

# ON THE MOTION OF THE EQUATOR AND THE ECLIPTIC

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**Abstract.** A report is given on work in progress on the available observational evidence for an excess secular change of the obliquity of the ecliptic. Some of the recent determinations suggested that the conventionally adopted value of the secular change requires a correction of the order of  $\Delta\dot{\epsilon} = -0.3$  per century. Since an error of this size in the adopted motion of the ecliptic must be ruled out, the observed corrections may indicate either a rotation of the equatorial plane with respect to an inertial system about an axis passing through the equinox or the existence of systematic errors of the observations. In following Aoki's suggestion of a real motion of the equator, the averaged proper motions in the systems FK4 and N30 yield a rotation of the galaxy with an angular velocity of  $43.6 \text{ km s}^{-1} \text{ kpc}^{-1}$  near the Sun and a positive gradient of the circular velocity in the galaxy near the Sun. If the distance of the Sun from the galactic center is 10 kpc, the circular velocity of the galaxy would be  $436 \text{ km s}^{-1}$ . Should, however, the circular velocity be less than  $300 \text{ km s}^{-1}$ , the distance of the Sun from the galactic center would have to be smaller than 7 kpc.

For the following reasons such far reaching conclusions are not well founded:

(1) Fundamental observations of the stars, the Sun and the planets carried out before about 1900 show appreciable systematic deviations from the average of the observations carried out after 1900. The excess secular change of the obliquity is suspected to be the consequence of systematic errors of older observations.

(2) The determinations of individual values of  $\Delta\epsilon$  from observations of the Sun and the planets show a steep decrease of  $\Delta\epsilon$  from about 1780 to 1900; the individual values of  $\Delta\epsilon$  derived from observations after 1900 do not deviate significantly from zero and do not show a significant secular decrease. On the other hand, a small secular decrease cannot be excluded.

(3) The first results of determinations of Oort's constant  $B$  from proper motions of stars with respect to galaxies do not indicate significant deviations from the results derived on the basis of proper motions measured in the fundamental system.

This investigation, which is not yet completed, concentrates on an analysis of fundamental observations of stars, the Sun and planets. From the systematic errors of observations which have contributed to the formation of the FK4 it can already be stated that modern observations cannot exclude the possibility of an excess secular change of the obliquity within the limits of  $-0.1 < \Delta\dot{\epsilon} < +0.1$  per century and, consequently, the possibility of a real motion of the equatorial plane within these limits. It appears, therefore, that Aoki's suggestion deserves further attention, but that its effect on galactic rotation is smaller than was originally assumed.