Scattered light of cometary dust: A window to look at the evolutionary product of comets

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Comets are the most pristine reservoir of the materials left over from the formation epoch of the solar system. When they are heated and expel such ancient materials in their orbital motions around the Sun, however, a dust mantle could be developed over the surface as a result of sublimation-driven cometary activity, disguising natal information encoded in each comet as similar properties of the evolved dust particles.

Cometary dust in the coma and on the nuclei scatter sunlight mainly at visible and near-infrared (NIR) wavelengths. In general, linear polarization (P) of cometary dust particles can be exploited to constrain physical properties, such as their size and porosity (see, e.g., Kiselev et al. 2015). Most comets show a quite homogeneous distribution of P with regard to the phase angle (an angle of the Sun-Comet-Observer), suggesting their similar dust properties. Herein, we report the results of two interesting comets, comet 2P/Encke and 252P/LINEAR observed all at high phase angle (>70 deg). Both comets show significantly different polarimetric behaviors from that of a majority of comets. We observed comet 2P/Encke in its 2017 apparition via spectropolarimetry at optical wavelengths (0.5–1.0 μm). For comet 252P/LINEAR, we observed it via NIR imaging polarimetry (simultaneously in JHK_S filters), covering its perihelion passage in 2016. Based on the observational evidence, we will discuss their abnormal P behaviors in terms of the aging of the surface dust structure.