let us say `mk`, the prompt becomes measure mk¿. Entering `help` again will inform you that the program is waiting for one or several star numbers. This help facility will guide you at every prompt during your database query session.

It may be useful to keep the help window that is opened when you enter `help` at the prompt bda¿ to look at the list of agents and get information on them. You can also close it and you'll get an icone with the label "BDA help". When you say `bye` to the prompt help¿, the window will close.

Chapter 9

The graphical user interface

9.1 The panel "Interrogation"

To use it, move first to a cluster directory, and enter `xbda`. On-line help has been prepared for most buttons. To read it, locate the mouse cursor on the chosen button and press <help> on the keyboard. Basically, the right hand settings define the type of data you want from the database, and the command button executes the action. A dialogue line allows you to enter star numbers when required. You can change of cluster by entering a cluster number, changing also from NGC to IC or anon (abbreviated menu button) and clicking on the button labelled "chdir". "Next" presents either a menu or moves you to the next panel. "Quit" terminates the work.

Part III

ADVANCED USE and APPLICATIONS

Chapter 10

Data Analysis

10.1 The data comparaisons

BDA offers a number of facilities to analyse the data. At present, they concern the UBV (pe, pg, CCD), Hβ and Vsini data and the individual radial velocities. The results of the analysis already obtained on UBV photoelectric data may be displayed with the option "-y". The interactive analysis also provides a graphics facility which is very useful to check for trends in the parameter differences.

> `ngc 6322`	cluster chosen for the example
> `ubv -c`	starts a fortran programme
> `compar ubv`	is an alternative syntax

```
Enter the first reference:                          461
Enter the second reference:                         902
Number of stars to suppress:                          0

Do you want to look at the resulting file (y/n)?   y
Do you want to plot the diagrams (y/n)?             y

Give the y parameter:                                 4
Give the x parameter:                                 4

What do you want to do?                               h
- suite -                                      "return"
What do you want to do?                               z
Give the limits (l r t b):                0 1.6 .5 -.2
What do you want to do?                               r
Give your choice:                                     1
- suite -                                      "return"

What do you want to do?                               a
Give the y parameter:                                 1
Give the x parameter:                                 1
```

```
          What do you want to do?                           f
```

You may start this process from the menu for data analysis:

`> ana`
`Give your choice:u`

or directly from the main menu:

`> go`

```
          Express your wish:        ana
               Give your choice:    u
```

In the interactive way, you can also compare any of the ubv, pgh, ccd or sit data by using the following syntax:

`> ubv -c pgh`	compare the UBV photoelectric and photographic data
`> pgh -c ccd`	compare the UBV photographic and CCD data

The programme asks for the respective references and then behaves as described above

10.2 Comparaison of the V magnitudes

10.3 Comparaison of the colour indices

Chapter 11

Photometric Diagrams

11.1 The UBV system

If SM is you already installed, you can try the following commands. In the command mode, photometric diagrams in the UBV and related systems is obtained with the command `diag`. By default, the file *ubv.cmd* is used and the diagram is (V, B-V). The parameters may be changed with the menu options (8 o). To plot UBV diagrams from CCD data, enter `diag ccd`. The program will ask for the reference, enter 0 if you do not know it. Possible types are: ubv, pgh, ccd, sit, cam, cmd, hrd. cmd is the default type. The file has one line per star.

The main menu also offers some facilities to plot photometric diagrams through the option `pho`. This starts a pull down menu which offers predefined common diagrams. The same menu can be directly called by `diaphot` when you already are in a cluster directory. It works correctly, although I did not have time to prepare all the necessary scripts. Note that it only works with files containing mean data. These have not been systematically computed for the UBV system. The present uvby files do not contain the V magnitudes; these have to be included in the next version of the uvby mean catalogue.

Thie example given below shows you the possibilities and the philosophy of the whole thing.

