

Some Results in the Near-miss Occultation Survey for Extinct Comet Candidates. H. Meng¹, J. Zhu^{1,2}, M. Zhai^{2,3}, L. Mei^{2,3}, J. Southworth⁴, ¹Meteorite and Cosmochemistry Laboratory, Beijing Planetarium, Beijing 100044, China, ²National Astronomical Observatories, Chinese Academy of Sciences, Beijing 100012, China, ³Graduate University of Chinese Academy of Sciences, Beijing 100049, China, ⁴Department of Physics, University of Warwick, Coventry, CV4 7AL, UK.

Introduction: Near-miss occultations of bright stars by extinct comet candidates and distant comets may provide useful constraints on the remnant dust structures surrounding the nucleus. An observational survey for such occultations was performed from late 2005 to 2007, covering 43 near-miss occultation events of 20 objects. Here we report the results on 3 objects: (3200) Phaethon, 107P/(4015) Wilson-Harrington, and (85490) 1997 SE5.

(3200) Phaethon: As a high T_j object and the parent body of the Geminid meteor shower [1], Phaethon is among the most controversial objects on its nature. Three near-miss occultations of it were observed in our survey. The first two happened consecutively on October 31 and November 1, 2005. The events were monitored simultaneously with the 0.8-m Tsinghua-NAOC Telescope (TNT) and the 0.6-m/0.9-m Schmidt Telescope, both at Xinglong Station, NAOC. The miss distances for the site were 0.881'' (944 km) and 0.897'' (959 km) in the two events, respectively, but at different sides. A confident but inexplicable brightening upon the approach between the star and Phaethon, at the level of 0.04 magnitude, was detected in the October 31 event by both telescopes in three different wavebands. But similar feature did not repeat on the lightcurve of second night. Numerical simulations eliminate the possible cause by a particularly shaped spatial dust structure.

The third event of Phaethon was observed on October 29, 2007, with the 2.56-m Nordic Optical Telescope at La Palma. The miss distance was only 0.101'' (67 km) from the asteroid. Nevertheless, neither significant brightening nor extinction was observed. This observation put a 3 σ upper limit of 0.0019 for the mean optical depth within projected 1000 km from Phaethon.

107P/(4015) Wilson Harrington: An outstanding event of this object was well observed on February 3, 2006, with the 0.8-m TNT at Xinglong Station, NAOC. The impact parameter was 0.006'' or only 6 km at the object. No significant signal correlated with the near miss was detected, but instead we determine the mean optical depth was 0.0031 ± 0.0034 within projected 1000 km from the nucleus of W-H.

(85490) 1997 SE5: A moderate opportunity of this object was seized on January 24, 2007, simultaneously by the 0.8-m TNT at Xinglong Station, NAOC (0.686''

= 2263 km), and the 1.0-m YAO telescope at Phoenix Hill, Kunming (1.296'' = 4275 km). Significant attenuation of the occulted star was detected at Xinglong in the time scale ~1000s. Meanwhile, shorter and specious feature was evident in the lightcurve obtained in Kunming. At the time of our observation, the asteroid was also ~1.5 magnitude brighter than expected.

Follow-up multicolor imaging was thus performed with two of VLTs at Paranal, Chile, in May 2007. In our 2.8 hours' observing run (much shorter than 9.0 hours' rotation of this object [2,3]), the brightness of the object faded by 1.2 magnitude in U band, but remained generally stable in other redder wavebands. Moreover, the object exhibited as a slightly extended source only in the first U-band image with its highest brightness. This may be attributed to a transient outgassing of NH at a production rate of some 10^{24} molecule s⁻¹. The observed reflectance spectral gradient was considerably redder than previous observations even at much larger phase angle [2,4].

We also determine the phase coefficient of this object by investigating the historical brightness estimation reported to MPC, and find its absolute magnitude in 2004 apparition is likely to be positively correlated with heliocentric distance, suggesting this "asteroid" might be still occasionally active.

(85490) 1997 SE5 is one of the very few known NEAs with 100% probability evolved from Jupiter-family comet [5], and has a T_j of 2.65.

References:

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