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STRÖMGREN PHOTOMETRY OF STARS IN BAADE'S WINDOW. I. THE DATA[1]

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RESUMEN

Se han tomado datos *uvby* de una muestra de 232 estrellas en la Ventana de Baade. Se presentan estas observaciones y los diagramas correspondientes.

ABSTRACT

We have obtained *uvby* data of a sample of 232 stars in Baade's Window. These observations are presented along with the corresponding diagrams.

Key words: **GALAXY – CENTER — GALAXY – STELLAR CONTENT — STARS – HR-DIAGRAM — TECHNIQUES – PHOTOMETRIC**

1. INTRODUCTION

Baade's Window (BW) has long been observed because of its low absorption and its position near the galactic centre. These characteristics permit the observation of many stars which are presumably members of the galactic bulge; although it is certain that there is contamination of this field by stars belonging to the galactic disc. Geometric arguments as well as galactic models allow to see that most of the stars are located far away from the solar neighbourhood; this suggests the interesting possibility of finding both bulge and disc stars in the surroundings ($\sim$ 500 pc) of the galactic centre.

Over the last few years, research on the bulge has been actively conducted by several astronomical groups. Much of this research is summarized in recent reviews by Frogel (1988), Rich (1993), and King (1993).

In previous papers we have presented a series of arguments which indicate that, even though the stars are —in its majority— located far away from the Sun, we can separate them into two radically different groups. One of these groups we have called the 'true' bulge and the other the 'true' disc populations respectively. For a complete discussion of these arguments refer to Ruelas-Mayorga (1987), Ruelas-Mayorga & Teague (1992a,b, 1993), (see also Ruelas-Mayorga & Peimbert 1994; Ruelas-Mayorga & Noriega-Mendoza 1995; Ruelas-Mayorga & García-Ruiz 1995; Ruelas-Mayorga, Noriega-Mendoza, & Román-Zúñiga 1996; Ruelas-Mayorga 1996). We would like to stress that the arguments presented do not prove that the stellar population in BW is really made up of disc and bulge components, they merely indicate that this suggestion is not inconsistent with the data.

As time evolves, and more research on the metal content of the stars in BW is collected, their metallicity value has decreased. This point indicates that there is a mixture of different stellar populations in BW. At first these stars were considered as super metal rich [Fe/H] $\sim +0.3$ (Whitford & Rich 1983; Frogel & Whitford 1987; Rich 1988), now, they have a metallicity value of [Fe/H] ~ 0.0 with a spread from -1.0 to $+0.5$, whereas previously the spread extended up to $+1.0$ (as indicated by Terndrup, Sadler, & Rich 1995 from previous work). Very recently new JHK photometry of bulge stars (Tiede, Frogel, & Terndrup 1995) determined metallicity values for six bulge windows, including BW. Their values range from [Fe/H] ~ -1.05 for BW8 to [Fe/H] ~ -0.28 for BW4 (Baade's Window, see their Table 7) pushing down, even further, the metallicity values of the stars in the Galactic bulge.

The determination of the metallicity distribution

[1] Based on observations collected at the Observatorio Astronómico Nacional, San Pedro Mártir, B.C., México.

TABLE 1

EXTINCTION COEFFICIENTS FOR MAY 1993

Date	k_v (mag/airmass)	k_{b-y} (mag/airmass)	k_{m_1} (mag/airmass)	k_{c_1} (mag/airmass)
22 – 23 May 1993	0.127	0.048	0.060	0.123
23 – 24 May 1993	0.161	0.054	0.073	0.140
24 – 25 May 1993	0.184	0.053	0.069	0.120
25 – 26 May 1993	0.143	0.060	0.061	0.125
26 – 27 May 1993	0.158	0.051	0.060	0.128
average	0.155 ± 0.021	0.053 ± 0.004	0.065 ± 0.006	0.127 ± 0.008

in the bulge of our Galaxy is critical for setting limits on the age distribution of its stars, which at present is poorly understood.

We decided to observe a number of stars in this region using Strömgren photometry, in order to see whether this photometry allowed us to discover any other characteristics which confirm or deny our separation of its stellar population in two distinct groups.

In § 2 of this paper, we present the observational procedure and reductions, § 3 presents the results and § 4 features our summary and preliminary conclusions.

2. THE OBSERVATIONS

The observations were obtained using the 1.5-m telescope at the Observatorio Astronómico Nacional (OAN) at San Pedro Mártir, Baja California, México, from 22 to 26 May 1993. The *uvby* instrument was a four-channel spectrograph-photometer. It uses exit slots and optical interference filters to define the bandpasses; the edges of the exit slots fall at wavelengths where the filter transmissions are low, generally about 15%.

