Asteroids, Comets, Meteors 1991, pp. 191–194
Lunar and Planetary Institute, Houston, 1992

SPECTROSCOPY OF D-TYPE ASTEROIDS

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ABSTRACT

We have performed a spectroscopic survey of 19 D-type asteroids. Comparison with previous photometry shows excellent agreement. Although the majority have similar colours to cometary nuclei, no cometary emission bands were present in any of the spectra. Absorption bands sporadically appearing were apparently due to stellar objects, and no features inherent to the asteroids were observed.

INTRODUCTION

The D-type asteroids are one of the most interesting groups of objects in the solar system. It was suggested over a decade ago by Gradie and Veverka (1980) that their reddish colouration stems from complex hydrocarbons covering their surfaces. Thus such objects are expected to be among the most primitive of asteroids available for study. Their general low albedos give them an uncanny resemblence to cometary nuclei, whose optical properties they share (*e.g.* Weissman *et al.*, 1989). Thus we have embarked on a spectroscopic survey of asteroids classified as D-type in the taxonomy of Barucci *et al.* (1987), who used both IRAS measured albedos and the ECAS data of Zellner *et al.* (1985) to identify such objects.

OBSERVATIONS AND REDUCTION

All spectra were obtained using the Faint Object Spectrograph on the 4.2m William Herschel Telescope at the Observatory de Rogue de los Muchachos, La Palma. The spectrograph is a fixed-format instrument with a 150 lines mm^{-1} plane transmission grating, recording data in two spectral orders covering wavelengths 3400–4900Å and 4800–9600Å. The detector is a cooled coated 400×590 pixel GEC CCD, giving resolutions of 4.3Å $pixel^{-1}$ and 8.6Å $pixel^{-1}$ respectively. Both detector and spectrograph are permanently mounted at the cassegrain focus of the telelscope, giving great stability to the system. All targets were observed with

a slit of dimensions 2 arcsec by 20 arcsec, and placed with the long axis at the parallactic angle to minimise the effects of atmospheric dispersion. The asteroids were observed on two consecutive observing runs, on the nights of 8th December 1990 and 7th-8th March 1991. Observations of the solar analogues 16 Cyg B and Hyades 64 were also performed to allow production of reflectance spectra. Details of data reduction will be given in a forthcoming paper (Fitzsimmons *et al.*, 1991, in preperation).

RESULTS

Reflectance spectra were produced in an analogous manner to Luu and Jewitt (1990). However, our resulting spectra were normalised at 5500Å to facilitate comparison with previous photometry published in the ECAS and TRIAD databases (Zellner *et al.*, 1985; Chapman and Gaffey, 1979). The agreement is generally excellent as can be seen from figure 1. In none of the asteroids did we detect any sign of the cometary emission that would be expected from a weakly active cometary nucleus. This should not be surprising though, as the majority of our targets lie in stable main-belt orbits.

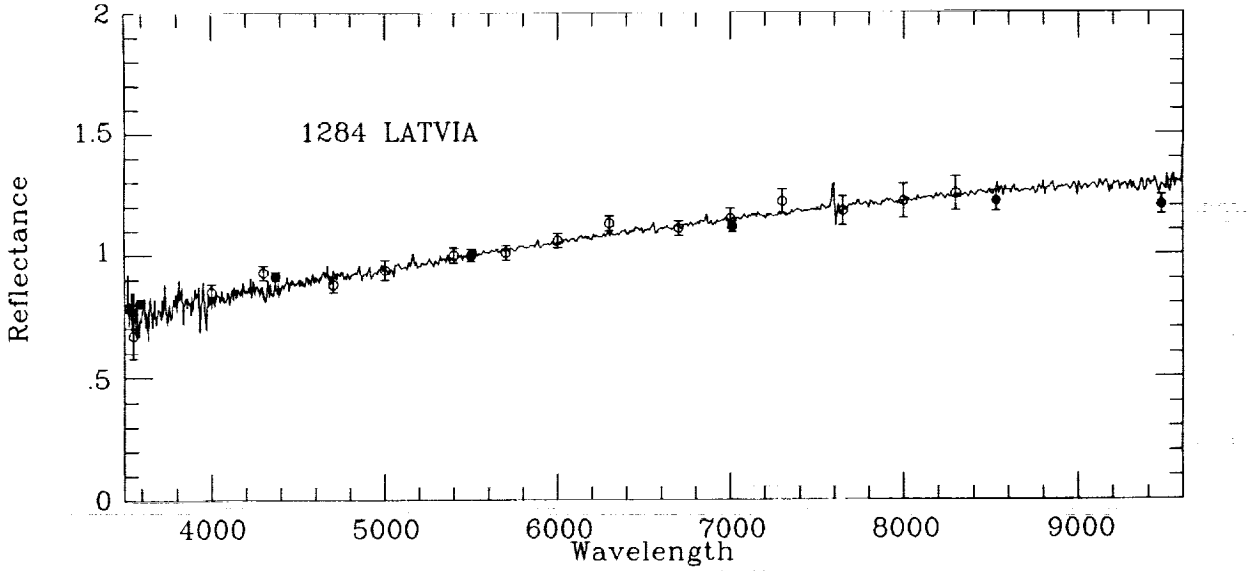

Figure 1. Reflectance spectrum of 1284 Latvia, showing good agreement with both ECAS data (solid points) and TRIAD data (open points).

