On the activity of comet 119P/Parker-Hartley in 1986

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Abstract. The periodic comet 119P/Parker-Hartley, discovered on March 2, 1989 at Siding Spring, was identified as 1986 TF, an object reported as a minor planet by both the Kleť Observatory and Brorfelde. While P. Jensen reported in 1989 that the object is slightly diffuse compared with images of other minor planets, no report came from the Kleť Observatory. The re-analysis of plates from the Kleť archive shows evident coma indicating cometary activity before perihelion.

Key words: comets – cometary activity

1. Introduction

In 1986, P. Jensen at Brorfelde discovered object 1986 TF, for which a Hilda-type orbit was computed (Marsden, 1986). This object was independently discovered by A. Mrkos at Kleť. No cometary activity was detected in 1986.

On March 4, 1989 R.H. McNaught, Siding Spring Observatory, reported that Q.A. Parker and M. Hartley had discovered a comet on an R plate taken by Parker with the 1.2-m U.K. Schmidt Telescope on March 2, 1989 (McNaught, 1989). S. Nakano identified P/Parker-Hartley as 1986 TF, an object reported as a minor planet by both Mrkos at Kleť and Jensen at Brorfelde (Nakano, 1989). On March 9, 1989 Jensen reported that further inspection of his 1986 plates showed that the comet's images are slightly diffuse compared with images of other minor planets on the same plates. The comet showed no sign of central condensation or tail (Jensen, 1989). No further analysis of 1986 images have been made at Kleť so far.

2. Analysis of 1986 TF

We re-analysed images of 1986 TF = 119P/Parker-Hartley on a plate obtained in the course of the Kleť photographic search programme for minor planets on 1986 September 29 (Tichá *et al.*, 1998, 1999). This image was taken with a 0.63-m f/3 Maksutov telescope using an ORWO ZU-21 plate and 20 + 20 minutes double-exposure. The magnitude of object was $m_B = 16.5^m$, total daily motion was 0.19° in p.a. 246°, heliocentric distance 3.42 AU and geocentric distance 2.43 AU.

We scanned the plate using a scanner UMAX Astra 1200S at 600 dpi and 10-bit grayscale. The image of 1986 TF was compared with those of three nearby stars of similar brightness. We used only the image from the second exposure, because there is a star involved with the first image. The pixel size of the scanned image is 4.71 arcsec.

For numerical description of the object profile we adopted two models. In model A we fitted a two-dimensional, elliptical Gaussian equation to the data:

$$F(x,y) = B + P\exp\left\{-\frac{1}{2}\left[\left(\frac{x'}{\sigma_x}\right)^2 + \left(\frac{y'}{\sigma_y}\right)^2\right]\right\} \qquad (1)$$

where B is the background brightness and P is the peak value of the analysed object, and

$$x' = (x - x_0)\cos\varphi - (y - y_0)\sin\varphi$$

$$y' = (x - x_0)\sin\varphi + (y - y_0)\cos\varphi$$

are coordinates in the rotated coordinate system, σ_x and σ_y are widths of a Gaussian in the x' and y' direction, respectively, x_0 and y_0 are locations of the X and Y center, respectively, and φ is the rotation angle from the X axis, measured counter-clockwise. The X axis is in the R.A. direction, the Y axis is in the Decl. direction.

In model B we used an elliptical function with a correlation coefficient ρ, which can be used for representation of the deformations of the image:

$$F(x,y) = B + P\exp\left\{\frac{1}{1-\rho^2}\left[\left(\frac{x'}{\sigma_x}\right)^2 - \frac{2\rho x'y'}{\sigma_x\sigma_y} + \left(\frac{y'}{\sigma_y}\right)^2\right]\right\} \qquad (2)$$

Table 1. Parameters of the light distribution of 1986 TF and comparison stars in model A

object	B	P	σ_x	σ_y	x_0	y_0	φ
1986 TF	621	62	3.08	2.45	8.7	8.7	174.1°
star #1	624	106	2.25	1.98	9.5	9.0	0
star #2	615	146	2.41	1.95	8.3	8.6	0
star #3	617	151	2.47	1.97	9.4	8.1	0

Table 2. Parameters of the light distribution of 1986 TF and comparison stars in model B

object	B	P	σ_x	σ_y	x_0	y_0	ρ	φ
1986 TF	620	64	3.23	2.55	8.7	8.8	0.164	136.3°
star #1	624	106	2.25	1.98	9.5	9.0	0.035	0
star #2	615	147	2.41	1.95	8.3	8.6	-0.002	0
star #3	617	151	2.47	1.97	9.4	8.1	-0.004	0

3. Results

The image of 1986 TF is diffuse with a coma diameter about 50 arcsec. Results derived from model A and B are summarized in Tables 1 and 2, respectively.

In either model, the width of the Gaussian fit of 1986 TF is greater then those of comparison stars. Although the width in the X axis is affected by the motion of 1986 TF, the width in the Y axis is about 25% greater for either model. The magnitudes of comparison stars were from $m_B = 15.0^m$ to $m_B = 16.5^m$, the magnitude of 1986 TF was $m_B = 16.5^m$.

4. Conclusion

The image of 1986 TF is diffuse on plates taken at Kleť Observatory and Brorfelde. Therefore there is no longer a reason to present the comet 119P/Parker-Hartley as an asteroidal object in 1986.

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