

Optical properties of distant and close to the Sun comets from linear and circular polarimetry

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We present an analysis of the results of measurements of linear and circular polarization in recent comets. The observations of comets were obtained at the 6-m telescope of the SAO RAS with the multi-mode focal reducer SCORPIO-2 during 2011–2014. The following modes of the instrument were used for observations: direct CCD images in broad-band standard filters and narrow-band cometary continuum filters; the low-resolution linear and circular spectro-polarimetry; and imaging linear and circular polarimetry. The short-periodic comets 2P/Encke, 29P/Schwassmann–Wachmann 1, and 290P/Jager and dynamically new comets C/2009 P1 (Garradd), C/2010 R1 (LINEAR), C/2010 S1 (LINEAR), C/2011 L4 (PanSTARRS), C/2011 R1 (McNaught), C/2012 K1 (PanSTARRS), C/2012 S1 (ISON), and C/2014 Q3 (Borisov) were observed at different distances from the Sun (0.5–7.0 AU) and phase angles (6.2–83.5 deg). The maps of intensity and linear and circular polarization over the coma are derived for different comets.

The polarimetric data obtained are compared with the phase-angle dependences of linear polarization typical for the high-polarization and low-polarization comets observed at different heliocentric distances. The linear polarization of distant comets with a high level of activity beyond Jupiter's orbit (29P/Schwassmann–Wachmann 1, C/2010 S1 (LINEAR), C/2010 R1 (LINEAR)) are the first ever measured at the heliocentric distances larger than 5 AU. It turned out that the degree of linear polarization for these comets ($-2\div-3.5\%$) are significantly higher (in absolute value) than the typical value of the whole coma polarization ($[U+F07E]^{-1}.5\%$) at the minimum of negative polarization branch for comets which were closer to the Sun.

The maps of circular polarization and its variations over the coma are obtained for a number of comets. In all cases, the left-handed circular polarization is detected with accuracy (0.01–0.03%) and its value is within the range from -0.04% up to -0.3% . Detection of left-handed circular polarization in these comets has confirmed our previous conclusion that circular polarization of comets is predominantly left-handed.

We will present additional results from our continuing analysis of comet polarimetry and discuss the possible reasons of diversity and similarity of linear and circular polarization in comets.