THE TAUTENBURG PART OF THE PROGRAMME STUDYING THE MAIN MERIDIONAL SECTION OF THE GALAXY

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ABSTRACT. The programme for the determination of proper motions with reference to galaxies for 6000 stars on 17 fields near the main meridional section of the Galaxy is presented. For each field there are 2 or 3 first-epoch plates taken with the Tautenburg Schmidt-telescope before 1970. In preliminary investigations the mean error of an individual proper motion was found to be 0".7 per century both for bright (8^m-12^m) and for faint (16^m-18^m) stars.

Since 1985 the Central Institute of Astrophysics has been participating in the programme studying the main meridional section of the Galaxy defined by the plane passing through the rotation axis of the Galaxy and the Sun. The programme initiated by Soviet astronomers aims at the compilation of a catalogue of astrophysical and astrometrical observations and an analysis of these data for complex study of stars in selected fields nears this plane (Malyuto et al. 1981; Kharchenko 1983). The main task for the Central Institute in the framework of this programme is the determination of proper motions of stars with reference to the system of extragalactic objects. The proper motions will be derived on plates taken with the 2m-Schmidt telescope installed in the Karl-Schwarzschild Observatory at Tautenburg.

1. TELESCOPE

With regard to the instrumental parameters, the Tautenburg Schmidt telescope, up to now, has been the largest telescope of this type. A 20-minute exposure of B-plates has a limiting magnitude of 19^m to 21^m. The main disadvantage of Schmidt telescopes connected with the necessary bending of the plates during exposure is reduced to a minimum for the Tautenburg telescope. Some of the properties of the instrument are given in Table I.

S. Débarbat et al. (eds.), Mapping the Sky, 451–454.

TABLE I. Tautenburg Schmidt Telescope.

Focal length	401 cm
Diameter of the spherical mirror	203 cm
Diameter of the correction plate	134 cm
Scale on the plate	51".4 per 1 mm
Size of the plate	24 cm x 24 cm ($3^{o}.4$ x $3^{o}.4$)

2. ACCURACY OF ASTROMETRIC RESULTS

2.1. The measuring accuracy

Up to now the semi-automated measuring machine Ascorecord 3DP has been used for astrometric investigations on Tautenburg plates. As a rule, each object has been measured in two opposite positions of the reversal prism. From duplicate measurements the repeatability accuracy on plates of variable quality was estimated for different kinds of objects. The accuracies are shown in Table II.

TABLE II. Mean error in mean measuring coordinates (repeatability accuracy)

objects	magnitude range	r.m.s. measuring error (in μm)
AGK3 stars	7 - 12	0.8 ... 1.6
faint stars	17 - 18	0.6 ... 1.1
blue objects	18 - 20	1.0 ... 1.3
galaxies	18 - 20	0.8 ... 2.6

2.2. Plate-to-plate errors

Usually, prior to the reduction, every measurement has been corrected to take account of the bending of the plate:

$$\Delta x = kx\ (x^2 + y^2)$$

$$\Delta y = ky\ (x^2 + y^2),\ k = 1/3f^2 = 2.07 \cdot 10^{-8}\,mm^{-2}$$

For the plate-to-plate reduction, polynomials with ten unknown parameters has been used:

$$\begin{aligned} x_o - x_i &= a_o + a_1 x + a_2 y + a_3 x^2 + a_4 xy \\ y_o - y_i &= b_o + b_1 x + b_2 y + b_3 xy + b_4 y^2 \end{aligned} \qquad (1)$$

No other higher-order terms have been found to be significant.

The mean error of unit weight in positions derived from the least square solution of equations (1) is given in Table III.

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TABLE III. The r.m.s. error (m_o) in object positions on Tautenburg plates (plate-to-plate solution)

objects	m_o		
stars	0".07	...	0".13
	(1.4 μm	...	2.6 μm)
galaxies	0".11	...	0".21
	(2.2 μm	...	4.2 μm)

2.3. Accuracy of star proper motions

The Tautenburg plates were used for the determination of proper motions of stars with respect to extragalactic objects. Generally we derive proper motions from measurements of two or three plate pairs with an epoch difference of 15 to 18 years. On average 45 to 55 uniformly distributed galaxies were selected as reference points. The investigation showed that the internal accuracy of 0".7 per century can be achieved both for the bright (8^m–12^m) and for the faint (16^m–18^m) stars (Schilbach 1982, Scholz and Rybka 1987).

3. THE TAUTENBURG PROPER MOTION PROGRAMME

A total of 17 fields with two or three plates of good quality taken between 1961 and 1969, were selected from the Tautenburg plate archives. All fields are situated no more than 20^o away from the main galactic meridian. The plates were taken with or without filter. If a first-epoch plate was obtained with a filter (B or V) the corresponding second-epoch plate will be taken with the same filter.

It is proposed to determine absolute proper motions at first only for some selected stars. These include:

All stars with magnitudes between 8.5 and 12; for these stars the photometric and spectroscopic observations will be carried out by the co-operators.

All stars with magnitudes from 12 to 18 inside a circle with the centre in the middle of the plate; the circle radius will be chosen in such a way that the number of measured stars contained in this circle should be not larger than 200. These data will be used for obtaining the kinematic parameters of faint stars.

According to a preliminary estimation the Tautenburg catalogue will contain about 6,000 stars.

As soon as the Tautenburg plates can be measured automatically, the proper motions will be determinated for all stars with magnitudes from 12 to 18.

References

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