SM opens a graphics window and the program presents you a compact menu which allows you to perform various actions on the graphics:

```
Box, Dimension, Title ................. 1
Modulus, Reddening .................... 2
Isochrones ............................ 3
Double Stars .......................... 4
Membership ............................ 5
Identifications ....................... 6
Selections V or x,y ................... 7
Hardcopy, Other, End .................. 8
```

After you choose one of the possibilities, a second menu be presented, corresponding to the topics selected. For example, for 1:

```
Change of the limits .................. z
Change of the box size ................ t
Definition of the size in cm .......... T
Change of the expand factor ........... x
Definition of a title ................. l
Print of the cluster parameters ....... L
```

If necessary the program will ask you for the values of the parameters you want to change.
If you do forget the reference number, you can also use the following syntax:
> `diag ubv` without argument

```
Which reference?          h

                    produces an output equivalent to
                    "ubv -d" or "detail"

Which reference?        324

Which parameter en y?     v

Which parameter en x?   b-v
```

11.2 The Geneva system

11.3 The uvby system

Chapter 12

Calibrations

12.1 The Geneva system

12.2 The uvbyβ system

12.3 The DDO system

12.4 The Washington system

Chapter 13

Radial Velocity

13.1 The menu avr

13.2 Spectroscopic binaries

Chapter 14

Integrated Colours

Chapter 15

Star Membership

15.1 The Expert system

Part IV

DEVELOPMENT and MAINTENANCE

Chapter 16

The Data

16.1 The menu maj

Updating the data is rather easy through the command `maj` which presents a pull-down menu. After you entered `maj` the program requests the kind of data you are updating. The first menu concerns the references. You can add a new reference at the end of the reference file or edit it; you are then in "vi".

The second menu offers four possibilities:

1. add new data in the file which is then automatically sorted;
2. add a supplementary file called "f.sup";
3. create a new file of the data type;
4. edit the data file.

The third menu handles the files in the bda/contenu directory. The first item automatically updates these files after modification for the NGC and IC clusters only. The anon clusters have to be updated manually by using the third item "editer". You can also create a new file.

The fourth menu handles the statistics. The first item produces counts of the number of lines and of the different stars for the file corresponding to the data type. The second item gives the total number of clusters, measurements and stars in BDA for this kind of data. The third one allows the user to edit and update the BDA summary file.

The last menu offers some facilities to handle the file corresponding to the data type. In particular the item "zeroter" (a neologism) adds "0" before the star number in the first column. You can also compress a file, sort it, display the first 15 lines or edit it.

The figures 2, 8 move the reverse video band and 4, 6 change the menu displayed. 1 changes the cluster, and 7 changes the data type. 0 executs the task.

Chapter 17

The Coordinates

17.1 The menu trc

Chapter 18

Rectangular Positions

18.1 The menu xy

Chapter 19

The Cross-References

19.1 The menu ttr

Part V

APPENDIX

Appendix A

Command Names

A.1 Shell commands

Table A.1: Command Names

Commands	Objects
Commands on photometric data	
ubv	UBV photoelectric data
pgh	UBV photographic data
ccd	UBV CCD data
sit	UBV data from video cameras (SIT)
cmd	UBV data from the file *ubv.cmd*
hrd	UBV data with individual dereddening
rgu	RGU photographic photometry
uvby	uvby measurements
uvbym	uvby mean values
egg	uvby data from Eggen
ccdy	uvby CCD data
beta	Hβ measurements
betam	Hβ mean values
gen	Catalogue of magnitudes in the Geneva system
mpg	Photographic and photovisual data
prm	Geneva parameters
ric	RI (Cousins) data
rie	RI (Eggen) data
rij	RI (Johnson) data
rik	RI (Kron) data
jhk	JHK measurements
ddo	DDO measurements
wal	Walraven measurements
cmt	Washington measurements
vil	Vilnius measurements

Commands	Objects
smi	Measurements in the system of Lindsey Smith
Commands on spectroscopic data	
mk	MK spectral types
mks	Selected MK types
spt	One dimensional spectral types (HD format)
vsn	projected rotational velocities Vsini
irv	Individual radial velocities
mrv	Mean radial velocities
gpo	Objective prism radial velocities
rfs	Radial velocities from Geyer et Nelles
orb	Orbital elements of spectroscopic binaries
Commands on identifications, positions and proper motions	
idm	Identifications BS, HD, DM, GCVS, ...
idm1	Identifications BS, HD, DM, NLS, LSS, GCVS
idm2	Identifications IDS, ADS, SAO, misc.
ids	Identifications of components in the IDS catalogue
tab	Cross-reference tables
coo	Full coordinates
pos	Rounded off coordinates
hpd	Positions (x,y) from the file *hipad.xy*
apm	Absolute proper motions
rpm	Relative proper motions
Miscellanous commands	
aud	Provide other types of data for a sample
prob	Membership probabilities
rem	Remarks
ref	References
bib	Bibliography (A.A.A)
bdp	Bibliography of Alter et al. and Ruprecht et al.
lyn	Lyngå's catalogue
gk	Red giants in cluster fields
multi	Multiple types of data
sysno	Give the adopted reference for each cluster
Selection of clusters	
slm	Display the number of available data per cluster for a given type of data
ocl	Select clusters according to their parameters: distance, reddening, age and position.

