

# ASSA Observations of Comet 9P Tempel 1

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## Background

Comet 9P Tempel 1 was discovered by Ernst Wilhelm Tempel on 1867 April 3.9. It was then determined to be of short period with an orbital period of 5.68 years. The comet made close approaches to Jupiter in 1881, 1941 and 1953, ultimately changing the orbital period to the current 5.50 years. This period means that the comet makes alternate favourable and unfavourable apparitions, with favourable apparitions separated by almost exactly 11 years. Thus in 1994 comet 9P reached magnitude 9.5, and close approach to earth on May 5 at  $\Delta=0.68$  AU. In 2005 the apparition was similar with close approach on May 3 at  $\Delta=0.71$  AU

and perihelion on July 5. In addition, the comet was identified as a suitable candidate for the NASA Deep Impact mission, in which a 370kg impactor was programmed to penetrate the nucleus of the comet. This paper compares the ASSA observations of both 1994 and 2005 apparitions, and the visible effects of the impactor.

## Results

The light curve of the 1994 and 2005 apparitions is shown in Figure 1. The 1994 data is based on 5-day means from the observations reported in the *International Comet Quarterly* (ICQ) and

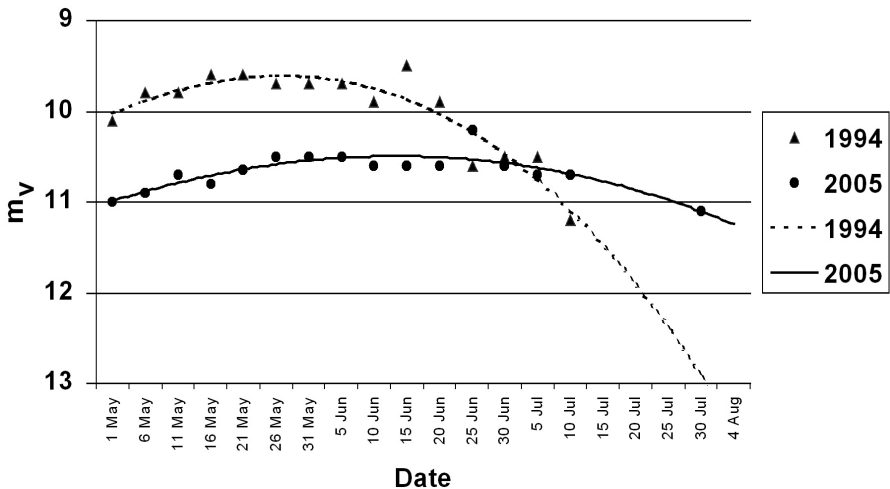


Figure 1. Light-curve of comet 9P in 1994 and 2005.

presented at the 1996 ASSA Symposium in Bloemfontein (Cooper 1996). Similarly, for consistency, the 2005 data is based on 5-day means from global data reported in the ICQ. The results of the following ASSA observers are included in this data: Mike Begbie (BEG01), Magda Streicher (STR03), Koos van Zyl (VAN15) and Tim Cooper (COO02).

The 2005 curve is based only on telescopic observations. While many observers initially observed the comet telescopically, some changed mid-apparition to binoculars after some discussion over the Internet. The binocular observations were consistently brighter than the telescopic ones, and only the latter were used here for consistency. Based on Figure 1 it appears comet Tempel 1 was about a magnitude fainter at the 2005 apparition, reaching only about magnitude 10.5 compared to about 9.5 in 1994.

The appearance of the comet was not

substantially different between the two apparitions. The degree of condensation of the coma (DC) is shown in Figure 2. It should be born in mind that DC measurements may show considerable scatter depending on the observer, conditions and instrument. Hence these results should be seen as a general trend rather than a definitive measure of the coma morphology. Again only telescopic measures were used, with binocular observations generally leading to a much higher degree of condensation.

Inspection of Figure 2 shows a similar decrease in condensation of the coma at both apparitions, from moderately condensed around date of closest approach to Earth (early May) to little condensed around and after date of perihelion (early July). Indeed, many observers in 2005 reported little evidence of condensation at all around time of perihelion, the comet appearing as a faint diffuse smudge.

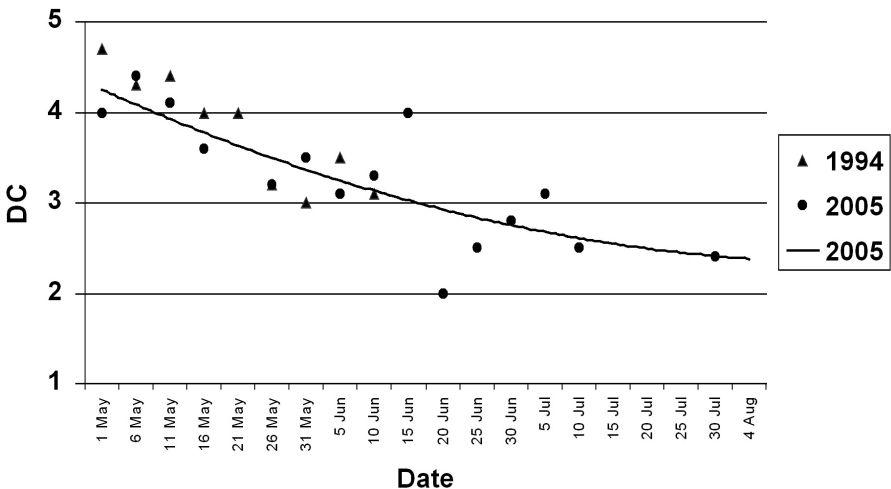


Figure 2. Degree of condensation of the coma (DC) of comet 9P in 1994 and 2005.

