THIRD PRELIMINARY CATALOGUE OF STARS OBSERVED WITH THE PHOTOELECTRIC ASTROLABE

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ABSTRACT On the basis of the data observed with the Photoelectric Astrolabe Mark II of the Beijing Astronomical Observatory during the period from 1982 to 1988, residuals of 355 fundamental stars and 2921 catalogue stars are reduced and analyzed. The relations between the residuals V and the magnitude M, and the spectral type S of FK5 stars are discussed. The position corrections (PACP3−FK5), $\Delta\alpha's$ and $\Delta\delta's$, from the double passage of the stars are determined. There are 910 in $\Delta\alpha$ and 696 in $\Delta\delta$. The mean precisions of $\Delta\alpha's$ and $\Delta\delta's$ are ±3.9 ms and $\pm0''.067$, respectively. Under certain conditions 328 $\Delta\alpha's$ and 12 $\Delta\delta's$ from the observed single passage of the stars are determined. Finally systematic corrections of PACP3−FK5 are given.

1. Introduction

Since 1976, two preliminary catalogues of stars have been compiled[2][3]. With the positions at J2000.0 of the Fifth Fundamental Catalogue (FK5) and new astronomical constants (IAU, 1976), the data observed with the Photoelectric Astrolabe Mark II (PA II) during 1979 to 1988 are re-reduced to the FK5 system. With the data of the catalogue stars observed from 1982 to 1988, the Third Preliminary Catalogue observed with PA II is compiled with the stars whose magnitudes are from 0.1 to 7.3 and the declinations are from 11° to 69°. The mean observational epoch is 1985.9. Finally, with the position corrections of $\Delta\alpha$ and $\Delta\delta$ of the FK5 stars obtained from the double transits, the systematic corrections(PACP3−FK5) are given.

2. The Reduction of Residuals and the Instrumental System Errors

2.1 The Reduction of Residuals of Stars

There are 355 stars in the fundamental group. The corrections of astronomical time, latitude, zenith distance, and residuals v_i are obtained by the method of least squares. The residuals of the catalogue stars are calculated with the corrections of astronomical time, latitude and zenith distance of the reference group of stars. Then, the mean values of the residuals of stars are calculated by weighted average.

2.2 The Correlations of Residuals with Magnitude

The mean values of residuals of FK5 stars for every 0.5 of magnitude are made by weighted average according to the precision of residual. The results are given in Table 1.

Table 1. The Correlations of Residuals V With Magnitude M

$\bar{M}$	2.00	2.80	3.31	3.73	4.24	4.79	5.25	5.75	6.29
$\bar{V}_m(0''.01)$	4.4	1.6	2.9	0.4	0.7	-1.2	-1.1	-0.2	-0.2

2.3 The Correlations of Residuals With Spectral Types

The mean values of residuals of FK5 stars are calculated for each spectral type after the system corrections on magnitude is considered. The results are shown in Table 2.

Table 2. The Correlations of Residuals V With Spectral Type S

S_p	B	A	F	G	K	M
$\bar{V}_s(0''.01)$	-1.1	0.2	-0.5	1.0	0.2	0.2

3. The Group Corrections

With the results of PA II from 1980 to 1988, the group difference of the astronomical time, latitude and zenith distance, Δt, $\Delta\varphi$, and Δdz are obtained. The group corrections of t, φ and dz are calculated by a chain method. The results are given in Tables 3.

Table 3. The Group Corrections and Precisions of t, φ, and dz

Group	0	2	4	6	8	10	12	14	16	18	20	22
$t(0^s.0001)$	8	15	18	38	4	-4	-24	-39	-4	-2	-12	2
$\varphi(0''.001)$	15	-1	3	10	-3	-27	50	46	7	-47	-19	-34
$dz(0''.001)$	5	3	19	0	4	6	-20	-6	-23	-11	-2	25

4. The Calculation of 2K

Strictly speaking, the calculation of 2K should be made using the stars of $\cos q = 0$, that is $q = 90°$. But these stars are very few. So we used the stars of $|\cos q| < 0.1$ (in this catalogue there are 130 stars) to calculate 2K and obtained $2K = 0''.013 \pm 0''.014$.

5. $\Delta\alpha$ and $\Delta\delta$ of Stars

There are 910 $\Delta\alpha$'s and 696 $\Delta\delta$'s obtained from the passage observations of the same stars at both east and west sides with the average precisions $\pm 3.9ms$ and $\pm 0''.067$, respectively.

There are 328 $\Delta\alpha$'s and 12 $\Delta\delta$'s obtained from single passage.

6. The Systematic Corrections of the Catalogue of Stars

By the method [4] and [5] and with the $\Delta\alpha$ and $\Delta\delta$ of FK5 stars obtained from the double passage, the systematic corrections of the preliminary catalogue of stars (PACP3−FK5) are analyzed. The system corrections are given in Tables 4.

Table 4. The Systematic Errors (PACP3−FK5) $\Delta\alpha_\delta$ and $\Delta\delta_\delta$

$\delta°$	15.0	17.5	20.0	22.5	25.0	27.5	30.0	32.5	35.0	37.5	40.0
$\Delta\alpha_\delta(0^s.0001)$	-7	27	28	18	11	8	8	6	2	-6	-10
$\Delta\delta_\delta(0''.001)$	0	23	26	18	8	-1	-5	-7	-5	-1	

$\delta°$	42.5	45.0	47.5	50.0	52.5	55.0	57.5	60.0	62.5	65.0
$\Delta\alpha_\delta(0^s.0001)$	-11	-6	6	17	26	26	18	6	-8	-10
$\Delta\delta_\delta(0''.001)$					-4	-8	-10	-5	1	15

References

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