SEMIANNUAL VARIATIONS IN THE NORTH-SOUTH ASYMMETRY OF POLARIZED LIGHT OF JUPITER.
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Introduction: Results of our polarimetric observations of Jupiter over a 25-year period are compared with observations of other authors. All the data confirm the presence of semiannual variations in the north-south asymmetry of polarized light of Jupiter. Time-dependent influence throw the changing position of the planet relative to the solar equator is supposed.

Observational data and discussion: Seasonal changes in the north-south asymmetry of polarization at high latitudes of Jupiter have been revealed by polarimetric observations in blue light (λ 0.440 – 0.470 μm) over an 18-year period (1981-1999) [1] and have been confirmed by new observations (2000-2007) [2,3]. The bottom panel in our Figure 1 presents polarization degree difference between the north (N) and south (S) regions at planetocentric latitudes ±60º as a function of planetocentric orbital longitude of the Sun L_S, measured eastward from the planet's vernal equinox in the jovian orbital plane. Values L_S of 0º, 90º, 180º, and 270º correspond to the beginning of spring, summer, autumn, and winter for the northern hemisphere. The labels mark the year of observation. The filled circles are our previous (1981-1999) observations and the curve is the approximation $1.3\sin(2L_S)+0.55$ for them. The open circles are the new observations (2000-2007). The error bar for 2007 is equal to ±1.1%, and it is absent here to not overload the Figure. Crosses are the data of Gehrels et al. [4] for λ 0.460 μm from their Figures 3 and 4. The square is from the data of Bolquadze [5] (λ 0.400-0.700 μm) for the phase angle 5º.7 from his Figure 2 if the positive value of planetocentric declination of the Earth is taken into account. Triangles are the data of Hall and Riley [6,7] for λ 0.376 μm. Discrepancy between the data of Bolquadze and those of Hall and Riley for 1974 may be explained by difference in spectral regions used by these authors. The value at λ 0.376 μm that equals zero in the data of Hall and Riley, increases up to 1.5 – 2.0 % when reduced to λ 0.440-0.470 μm according to the spectral dependence of polarization in the data of Gehrels et al. [4, Fig.4 and Table III]. In turn, the value of polarization degree difference from the broad-band observations of Bolquadze may increase up to ~ 2% if it is reduced to λ 0.440-0.470 μm as well.

The seasonal curve demonstrates two maxima falling on the heights of spring and autumn, and two minima falling on the heights of summer and winter. Temporal variations of such a kind are well established in the Earth's auroral events and in the geomagnetic disturbances [8]. The so called axial hypothesis, in which heliographic latitude of the Earth plays a role, is one of possible explanations for such semiannual variations in geomagnetic activity [8]. A similar assumption could be correct for Jupiter as well. At least the spring and autumn maxima of the asymmetry value in our data have coincided with the north and south maxima of heliographic latitude of Jupiter [1]. The upper panel in the Figure 1 demonstrates a behavior of the absolute value of heliographic latitude of Jupiter during a jovian year. The dots are the absolute latitude values calculated for the moments of our observations. There is a good agreement between the seasonal variations of the asymmetry value and those of the absolute heliographic latitude of Jupiter, with only a small phase shift of about 25º.

Conclusion: Such explanation of semiannual variations in the north-south asymmetry is needed to be examined and developed in the future, of course. At present, our data seem to give an evidence that changing position of Jupiter relative to the solar equator may serve as a modulating factor, which influences the processes of polar haze formation.

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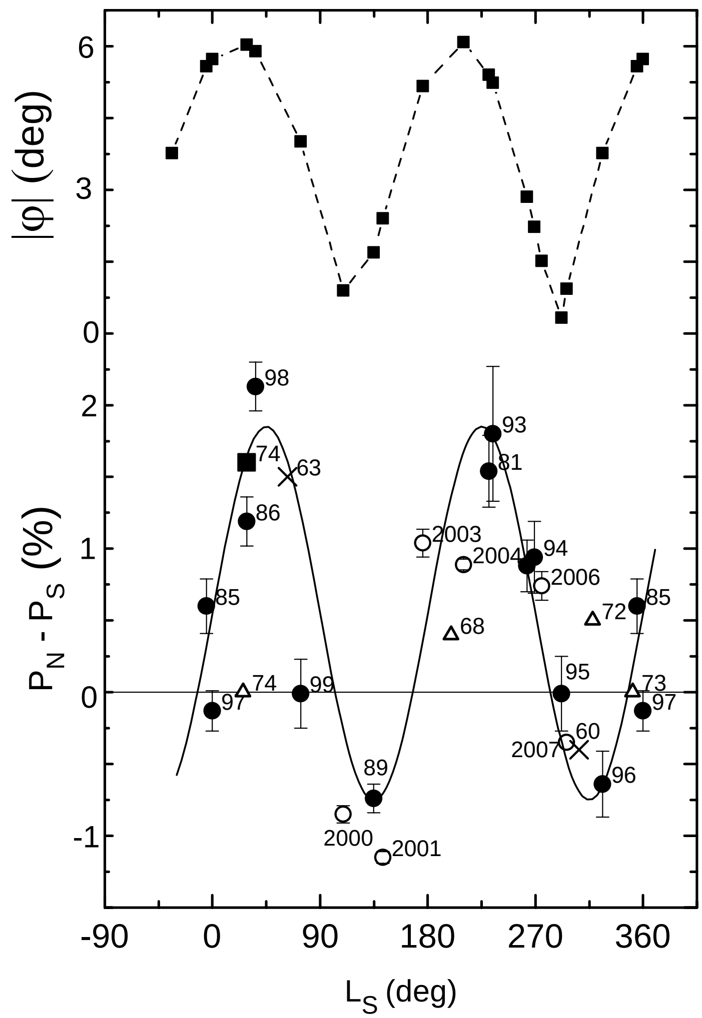

Fig. 1. Polarization degree difference between north (N) and south (S) regions at planetocentric latitudes ±60°(lower panel) and a behavior of of the absolute value of heliographic latitude of Jupiter during a jovian year. (upper panel)