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Groud-based photometric observations of Jupiter's inner satellites Thebe, Amalthea, and Metis at small phase angles

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Photometric measurements of the inner Jovian satellites Thebe, Amalthea and Metis based on ground-based observations taken from October 1999 to January 2002 are presented. The observations were made in the range of phase angles α from 8.1° to 0.3°. The Two-Channel Focal Reducer of the Max-Planck-Institut für Sonnensystemforschung attached to the 2-m RCC telescope at Terskol Observatory (Pik Terskol, Northern Caucausus) was used in coronagraph mode. The

observations were performed in the methane band centered at the wavelength of 0.887 μm.

Mean observational uncertainties corresponding to 1σ rms errors were 3% for the leading and trailing sides of Amalthea, 7% and 9% for the leading and trailing sides of Thebe and 9% for the leading side of Metis after taking into account the longitude variations of brightness. Magnitudes and reflectivities calibrated on an absolute scale were used to evaluate the near-opposition behavior of Thebe, Amalthea, and Metis. All three satellites exhibit significant opposition brightening. This effect is particularly strong for the leading hemispheres of Thebe and Amalthea at very small phase angles ($< 3^\circ$), where the rise of brightness becomes nonlinear. In order to measure the opposition surge parameters, the empirical law proposed by Karkoschka and Hapke's model were used. The parameters of the satellite opposition effects are presented and discussed. The geometric albedos of the moons calculated with best-fit Hapke parameters are 0.096, 0.157, and 0.24 for Thebe, Amalthea, and Metis respectively. These values show a systematic variation of albedo with distance from Jupiter: the satellites

closer to Jupiter are brighter. Analysis of the albedo ratio of the leading and trailing hemispheres of the satellites indicates that the leading hemispheres of Thebe and Amalthea are brighter than the trailing ones, but the albedo distribution with respect to the hemispheres of Metis is uniform within the errors of our observations. The extent of the albedo asymmetry varies from satellite to satellite and with distance from Jupiter. Probably this is connected with pollution of the trailing hemispheres of Thebe and Amalthea caused by the interaction of sulphur ions entering the Jovian magnetosphere in course of the vulcanic activity of Io.

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