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Monitoring the outburst of comet 29P/SW 1

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Abstract

We present an analysis of the dynamic dust coma of Centaur 29P/Schewassmann-Wachmann 1. This distant comet has exhibited a considerable level of activity (so-called outbursts) since its discovery in 1925. During the outburst stage, the morphology of comet P/SW 1 showed dust features in the form of jets, spirals and shells. We have obtained R-band CCD images of P/SW 1's dust coma from early 2011 to the present time using the Lulin 1-m and Tenagra II telescopes. In this study, we will present preliminary results including the morphological analysis and the behavior of the dust coma.

1. Introduction

The Centaur 29P/Schwassmann-Wachmann 1, hereafter P/SW 1, discovered on November 15, 1925, by A. Schwassmann and A. A. Wachmann moves along a near-circular orbit with an orbital period of 14.9 years[1]. The comet is unusual in that while normally hovering at around 16th magnitude, it could suddenly undergo an outburst. So far, there is no clear sign of periodicity in the detected outbursts[2]. Trigo-Rodriguez et al (2010) [3]. detected 28 outbursts during their 2002-2007 observational campaigns. The outbursts might sometimes increase the visible brightness of P/SW 1 by 1 up to 4 magnitudes, fading within a week or two [4].and the outburst happens with a frequency of about 7.3 per year[3]..

2. Observation

Two telescopes have been used to perform the long-term monitoring observations (see Table 1). The first one, labeled L in Figure 1, is the 1-m telescope at Lulin Observatory, in Taiwan. The other one, labeled T, is the 80cm telescope at Tenagra Observatory, in Arizona. In the beginning, we applied for the observing time when we received the outburst alert. Unfortunately, the weather in the last six months was not good for observing this target at Lulin and we didn't get any data in February and May, 2012. At the Tenagra observatory, the weather there was good for doing monitoring program. However, we still missed some nights in the late-February, 2012 due to an instrument problem.

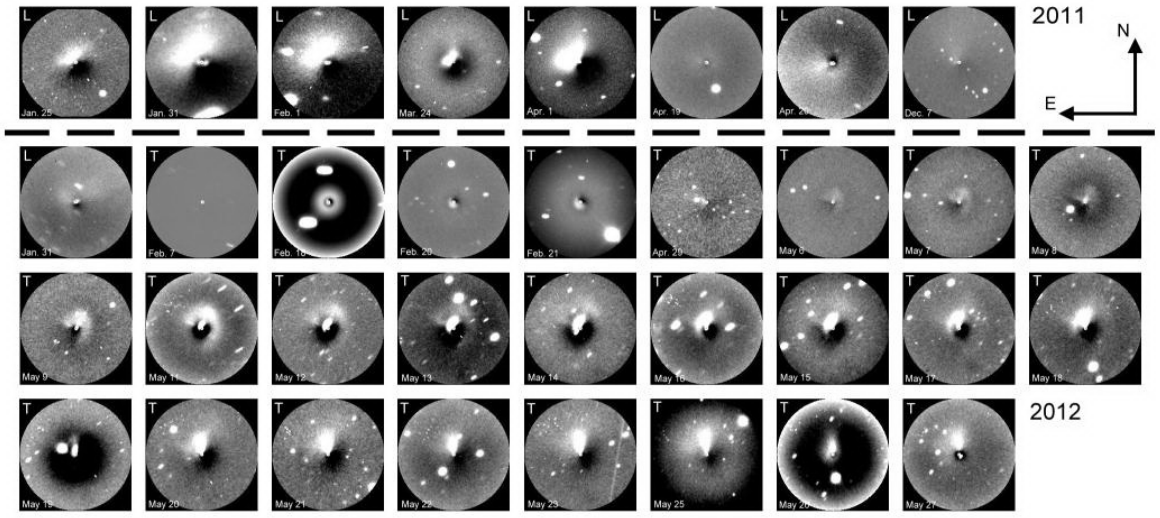

Figure 1. Ring-masking images obtained by subtracting the original images from the azimuthal average profile taken from early 2010 to late-May, 2012. The field of view is 1.13'x1.13' in Tanagra's images and 1.72'x1.72' in Lulin's images. Note: the images starting on April 29, 2012 have been all obtained from the Tenagra observatory. Label "T" referred to Tenagra II, and "L" is obtained by Lulin 1-m telescopes.

Table 1: Observatories and instruments

Observatory	Instrument	Telescope	Pixel size
Lulin	PI 1300B	1-m	0.516”
Tenagra	SiTe	0.8-m	0.34”

3. Coma morphology and light curve

Figure 1 shows the dust features revealed by subtracting the azimuthal average profiles from the cometary coma. From our observations, there are three types of coma behaviors, First, there could be intervals when no outgassing activity could be seen , and the comet appeared to point-like source (see Fig 2a). Second, P/SW 1 could be characterized as being surrounded by weak coma (see Fig. 2b.). Finally, the comet underwent outburst forming jet or fan-like features (see Fig. 2c). In Figure 1, we list some selected images to illustrate the appearance of the coma behaviors. As can be seen, fan structures were found in early 2011 (Lulin) and early-May 2012 (Tenagra II). The clockwise movement of such fan features would allow to estimate the rotational period and the projected velocity of dust particles.

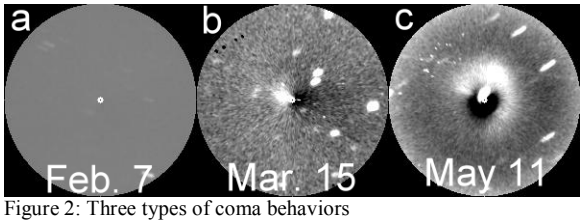

Figure 2: Three types of coma behaviors

In total, we observed 4 outbursts during quiet time in Figure 1 without showing the images.

(1) from January 25 to April 1, 2011
(2) from February 18 to February 20, 2012
(3) from May 9 to May 12, 2012
(4) from May 15 to May 20, 2012

The magnitude increase could reach Δm=2. Figure 3 shows the light-curve of one double-peak outburst which appeared abruptly on May 9 and slowly decayed until the occurrence of the second outburst of smaller magnitude. The total time interval is 20 days This pair of together has the physical property of the Case Two events classified by Trigo-Rodríguez (2010)[3]

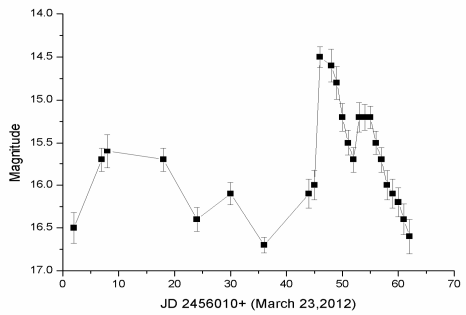

Figure 3: The time variation of the R-band magnitude estimated within a radius of 10 pixels from the optocenter of the cometary coma using the Tenagra II telescope.

4. Conclusions

From our monitoring program of P/SW 1 at Lulin observatory, Taiwan and the Tenagra observatory, Arizona, ISA in 2011 and 2012, we found three types of coma activities, having absence of coma, weak outgassing, and outbursts. In total, four outbursts could be indentified with major one taking place between May 9 to May 12, 2012. The time interval from a sudden rise to decay is 4 days.

In future, we will estimate the mass content and some mechanism of these outbursts.

Acknowledgements

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