ASTROMETRY WITH OBJECTIVE PRISM

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A number of years ago the author (Stock, 1978) showed that astrometric positions free of magnitude- or color-dependent errors may be obtained from pairs of objective prism plates with opposite dispersion, since these allow monochromatic measurements as well as a restriction of the photographic density range without restricting the range of magnitudes that can be covered. Results from a series of plates taken originally for a radial velocity survey can now be compared with two new catalogues of positions from meridian circle positions, namely the Perth 70 (Høg 1976) and the Santiago 67 (Carrasco 1982) catalogues.

The Mighigan Schmidt telescope located on Cerro Tololo, in conjunction with a four degreee prism, was used for the objective prism survey. The Kodak IIaO plates were exposed for 15 minutes. The spectra were widened to about 0.2 mm. Each field of about five by five degrees was covered with two plate pairs. The overlap between neighboring plates is about 15 millimeters. At the time the plates were taken it was not anticipated that they would be used also for astrometric purposes. Otherwise a half-plate overlap scheme would have been used. The area covered is shown in Fig. 1, together with the mean epochs of its different sections.

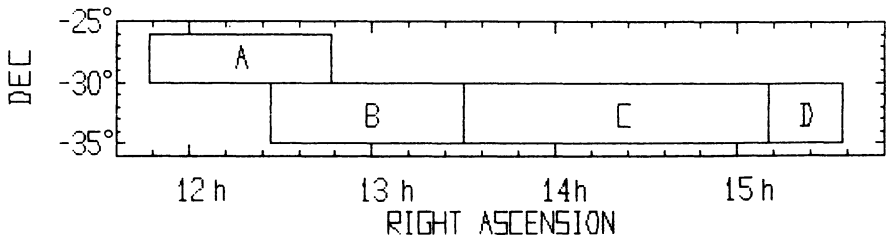

Fig. 1 The area covered by the objective prism survey, with the mean epochs.

H. K. Eichhorn and R. J. Leacock (eds.), Astrometric Techniques, 253–257.

Details of the measuring and reduction procedures are outlined elsewhere (Stock 1984). For our present purpose it is sufficient to recall that the Yale Zone Catalogue (Hoffleit 1967) served as the reference source. Our final catalogue contains positions with a mean error of about 0.2 arcseconds, as well as magnitudes, spectral types, and approximate radial velocities for 10057 stars.

Results of a global comparison of four catalogues (Perth 70, Santiago 67, Yale, OP = objective prism) are shown in Table I, which given the rms - difference between the positions of the different sources after removal of constant terms. When preparing the statistics for comparing the Yale catalogue with the meridian circle positions, a systematic behavior across the area was noted. This, consequently, is also true for the objective prism data when compared with meridian circle date. Restriction of the latter to limited sections of the strip results in smaller rms-numbers, as also shown in the Table.

Table 1.
Mean rms - difference

Sources	R.A.(s)	Dec.(")
Santiago Perth	0.018	0.36
Santiago-OP	.042	.63
Perth-OP	.038	.61
Perth-OP(restr.)	.024	.44
Perth-Yale	.059	.71
Yale-OP	.068	.60

The presence of magnitude- and color-dependent systematic errors in the Yale catalogue has been suspected for a long time (cf. Stock, 1978) or Della Prugna (1981). However, even the more than one thousand stars in common with the objective prism position catalogue do not allow the determination of the nature of these errors. Their analysis would require knowledge of the original position of each star on the Yale plates.

An attempt can be made, though, to test the meridian circle catalogues for such errors. The relatively small area covered makes it likely that such errors are constant within its boundaries, if they exist at all. In view of the systematic error depending on the location within the area, inherited from the Yale catalogue, the area was divided into four different sections (A,B,C, and D in Fig. 1). A test for magnitude dependence was negative. The position differences, averaged for different sectral types within each area, are shown in Fig. 2a and Fig. 2b for the Santiago catalogue for the four areas. The similarity between several curves seems to hint a spectral-type-dependent effect.

It is premature to advocate that a spectral type effect has been detected in a meridian circle catalogue. The results are still too uncertain. However, a more precise and more extensive study seems justified. It also becomes clear that adequate plate material should be taken for such a study (i.e. better overlap). At the same time the catalogue to be tested should also be the reference source, thus automatically avoiding systematic differences depending on position.

