Asteroid observations at low phase angles. Average parameters for the new three-parameter H,G_1,G_2 magnitude system

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We present new observational data for selected main-belt asteroids of different compositional types, namely, 10 Hygiea, 176 Iduna, 214 Aschera, 250 Bettina, 419 Aurelia, 596 Scheila, 635 Vundtia, 671 Carnegia, 717 Wisibada, 1021 Flammario, and 1279 Uganda. The detailed magnitude-phase dependencies including low phase angles (< 1 deg) were obtained for all these asteroids. For some asteroids the dependencies of color indexes $B - V$, $V - R$, and $R - I$ with phase angle were investigated.

We found a great diversity in opposition effect behavior both in magnitude and width of opposition surges. Some low albedo asteroids (e.g. ,10 Hygiea) display a broad opposition effect with an amplitude of 0.15–0.20 mag relative to the extrapolation of the linear part of the phase curve. Other asteroids (596 Scheila, 1021 Flammario) show linear magnitude phase functions down to very low phase angles (0.1–0.2 deg). Possible causes of the observed differences in the opposition effect behavior are discussed.

Using numerous data sets on magnitude-phase dependencies with good phase angle coverage and small scatter within the observational data (e.g., Harris & Young 1989; Harris et al., 1992; Shevchenko et al. 2010; Shevchenko et al. 2012), we examined in more detail the new three-parameter H,G_1,G_2 magnitude system (Muinonen et al. 2010). We determined the values of the G_1 and G_2 parameters for each of the magnitude phase dependencies. We obtained average parameters for the main spectral classes of asteroids which can be used for the calculation of asteroid absolute magnitudes and the prediction of asteroid apparent magnitudes.

References: Harris, A.W., Young, J.W., 1989. Asteroid lightcurve observations from 1979–1981. Icarus 81, 314–364; Harris, A. W., et al. 1992. Asteroid lightcurve observations from 1981. Icarus 95, 115–147; Muinonen, K., et al. 2010. A three-parameter phase-curve function for asteroids. Icarus 209, 542–555; Shevchenko, V.G., et al. 2010. Kharkiv Asteroid Magnitude-Phase Relations V1.0. EAR-A-COMPIL-3-MAGPHASE-V1.0. NASA Planetary Data System; Shevchenko, V. G., et al. 2012. Opposition effect of Trojan asteroids. Icarus 217, 202–208;