During these five nights, we observed 232 stars in BW. They were selected by eyeball. During this selection the observers exercised the criteria of brightness and colour; that is, we tried to choose all those stars in the field that appeared brighter than certain limit and also that appeared to be distributed from the red to the blue equally. In this respect our 232-star sample is an almost totally randomly chosen stellar sample. The photometric standards were carefully selected from the lists by several authors (Crawford & Mander 1966; Crawford & Barnes 1970; Grønbech, Olsen, & Strömgren 1976; Grønbech & Olsen 1977; Olsen 1983, 1984; Olsen & Perry 1984). Great care was taken in transforming our data to the *uvby* system of Olsen (1983, 1984), which is essentially equal to the systems of Crawford & Barnes (1970) and Crawford & Mander (1966) with an extension to metal-poor stars.

During this run the seeing was very good and always smaller than ~ 2 arcsec. The photometric observations of the stars and the sky were taken through a diaphragm ~ 12 arcsec in size. Great care was taken that no two stars were included within ~ 2 diaphragm radii of the star under observation, in order to ensure the best sky subtraction possible.

The reduction techniques used were standard for this set-up (Arellano & Parrao 1989) and are aimed to obtain, for each star, the following quantities: v, $b-y$, $m_1 = (v-b)-(b-y)$ and $c_1 = (u-v)-(v-b)$.

The atmospheric extinction coefficients obtained for each observing night are presented in Table 1, where column 1 presents the observing date, columns 2, 3, 4 and 5 give the values of the extinction coefficients calculated for v, $b-y$, m_1 and c_1. At the bottom of each column we have written the average extinction coefficients for this run during May 1993. These values compare well with those reported by Arellano & Parrao (1989) for observing seasons in October 1984, February 1985 and June 1989.

The m_1 and c_1 indices are transformed to the reddening independent quantities $[m_1]$ and $[c_1]$ by application of the following equations (Strömgren 1966):

$$[m_1] = m_1 + 0.18(b-y) \ , \qquad (1)$$

$$[c_1] = c_1 - 0.20(b-y) \ . \qquad (2)$$

The observed values may be dereddened using the following equations from (Strömgren 1963, 1966):

$$E(b-y) = 0.70E(B-V) \ , \qquad (3)$$

$$E(B-V) = 0.45 \ , \qquad (4)$$

(see, Ruelas-Mayorga & Teague 1992a).

$$E(m_1) = -0.18E(b-y) \ , \qquad (5)$$

$$E(c_1) = 0.20E(b-y) \ . \qquad (6)$$

3. RESULTS

Table 2 gives the photometric values for the observed stars in BW; column 1 gives the source name, columns 2 and 3 give the right ascension and declination in epoch 2000 referred to the SAO 186186 star [$\alpha(2000) = 18^h\ 03^m\ 36.2^s$, $\delta(2000) = -29^\circ\ 51'\ 41.6''$], the errors in right ascension and declination equal $\sim \pm$ 1 arcsec. Columns 4, 5, 6 and 7 present the observed values for v, $b-y$, m_1 and c_1. The photometric errors are small and we shall take upper-bound values of $\pm$ 0.02 for v and $\pm$ 0.01 for $b-y$, m_1 and c_1.

We shall present here the typical diagrams which are usually obtained when Strömgren photometry is taken. Interpretations of these results in terms of models are left for a further publication (Ruelas-Mayorga & García-Ruiz 1996b).

Figure 1 presents a graph of $[c_1]$ versus $[m_1]$. It is interesting to notice that below $[m_1] \sim 0.55$, most of the stars occupy a very tight sequence which becomes almost vertical at a value of $[m_1] = 0.20$, whereas towards higher values of $[m_1]$ the stars seem to spread much more over this diagram. We believe there is an intrinsic characteristic of the stellar population in BW which determines this clear dichotomy. However, we are at present unable to say with certainty what this characteristic is. Of course, it is possible that some of the stars in the interval $0.1 \leq [m_1] \leq 0.3$ are foreground main sequence stars with spectral types from $A0V$ to $K0V$.

In Figure 2 we present a diagram of $[c_1]$ versus $(b-y)_0$. It is clear from this figure that there is a well established tendency for these stars to become redder as the value of $[c_1]$ decreases. Again, there seems to be a break at $(b-y)_0 \sim 0.4$, at which

