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uvbyβ photoelectric photometric catalogue

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Abstract. We present a new version of the *uvbyβ* catalogue. The survey of the literature is complete to the end of 1996 and 63313 stars are included in this version. This represents 36683 new measurements. New precepts have been used to compute mean values.

Key words: stars: general — stars: fundamental parameters — catalogue — techniques: photometric

1. Introduction

Since 1970, we have been compiling the published photoelectric data in many photometric systems and in particular the *uvbyβ* system. The previous version was completed in 1989 (Hauck & Mermilliod 1990) and many new data have been published during the past years. Thus we have updated the catalogue, which is, like the previous one, constitued of two parts. First, we have maintained all the data published; thus it perfectly reflects the literature data, and it is possible to retrieve easily the data published by one or a group of authors. Nevertheless, on many occasions only one value per star is needed, i.e. the best average value, and this is why we have made a critical evaluation of the compiled data in order to publish a second part of the catalogue which contains the homogeneous data for 63313 stars.

Both parts are available in machine-readable form from the Strasbourg Data Center, but an access is also provided by our World Wide Web service at http://obswww.unige.ch/gcpd/ (Mermilliod et al. 1997).

2. The critical evalutation

The first step of the evaluation of the data is the same as that used in the past, i.e. a search for common stars with a master list, and the computation of mean differences and standard errors. On this basis, each publication receives a weight. As the system is used by more and more persons, its homogeneity diminishes and systematic errors appear as well as more or less discrepant data. Due to the size of the catalogue, it is neither possible to trace back every problem nor feasible to explain each difference. Therefore, the procedure adopted here keeps the publication weights, but gives a low weight to discrepant data. We have adopted for this new version the precepts developed for computing mean values for the *UBV* system (Mermilliod & Mermilliod 1994), which are explained below.

A two-step iterative procedure has been adopted: the first step consists of a simple weighted mean, the weight being the number of measurements to the 2/3 power and the publication weight. The exponent used gives slightly less weight to observations with a number of measurements much larger than usually found. This is also the unique step for stars with only two sources of measurements.

$$\overline{X} = \frac{\sum_i w_{\rm p} X_i \, n_i^{2/3}}{\sum_i n_i^{2/3}}$$

where X represents V, $(b-y)$, m_1, or c_1. n is the number of measurements and $w_{\rm p}$ is the weight (in a scale 0 to 4) of each publication. The second step uses the differences $E_i = X_i - \overline{X}$ of the individual values (X_i) to the mean $(\overline{X})$ to compute new weighted mean values. The weight (p_i) has the form:

$$p_i = \frac{\alpha \sqrt{2}\, \varepsilon_X \, n_i^{2/3}}{\sqrt{E_i^2 + \varepsilon_X^2}}$$

where

$$\alpha = \frac{N}{\sum_i n_i^{2/3}}$$

is a normalisation factor, so that the sum of the weights is close to the sum of sources when the error (E_i) is close to the mode of the errors (ε_X). The weighted mean values are simply computed with the formula:

$$\overline{X} = \frac{\sum_i p_i \, X_i}{\sum_i p_i}.$$

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The values of ε_X have been estimated from the distribution of the differences for stars with two sources. The adopted values for ε_V, $\varepsilon_{(b-y)}$, $\varepsilon_{(m_1)}$, $\varepsilon_{(c_1)}$, and $\varepsilon_{(\mathrm{beta})}$are equal to 0.005, 0.003, 0.004, 0.005, and 0.005 respectively. This means that the expression

$$\frac{\sqrt{2}\,\varepsilon_X}{\sqrt{E_i^2 + \varepsilon_X^2}} \sim 1$$

for values of E_i close to ε_X and p_i is close to unity for the majority of the stars. The dispersion is computed in the usual way:

$$\sigma_X = \sqrt{\frac{\sum_i (X_i - \overline{X})^2\, p_i}{\sum_i p_i}}.$$

As desired, this procedure gives a lower weight to discrepant values, and the computed mean value is closer to that defined by the majority of the sources.

Mean values of variable stars have been computed in the same manner. Due to the procedure used to include them in the catalogue (only the brightest value of the published light curve or list of observations has been taken) the final dispersion may be artificially small and not representative of the real amplitude of variation. For a number of stars with large deviant data which could affect too much the computation of mean values, the number of measurements has been set "manually" to 0. Thus the reference is kept but the values are not taken into account in the computation of the mean value.