Commands	Objects
stcn	Display the total number of measurements and stars for a given type of data
Menus	
go	General menu for interrogating BDA
dsc	Choice of the descriptions of BDA
doc	Documentation on BDA
apl	Description of coded applications
dia	Description of graphical capabilities
ans	Description of open cluster analysis
anl	Description of data analysis
msj	Description of up-dating processes
ncm	Names and objects of commands
atp	Astrophysical study of clusters
ana	Analysis of the data
avr	Handling of radial velocities
cbr	Calibrations
sbs	Spectrocpic binaries
trc	Handling the coordinates
ttr	Cross-references
xy	Working with the x,y positions
maj	Update of the database
diaphot	Plot photometric diagram
testenv	Test the setting of BDA environment variables
Commands on compressed files	
scl	Display a scale and 10 lines of a file
zex	Cat a compressed file
zp	List a compressed file page after page
zhd	List the first 15 lines of a compressed file
ztl	List the last 15 lines of a compressed file
zpr	Print a compressed file with `lpr`
vz	Edit a compressed file with `vi`
wz	Count the number of lines of a compressed file
Help commands	
emploi	Describe the capabilities of commands
man	Display the command manual pages
mnl	Display the command manual pages (French)
doc	Display the menu of BDA descriptions
xhelp	Hypertext command description

Commands	Objects
dtype	Display the data type summary
ncm	Access to descriptions of the command names
option	Display the option description
nfile	Display the filename related to a datatype
fichier	Display the file content description
field	Display the field names of a datatype
form	Display the format of the datatype specified

Table A.2: Further commands

Name	Action
carte	Plot a cluster chart from (x,y) data
cmpv	Compare V magnitudes
cmpbv	Compare colour indices
compar	Compare UBV photometric data
dbms	prompt mode query program
diag	Plot photometric diagrams for UBV data
diagen	Plot photometric diagrams in the Geneva system
detail	Display the detailed file content
detref	Display the content and references
ecasy	Display the difference in the UBV data
extrf	Select data from the source reference
list	List a file
meas	Extract data for a list of stars
moyen	compute average for UBV data
nbmeas	Number of entries for a star
nbsrc	Number of data source per stars
olps	Keep one line per star
post	Prepare data for sending by E-mail
slct	Make a selection
total	Total number of measurements and stars
xhelp	Hypertext help with NCSA Mosaic
ximage	Display the scanned maps
xprimage	Print the scanned maps

A.2 Program names

Table A.3: Program names

Name	Action
Fortran programs	
ana_ddo	calibration in the DDO system
astrom	transformation from (x,y) in " of arc to RA Dec
beta_eca	comparaison of Hβ indices
bibg	bibliographic search
cbr_uvby	calibration for uvby
ccd_eca	comparaison of CCD data, a link to ubv_eca
chgtno	change of numbering system
cintf	compute integrated colours and magnitudes
cogxy	transformation from (x,y) in arbitrary units to RA Dec
cordn1	transformation from the type coo to pos
corresp	search for cross-identifications
decon_bv	perform a photometric deconvolution of a binary
degrah	transformation from RA in degrees to RA in hours
dered	code to deredden UBV colours
efem	ephemeris for spectroscopic binaries
gould	transformation from (x,y) in minute of time and degrees
hyad	compute the distance of Hyades stars from proper motions
lucke	determine an orbit for a spectroscopic binary
magV_eca	comparaison of V magnitudes
moy_ubv	compute mean values for UBV data
moy_vr	compute mean radial velocites
prepost	compute precession (B system)
prepxy	prepare the (x,y) file for plotting cluster chart
retab	use of cross-reference tables
rgl	compute regressions
rgu_ubv	transform RGU into UBV
sref	interactive query of the references
sysxy	transformation of a (x,y) system into another one
ubv_eca	comparaison of two sources of UBV data
ubv_moy	compute mean values for UBV data
wal-john	compute Johnson's V and B-V from Walraven V and V-B
xystd	compute (x,y) from RA and Dec
C programs	
ajzero	format coordinates
b2v1_bvj	transform B2-V1 into B-V Johnson
cinte	compute integrated colours
diaphot	menu (with curses) for photometric diagrams