TABLE 2

PHOTOMETRIC INFORMATION FOR THE OBSERVED STARS IN BW

Name	R.A. (2000) ($\pm$ 0.1^s)	Dec. (2000) ($\pm$ 1$''$)	v	b-y	m_1	c_1
BW 001	$18^h03^m22.0^s$	$-30^\circ03'37''$	13.27	0.40	0.12	0.55
BW 002	18 03 23.6	−30 04 21	12.78	1.00	0.52	0.98
BW 003	18 03 23.8	−30 03 20	12.24	1.41	0.67	0.76
BW 004	18 03 24.6	−29 58 00	12.83	0.88	0.37	0.43
BW 005	18 03 25.3	−29 58 38	14.92	0.59	0.05	0.61
BW 006	18 03 29.6	−29 57 51	11.48	0.77	0.35	0.41
BW 007	18 03 30.0	−29 58 20	11.48	0.81	0.29	0.50
BW 008	18 03 30.1	−29 57 29	14.25	0.99	0.37	−0.32
BW 009	18 03 30.6	−30 02 56	12.85	1.00	0.65	0.88
BW 010	18 03 31.4	−29 58 21	12.95	0.68	0.22	0.46
BW 011	18 03 38.5	−29 56 54	13.22	0.92	0.55	0.44
BW 012	18 03 39.0	−29 57 36	13.19	0.95	0.51	0.43
BW 013	18 03 39.9	−29 56 00	11.59	0.19	0.09	1.08
BW 014	18 03 40.6	−29 56 39	13.91	0.60	0.24	0.25
BW 015	18 03 40.8	−29 56 45	11.58	0.20	0.07	1.12
BW 016	18 03 41.4	−29 55 30	11.94	0.43	0.12	0.39
BW 017	18 03 41.7	−29 56 54	13.92	0.60	0.26	0.27
BW 018	18 03 41.8	−29 58 36	13.50	0.41	0.11	0.42
BW 019	18 03 42.3	−29 58 24	14.31	0.36	−0.05	0.69
BW 020	18 03 44.4	−29 56 04	12.68	0.21	0.22	0.78
BW 021	18 03 45.8	−29 53 30	12.31	0.12	0.17	0.99
BW 022	18 03 46.9	−29 57 37	12.69	0.68	0.41	0.32
BW 023	18 03 47.3	−29 55 54	14.23	0.92	−0.09	0.83
BW 024	18 03 47.7	−29 57 25	13.39	0.90	0.60	0.23
BW 025	18 03 48.6	−29 57 35	14.23	0.37	0.40	0.20

TABLE 2 (CONTINUED)

Name	R.A. (2000) ($\pm$ 0.1^s)	Dec. (2000) ($\pm$ 1$''$)	v	b-y	m_1	c_1
BW 026	18 03 49.4	−29 52 03	13.94	0.82	0.41	0.65
BW 027	18 03 50.1	−29 53 47	10.40	0.13	0.04	0.50
BW 028	18 03 51.1	−29 54 13	14.45	0.47	0.05	0.57
BW 029	18 03 53.7	−29 54 40	13.57	0.85	0.41	0.50
BW 030	18 03 56.6	−29 54 42	14.35	0.40	0.07	0.64
BW 031	18 05 07.5	−29 46 01	13.89	0.90	0.87	0.50
BW 032	18 05 11.0	−29 45 24	14.06	0.70	0.09	0.61
BW 033	18 05 12.5	−29 47 37	13.09	1.15	1.03	0.55
BW 034	18 05 13.1	−29 45 00	14.19	0.77	0.03	0.44
BW 035	18 05 14.4	−29 46 36	12.90	0.58	0.35	0.24
BW 036	18 05 14.6	−29 49 16	13.92	0.69	−0.10	0.45
BW 037	18 05 15.5	−29 44 24	13.52	0.87	0.44	0.25
BW 038	18 05 15.7	−29 47 16	11.86	0.31	0.14	0.97
BW 039	18 05 16.2	−29 47 09	13.24	0.54	0.03	0.72
BW 040	18 05 17.0	−29 48 13	13.92	0.69	−0.10	0.45
BW 041	18 05 17.4	−29 44 27	13.24	0.99	0.65	1.66
BW 042	18 05 18.5	−29 44 39	12.65	0.54	0.11	0.48
BW 043	18 05 21.8	−29 50 53	12.69	1.00	0.56	0.62
BW 044	18 05 22.8	−29 51 23	14.08	0.28	0.17	0.84
BW 045	18 05 24.5	−29 52 34	15.96	2.56	2.08	0.68
BW 046	18 05 24.8	−29 52 42	15.11	0.75	0.84	−0.29
BW 047	18 05 27.3	−29 52 26	13.50	0.67	0.17	0.27
BW 048	18 05 28.2	−29 49 31	10.76	0.95	0.74	0.19
BW 049	18 05 29.5	−29 50 29	13.69	0.76	0.27	0.43
BW 050	18 05 31.1	−29 51 10	11.77	1.18	0.72	0.22
BW 051	18 05 31.2	−29 50 56	13.94	1.42	0.55	0.31
BW 052	18 05 32.2	−29 51 03	12.76	0.57	0.31	0.35
BW 053	18 05 33.0	−29 50 56	13.93	1.42	0.55	0.30
BW 054	18 05 40.3	−29 48 57	13.62	0.54	0.13	0.40
BW 055	18 05 40.4	−29 51 00	10.77	0.09	0.11	0.98
BW 056	18 05 43.1	−29 53 06	13.97	0.46	−0.02	0.90
BW 057	18 05 43.6	−29 50 17	14.55	1.27	0.05	3.39
BW 058	18 05 44.3	−29 50 22	14.30	1.07	0.15	0.36
BW 059	18 05 45.2	−29 53 23	13.86	1.17	0.16	0.53
BW 060	18 05 47.1	−29 53 28	15.28	0.28	0.72	−0.16
BW 061	18 05 47.4	−29 51 42	11.19	0.22	0.12	1.12
BW 062	18 05 48.2	−29 52 32	12.37	0.84	0.41	0.30
BW 063	18 05 48.7	−29 51 47	11.18	0.21	0.11	1.12
BW 064	18 05 50.7	−29 54 15	14.13	0.68	−0.07	0.44
BW 065	18 05 51.2	−29 53 07	13.83	0.48	0.22	0.30
BW 066	18 05 52.2	−29 52 46	14.73	0.56	0.15	0.43
BW 067	18 05 52.3	−29 51 54	14.77	0.20	0.19	0.33
BW 068	18 05 52.5	−29 53 39	13.84	0.81	0.77	0.16
BW 069	18 05 53.5	−29 52 14	14.43	0.63	0.03	0.26
BW 070	18 05 54.1	−29 50 57	12.87	0.77	0.40	0.44
BW 071	18 05 54.1	−29 51 51	11.62	0.90	0.50	0.31
BW 072	18 05 54.1	−29 51 07	14.81	0.88	0.83	−0.77