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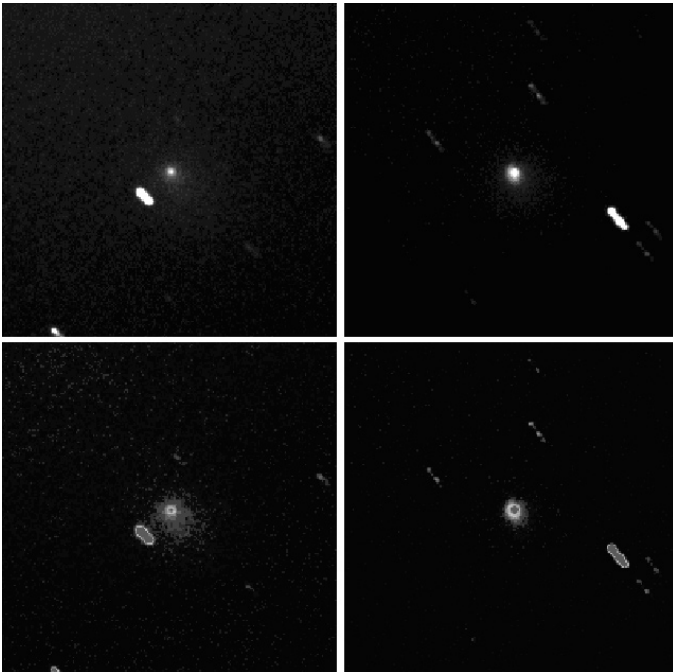
## Comet impact

The Deep Impact probe was programmed to impact the nucleus of comet Tempel 1 early on the morning of July 4 (UT). The comet was not visible from southern Africa at the time of impact, and was only visible after sunset, some 11 hours later. It is thus useful to compare the appearance of the comet on the evenings of July 3 to 5.

The appearance before and after impact can be well seen in the images by Mauritz Geyser in Figure 3. These images are a good representation of the visual difference too, as evidenced by the following descriptive observations:

Jul. 3.70: comet at limit of visibility, no size measurement attempted

[COO02]. Jul. 3.87: very difficult object in 6.0B x15, increasingly diffuse, in 20cmL f/9 x72, even more difficult, with little or no central condensation obvious [BEG01]. Jul. 4.70: more easily visible after impact, not much brighter but central condensation more prominent and coma more condensed [COO02]. Comet easily visible, central condensation bright and larger, about 30 arcseconds, faint fan shaped tail visible [STR03]. Jul. 4.76: coma seems smaller, but with a higher surface brightness, detection is possible without averted vision [VAN15]. Jul. 4.83: comet no brighter than observation earlier in evening [COO02]. Jul. 5.72: comet is back to 'normal',



**Figure 3.** Comet 9P imaged by Mauritz Geyser (Eta Carina Observatory, Pretoria) with a SBIG ST7 CCD camera attached to a 20-cm f/5 SkyWatcher Newtonian. Each image is a composite of fifteen 7-second exposures taken on July 3.7 (left pair) and July 4.7 UT (right pair).

surface brightness slightly fainter than before Deep Impact [VAN15]. Jul. 5.77: coma is again very diffuse, central point very faint and inconspicuous, comet has returned to its pre-impact appearance [COO02]. Jul. 5.80: coma displayed a more condensed central condensation, almost but not quite stellar, with the faint outer coma much the same as before, except that it is asymmetrical, slightly extended in p.a. 110 degrees [BEG01]. Jul. 8.82: difficult object again, comet has returned to the diffuse appearance that it had before the impact, and coma appears spherical with no sign of extension [BEG01].

These observations and Table 1 indicate a marginal increase in brightness and a perceptible increase in condensation of the coma after impact, but a rapid return to the pre-impact appearance thereafter.

### Conclusion

Despite similar circumstances Comet 9P Tempel 1 was observed to be fainter at its 2005 apparition, but with similar

**Table 1.** ASSA observations of comet 9P.

July UT	$m_v$	DC	Observer
03.70	11.6	1-2	COO02
03.72	10.9	0	VAN15
03.85	11.1	2	STR03
04.70	11.2	6	COO02
04.70	11.0	5	STR03
04.76	10.6	1	VAN15
05.72	11.2	0	VAN15
05.77	11.4	1	COO02

coma morphology, than in 1994. A marginal increase in brightness but distinct increase in condensation was observed as a result of the Deep Impact event. The comet returned to its pre-impact appearance in less than 48 hours after the impact.

### Reference

Cooper, T.P. (1996) Recent Comet Observations from southern Africa. *MNASSA*, 55, 126.

### ASSA website

The ASSA website has a new URL:

<http://assa.saao.ac.za>

The old URL is still valid but will be phased out by the end of 2006. The SAAO continues to host the site on their server, and Ms Veronique Kazie-Ravat & Dr Luis Balona are thanked for their support and patient assistance.

Gerrit Penning (ASSA Bloemfontein Centre) will take over as ASSA Webmaster from Auke Slotegraaf in mid-2006.