Name	Action
fparam	compute Geneva parameters
maj	menu (with curses) for updating the database
notab	preparation of a new cross-reference table
param	compute Geneva parameters
sysexp	expert system for membership determination
test_env	program to test the settings of environment variables
C programs using SM libraries	
diag	plot diagrams in the UBV system
diagen	plot diagrams in the Geneva system
Histo	make histrograms
plt_eca.ubv	plot the results of UBV data comparaisons
splt_irv	plot the spectroscopic binary orbits
User interface	
xbda	user interface

Appendix B

Option Names

Table B.1: Option Description

Option	Meaning	Action
Data query		
-m stars	multiple	: several star numbers at the same time
-r star	reference	: give the reference as well as the data
-q id	quelconque	: query with any identification
-a star	average	: compute also the average value (ubv)
-u ref star	uniq	: select "star" in the reference "ref"
Forming samples		
-gt lim	greater than	: stars with parameter $>$ lim
-lt lim	less than	: stars with parameter $<$ lim
-i lim1 lim2	interval	: stars with lim1 $<$ parameter $<$ lim2
-eq ref	equal to	: data from the reference "ref"
-ne ref	non equal	: data not belonging to "ref"
-k string		: stars corresponding to "string"
Information on files		
-d [lim]	detail	: count the number of stars per reference
-dr [lim]	detail/ref	: same as above, but adds the list of ref.
-nb [lim]	number	: number of measures per star [$\geq$ lim]
-t	total	: count the number of measures and stars
Help		
-h	help	: display the usage description

Option	Meaning	Action
Applications		
-c [type]	comparaison	: run the comparaison program
-dn [lim]	detail night	: give the number of stars per night
-v star	voir	: select the measures and plots them
-bin star	binary	: start the code for orbit computing
-bin2 star	binary	: start the code for orbit computing
-sb1 star	SB1	: plot the orbit of a SB1 binary
-sb2 star	SB2	: plot the orbit of a SB1 binary
-sort param	sort	: sort the output according to "param"
Results		
-y		: display the results of the analysis
-histo	histo	: plot a histogram of BDA content
-info	information	: technical information
Use of the files		
-f filename	file	: use the file given
-s	sortie	: use the file sortie.out
-l	liste	: use the file liste.noet

Appendix C

Data types

Table C.1: Data types

Type	Data
apm	: absolute proper motion
beta	: measurements in the Hβ system
betam	: mean Hβ data
ccd	: CCD measurements in the UBV system
ccdric	: CCD measurements in Cousins's RI system
ccdy	: measurements CCD in the uvby system
cmd	: mean values UBV for plotting the HR diagram
cmt	: measurements in the system of Washington
coo	: coordinates (1950) from astrometric sources
ddo	: meaurements in the DDO system
egg	: measurements uvby in Eggen's modified system
gen	: mean values from the Geneva catalogue
gk	: list of red giants in the cluster field
gpo	: objective prism radial velocities (GPO)
hpd	: rectangular x,y positions
idm1	: identifications (IDAM), first part
idm2	: identifications (IDAM), second part
ids	: identifications of double star components (IDS)
irv	: individual radial velocities
jhk	: measurements in the JHK photometric system
mk	: MK spectral types
mks	: selected MK types
mpg	: measurements in the m_{pv}, m_{pg} system
mrv	: mean radial velocities from the literature
orb	: orbital elements of spectroscopic binaries
pgh	: measurements UBV photographic
pghm	: mean values UBV photographic
pos	: rounded off coordinates (1950)
prm	: Geneva parameters

Type	Data
prob	: membership probabilities (proper motion)
probr	: membership probabilities (radial velocity)
rem	: remarks
rgu	: measurements in the RGU photographic system
ric	: measurements in Cousins's RI system
rie	: measurements by Eggen in Kron's RI system
rij	: measurements in Johnson's RI system
rik	: measurements in Kron's RI system
rpm	: relative proper motion
sit	: measurements UBV from video (SIT) cameras
spt	: unidimensional spectral types (HD format)
tref	: references for cross-reference tables
tab	: cross-reference tables
ubv	: measurements UBV photoelectric
ubvm	: mean value UBV photoelectric
uvby	: measurements uvby
uvbym	: mean uvby values
vic	: VI measurements in Cousins's system
vie	: VI measurements in Kron's system
vil	: measurements in the Vilnius system
vsn	: projected rotational velocities
wal	: measurements in the Walraven system