TABLE 2 (CONTINUED)

Name	R.A. (2000) (± 0.1^s)		Dec. (2000) (± 1″)	v	b-y	m_1	c_1
BW 073	18 05	56.8	−29 53 37	12.62	0.27	0.15	0.86
BW 074	18 05	57.4	−29 53 53	12.74	0.46	0.15	0.28
BW 075	18 05	57.8	−29 53 02	14.10	0.41	0.15	0.65
BW 076	18 06	00.5	−29 53 13	13.72	0.89	0.56	0.53
BW 077	18 06	01.5	−29 53 11	13.70	0.88	0.55	0.52
BW 078	18 06	02.0	−29 51 45	13.89	0.22	0.17	0.94
BW 079	18 06	06.9	−29 53 16	13.46	0.44	0.10	0.62
BW 080	18 06	07.5	−29 52 30	11.90	0.18	0.15	1.12
BW 081	18 06	12.7	−29 51 57	07.43	0.67	0.42	0.36
BW 082	18 06	14.7	−29 48 09	12.56	0.27	0.09	1.13
BW 083	18 06	18.1	−29 48 00	12.01	0.65	0.28	0.51
BW 084	18 06	20.3	−29 48 51	13.05	0.29	0.16	0.44
BW 085	18 06	22.6	−29 47 56	14.57	0.90	0.46	−0.07
BW 086	18 06	23.4	−29 49 50	12.20	0.91	0.60	1.06
BW 087	18 06	24.3	−29 47 02	11.99	0.13	0.07	0.81
BW 088	18 06	34.7	−29 48 54	13.47	0.18	0.16	0.63
BW 089	18 06	36.0	−29 45 46	13.55	0.33	0.16	0.42
BW 090	18 06	36.6	−29 45 23	11.68	1.11	0.77	0.54
BW 091	18 06	36.8	−29 39 58	13.22	0.37	0.11	0.56
BW 092	18 06	37.1	−29 40 51	12.44	0.37	0.15	0.42
BW 093	18 06	38.5	−29 45 53	13.42	1.54	0.23	0.22
BW 094	18 06	38.5	−29 41 18	12.44	0.37	0.15	0.41
BW 095	18 06	39.1	−29 49 24	13.01	0.90	0.44	0.73
BW 096	18 06	39.3	−29 42 03	14.13	0.72	0.65	−0.04
BW 097	18 06	39.3	−29 48 01	13.82	0.27	0.15	0.88
BW 098	18 06	40.2	−29 44 06	14.53	0.90	0.47	−0.05
BW 099	18 06	40.3	−29 48 31	13.34	1.24	0.56	0.71
BW 100	18 06	41.4	−29 47 00	13.08	0.15	0.21	0.83
BW 101	18 06	41.5	−29 50 09	10.73	0.61	0.15	0.38
BW 102	18 06	43.2	−29 44 31	12.44	0.94	0.72	0.20
BW 103	18 06	43.7	−29 48 17	12.93	0.93	0.56	0.46
BW 104	18 06	45.5	−29 46 45	13.50	0.34	0.17	0.68
BW 105	18 06	46.6	−29 46 47	13.53	0.46	0.10	0.79
BW 106	18 06	46.9	−29 43 58	13.37	0.76	0.55	0.05
BW 107	18 06	46.9	−29 46 01	13.02	0.20	0.17	1.02
BW 108	18 06	46.9	−29 43 58	13.67	1.24	0.60	0.58
BW 109	18 06	50.1	−29 45 26	13.21	0.85	0.36	0.42
BW 110	18 06	50.9	−29 45 57	14.67	1.09	0.82	0.63
BW 111	18 06	53.2	−29 46 02	12.52	0.78	0.28	0.40
BW 112	18 06	54.2	−29 47 28	14.61	0.51	0.25	0.53
BW 113	18 07	00.3	−29 46 38	13.58	0.36	0.19	0.41
BW 114	18 07	01.1	−29 46 29	13.54	0.41	0.10	0.52
BW 115	18 07	02.0	−29 46 01	15.16	0.30	0.20	0.73
BW 116	18 07	07.0	−29 47 19	13.53	0.41	0.10	0.52
BW 117	18 07	10.7	−29 47 17	13.53	0.41	0.10	0.52
BW 118	18 07	12.8	−29 47 15	14.29	0.41	0.15	0.40
BW 119	18 07	15.0	−29 46 16	11.30	0.62	0.34	0.37
BW 120	18 07	17.5	−29 46 40	11.30	0.62	0.34	0.37

