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## A STUDY OF PHOTOGRAPHIC PLATES NT-1 FOR ASTROMETRY<sup>†</sup>

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A study of nonsensibilized astrophotoplates NT-1 used for photography of celestial objects with long exposures, based on emulsions with the quasi-T-crystals of silver halogenides is made. The photographic plates should be hypersensibilized with hydrogen before observations. They have a fine graininness and a high resolving power. Since 1991, they have been used at Pulkovo for long-exposure photography of various celestial objects with the Normal Astrograph (Pluto, the Pleiades, the Coma cluster and radio sources) and were compared with ORWO plates.

KEY WORDS Photographical astrometry: astrophotoplates, hypersensibility of hydrogen

In spite of the fact that observations with CCD matrices have lately become more popular, the role of photographic observations is still significant. Observing astronomers are interested in the improvement of the characteristics of photographic emulsions: a decrease of the graininess, an increase of the effective supersensibility, and durability of their characteristics for a longer time. During the last 4 years, the joint stock company "Slavitch" has been producing trial non-sensibilized astrophotographic plates NT-1 devised for the photography of celestial objects with long exposures. The latest technology is used in the production of these plates. The emulsion developed by D. K. Mikhailov contains microcrystals of silver (Ag) halogenides resembling T-crystals in shape. They can be called quasi-T-crystals. The numerical value of the aspect ratio (the microcrystals diameter to microcrystal thickness ratio) of such crystals is from 3 to 5. After a chemical-photographic processing, the dimension of the developed grains of the photographic image is  $1.1 \pm 0.1$  mkm.

Originally the plates have a low light-sensitivity (several units) and can be kept for a long time under general conditions. Before excopying, they are sensibilized by hydrogen. For this purpose they are kept for some time in a chamber filled with hydrogen. Thus hypersensibilized photographic plates acquire a high light

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Slavitch plates					Kodak 103 vO plates, mean				
texp	10*	1 ** 30*	12 <sup>m</sup> 30*	50 m	texp	10•	1 ** 30 *	12 30 *	50 m
s	60.0	50.0	45.0	40.0	S	75.0	60.0	45.0	40.0
γ		2.0			γ			1.8	
$D_0$		0.2			$D_0$			0.15	

Table 1.

sensitivity and should be kept in a refrigirator at low temperatures. They stay good for three months.

These plates are different from Kodak 103 uO. Their grains are smaller, their resolving power is higher, from 110 to 130 min per 1 mm (Kodak 103 uO has 100 min/mm, Z421 ORWO has 90 min/mm). Below we give a Table 1 where S is the light sensitivity of the threshold part of the characteristic curve,  $\gamma$  is the contrast and  $D_0$  is the veil.

The spectral sensitivity curves of both emulsions coincide. The photoplates are made of two kinds of glass (1.7 mm and 2.6 mm) with a red antihalo layer.

The NT-1 plates have been used at Pulkovo for photography of various celestial objects with the Normal Astrograph since 1991. In 1991, the Coma cluster was observed using the plates NT-1, ORWO Z421 and ORWO Z41 hypersensibilized, with the exposure time  $20^m$ . Their variations showed that the sensitivity of NT-1 is analogous to that of ORWO Z421. Besides, another effect was noted: on the plates NT-1 used on different nights, the brightest stars have a radial structure at approximately 120°. Such a structure was never observed on the photoplates ORWO Z421 and Z41 of the same stars with the same exposure time. After a careful analysis we have come to the conclusion that this structure develops as a result of the objective being too tightly screwed on. As is known, the objective of the normal astrograph is fixed with 3 screws, located at an angle 120°. On ORWO and Kodak, this effect was unnoticeable. Thus the defect was removed thanks to a high resolving power of NT-1 plates.

Systematic observations of Pluto were made in 1991, 1992 and 1993 with the exposure time 30 min. Plates with Pleiades (exposure time 10 min) and 6 plates with radio sources (exposure time 30 min) were taken.

On the 1993 plates of the Pleiades, we had a gain over nearly  $0.5^m$ . Star images and Pluto on all NT-1 plates are sharper than those on ORWO Z421 and the celestial veil is 2.5-3 times less than on the ORWO plates with long exposures and a considerable illumination from the city.

#### CONCLUSIONS

The NT-1 plates are quite good for astrometric observations. After their hypersensibilization by hydrogen they can keep their characteristics for 3 months. Nonhypersensibilized plates can be kept under room conditions as long as necessary. Sometimes they have defects as "bright dots" and fine fibrils – the result of cutting in laboratory conditions.

The thickness of the plates is 2.6 mm and it did not interfere with the work since the cassette of a normal astrograph enables observations with such plates. When the plates will be launched for the mass production, the defects found will be removed.