Appendix D

Files Names

Table D.1: Data file names and content

Name	Content
adel.and	: coordinates (1950) from Andersen and Reiz
adel.coo	: coordinates (1950) from astrometric sources
adel.pos	: rounded off coordinates (1950)
baas.dat	: information on ongoing work
beta.mes	: measurements in the Hβ system
beta.moy	: mean Hβ data
bdp.cat	: Budapest bibliography
cmt.mes	: measurements in the system of Washington
ddo.mes	: meaurements in the DDO system
elem.orb	: orbital elements of spectroscopic binaries
gen.cat	: mean values from the Geneva catalogue
gen.prm	: Geneva parameters
gK	: list of red giants in the cluster field
hipad.xy	: rectangular x,y positions
idam.id1	: identifications (IDAM), first part
idam.id2	: identifications (IDAM), second part
idam.ids	: identifications of double star components (IDS)
jhk.mes	: measurements in the JHK photometric system
lyn.dat	: information from Lyngå's 5th catalogue
mem.fin	: membership estimates according to mu,vr,phot
mkk.don	: MK spectral types
mkk.sel	: selected MK types
mpg.mes	: measurements in the m_{pv}, m_{pg} system
prob.mu	: membership probabilities (proper motion)
prob.vr	: membership probabilities (radial velocity)
rem.txt	: remarks
pm.abs	: absolute proper motions
pm.rel	: relative proper motions
ric.ccd	: CCD measurements in Cousins's RI system
ric.mes	: measurements in Cousins's RI system

Name	Content
rie.mes	: measurements by Eggen in Kron's RI system
rij.mes	: measurements in Johnson's RI system
rik.mes	: measurements in Kron's RI system
rgu.mes	: measurements in the RGU photographic system
spt.don	: unidimensional spectral types (HD format)
trans.ref	: references for cross-reference tables
trans.tab	: cross-reference tables
ubv.ccd	: CCD measurements in the UBV system
ubv.cmd	: mean values UBV for plotting the HR diagram
ubv.eca	: differences between two sources of UBV data
ubv.sit	: measurements UBV from video (SIT) cameras
ubv.peg	: merge of the corrected pe and pg UBV data
ubv.peo	: measurements UBV photoelectric
ubv.pem	: mean value UBV photoelectric
ubv.pgo	: measurements UBV photographic
ubv.pgm	: mean values UBV photographic
uvby.ccd	: measurements CCD in the uvby system
uvby.egg	: measurements uvby in Eggen's modified system
uvby.mes	: measurements uvby
uvby.moy	: mean uvby values
vic.mes	: VI measurements in Cousins's system
vie.mes	: VI measurements in Kron's system
vil.mes	: measurements in the Vilnius system
vrad.gpo	: objective prism radial velocities (GPO)
vrad.irv	: individual radial velocities
vrad.mrv	: mean radial velocities from the literature
vsini.don	: projected rotational velocities
vsini.moy	: mean or selected rotational velocities
wal.mes	: measurements in the Walraven system

Appendix E

Data file fields

Table E.1: Data file fields

Datatype	Filename	Fields
apm	pm.abs	no ref mux muy ex ey
beta	beta.mes	no ref hb
betam	beta.moy	no ns hb
ccd	ubv.ccd	no ref v b-v u-b
ccdric	ric.ccd	no ref v v-r r-i
ccdy	uvby.ccd	no ref v b-y m1 c1
cmd	ubv.cmd	no ns v b-v u-b
cmt	cmt.mes	no ref t1 c-m t1-t2 m-t2
coo	adel.coo	no ref ah am as dd dm ds
ddo	ddo.mes	no ref c4548 c4245 c4142
egg	uvby.egg	no ref v b-y M1 C1 nm
gen	gen.cat	no q sv v p sc u v b1 b2 v1 g
gk	gK	no p M V P vr ph cl v b-v ts
hpd	hipad.xy	no v x y
hrd	ubv.hrd	no ref v b-v u-b ebv
irv	vrad.irv	no ref jd cp rv nl me disp tech
idm1	idam.id1	no bs hd dm nls lss gcvs
idm2	idam.id2	no ids ads sao misc
ids	idam.ids	no ids ads mult theta sep ma mb
jhk	jhk.mes	no ref k j-k h-k
mk	mkk.don	no ref ts cl
mks	mkk.sel	no ref ts cl
mrv	vrad.mrv	no ref rv sig
ocl	ocl.dat	cat no ah am dd dm l b d m-M ebv t ts z D
orb	elem.orb	no ref p t0 e omg v0 k1 k2 omc
pgh	ubv.pgo	no ref v b-v u-b
pghm	ubv.pgm	no ns v b-v u-b
pos	adel.pos	no ref ah am as dd dm
prob	prob.mu	no ref p
prm	gen.prm	no v u-b b-v u-b1 b2-v1 d delta m2 g

