JUPITER'S LIGHT REFLECTION LAW. E. V. Shalygin, Yu. I. Velikodsky, and V. V. Korokhin. Astronomical Institute of Kharkov National University. Sumskaya Ul., 35, Kharkov, 61022, Ukraine. E-mail: dslpp@astron.kharkov.ua.

Abstract: A reflection law for Jupiter in form of linear combination of Lambert and Lommel-Seeliger is proposed. It is showed that proposed law quite well describes brightness distribution over Jovian disk at phase angle 2.7 degrees.

It is usually considered that Jupiter reflects light by Lambert's law (see e.g. [1]). Indeed, Jovian atmosphere is optically thick and albedo is high enough for this approximation. However, single scattering can make significant contribution in the brightness, which can be described by Lommel-Seeliger's law multiplied by indicatrix of a particle. So, let us approximately write reflection law as a linear combination of Lambert's and Lommel-Seeliger's functions:

$$f(\alpha,i,\varepsilon)=a\left(\cos i+b\frac{\cos i}{\cos i+\cos\varepsilon}\right), \qquad (1)$$

where α – phase angle, *i* – angle of incidence, ε – angle of emergence, $f(\alpha,i,\varepsilon)$ – photometric function, *a* – normalizing factor, *b* – weighting coefficient of single scattering term. We will try to find Jupiter's reflection law just in a such form.

It is clear that parameter *b* should depend on particle albedo and indicatrix. Taking into account the fact that well known Jovian belts, zones and other atmospheric details elongated along equator, one can expect relative stability of parameter *b* along parallels and strong variations along meridians.

Parameters of this law were found for different Jovian latitudes using ground based observations data of Jupiter of 1998 by L. Akimov, V. Korokhin and O. Starodubtseva at Astronomical Institute of Kharkov National University. Observations were carried out in two spectral regions: "blue" – 450 nm and "red" – 710 nm.

The parameters search algorithm was following: the theoretical intensity dependence along Jovian parallel was calculated by formula (1), then it was smoothed out by point spread function to take into account Earth's atmosphere, then this dependence was compared to observational one.

Errors of determination of parameter *b* are shown on figure 1. They were obtained as mean-square deviations on 6 observation series. One can see that in latitude region between –55 and +55 degrees the level of errors is quite small. On latitudes higher than 55 degrees dependence behavior becomes unstable, that can be explained by strong blurring in meridian direction by Earth's atmosphere, or by changing atmosphere properties on high latitudes.

Relatively large errors in latitudes region from –35 to –25 degrees are caused by Red Spot.

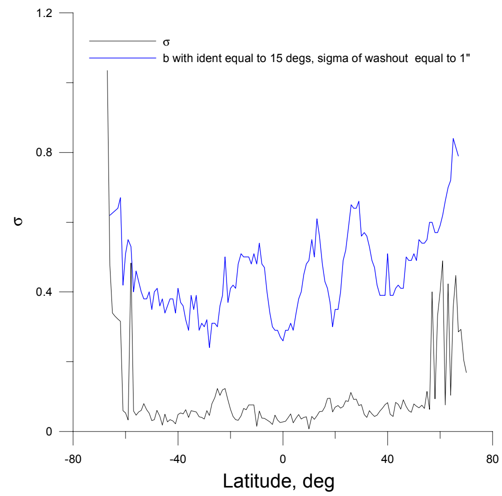

Figure 1. *Distribution of b along central meridian in comparing with errors level*

Figure 2 shows *b* distribution along Jovian latitude compared to brightness distribution along central meridian. One can see a good anticorrelation between parameter *b* and brightness in zones and belts.

It is interesting that double belt (latitude 20-40 degrees) in northern hemisphere is well visible on *b* distribution, but almost non-visible on intensity distribution. Moreover, one can see that south belt consists of two parts (latitudes about 10-20 degrees).

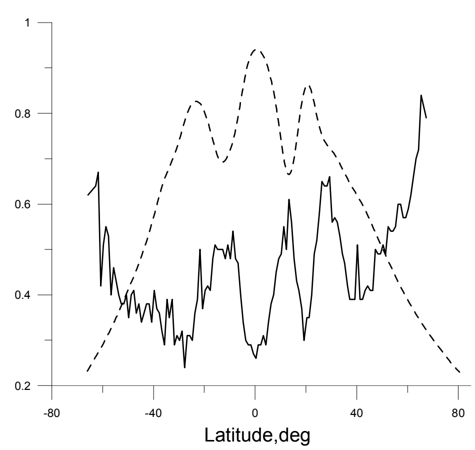

Figure 2. *Distribution of b along Jovian latitude in comparing with brightness distribution along central meridian*

Figures 3 and 4 show deviation of values calculated with (1) from observational data. Jupiter's bounds are located at 110 and 550 pixels of image.

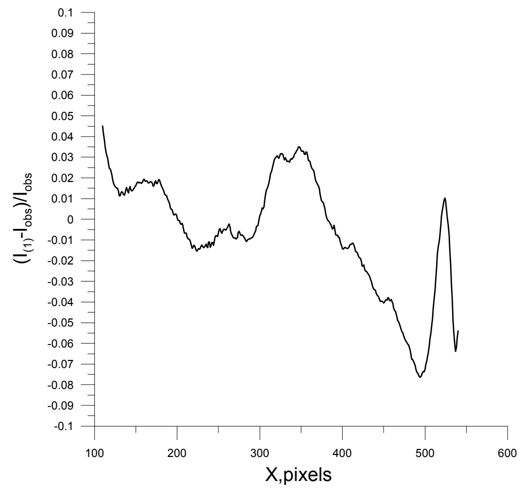

Figure 3. *Relative deviation of values calculated with formula (1) from observational data for equatorial zone*

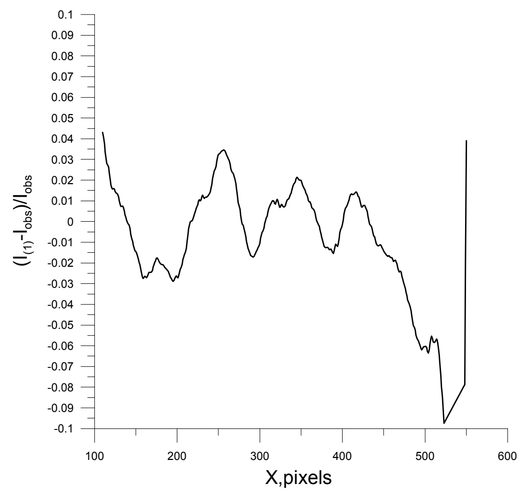

Figure 4. *Relative deviation of values calculated with formula (1) from observational data for south belt*

One can see a good agreement between observed and calculated profiles (fig.3, 4). Small difference between observed and calculated intensities (about 4%) is caused by atmospheric details (systematical trend is caused by bad determination of Jupiter's disk center).

Conclusions: It is showed that proposed reflection law (1) quite well describes brightness distribution over Jovian disk at phase angle 2.7 degrees. It is showed that there is a significant difference between Lambert's law and observed reflection law in dark belts.