Spectrophotometric properties of Moon’s and Mars’s surfaces exploration by shadow mechanism

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Abstract. Typically, to analyze the data of the phase dependence of brightness atmosphereless celestial bodies one use some modification of the shadow mechanism involving the coherent mechanism. There are several modification of B.Hapke [2] model divided into two groups by the number of unknown parameters: the first one with 4 parameters [3,4] and the second one with up to 10 unknown parameters [1] providing a good agreement of observations and calculations in several wavelengths. However, they are complicated by analysing of the colorindex $C(\alpha)$ dependence and photometric contrast of details with phase $K(\alpha)$ and on the disk $(\mu = \cos i)$. We have got good agreement between observed and calculated values of $C(\alpha) = U(\alpha)-I(\alpha)$, $K(\alpha)$, $K(muo)$ for Moon and Mars with a minimum number of unknown parameters [4]. We used an empirical dependence of single scattering albedo ($\omega$) and particle semi-transparency($\alpha$): $\alpha = (1-\omega)n$. Assuming that $[\chi(0^\circ)/\chi(5^\circ)] = \chi(5^\circ)/\chi(0^\circ)$, where $\chi(\alpha)$ is scattering function, using the phase dependence of brightness and opposition effect in a single wavelength, we have defined $\omega, \chi(\alpha), g$ (particle packing factor), and the first term expansion of $\chi(\alpha)$ in a series of Legendre polynomials $x1$. Good agreement between calculated and observed data of $C(\alpha) = U(\alpha)-I(\alpha)$ for the light and dark parts of the lunar surface and the integral disk reached at $n \approx 0,25$, $g = 0,4$ (porosity 0,91), $x1 = -0,93$, $\omega = 0,137$ at $\lambda = 359nm$ and 0,394 at $\lambda = 1064nm$; for Mars with $n \approx 0,25, g = 0,6$ (porosity 0,84), $x1 \approx 0$, $\omega = 0,210$ at $\lambda = 359nm$ and $\omega = 0,784$ at $\lambda = 730nm$.