TABLE 2 (CONTINUED)

Name	R.A. (2000) ($\pm$ 0.1^s)		Dec. (2000) ($\pm$ 1$''$)	v	b-y	m_1	c_1
BW 121	18 07	17.6	−29 48 53	12.85	0.49	0.08	0.63
BW 122	18 07	19.3	−29 47 38	14.06	0.75	−0.03	0.94
BW 123	18 07	20.2	−29 47 14	14.07	0.75	−0.02	0.94
BW 124	18 07	55.4	−29 40 18	09.84	0.67	0.39	0.37
BW 125	18 07	56.7	−29 40 34	13.99	0.66	−0.05	0.64
BW 126	18 07	57.0	−29 41 33	14.00	0.85	−0.05	0.46
BW 127	18 07	57.4	−29 42 35	13.76	0.99	0.51	0.23
BW 128	18 07	58.4	−29 42 47	13.69	1.13	0.33	0.18
BW 129	18 08	01.1	−29 41 21	12.55	0.78	0.34	0.30
BW 130	18 08	01.9	−29 43 10	12.89	1.03	0.62	0.48
BW 131	18 08	03.1	−29 42 08	13.40	0.48	0.19	0.42
BW 132	18 08	03.5	−29 42 57	14.30	0.95	0.58	0.47
BW 133	18 08	04.5	−29 40 45	12.47	0.25	0.23	0.64
BW 134	18 08	07.0	−29 42 23	11.83	0.71	0.54	0.26
BW 135	18 08	58.0	−29 37 08	14.04	0.25	0.22	0.48
BW 136	18 08	58.7	−29 36 40	13.69	0.84	0.73	−0.37
BW 137	18 09	11.8	−29 36 65	12.76	0.87	0.31	0.52
BW 138	18 09	13.1	−29 36 23	13.12	1.08	0.83	0.25
BW 139	18 09	18.8	−29 36 05	11.89	0.34	0.13	0.49
BW 140	18 09	22.9	−29 36 31	14.42	0.90	0.35	0.25
BW 141	18 09	23.5	−29 36 45	14.24	1.28	0.40	0.07
BW 142	18 09	23.8	−29 37 33	15.16	0.31	0.07	0.68
BW 143	18 09	25.5	−29 37 04	12.17	0.80	0.24	0.37
BW 144	18 09	30.3	−29 37 20	12.71	1.04	0.89	0.26
BW 145	18 09	31.5	−29 37 17	12.55	0.35	0.13	0.65
BW 146	18 09	33.9	−29 38 47	13.20	0.47	0.13	0.42
BW 147	18 10	00.2	−29 50 17	10.00	0.72	0.45	0.28
BW 148	18 10	04.1	−29 48 60	13.01	0.38	0.09	1.04
BW 149	18 10	04.4	−29 49 60	14.87	0.30	0.37	0.29
BW 150	18 10	06.2	−29 49 40	13.55	0.56	0.66	0.10
BW 151	18 10	06.8	−29 48 40	12.97	0.37	0.14	0.36
BW 152	18 10	08.2	−29 48 36	12.85	0.42	0.12	0.37
BW 153	18 10	09.9	−29 46 10	14.20	-0.08	0.43	0.40
BW 154	18 10	11.3	−29 47 45	12.56	0.65	0.36	0.30
BW 155	18 10	12.0	−29 49 09	12.56	0.66	0.36	0.31
BW 156	18 10	13.2	−29 49 13	13.56	0.46	0.24	1.13
BW 157	18 10	13.6	−29 47 43	13.57	0.46	0.24	1.13
BW 158	18 10	20.3	−29 48 39	14.76	0.60	0.47	0.84
BW 159	18 10	20.7	−29 48 49	14.77	0.61	0.47	0.84
BW 160	18 10	24.3	−29 48 47	12.16	0.22	0.10	1.10
BW 161	18 10	25.7	−29 48 08	13.78	0.30	0.24	0.21
BW 162	18 10	27.0	−29 47 35	09.73	0.96	0.67	0.32
BW 163	18 10	31.3	−29 49 09	13.79	0.68	0.58	0.20
BW 164	18 10	32.1	−29 50 14	13.46	0.33	0.10	0.98
BW 165	18 10	36.2	−29 48 53	11.01	0.30	0.17	0.59
BW 166	18 10	49.2	−29 48 51	14.31	0.43	0.44	0.26
BW 167	18 10	49.5	−29 48 19	13.28	0.45	0.08	0.74