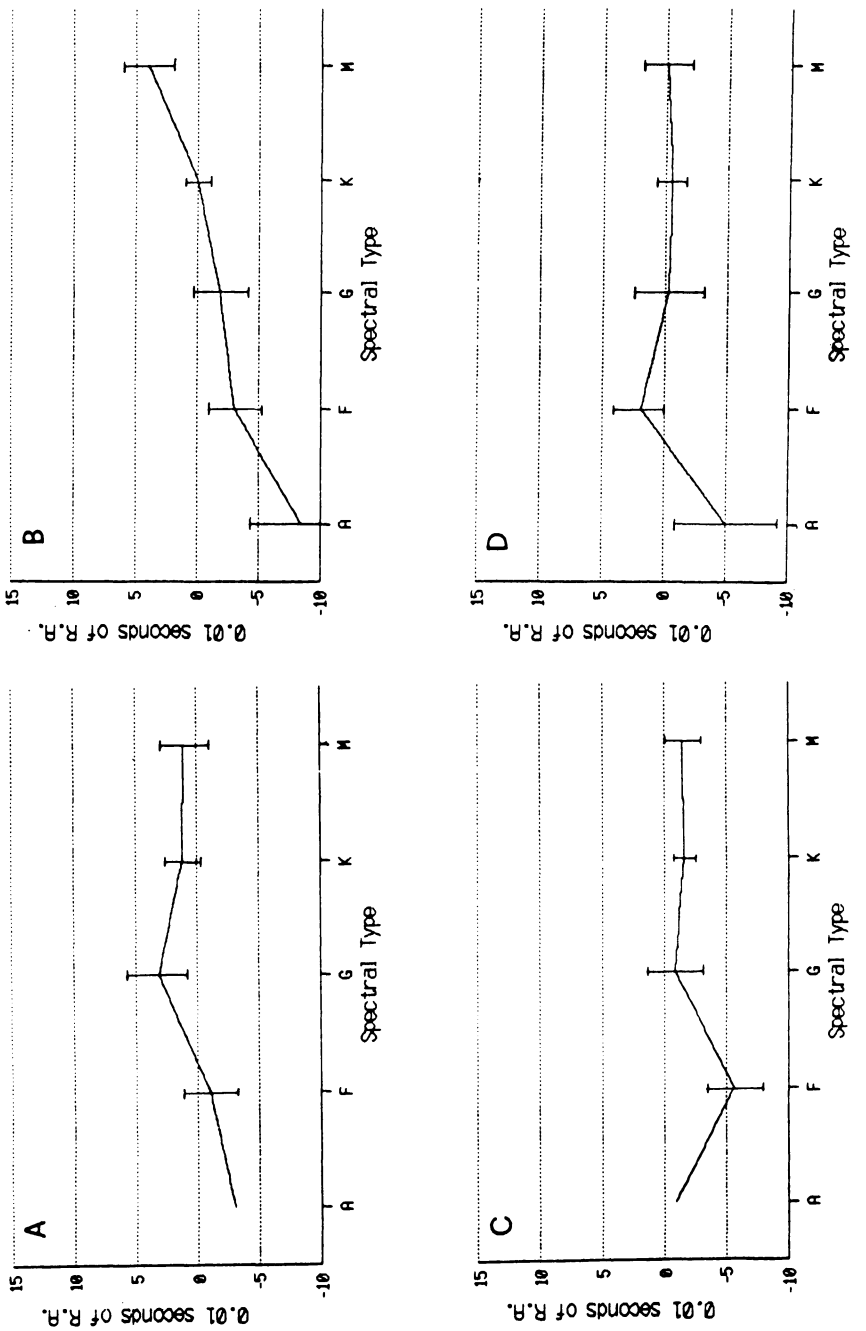

Fig.2a Average difference in R.A.
(Santiago - OP)

