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The Outburst of the Main-Belt Asteroid 596 Scheila

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Abstract

During survey main belt asteroid 596 Scheila was discovered to have a cometary appearance on 2010 Dec. 11.4 UT (IAUC 9188) as part of the Catalina Sky Survey for NEOs. Archived survey images indicate that the outburst started not long before 2010 Dec. 3 when it was more than 1.3 magnitude brighter than normal, but with little, if any discernable dust cloud. The evolution of the dust cloud was consistent with the ejection of dust blown back by solar radiation pressure. It had all but dissipated by the end This would most likely have been the result of an impact of a relatively small asteroid.

1. Introduction

During the course of surveying for near-earth objects by the Catalina Sky Survey, the main belt asteroid 596 Scheila was found to have a cometary-like coma. Normally, known asteroids are identified so that the observer does not have to waste time validating their reality in the four images in a typical survey sequence. In this case, the coma offset the brightness centroid enough that the software did not identify it with 596 Scheila. The observer (SL) on the 0.7-m Catalina Schmidt (MPC 703) spent a few minutes checking to see if it was a known comet before realizing that it was moving the same rate and direction as 596. A request of the Mt. Lemmon 1.5-m to get a sequence before twilight was carried out successfully confirming the morphology of the coma., and an announcement was immediately sent out to alert the community [3].

Minor planet 596 Scheila was discovered by August Kopff at the Heidelberg Observatory on 1906 February 21. Its orbit has a major axis of 2.93AU, eccentricity of 0.16, and inclination of 14.7 degrees. It is 113 km in diameter with a rotation period of 15.8h [4]. At the time of outburst, it was 3.1 AU from the sun, and inclined out of the ecliptic plane by about 0.8 AU.

2. Evolution of the Dust Cloud

Inspection of archived images of 596 Scheila showed no activity, except that on 2010 Dec. 3.4UT, it was 1.3 magnitudes brighter than usual and had a symmetric point spread function slightly larger than field stars.

As Figure 1. shows, the dust cloud had three components: a broad, bright arc coming off the north-east direction before curving back into the anti-solar direction to the west; a thinner, narrow arc coming off to the south and curving towards the southwest; and a linear “spike” pointing west in the anti-solar direction. The main difference between Dec. 11 and 15 is that more dust was driven back into the “tail”. By 2011 Jan. 14 UT, the features became very faint and elongated in the anti-sunward direction. Also, the sunward extent of the dust was diminished.

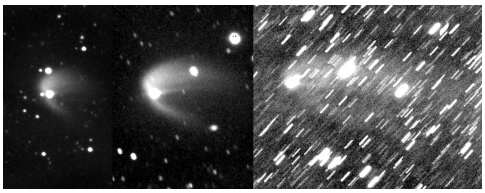

Figure 1. The evolution of the dust cloud on 2010 Dec. 11 UT (left), Dec. 15 UT (middle) and 2011 Jan. 14 UT (right). They were all taken unfiltered with the Mt. Lemmon 1.5-m telescope. North is up, and east to the left. The sun to the left, and the phase angle was 16 to 10 degrees (left to right). The images are coadds of 4, 30 and 100 images (left to right) each of 20 seconds exposures tracked on Scheila. No image enhancement has been applied to these images.

3. Main Belt Comets

Before this, there were six known main belt comets [2], all less than 5km in diameter – much less than Scheilas 113km. They may have been collisionally activated – especially P/2010 A2 [1]. 596 Scheila had all the appearance of a comet, however, it showed no cometary emissions in spectra obtained with the 6.5-m MMT, Palomar 5-m (M. Hicks, private communication), or IRTF (Howell, private communication). The "coma" was dust replecting sunlight. Plus, there was no obvious sustained activity that might be expected from an endogenic source. The long duration tail "spike", presumably made of larger particles that just reached escape velocity, was largely dissipated by mid-January. The simplest explanation is an impact of a small, unseen asteroid, although it would seem to be a rare event given that Scheila was about 0.8 AU out of the ecliptic.

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References

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