Rev. Mexicana Astron. Astrof., 8, 139-140 (1983)

RESULTS FROM A FIRST ASTROMETRIC TEST OF THE 2.12 m TELESCOPE OF THE MEXICAN NATIONAL ASTRONOMICAL OBSERVATORY AT SAN PEDRO MARTIR

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Received 1983 March 16

RESUMEN

Se ha estudiado la posibilidad del uso astrométrico del telescopio de 2.12 m en San Pedro Mártir. Con un modelo de reducción cúbico se puede alcanzar en el centro de la placa una precisión de 0.04 segundos de arco.

ABSTRACT

The possibility of the astrometric use of the 2.12 m telescope at San Pedro Mártir has been studied. With a cubic reduction model an accuracy of 0".04 can be achieved in the center of the plate.

Key words: **ASTROMETRY**

For the study of astrometric telescopes Russell (1976) has provided positions of stars in the Praesepe cluster with high internal accuracies. From that region one plate has been taken by F. Diego with the 2.12 m telescope in March 1982. It covers about 0°.7×0°.9; this field was also used almost completely by us. Descriptions of the telescope were given by de la Herrán (1981) and by Noble *et al.* (1982). According to the latter source, the focal length at the photographic plate was derived from a field around M44 to be F = 15 775 mm, corresponding to a plate scale of 13".076 mm^{-1}. For our plate we obtained a scale of 12".957 mm^{-1}. A 103a-E emulsion has been used without filter, the exposure time was 15 minutes. On the plate the diameter of the images of the brightest stars is more than 2000μm, as it is usual for telescopes with large focal lengths. Due to the difficulties while measuring large star images, 26 stars from Russell (1976) have been chosen in the magnitude range from only 10^m to 14^m. These stars seemed to be well suited for measurements with the objective centering of our coordinate measuring engine (Hoffmann and Geffert 1978). Measurements of 0° and 180° directions were combined to exclude the instrumental magnitude equation. A reduction model with a least-squares solution of ten parameters (coefficients of $1, x, y, x^2, y^2, xy, x^3, x^2y, xy^2, y^3$) for each coordinate was used. Although a large number of coefficients is not desirable, the distortion terms seemed indispensable to us in case of a Ritchey-Chrétien telescope (Siedentopf 1965). The mean deviations of one star from the Russell coordinates were 7.8μm (x-coordinate) and 9.4μm (y-coordinate), corresponding to 0".12 and 0".14, respectively. The postfit residuals for the reference stars are shown in Figure 1. The large values for some stars are remarkable. However, no significant mag-

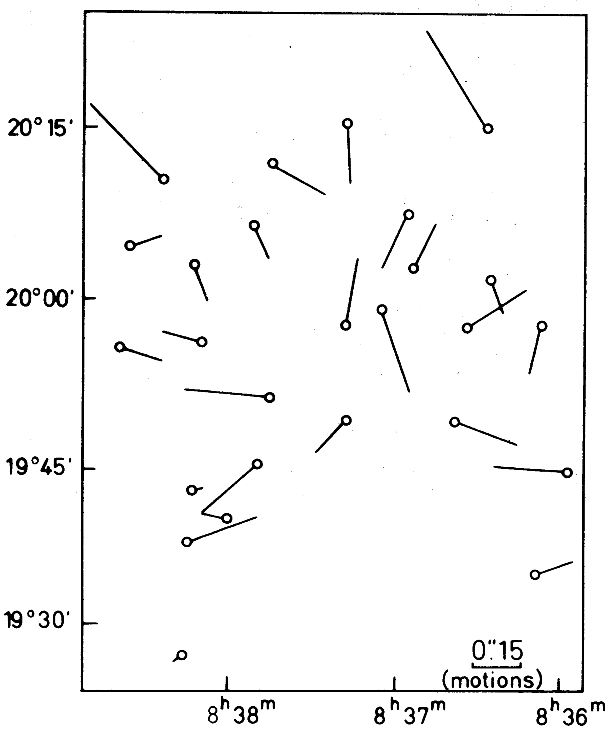

Fig. 1. Individual deviations of the stellar coordinates. The lines originating from the stars (circles) represent the postfit residual vectors against the Russell coordinates.

nitude or color equations were found, nor is any preferred direction visible in Figure 1.

