EPSC Abstracts
Vol. 6, EPSC-DPS2011-1581, 2011
EPSC-DPS Joint Meeting 2011

Near Infrared Observations of Comet-Like Asteroid (596) Scheila

B. Yang (1) and H. Hsieh (1,2)
(1) Institute for Astronomy, University of Hawaii, 2680 Woodlawn Drive, Honolulu, HI 96822
(2) Hubble Fellow

Abstract

Asteroid (596) Scheila was reported to exhibit a cometary appearance and an increase in brightness on UT 2010 December 11. We used the IRCS spectrograph on the 8-m Subaru telescope to obtain medium-resolution spectra of Scheila in the HK-band (1.4 - 2.5 μm) and low-resolution spectra in the KL-band (2.0 - 4.2 μm) on UT 2010 December 13 and 14. In addition, we obtained low-resolution spectroscopy using the SpeX spectrograph on the 3-m IRTF telescope on UT 2011 January 04 and 05. The spectrum of Scheila shows a consistent red slope from 0.8 to 4.0 μm with no apparent absorption features, resembling spectra of D-type asteroids. An intimate mixing model suggests that the amount of water ice that might be present on the surface of Scheila is no more than a few percent. The spectrum of the Tagish Lake chondrite matches the asteroid's spectrum at shorter wavelengths ($\lambda < 2.5\mu$m), but no hydration features are observed at longer wavelengths on Scheila. Our prompt observations together with other studies of Scheila suggest that its observed cometary-like activity is likely not caused by the sublimation of water ice. Instead, the dust coma and tail may be results of a recent impact event.

1. Introduction

Asteroid (596) Scheila, with a semi-major axis of 2.93 AU, is located in the outer asteroid main belt, where several main-belt comets(MBCs; Hsieh & Jewitt, 2006) are found. On 2010 Dec. 10.4, observations by S. Larson using the 0.68 m Catalina Schmidt telescope show that Scheila exhibit a cometary appearance and an increase in brightness (Larson, 2010). The reported sudden activity of (596) Scheila shares several similarities with cometary outbursts. If the observed cometary activity is powered by the sublimation of water ice, then icy grains may be found in the vicinity of the nucleus. Pioneering studies of asteroids have recognized that observations in the near infrared, particularly in the 3μm region, provide the best chance of detecting diagnostic features (Lebofsky, 1980; Jones et al., 1990; Rivkin et al., 2002). We performed prompt spectroscopic observations of Scheila using 8-m Subaru and 3-m IRTF telescopes to search for water ice features and to characterize the composition of this asteroid.

2. Figures

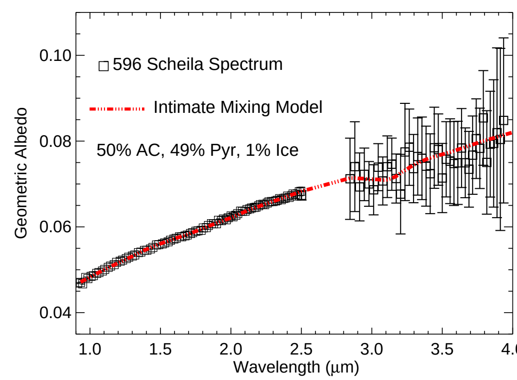

Figure 1: Open squares are the combination of Subaru observation and IRTF observation of Scheila from 1.0 to 4.0 μm. The red dashed line is the best-fit Hapke radiative transfer model. AC stands for amorphous carbon and Pyr stands for pyroxene. No absorption features are observed. Our model suggests that surface water ice is no more than 1 wt.% on this object.

3. Summary and Conclusions

Our Subaru and IRTF observations of Scheila in the spectral range 1.0 μm $< \lambda <$ 4.0 μm are presented in Figure 1, which shows that Scheila has a linear spectrum with a reddish slope. Water ice and hydroxyl-bearing minerals, if present, would produce broad absorption bands in the spectral region from 2.7 to 3.4

μm (Rivkin et al., 2002). These diagnostic features, however, are not observed in the spectrum of Scheila. We use an intimate mixing code to estimate an upper limit to the amount of water ice on Scheila's surface. Our model suggest that the surface of Scheila probably consists of fine-grained regolith and no more than 1wt.% water ice. Considering all the available observations, we conclude that the sudden activity of asteroid (596) Scheila is unlikely powered by sublimation of water ice but is produced via an impact event.

Acknowledgements

BY was supported by the National Aeronautics and Space Administration through the NASA Astrobiology Institute under Cooperative Agreement No. NNA08DA77A issued through the Office of Space Science. HHH was supported by the National Aeronautics and Space Administration (NASA) through Hubble Fellowship grant HF-51274.01, awarded by the Space Telescope Science Institute, which is operated by the Association of Universities for Research in Astronomy, Inc., for NASA, under contract NAS 5-26555.

References

Hsieh, H. H., & Jewitt, D. 2006, Science, 312, 561

Jones, T. D., Lebofsky, L. A., Lewis, J. S., & Marley, M. S. 1990, Icarus, 88, 172

Larson, S. M. 2010, International Astronomical Union Circular, 9188

Lebofsky, L. A. 1980, AJ, 85, 573

Rivkin, A. S., Howell, E. S., Vilas, F., & Lebofsky, L. A. 2002, Asteroids III, W. F. Bottke Jr., A. Cellino, P. Paolicchi, and R. P. Binzel (eds), University of Arizona Press, Tucson, 235