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#### **A Possible Signature of Split Event on (3200) Phaethon**

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#### **ABSTRACT**

**Summary** Past orbital integrations and observations suggested a possible genetic association between a pair of NEOs, (3200) Phaethon and (155140) 2005 UD [1][2]. In order to strengthen the hypothesis on the common origin of these two NEOs, we investigated the surface property of Phaethon through a time-resolved, low-resolution visible spectroscopic observation. The averaged spectrum of Phaethon over the entire rotational phase has a slight negative slope consistent with F/B-type asteroids. Spectral gradients of individual spectrum are found to be in the range between F/B-type asteroids and C-type asteroids, and they exhibit time variation. Possible surface heterogeneity, which is similar to the one found on 2005 UD, is anticipated from the combination of the exposition of the fresh surface by a splitting event in the past and successive surface alteration by the space-weathering or thermal metamorphism.

**Spectroscopy** We carried out a VIS spectroscopic observations of Phaethon by using the Lulin 1.0-m Telescope with the low-dispersion spectrograph named *Hiyoyu* at Lulin Observatory operated by the Institute of Astronomy, National Central

University, China Taiwan. We conducted the observation on three successive nights from November 30 to December 2 in 2007. Consequently, a total of 68 VIS spectroscopy data were successfully recorded, which may cover more than one full rotational phase, among which 24, 27, and 17 data were obtained in each night, respectively. The spectral gradient of (3200) Phaethon deduced from the combined spectrum averaged over the entire rotational phase is measured to be  $-2.6\%/1000\text{\AA}$ , which is consistent with previous studies.

**Photometry** At the same time we carried out photometric observations of Phaethon by using a 0.36-m Ritchey-Chretien (F/8) telescope at the Miyasaka Observatory, Japan, in order to determine its rotational period. We carried out observation on two nights, November 30 and December 1, 2007, simultaneously with the spectroscopic observation at Lulin. As a result we derived two possibilities for the rotation period of this asteroid:  $P\sim 3.6$  hours or  $P\sim 7.2$  hours.

**Result** The most significant discovery in this study is the existence of a variation of spectral gradient on this asteroid: Ranging from bluer color that corresponds to F/B-type asteroids to neutral to slightly redder color that corresponds to C-type asteroids. We folded time-series spectral gradients using possible rotational periods of  $P\sim 3.6$  and  $P\sim 7.2$  hours. When we adopt  $P\sim 7.2$  hours, the spectral gradient seems to change smoothly along the rotation of the body. The longitudinal inhomogeneity on the surface of Phaethon could be the remnant of a split event in the past.

**References** [1] Ohtsuka *et al.*, *Astron. Astrophys.*, **450**, L25-L28, 2006. [2] Kinoshita *et al.*, *Astron. Astrophys.*, **466**, 1153-1158, 2007.

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