Spectra of 1583 Antilochus and 2260 Neoptolemus did show transient absorption features in their reflectance spectra, similar to those suspected on other asteroids (Fitzsimmons *et al.*, 1990). Two spectra of Neoptolemus taken 90 minutes apart on 8th March 1991 are shown in figure 2. A very similar pair of discrepant spectra were also obtained for Antilochus. Recent photometry by Binzel (R.B.Binzel, private communication) indicates that both of these

objects have a rotation period of at least 12 hours. A variation due to surface properties would not thus be expected with a timescale of 90 minutes. Comparison of the abnormalo spectra with the spectra of K0-K4 stars as presented by Margon (1991) shows a very similar set of absorption features and a possibility is therefore contamination by such a star being present in

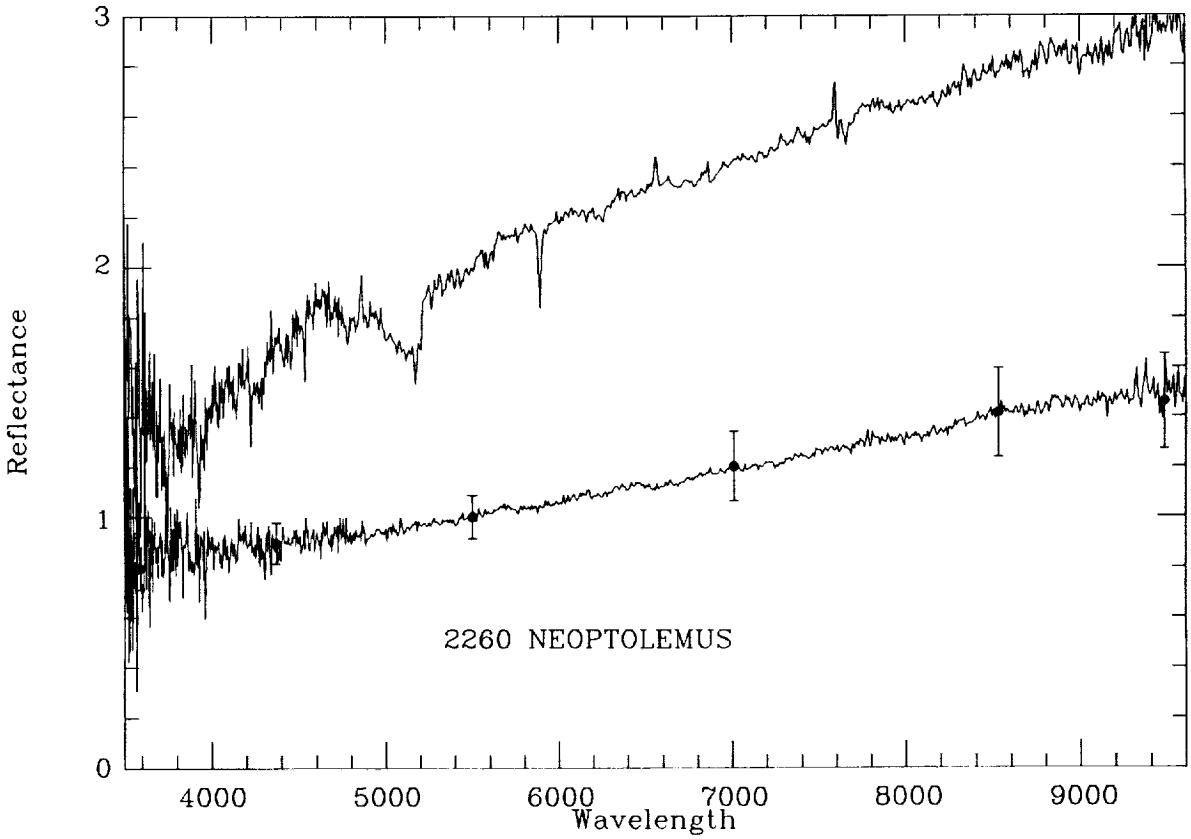

Figure 2. Spectra of 2260 Neoptolemus obtained on 8th March 1991. The upper spectrum has been shifted upwards by unity to ease comparison. Photometric points are taken from the ECAS database.

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the slit of the spectrograph. However there was no evidence for such a star being present in the TV finder screen on any of the exposures and neither was there evidence for a secondary source in the original two-dimensional image. We also note that Jewitt and Luu (1990) possibly observed a similar feature at about 5100Å in the Trojan asteroid 1988by1. If contamination turns out to be the correct interpretation, it shows that more care than has hitherto been taken by observers is necessary to eliminate overlapping stars. Inspection of the field and of the CCD chip before reduction may not be adequate.

ACKNOWLEDGEMENTS

AF and PM acknowledge support from the Science and Engineering Research Council. CIL and MD acknowledge support from the Swedish Research Council. The authors would like to thank the staff of the Observatorio de Roque de los Muchachos on La Palma for their help and guidance during the observations.

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