PULKOVO PROGRAMME FOR THE PHOTOGRAPHIC OBSERVATIONS OF SATELLITES OF PLANETS

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ABSTRACT. The satellites of Mars, the Galilean satellites of Jupiter and the first eight satellites of Saturn have been observed with the 26-inch refractor, the normal astrograph at Pulkovo and with the luni-planet telescope at the Ordubad station of the Pulkovo observatory since 1972.

Observations

Regular photographic observations of the planet satellites have been made at Pulkovo observatory since 1972. The observations were made with the 26-inch refractor (650/10000), the normal astrograph (300/3400), and the lunar-planet telescope (700/10000). The aim of the Pulkovo programme is to obtain highly precise positions of satellites relative to planets, which may be used for improving modern theories. The 26-inch refractor is the leading instrument in this programme. The most and the best observations have been made with this telescope (Kisseleva, 1986, 1987).

About ten exposures are taken on each plate nightly by the "scale-trail" technique. The exposure time is 30–60 sec for Galilean satellites and 1–3 minutes for Saturn's and Martian satellites.

For the Galilean satellites we used low sensitive ORWO WO-3 plates and highly sensitive NP-27 plates for Saturn's and Martian satellites combined with yellow filters. The evaporative chrome coated filters are used before the photographic plates in the filmholder for reducing the brightness of the planets by 5–6 magnitudes. The same filters are used for observations with the normal astrograph.

Astrometric Reduction

As mentioned above the "scale-trail" technique with two trails (before and after exposures) are used for observations by the long-foci telescopes: the 26-inch refractor and lunar-planetary telescope (Kisselev, 1989).

J. H. Lieske and V. K. Abalakin (eds.), Inertial Coordinate System on the Sky, 73–74.

As regards the planets obtained with the help of the short-foci telescope the reference stars technique is used. The reference catalogues are the AGK-3 and FOCAT-S.

Two systems of reference stars are used for Saturn satellites. The plate measurements are carried out with the help of the semiautomatic machine "ASCO RECORD".

As the result of observations we have the planetocentric coordinates of satellites for every exposure on the plate. Then the average differences (Satellites – Planet) are calculated. The differences (Satellite – Satellite) are also determined.

In the "scale-trail" technique the effect of the variation of orientation due to the motion of planet system and other systematic errors are taken into account. The photographic phase effect of planets is taken into account by the methods proposed at Pulkovo (Kisseleva, 1986).

The Results and Their Comparison with Modern Theories

During 1972–1988 about 825 exposures of Martian satellites, 8000 exposures of Galilean satellites and 2000 exposures of Saturn's satellites were obtained.

Planetocentric coordinates of satellites were compared with modern theories of J.H. Lieske (E1, E2), J.E. Arlot (G5) for the Galilean satellites, V.A. Shor for the Martian satellites and G. Struve - T.K. Nikolskaya for the Saturn satellites. The ephemerides were calculated at the Institute of Theoretical Astronomy.

The *O–C* analyses permited us to determine standard deviations of one observation which are 0".3 to 0".4 for Martian satellites, 0".1 - 0".2 for Galilean satellites and 0".2 - 0".3 for Saturn's satellites.

The observations of satellites of planets are planned to be continued.

References

Kisselev, A.A.: 1989, The theoretical foundations of photographic astrometry. Moscow, "Nauka".
Kisseleva, T.P.: 1986, Proc. IAU Symposium 141, *Relativity in Celestial Mechanics and Astrometry*, 129–134.
Kisseleva, T.P.: 1987, Isv. Gl. Astr. Obs. Pulkovo, **204**, 57–63.

Discussion

WILKINS: Have these observations been made available for analysis by other groups?
ABALAKIN: We can make them available.

CHEREPASHCHUK: Did you try to eliminate the scattered light from the central planet?
KISSELEVA: Yes, we have used filters for this purpose.