

Polarimetric and Photometric observations of NEAs with the 1.6m Pirka Telescope

*Ryo Okazaki¹, Tomohiko Sekiguchi¹, Akari Kamada¹, Masateru Ishiguro², Hiroyuki Naito³, Masataka Imai⁴, Tatsuharu Ono⁴

1. Hokkaido University of Education, 2. Seoul National University, 3. Nayoro Observatory, 4. Hokkaido University

Polarimetric observations of 3 near-Earth asteroids, 2000 PD3, 2012 TC4 and (3200) Phaethon, were carried out in 2017 using the 1.6m Pirka telescope at the Nayoro Observatory, Hokkaido, as well as BVRI photometric color observations were conducted for 2000 PD3.

Polarimetry is a useful method for investigating asteroids' physical properties such as the albedo, regolith particle size and taxonomy of asteroids. In general, Pr (the linear polarization degree) exhibits a strong dependence on the phase angle (Sun-Target-Observer' s angle, α).

2000 PD3

In order to understand Pmax (maximum Polarization degree) , we attempted to obtain polarimetric data at different phase angles ($\alpha=22^\circ$ - 120°). A geometric albedo of $p_v=0.26\pm 0.06\%$ were derived from a limited α range (25° - 84°) which is in good agreement with that of S-type asteroids. BVRI photometric data ($B-V=0.132\pm 0.002\text{mag}$, $V-R=0.114\pm 0.002\text{mag}$, $V-I=0.180\pm 0.002\text{mag}$) supports S-type classification.

2012 TC4

In October 2017, 2012 TC4 approached to the Earth at about 50,000 km of the closest distance. A fast rotation period about 0.2 hours (Ryan and Ryan, 2017) indicates a monolithic surface layer which is not covered with a rubble pile. The linear polarization $Pr=5.62\pm 5.26\%$ ($\alpha=34^\circ$) in the R-band is in close accord with that of C-type asteroids, although October run was performed under bad weather.

(3200) Phaethon

This asteroid is widely recognized as the parent body of the Geminid meteoroid stream. In December 2017, we had an opportunity to obtain polarimetric data at extremely large phase angle ($\alpha=110^\circ$ - 130°). However, only data down to $\alpha=58^\circ$ were acquired. The results of analysis show $Pr=1.58\pm 0.22\%$ ($\alpha=34^\circ$) and $15.02\pm 0.13\%$ ($\alpha=58^\circ$) in the V-band, which is consistent with those of low albedo asteroids such as B, F, and D-type.

Keywords: NEAs, polarimetric observations, polarization degree, albedo, taxonomy