Besides of the *individual* errors, the errors (or confidence intervals) of the transformation from plate coordinates (x,y) into spherical positions (α,δ) are of interest. To avoid misinterpretations: we speak here of the pure transformation error, the individual error has to be added, if a total error is wanted. These values depend on the reduction model, on the distribution of reference stars, and on the r.m.s. measurement error (the latter enters as scaling factor only). Their determination by use of the covariance matrix of the plate constants has been developed by Eichhorn and Williams (1963). The transformation errors have an ambivalent character: they are random quantities at every place at the plate but their size depends in a systematic manner on the place. Therefore the name of *"systematic accuracy"* chosen by Eichhorn and Williams (1963) is quite appropriate.

The results are exhibited in Figures 2 and 3. At least for the central region they demonstrate the suitability of the telescope for obtaining positions of faint objects. Because of the wide spectral range of the 103a-E emulsion and the atmospheric dispersion, color terms could be important in the future. It might be useful to analyse also plates from the Pleiades cluster with the coordinates from Eichhorn *et al.* (1970) and from Vasilevskis *et al.* (1979).

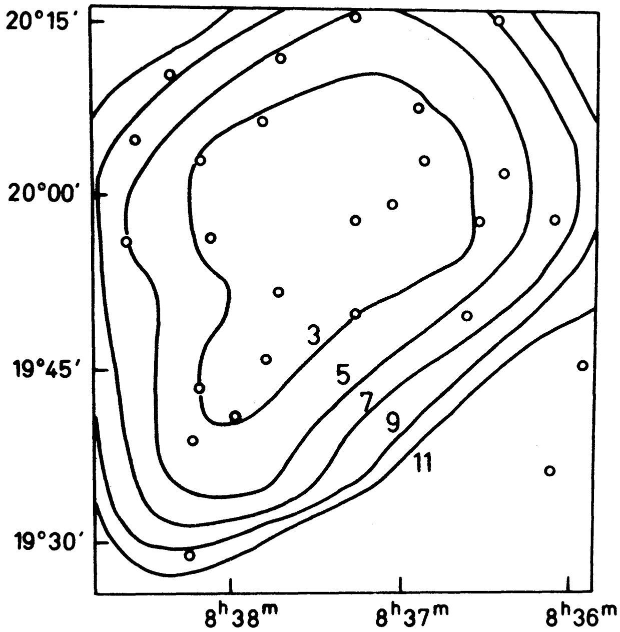

Fig. 2. Expectation value of the transformation error in right ascension. The unit is 0^{s}001. Reference stars are indicated by circles.

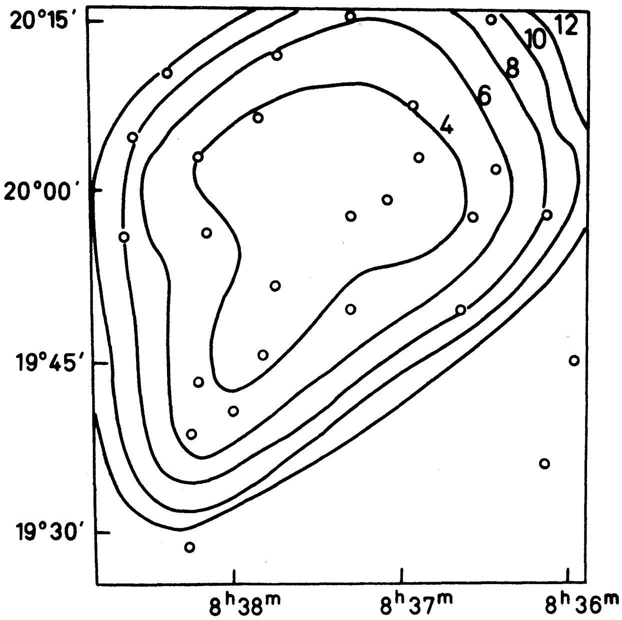

Fig. 3. As Figure 2, but for the declination; unit 0$''$01.

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