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Analysis of the surface dichotomy of Tethys, Dione, and Rhea based on the photometric and polarimetric measurements at low phase angles

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Ground-based and space observations of the Saturnian system revealed that photometric properties of leading and trailing hemispheres of the main icy Saturnian satellites are different. This is attributed to interaction of the moon surfaces with Saturn's magnetosphere and E-ring icy grains. While fundamental photometric values have been determined for the leading and trailing hemispheres separately, the polarimetric properties of the satellite surfaces are still poorly investigated. Photopolarimetric measurements performed at low phase angles (the angle between the Sun, target and observer), less than 2°, and in different wavelength regions can be especially informative because the incident radiation preserves the information about some characteristics of surface texture.
Photometric and polarimetric observations of Tethys, Dione, and Rhea were obtained in phase angle interval from 5.7 to 0.01 degrees in wavelength bands centered at 0.43, 0.67, and 0.89 nm. The dependences of brightness and linear polarization on phase angles are investigated for the leading and trailing hemispheres of the satellites separately and for three different wavelengths. The phase curves show the presence of narrow spikes of brightness and deep minimum of negative polarization for all three satellites. The amplitudes of the brightness surges are largely consistent with the contribution of coherent backscattering. Discussion of the hemispherical differences of moons' surfaces will be presented and some tentative conclusions will be made from the analysis of the shapes of the phase curves of the brightness and linear polarization near opposition.