EPSC Abstracts
Vol. 7 EPSC2012-493 2012
European Planetary Science Congress 2012


# Centaur 29P/Schwassmann-Wachmann 1: photometric activity during 2012

**J.M. Trigo-Rodríguez** (1), D.A. García-Hernández (2,3), D. Rodríguez (4), A. Sánchez (5), and J. Lacruz (6)
(1) Institute of Space Sciences (CSIC-IEEC), Campus UAB, Fac. Ciencias, 08193 Bellaterra, Barcelona, Spain, (trigo@ieec.uab.es / Fax: +34-935814363) (2) Instituto de Astrofísica de Canarias (IAC), La Laguna, Tenerife, Spain, (3) Depto. Astrofísica, Universidad de La Laguna (ULL), E-38205 La Laguna, Tenerife, Spain, (4) Guadarrama Observatory, Madrid, Spain, (5) Gualba Observatory, Barcelona, Spain, (6) La Cañada Observatory, Ávila, Spain;

## Abstract

We discuss here the importance to keep a continuous follow up of Centaur 29P/Schwassmann-Wachmann 1 (hereafter SW1). This object exhibits continuous changes in its coma appearance and brightness. After more than a decade of continuous photometric monitoring, our team wish to promote further studies to better understand the physico-chemical processes that are triggering its outbursts. The inferred pristine nature could make successful any future exploration mission to this Centaur.

## 1. Introduction

Centaurs, suggested to be transition objects scattered from the Kuiper Belt, probably escaped significant irradiative heating and impact processing being objects of significant astrobiological interest. These bodies located so far away from the Sun have surface temperatures below the sublimation of water ice so their inner structure should remain probably unaltered. Detection of cometary outbursts could be a good way to remotely identify good candidates to be sampled by future space missions. In this sense, SW1 is a great candidate to be carefully considered as we discussed in [1, 2, 3]. The unpredictability in the activity of this comet is well exemplified in the 2012 photometric data collected so far by our team.

## 2. Observational data

We have continued during 2012 our continuous follow-up of Centaur SW1 from different observatories listed in Table 1. By performing multi-band photometry in different Johnson-Kron-Cousin standard filters for a standardized 10-arcsec aperture we are able to notice subtle changes in SW1 activity. Images in each filter are 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 SW1 monitoring [3].

| 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. Main observatories involved in SW1 follow up.

During 2012 our target experienced a series of moderate outbursts reaching about +14 magnitude on Feb. 20th, 2012, and May. 1st, 2012. It is more precisely shown in Julian Dates (JD) 2455978.4, and 2456049.3 (Fig. 1). The first of them is shown in Fig. 2 where two images taken on consecutive nights nicely exemplify the chameleonic change in comet brightness and appearance during an outburst.

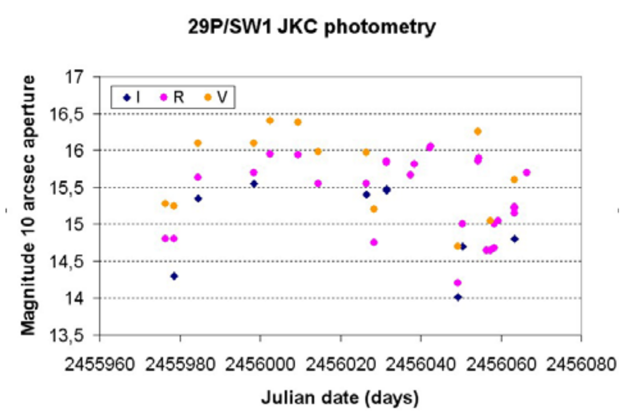


Figure 1: February to May 2012 JKC multiband photometry of 29P/SW1 obtained for a 10 arcseconds standardized aperture.

## 3. Discussion

A continuous follow-up of the photometric variations allows assessing the amount of dust released from the nucleus. It also helps to understand the role of solar activity in triggering cometary outbursts. In fact, the active Sun has produced significant flares that so far have not affected the activity of this comet. In any case, we plan to keep our standardized photometry for a 10 arc-sec nuclei-centered surface. V, R, and I filters of the Johnson-Kron-Cousins system are used, and accurately calibrated using standard Landolt stars. As we proposed in [2], we think the massive release of large (optically-thin) particles from the surface at the time of the outburst is the triggering mechanism to produce the outburst, and this can be announced by an early increase in the I magnitude. It seems that the sublimation of such ice-rich particles during the following days induces fragmentation, generating micrometer-sized grains that increase the dust spatial density to produce the outburst in the optical range due to scattering of sun light. When a massive ejection of dust takes place, the dust leaving the nucleus adopts a fan-like shape, formed by micrometer-sized particles, that is decaying in brightness as it evolved outwards. Such an overall picture requires confirmation by other techniques that we want to promote.

## 4. Summary and Conclusions

Cometary outbursts are produced by the release of comet particles from active regions in the nucleus and their later disintegration in the coma [3]. The 2-3 days decay of particles into μm-sized dust is probably driven by CO sublimation [4] and suggests that SW1 is a pristine comet, similar to fine-grained materials collected by Stardust mission from 81P/Wild 2 [5]. Additional studies of the magnitude increase and decay, plus spectroscopic observations could provide additional insight into the sublimation processes. As a by-product of SW1 monitoring we plan to predict future outbursts in order to have enough time to perform accurate spectroscopy with larger instruments.

## Acknowledgements

IAC-80 telescope is used under the Spanish IAC CAT Service Time. JMTR acknowledges support from the Spanish Ministry (project AYA2011-26522) and CSIC (grant #201050I043).

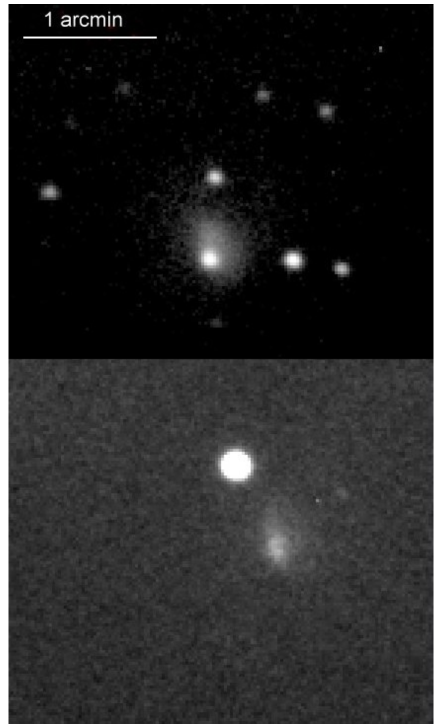


Figure 2. SW1 imaged on May 15.869 (top) and May 18.893 (bottom, during outburst) from MPC442.

## References

[1] Sekanina. Z. The problem of split comets in review. In Comets (L.L. Wilkening, ed.), pp. 251-287, 1982.

[2] Trigo-Rodríguez J.M. et al. Outburst activity in comets: I. Continuous monitoring of comet 29P/SW1. Astron. & Astroph. 485, 599-606, 2009.

[3] Trigo-Rodríguez J.M. et al. Outburst activity in comets: II. A multiband photometric monitoring of comet 29P/SW1. Mon. Not. Roy. Ast. Soc. 409, 1682-1690, 2010.

[4] Gunnarsson M. Icy grains as a source of CO in comet 29P/SW1. Astron. & Astroph. 398, 353-361, 2003.

[5] Brownlee D. Comet 81P/Wild 2 under a microscope. Science 314, 1711-1716, 2006.