TABLE 2 (CONTINUED)

Name	R.A. (2000) (± 0.1^s)	Dec. (2000) (± 1″)	v	b-y	m_1	c_1
BW 168	18 10 50.8	−29 45 06	13.41	0.47	0.20	0.21
BW 169	18 10 52.0	−29 47 37	13.60	0.28	0.06	0.84
BW 170	18 10 52.1	−29 45 35	14.10	0.49	0.02	0.75
BW 171	18 10 52.2	−29 46 19	13.21	0.37	0.01	1.11
BW 172	18 10 52.8	−29 46 36	13.63	0.61	−0.15	0.51
BW 173	18 10 53.2	−29 45 18	14.09	0.34	0.11	0.91
BW 174	18 10 55.1	−29 42 40	14.12	0.77	0.19	0.35
BW 175	18 10 55.2	−29 44 49	13.89	0.58	0.10	0.45
BW 176	18 10 55.2	−29 43 42	14.78	0.66	0.23	0.59
BW 177	18 10 55.4	−29 42 24	14.56	0.50	0.17	0.42
BW 178	18 10 56.7	−29 45 05	13.89	0.58	0.10	0.45
BW 179	18 10 58.5	−29 42 16	13.29	0.87	0.53	0.31
BW 180	18 10 58.5	−29 40 11	12.65	0.39	0.20	0.38
BW 181	18 10 58.8	−29 39 55	12.87	1.20	0.75	0.09
BW 182	18 10 59.1	−29 42 02	14.35	1.00	0.56	0.80
BW 183	18 11 00.2	−29 39 28	16.13	0.41	0.10	0.25
BW 184	18 11 00.3	−29 39 58	13.89	1.32	0.94	0.61
BW 185	18 11 00.8	−29 42 31	14.77	0.90	0.36	0.46
BW 186	18 11 02.8	−29 40 45	13.03	0.89	0.36	0.47
BW 187	18 11 05.3	−29 41 55	14.32	1.25	0.16	1.00
BW 188	18 11 08.5	−29 39 04	13.53	1.05	0.52	0.06
BW 189	18 11 10.4	−29 40 41	13.95	0.95	0.41	0.73
BW 190	18 11 12.5	−29 38 17	15.04	0.07	0.17	0.50
BW 191	18 11 12.7	−29 38 40	13.53	1.05	0.52	0.06
BW 192	18 11 20.6	−29 31 45	10.23	0.68	0.41	0.34
BW 193	18 11 21.0	−29 30 52	12.98	0.71	0.51	0.52
BW 194	18 11 22.8	−29 30 11	10.84	0.63	0.32	0.43
BW 195	18 11 22.8	−29 30 11	10.84	0.64	0.33	0.40
BW 196	18 11 23.9	−29 32 05	13.35	0.37	0.03	0.46
BW 197	18 11 24.6	−29 28 38	12.67	0.29	0.10	0.71
BW 198	18 11 27.8	−29 31 04	11.56	0.05	0.12	1.04
BW 199	18 11 28.7	−29 30 22	12.30	0.26	0.10	0.82
BW 200	18 11 32.1	−29 32 20	12.72	0.34	0.10	1.19
BW 201	18 11 33.8	−29 32 39	14.10	0.38	0.14	0.68
BW 202	18 11 34.0	−29 31 54	10.62	0.31	0.13	0.51
BW 203	18 11 34.9	−29 32 28	12.70	0.33	0.09	1.17
BW 204	18 11 37.1	−29 32 39	11.98	0.85	0.55	0.38
BW 205	18 11 38.0	−29 28 12	12.90	1.29	0.79	0.08
BW 206	18 11 39.2	−29 33 51	13.74	1.24	0.38	0.11
BW 207	18 11 40.0	−29 29 40	14.24	0.35	0.19	0.91
BW 208	18 11 41.3	−29 29 06	13.24	0.44	0.14	0.36
BW 209	18 11 44.5	−29 29 57	12.32	1.25	0.72	0.37
BW 210	18 11 56.8	−29 23 42	13.38	0.92	0.46	0.19
BW 211	18 11 57.3	−29 23 27	15.66	0.26	0.12	0.75
BW 212	18 11 57.5	−29 29 57	13.27	0.89	0.47	0.39
BW 213	18 12 00.0	−29 23 33	14.41	0.99	0.54	0.05
BW 214	18 12 00.0	−29 24 54	14.03	0.54	0.01	0.81
BW 215	18 12 01.2	−29 30 02	13.19	0.99	0.44	0.24

