

# ASTROMETRIC OBSERVATIONS OF URANUS IN 2002 WITH THE NORMAL ASTROGRAPH AT PULKOVO

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**ABSTRACT.** 22 positions of Uranus are given. The plates were taken with the normal astrograph at Pulkovo in 2002. The reference stars are taken from catalogue Tycho-2. The average (O-C) are as follows:  $(O - C)_\alpha = -0.014^s \pm 0.005^s$ ,  $(O - C)_\delta = -0.''410 \pm 0.''092$  from the comparison with the ephemeris DE200. The errors of one position are equal to  $\pm 0.''35$  for  $\alpha$  and  $\pm 0.''43$  for  $\delta$ .

## 1. RESULTS

The photographic astrometric observations of the Uranus with the Normal Astrograph at Pulkovo have been carried out from 1919 to 1974 until the planet was get over the zone of the large negative declinations. As a rule 3 – 4 plates were taken with the expositions 6 minutes in the year with the diaphragm 0.5 D. The observations 1919 – 1969 have been treated by V.V.Lavdovsky (Lavdovsky V.V. 1971) again using the Yale catalogues as a reference. In 1989 the plates taken from 1968 to 1974 have been treated too. The catalogue FOCAT-S was used (Bronnikova N.M, et al. 1989).

In 2002 it was decided to regenerate the observation of Uranus with the Normal Astrograph although the conditions of the observations was no enough favorable. From August 3 to December 3 have been taken 22 plates with the diaphragm. For increasing of the accuracy of the determination of the positions of the Uranus we were taken 3 – 4 images on the each plate. Sometimes it was obtained two plates at one night. The stellar brightness of Uranus did not attenuated.

The plates were measured with "Ascorecord". The reference stars were taken from catalogue Tycho - 2. The reduction carried by the method six constants. Every image was treated separately to estimate the internal error of one observation of one plate. The comparison of the obtained position with the ephemeris DE200 and DE405 using the programm EPOS (L'vov, et.al. 1999) were carried out.

The errors of one observation for one plate with three or more images are equal to  $0.''04 - 0.''48$  for right ascension and  $0.''10 - 0.''80$  for declination depending on the conditions of the observations, the quality of the images of the Uranus, the reference stars and the quality of the plates. Some plates were very foggy.

All position obtained with one plate were obtained as the average. In the end we were obtained 22 geocentric equatorial positions of the Uranus at the epoch and equinox J2000.0. In the table the data of the observations (UTC), (O-C) for the ephemeris DE200 and name of

the observers are given (Br–N.M. Bronnikova, Bb–V.V. Bobylev, Dm–A.A. Dement’eva, Na–N.V. Narizhnaya)

The mean errors of one position are equal to  $\pm 0.''35$  for right ascension and  $\pm 0.''43$  for declination .

In the work (Chanturia, et.al. 2002) 105 positions of the Uranus taken with DAZ in Abastumani in 1987-1994 were obtained. The catalogue PPM was used as a reference. The mean  $(O - C)_\alpha = -0.''262$ ,  $(O - C)_\delta = -0.''234$ . The errors of one observation are  $\pm 0.''200$  for  $\alpha$  and  $\pm 0.''245$  for  $\delta$ . The observations were taken with week of the brightness of Uranus and at the zenith of distances  $65^\circ - 66^\circ$ .

Table 1: Geocentric equatorial coordinates of Uranus in 2002.

Date (UTC)			$\alpha_{2000}$			$\delta_{2000}$			$(O - C)_\alpha$	$(O - C)_\delta$	Observer
			h	m	s	o	'	''	s	''	
2002	08	03.961641	21	59	40.084	-13	05	10.91	-0.022	+0.10	Br
2002	08	10.928843	21	58	37.889	-13	10	48.49	-0.012	+0.16	Br
2002	08	10.941827	21	58	37.754	-13	10	49.35	-0.030	-0.06	Br
2002	08	12.931400	21	58	19.618	-13	12	28.14	-0.025	-1.03	Br
2002	08	12.942654	21	58	19.551	-13	12	24.44	+0.011	-0.78	Br
2002	08	15.923312	21	57	52.156	-13	14	55.18	-0.012	-0.43	Br
2002	08	15.932315	21	57	52.051	-13	14	55.81	-0.033	-0.62	Br
2002	08	18.914584	21	57	24.536	-13	17	22.64	-0.017	-0.15	Br
2002	08	18.925260	21	57	24.452	-13	17	22.96	-0.001	+0.07	Br
2002	08	27.893836	21	56	01.726	-13	24	41.45	-0.038	+0.10	Br
2002	08	29.906178	21	55	43.464	-13	26	17.89	+0.044	+0.15	Dm
2002	09	02.878146	21	55	07.628	-13	29	25.90	-0.027	-0.61	Br
2002	09	02.888649	21	55	07.542	-13	29	26.17	-0.019	-0.39	Br
2002	09	08.867112	21	54	15.268	-13	33	58.04	-0.016	-0.73	Br
2002	09	10.832032	21	53	58.644	-13	35	23.80	-0.027	-0.57	Bb
2002	09	10.846576	21	53	58.537	-13	35	24.76	-0.013	-0.90	Bb
2002	09	10.856618	21	53	58.441	-13	35	25.24	-0.024	-0.95	Bb
2002	09	11.850211	21	53	50.142	-13	36	07.89	-0.030	-0.88	Br
2002	09	25.822398	21	52	03.847	-13	45	07.80	-0.052	-0.50	Bb
2002	11	29.659032	21	50	43.061	-13	49	53.58	+0.036	+0.21	Na
2002	11	30.623818	21	50	47.904	-13	49	26.58	+0.021	-0.16	Br
2002	12	03.653023	21	51	04.242	-13	47	55.68	-0.026	-1.04	Br

The means (O–C) relatively DE200 are  $-0.014^s \pm 0.005^s$  for RA and  $-0.''410 \pm 0.''092$  for DECL. Ones relatively DE405 are  $-0.013^s \pm 0.005^s$  for RA and  $-0.''403 \pm 0.''092$  for DECL.

## 2. REFERENCES

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