PRELIMINARY ANALYSIS OF THE SOLAR PHASE CURVES OF THE JUPITER'S SATELLITE GANYMEDE

V. I. Shavlovskij

Main Astronomical Observatory, NAS of Ukraine
27 Akademika Zabolotnoho, 03680 Kyiv, Ukraine
e-mail: svitaly@mao.kiev.ua

The Hapke's model parameters (w, g, h and B_0) were obtained separately for leading and trailing hemisphere of the Jupiter's satellite Ganymede by using the ground-based narrow band photoelectric observations at λ 0.346, 0.540 and 0.792 μm. The values of the obtained parameters confirm existence of hemispherical dichotomies in the photometric characteristics of Ganymede surface. The values of average single scattering albedo w and parameters of the opposition amplitude B_0 increase with increasing wavelength of observation.

The physical properties of the surface of Ganymede have been studied by several authors: Buratti [1], Domingue and Verbiscer [2]. The solar phase curves of Ganymede have been modeled by using the Hapke's theory [3, 4, 5].

Buratti [1] used a combination of telescopic observations and measurements from the Voyager images. She did not find any hemispherical differences on Ganymede. Buratti [1] attributed these results to a balance of magnetospheric interactions on the trailing hemisphere with micrometeoritic bombardment on the leading hemisphere.

Reanalysis of the solar phase curves of Ganymede by Domingue and Verbiscer [2] demonstrates that the trailing hemisphere of satellite is rougher than the leading hemisphere by about 6°. The results of Domingue and Verbiscer [2] indicate that the leading hemisphere of Ganymede is much more porous than the trailing hemisphere; at 0.55 μm both hemispheres are predominately backscattering with a little difference between them. These conclusions disagree with Buratti [1] results.

A possible reason of the discrepancy between the parameters derived by Domingue and Verbiscer [2] and those by Buratti [1] is that their curves are based on a few number of observations near opposition.

During 1980–1985 years the author obtained an extensive set of homogeneous high accurate photometric observations of Ganymede by using 11 narrow band filters. We have carried out quite a number of observations

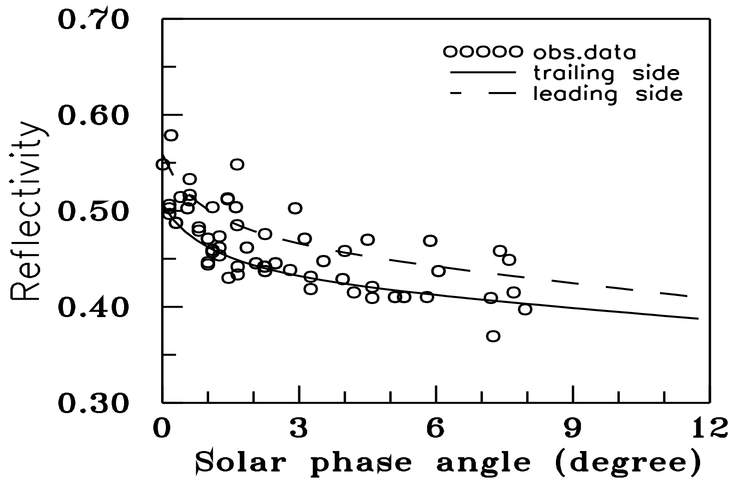

Figure 1: The observed reflectivity (points) of Ganymede at 5400 Å as a function of the solar phase angle. The model predictions are shown by the solid (trailing side) and dashed (leading side) lines

Table 1: Hapke model parameters for Ganymede

hemisphere	Hapke model parameters					λ
	B_0	h	w	g	$\theta°$	μm
leading	0.330	0.008	0.890	-0.230	28	0.346
	0.360	0.008	0.866	-0.250	29	0.346
	0.400	0.010	0.910	-0.270	28	0.540
	0.467	0.009	0.943	-0.217	29	0.540
	0.470	0.008	0.920	-0.240	28	0.792
	0.470	0.010	0.910	-0.250	29	0.792
trailing	0.300	0.010	0.878	-0.140	35	0.346
	0.300	0.012	0.878	-0.140	29	0.346
	0.450	0.012	0.920	-0.200	35	0.540
	0.533	0.014	0.930	-0.158	29	0.540
	0.450	0.014	0.930	-0.160	35	0.792
	0.450	0.014	0.930	-0.150	29	0.792

near opposition. A new approach to correct the observed orbital brightness variations has been proposed by the author.

The surfaces of the leading and trailing hemispheres differ by their properties, therefore an individual set of Hapke's parameters was taken for every side. The contribution of each hemisphere to the total light flux scattered by the surface is accepted to be proportional to the square of the projection of the hemisphere on the image plane. This contribution may be calculated by using the Hapke's theory equations for any sets of parameters and α, θ values during the observation.

The w, g, B_0, and h parameters were derived from the condition of the best fit of this model with observed values of the reflectivity. The derived values of parameters are presented in Table 1. The values of the roughness parameters $\bar{\theta}$ have been taken for leading and trailing hemisphere by Buratti [1] (29° and 29°) and by Domingue and Verbiscer [2] (28° and 35°).

The observational data and model curves of leading and trailing sides at λ 0.54 μm are presented in Fig. 1.

Analysis of the results in Table 1 shows that the surface of the leading side of Ganymede consists of particles with more strong backscattering and more porous state then those on the surface of the trailing side. The values of the average single scattering albedo (w) and the parameters of the opposition amplitude (B_0) increase with increasing the wavelength of observation.

Our results contradict to Buratti [1] conclusions and confirm the existence of hemispherical dichotomies in the photometric characteristics of the Ganymede surface [2].

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