IMPROVEMENT OF TYPE II PHOTOELECTRIC ASTROLABE AND PRIMARY RESULTS

Zhao Gang Zhang Jianwei
Shanghai Observatory,Academia Sinica
200030 Shanghai
China PR

ABSTRACT. Utilizing the photon counter to register the star through the 60^{o} altitude and a microcomputer to control the telescope pointing, the automatization was attained in the observation of type II photoelectric astrolabe. The limiting magnitude of the improved astrolabe is up to 11.0 and the precision of single determination is $\pm$ 0.2 arc - sec. This automatic instrument is more powerful in improving the FK5 system and expanding the current optical celestial system into faint stars.

1. AUTOMATIZATION OF TYPE II PHOTOELECTRIC ASTROLABE

The type II photoeletric astrolabe of Shanghai observatory has been used for the time and latitude determination and compiling star catalogue since September 1974. The precision of determining time and latitude belongs to the first level in the system of Bureau International de L'Heure (BIH). The capacity of the equipment in catalogue observation was limited because the limiting magnitude was 6.5 when the former photoelectric transformer was used. Improvements have been made to bring its potential into full play. Automatic pointing and tracking of the telescope is controlled by a personal computer of IBM/ 286 through a stepping motor and synchronous goniometer. The transit time of a star through altitude circle is recorded by means of photon-counting technique. The data is analysized on the computer.

2. PRIMARY RESULTS OF TIME AND LATITUDE DETERMINATIONS

Since 1988, the International Earth Rotation Service (IERS) has only adopted new techniques. Therefore, the determinations of time and latitude made by this equipment have been contributing to the Chinese Joint universal time System (CJS) and the global data Analysis Center of Optical Technique (ACOT).We made an experiment to examine the difference between two detectors, The photon counter and the former photoelectric transformer. Observations of time and latitude determinations were taken using the two record systems respectively on the same equipment in the same night. The results are given in Table 1. The precisions of the results obtained with the two record systems are of the same order, and no significant systematic difference was found.

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Developments in Astrometry and Their Impact on Astrophysics and Geodynamics, 85–87.

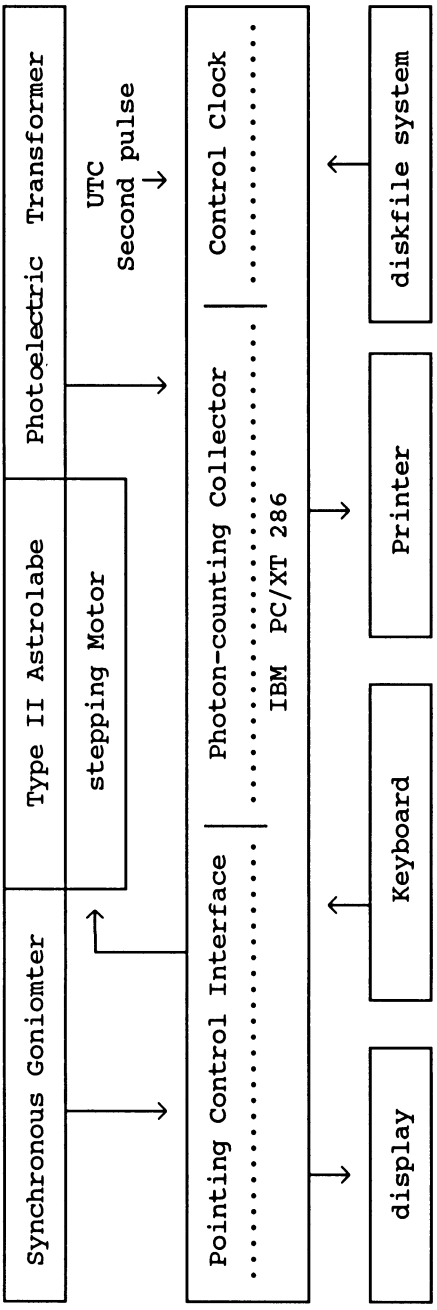

Fig.1 simplified block diagram of the equipment

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Table 1. Results of time and latitude determinations

Date	N	UTO	Φ 31 11′	Precision of Single Observation	Pecord System
Nov. 23. 1991	32	s 0 .7020	25".5428	±0".1677	former photoelectric transformer
Nov. 23. 1991	27	s 0 .7060	25".5424	±0".1535	Photon counter

3. LIMITING MAGNITUDE

According to the principle of the photoelectric astrolabe, the light of a star is split into two images passing through the record grating, so the effective apertures of forming the tow images is 10 cm (The apertures of the telescope si 20 cm). The width of graduation on grating is 0.2mm. The field of background light is 10,000 square arcsecond. Under this observing condition. The instrument can be used to observe 11.0 magitude stars effectively with the photon-counting record system. We observed 129 to list the results of the two faintest stars for expressing the capacity of observing faint stars with the improved type II astrolabe.Based on the observation of determinations of latitude and time. The averages of residuals, which were calculated in FK5 system, are listed in table 2.

Table 2. The averages of residuals and the mean error

CANC-04 No.	Magnitude	Epoch	N	Correction
407656	10.96	2448360.7	4	+0".1942±0.095
409619	10.84	2448360.7	4	-0".4480±0.194

4. SUMMARY.

The record grating of the instrument is still under improvement to reduce the limiting magnitude up to 13.0,so the equipment can be used to observe major planets, asteroides and re-observe the FK5 stars and observe the expanded faint stars. But the observable nights are not so many at Shanghai. Therefore, we hope to cooperate with the astronomers who work in equatorial zone or southern hemisphere to use the improved astrolabe for improving the optical reference systems in southern hemispheres.

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