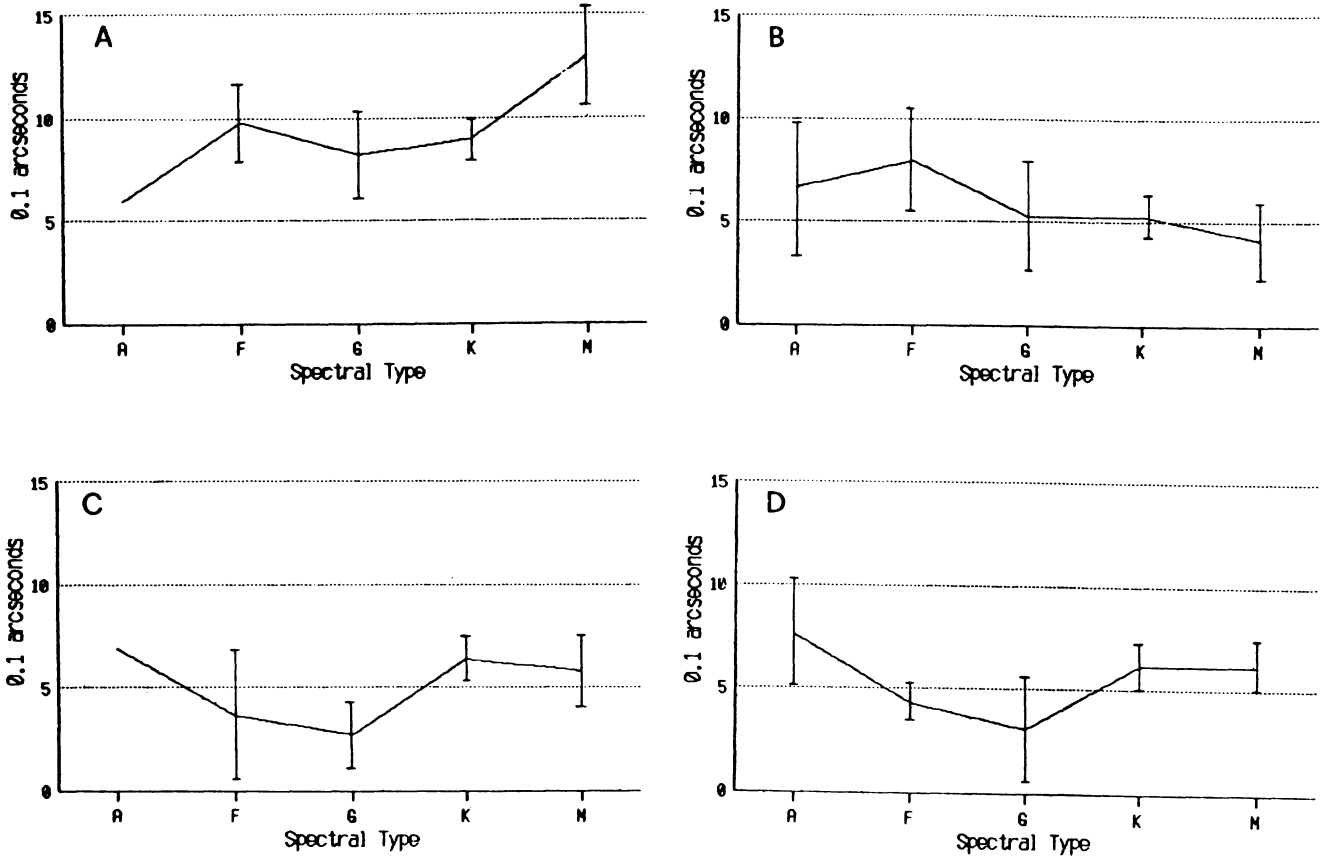

Fig.2b Average difference in Dec.

(Santiago - OP)

References

Carrasco, G., and Loyola, P., 1982, Publ. Dept. Astr. Univ. Chile.

Della Prugna, F. 1981. Rev. Mex. A. A., 6, 119.

Hoffleit, D., 1967; Trans. Astr. Obs. Yale Univ., Vol. **28.**

Høg, E., and von der Heide, J. 1976. Abh. Hamb. Sternwarte **9.**

Stock, J., 1978, in: IAU Coll. No. 48, Modern Astrometry. 1984. Rev. Mex. A. A., in press. (Vienna, Sept. 12-14, 1978. F. Prochafen & R. H. Tucker, eds. p. 411.

Discussion:

GUINOT: What is the magnitude of the stars which are used for this fitting?

STOCK: The magnitudes are limited by the catalogue.

GUINOT: In principle, one could remove in this way also the color effect.

STOCK: There is not enough material to do this effectively.

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