3. The catalogue

3.1. The catalogue

In a first file, we present the catalogue itself, giving for each star identifications, coordinates, visual magnitude, and the mean values of the photoelectric data concerning the star and the data sources. The information contained in the columns of this file is as follows:

1. LID, a code number for stellar identification
2. Remarks on duplicity/variability
3. HD, HDE number
4. DM number
5. ID acronyms and cross-identification
6. Co-ordinates for equinox 1950
7. N_s, number of sources used for the mean
8. Mean V magnitude. In the 148 cases where V was not published by the authors, we have introduced the mean V magnitude from the UBV system (Mermilliod & Mermilliod 1994)
9. $\sigma(V)$
10. Mean $b{-}y$ colour index
11. $\sigma\ (b-y)$
12. Mean m_1 colour index
13. $\sigma(m_1)$
14. Mean c_1 colour index
15. $\sigma(c_1)$
16. N_m, cumulated number of measurements
17. Mean β colour index
18. $\sigma\ (\beta)$
19. NB, cumulated number of measurements
20. Ref, key of the data sources.

3.2. The measurements

The second file contains the individual measurements for each star with the code number LID and the remarks (see Sect. 3.1, items 1 and 2), the V magnitude, the colours $b{-}y$, m_1, c_1 with the number of measurements, the β parameter with the number of measurements, and the key of the data source.

3.3. Coordinates

Coordinates are very important for performing selections based on the position in the sky. We have also made an effort to collect co-ordinates from the literature or the database for stars in open clusters (Mermilliod 1995) so that it will be posssible to query the *uvbyβ* catalogue by positions.

3.4. Data sources

As a rule, all astronomical journals are surveyed for new photometric data. The bibliographic references (data sources) are collected in a separate part (file 3). The reference numbers are generally attributed sequentially in order of arrival. The information entered in the file is the source number, the list of authors' names, the journal information (year, name, volume, page), the complete title, and the ADS/CDS bibliographic code to enter the ADS Abstract Service system.

3.5. Stellar identifications

In the last part of our catalogue, in file 4, we present all the acronyms used for the stellar identification (see Sect. 3.1, item 5) in alphabetic order and in respect of the convention of Fernandez et al. (1983). One of our main contributions concerns the stellar identifications. When necessary, we have transformed the published identifications into a uniform system: various names are used in the literature, generally depending on the kind of sample investigated, and the most time-consuming work is related to the necessity of collecting all the data for each star under the same identification, otherwise the advantage of working on large compilations partly vanishes. The basic principles adopted for this work have been explained in the description of the code numbering system (Mermilliod 1978) and the solution designed for star clusters is described by Mermilliod (1976).

4. Growth of the data

The *uvbyβ* system is one of the most important photometric systems. The first catalogue (Strömgren & Perry 1965) contained *uvby* data for 1217 stars. Hβ photometry was added by Crawford et al. (1965). Data showing the growth of this system are presented in Table 1.
Column 1 indicates the year of publication while Cols. 2, 3, and 4 indicate respectively the number of stars, number of measurements, and number of publications, the reference to the catalogue successive versions being given in the last column.

Table 1. Growth of the data in the *uvbyβ* system

	Number of			
Year	Stars	Meas.	Pub.	Cat. reference
1965	1217	1217	1	Strömgren & Perry (1965)
1973	7600	10500	76	Lindemann & Hauck (1973)
1975	9407	12900	106	Hauck & Mermilliod (1975)
1980	19884	31161	223	Hauck & Mermilliod (1980)
1985	40848	60016	336	Hauck & Mermilliod (1985)
1990	44896	69190	414	Hauck & Mermilliod (1990)
1997	63313	105873	533	present catalogue

5. Distribution of the data

The Strasbourg Data Centre normally distributes the full version of the *uvbyβ* catalogues. It will also be accessible through the CDS/ESRIN facilities called VizieR (http://vizier.u-strasbg.fr/cgi-bin/VizieR).
An access is also provided by our World Wide Web service at http://obswww.unige.ch/gcpd/ (Mermilliod et al. 1997).

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