TABLE 2 (CONTINUED)

Name	R.A. (2000) ($\pm$ 0.1^s)	Dec. (2000) ($\pm$ 1$''$)	v	b-y	m_1	c_1
BW 216	18 12 01.8	−29 23 08	13.92	1.28	0.86	0.72
BW 217	18 12 02.8	−29 23 24	13.23	0.41	0.19	0.31
BW 218	18 12 03.1	−29 24 48	10.65	0.48	0.18	0.47
BW 219	18 12 04.9	−29 24 51	13.21	0.83	0.44	0.65
BW 220	18 12 08.6	−29 23 38	14.33	1.60	0.61	0.77
BW 221	18 12 10.1	−29 25 32	11.50	1.08	0.59	0.38
BW 222	18 12 10.7	−29 29 24	14.40	0.48	0.13	0.74
BW 223	18 12 11.5	−29 25 18	11.50	1.08	0.59	0.38
BW 224	18 12 12.0	−29 24 00	13.22	0.48	0.23	0.34
BW 225	18 12 15.9	−29 30 47	12.71	1.10	0.65	0.37
BW 226	18 12 16.7	−29 25 44	13.74	0.77	0.52	0.28
BW 227	18 12 16.8	−29 28 45	12.85	1.12	0.46	0.60
BW 228	18 12 20.3	−29 29 25	14.08	0.56	0.03	0.28
BW 229	18 12 23.6	−29 26 08	12.10	0.31	0.15	0.51
BW 230	18 12 24.0	−29 25 42	11.84	0.77	0.33	0.42
BW 231	18 12 26.3	−29 27 21	13.86	0.94	1.01	0.11
BW 232	18 12 28.1	−29 27 39	13.86	0.93	1.01	0.11

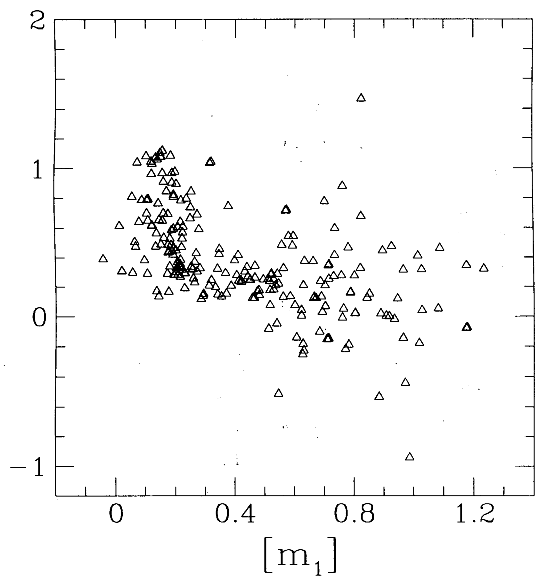

Fig. 1. $[c_1]$ versus $[m_1]$. Note how the spread increases at $[m_1] \sim 0.55$

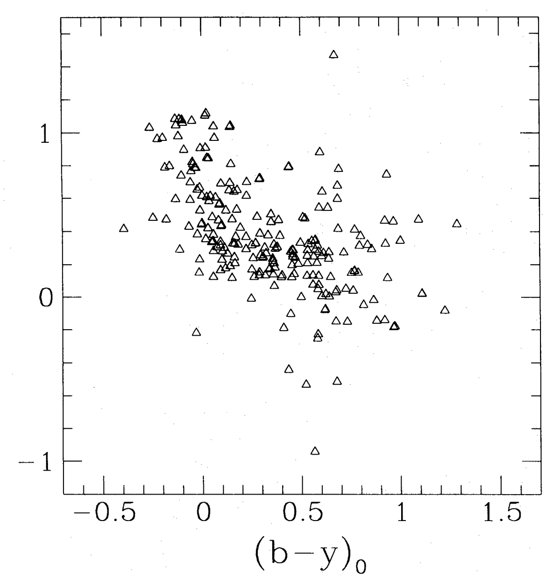

Fig. 2. $[c_1]$ versus $(b-y)_0$. Notice how $[c_1]$ decreases as the temperature of the stars decreases.

point the average spread seems to increase, suggesting a substantial difference between the stars with $(b-y)_0 \leq 0.4$ and those with $(b-y)_0 \geq 0.4$. Figure 3 presents a diagram of $[m_1]$ versus $(b-y)_0$, again there is a well established tendency for the stars to become redder as the value of $[m_1]$ increases. Both Figures 2 and 3 reveal that as the spectral type of the stars observed increases, the values of the parameters $[c_1]$ and $[m_1]$ change. In the case of $[m_1]$ this might mean that we are observing stars with higher