Datatype	Filename	Fields
rem	rem.txt	no text
rgu	rgu.mes	no ref g u-g g-r
ric	ric.mes	no ref v v-r r-i nm
rie	rie.mes	no ref v v-r r-i nm
rij	rij.mes	no ref v v-r r-i nm
rik	rik.mes	no ref v v-r r-i nm
rpm	pm.rel	no ref mux muy ex ey
smi	smi.mes	no ref v b-v u-b nm
spt	spt.don	no ref ts
ubv	ubv.peo	no ref v b-v u-b nm
ubvm	ubv.pem	no ns v b-v u-b
uvby	uvby.mes	no ref v b-y m1 c1 nm
uvbym	uvby.moy	no ns v b-y m1 c1
vic	vic.mes	no ref v v-i
vik	vik.mes	no ref v v-i
vil	vil.mes	no ref v u-p p-x x-y y-z z-v v-s
vsn	vsini.don	no ref vsn
wal	wal.mes	no ref vj v v-b b-u u-w b-l

Appendix F

SM macro names

Table F.1: SM macro names

Name	Object
carte 2	plot a (x,y) map
chk 1	check the cross-identifications
diag	plot for a user defined file
hsg	plot a histogram from a user defined file
plt_Dddo 2	plot the DDO C(45-48) vs C(42-45) diagram
plt_eca.BV 3	plot the colour-index comparaisons
plt_eca.magV 1	plot the differences on V magnitudes
plt_nrv 3	plot the diagram Vrad vs JDs
plt_uvby 2	plot the β vs c_o diagram
plt_vrv 3	plot the diagram Vrad vs time for one JD
sundim 4	define the plot dimension in [cm]
ttr	check the cross-identifications
vvv 1	comparaison of V magnitudes

Appendix G

Cluster names

Table G.1: SM macro names

Name	Acronym	Name	Acronym
Basel	bas	Berkeley	be
Biurakan	biu	Collinder	cr
Blanco	bl	Melotte	mel
Bochum	bo	Ruprecht	rup
Czernik	cz	Bergh-Hagen	vdbh
Dolidze	do		
Feinstein	fei		
Haffner	haf		
Harvard	ha		
Havlen-Moffat	hm		
Hogg	ho		
King	ki		
Lynga	Ly		
Markarian	ma		
Pismis	pis		
Roslund	ros		
Sher	sh		
Stephenson	ste		
Stock	st		
Tombaugh	to		
Trumpler	tr		
Turner	tu		
Upgren	up		
van den Bergh	vdb		
Waterloo	wat		
Westerlund	wes		

Appendix H

Alias

Table H.1: Useful aliases

Alias	Action
alias hyades	cd $BDA/anon/mel025
alias pleiades	cd $BDA/anon/mel022
alias coma	cd $BDA/anon/mel111
alias alpha	cd $BDA/anon/mel020
alias orion	cd $BDA/ngc/1976
alias praesepe	cd $BDA/ngc/2632
alias m44	cd $BDA/ngc/2632
alias m67	cd $BDA/ngc/2682
alias m11	cd $BDA/ngc/6705

Appendix I

Catalogues

I.1 The Catalogue of Red Giant in open clusters

The catalogue of red giants in the field of open clusters collects the red stars candidates for cluster membership from photometric studies. It results from the work made to prepare the systematic observations undertaken with the Coravel scanners. Each file, called *gK* is located in the clusetr directory and summarizes the available data for each star. The information has been coded and the keys to the codes is described below. Further information is provided by the hypertext description. (`xhelp gk`).

Each record of the files *gK* gives:

- the star identification,
- the membership probability from proper motion
- the estimated membership from proper motion (M), radial velocity (V) and photometry (P).
- the code for photometric system in which the stars have been observed:

    1. UBV photoelectric
    2. UBV photographic
    3. Geneva system
    4. DDO system
    5. Washington system
    6. RI
    7. Eggen's uvby
    8. UBViyz
    9. Wing's system

- a classification type from the evolutionary state:

- A: asymptotic
- B: branch (ascending)
- C: clump
- S: supergiant
- F: field (non-member)
- D: composite (double)
- B: binary (SB)

* the V magnitude (pe or pg, acoording to the UBV code)
* the B-V index
* the spectral type