A Multislit Photoelectric Star Micrometer for the Meridian Circle of the Nikolayev Astronomical Observatory.

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In the course of the cooperation between the Nikolaev and the Pulkovo Observatories, a photoelectric micrometer, similar to that proposed by E. Høg, was designed and installed on the Repsold meridian circle.

The optics of the finder includes an achromatic wedge for the deflection of light from the objective to the finder's eyepiece. The grating is composed only of a system of inclined slits (Høg 1970, p. 92, No. 2). The slits are $5\overset{''}{.}3$ wide and spaced at $38\overset{''}{.}3$.

One can use from 7 to 14 slit pairs in the micrometer for observations. A rectangular diaphragm isolates an element of 19" x 27" from the working grating. This has 4 initial positions. The required initial position depends on the instrument's position, the type of culmination and the observing interval (30^s or 60^s for an equatorial star).

The diaphragm is moved by a stepping motor, whose speed of rotation is controlled by the observer and depends on declination. The motor can be switched on either by hand or automatically after the star appears in the field defined by the diaphragm.

During transit, the clock readings of the start and the end of the observation are recorded with a precision of $0\overset{s}{.}001$. Photon counts are taken for every $0\overset{s}{.}1$ time interval.

There is a block for recording contact signals from a moving mark in the control unit (Konin et al., 1982).

Karyakina et al. (1981) gave additional information about the design and working of the micrometer. A computer processes the data in three steps: the computation of the epoch of the transits through the center of every observed slit; the calculation of the average transit epoch and declination reading for every pair of neighboring slits at various inclinations to each other, the check of the results, reduction to the meridian, analysis of the residuals and a calculation of average values of the transit epoch and the declination readings.

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Note that the instant of transit through the center of the observed slit is calculated as a clock reading, which divides the interval required for traversing the slit into such parts for which equal photon counts are counted.

An investigation of the dispersions of the declination readings and of the transit epochs for separate slit pairs reduced to the equator shows a dependence of the dispersion D on declination. These values were approximately represented by the formula

$$D = \underset{\pm 0.12}{(0\overset{''}{.}28)^2} + \underset{\pm 0.04}{(0\overset{''}{.}13)^2} \tan^2 z$$

This is in satisfactory agreement with the data obtained by Høg (1970, p. 93, Fig. 3) from the internal agreement of observations with the Bergerdorf meridian circle.

We verified that the micrometer can be used to observe faint stars up to a visual magnitude 10.3^m. It is, however, difficult to set the instrument to the transit altitude of the star with the precision needed for stars as faint as this.

We selected 17 series of RA observations for a preliminary evaluation of the quality of the meridian circle with the photoelectric micrometer. The observations lasted from March 17 through October 22, 1983. 687 FK4 stars (declinations from -34° to $+80^\circ$) were observed each night and the observations reduced separately by Bessel's formula, taking into account the weights of observations by the formula

$$p = (0\overset{''}{.}28)^2 \cos^2\delta / D$$

The standard error of a zenith star, reduced to the equator varies from $0\overset{s}{.}016$ for different series and its weighted mean value is equal to $0\overset{s}{.}0139$.

This result is quite satisfactory if one considers that it includes the errors of the FK4 stars, and reflects the instability of the values u+m, n and c during the course of the night (long nights give larger errors), and that it is possibly also affected by other systematic instrumental errors.

References

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