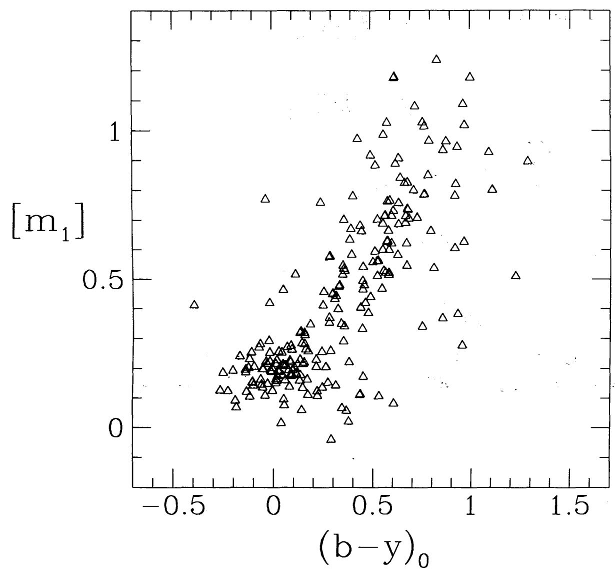

Fig. 3. $[m_1]$ versus $(b-y)_0$. Notice a clear tendency for $[m_1]$ to increase as the temperature of the observed stars decreases.

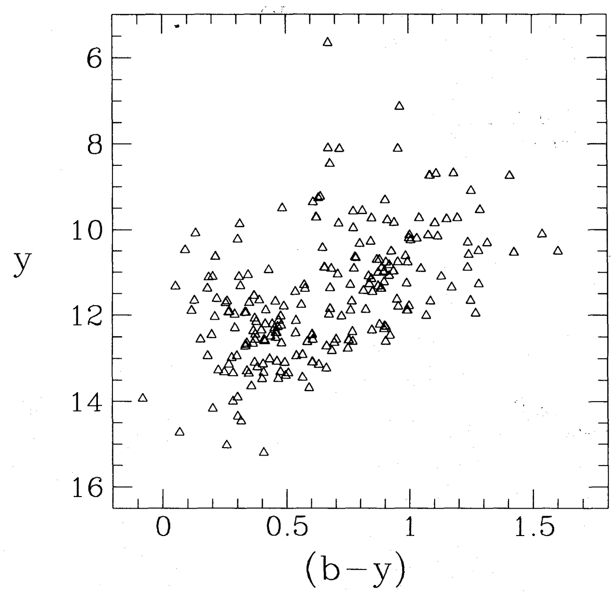

Fig. 4. HR diagram v versus $(b-y)$.

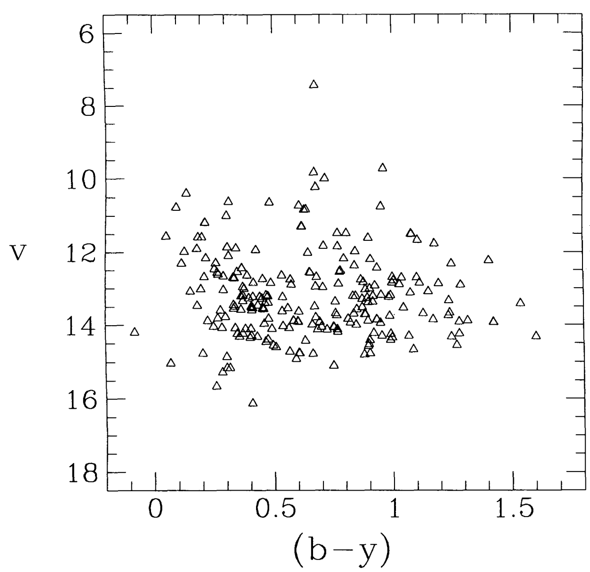

Fig. 4. HR diagram v versus $(b-y)$.

metallicities, while for the $[c_1]$ case, it is clear that as the stars become redder, cooler and perhaps more luminous, the Balmer discontinuity attains smaller values.

Figures 4 and 5 show reddened HR diagrams. Figure 4 gives the v versus $(b-y)$ diagram, whilst Figure 5 presents the y versus $(b-y)$ diagram. In both plots we can separate two stellar branches, one which extends from $(b-y) \sim 0.50$ towards bluer colours and towards brighter magnitudes, and another one which extends from approximately the same value of $(b-y)$ towards redder colours and brighter magnitudes; this latter branch we would like to associate with a giant branch, while the former might be associated with a young main sequence which probably contains foreground disc stars as well as stars in the far-away disc.

4. SUMMARY AND CONCLUSIONS

i) In this paper we present *uvby* photometry of randomly selected stars in BW.

ii) Although the majority of the stars are far away from the Sun and are, therefore giants; some of them $(b-y \leq 0.4)$ might be foreground main sequence stars with spectral types in the range $A0V$ to $K0V$.

iii) In some of the observational diagrams ($[c_1]$ versus $[m_1]$, $[c_1]$ versus $(b-y)_0$, v versus $(b-y)$ and y versus $(b-y)$), it is possible to see a critical point at which a break in the stellar population observed is noted.

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