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Multiband photometry of asteroid 596 Scheila after its December 2011 outburst

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Abstract

An unexpected dust cloud was identified around asteroid 596 Scheila on early December 2010 [1]. Our team has been monitoring its photometric behavior in order to get clues on the nature of the outburst, and the obtained results support that the dust cloud was generated by an impact as recently suggested [2].

1. Introduction

It is now well known that some asteroids experience activity periods in which their brightness increases significantly [3]. Identification of a new population of Main Belt comets opens the possibility to detect photometric outbursts in bodies previously identified as asteroids [4]. Our team keeps an eye into primitive objects with volatile-rich interiors that could exhibit outbursts when exposed to solar irradiation by different physico-chemical processes, including impacts. We heard with great interest about the dust cloud around asteroid 595 Scheila detected by the University of Arizona's Catalina Sky Survey on Dec. 11, 2010 [1]. We started observations with different instruments in order to study the effect that the dust cloud causes on the 10 arcsec photometric window that we are usually using for accurate follow-up of the activity of primitive solar system objects [5]. In the discovery images, it was first reported that the cloud increased the V band luminosity in 0.8 magnitudes, so the effect was not insignificant. This event could be used to calibrate our capabilities due to the likely collisional origin of this outburst, and the relative absence of volatile components in the object [2]. Our monitoring involved small to medium-sized telescopes to trace the capability of detecting such events in the future (Table 1).

2. Observations and data reduction

We performed multi-band photometry in different Johnson-Kron-Cousin standard filters for a standardized 10-arcsec aperture in order to notice subtle changes in the luminosity of 596 Scheila. Images in each filter were calibrated using standard stars given by the Landolt and Stetson calibration fields, in a similar way as was implemented in our recent paper on the 2008-2010 29P/Schwassmann-Wachmann monitoring [5].

Observatory (MPC code)	Instrument
Gualba, Barcelona (442)	SC 36.0 f/7
Guadarrama, Madrid (458)	SC 25 f/10
La Cañada, Ávila (J87)	RCT 40.0 f/10
Teide, IAC80	C 82.0 f/11.3

Table 1. Observatories involved in SW1 coverage.

The data obtained from December 2010 until April 2011 are shown in Figure 1, but our monitoring still continues. The results are discussed in Section 3.

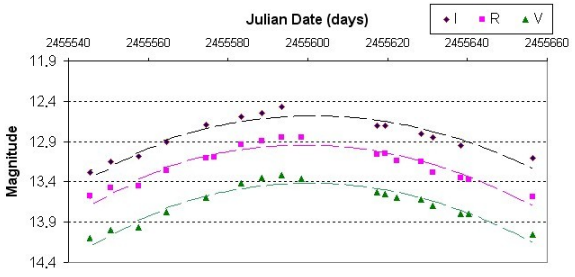

Figure 1: JKC multiband photometry obtained for a 10 arcseconds standardized aperture of 596 Scheila.

3. Preliminary results

Only the first two observations made on JD 2455545.5 and 2455550.5 (on Dec. 15 and 20, 2010) exhibit a clear increase over the predicted asteroidal magnitude. This can be shown on Figure 1 where a fit to the points obtained after Dec. 27, 2011 leaves the first two observations slightly over the fit. This is particularly evident for R and V bands as we should expect for scattering produced by μm-sized dust grains. In general the observed variations were about 0.2-0.3 magnitudes in the V and R bands in these mid-December observations. We considered the usual photometric variations of this asteroid due to its spin that can be photometrically traced during consecutive nights as its period is about 15.8 hours. Consequently, the magnitude increase was detected, and as by-product our data rules out any type of secondary or remnant activity.

3. Summary and Conclusions

We are conducting a monitoring program of ground-based photometry of suspicious dormant comets, and Centaurs by using standard Johnson-Cousin filters. Exposures are usually taken to achieve good signal/noise ratios in order to determine the presence or absence of cometary activity from the FWHM statistics and photometric curves. In the framework of such a program we decided to follow the evolving magnitude of 596 Scheila after its punctual outburst occurred on Dec. 2010. Taking into account the usual photometric variations of this asteroid due to its rotation, our data rules out any type of secondary or remnant activity. Consequently, the most likely explanation for the outburst is an unique event, probable associated with the proposed collisional excavation of 596 Scheila by a small asteroid [2].

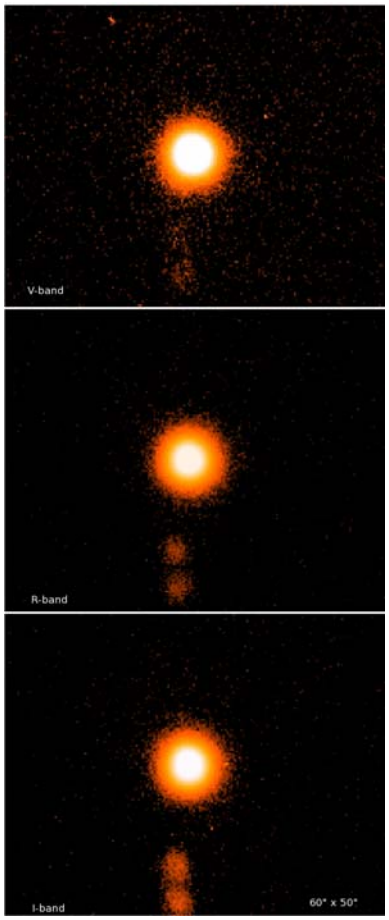

Figure 2. 596 Scheila imaged on Dec. 20, 2010 in the VRI bands by using the IAC80 telescope.

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