

Comet Shoemaker-Levy 1991 a<sub>1</sub>

A report of the Comet Section

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Introduction

Comet Shoemaker Levy 1991 a<sub>1</sub>, later designated comet 1992 XIX was discovered by the Shoemaker-Levy team with the Palomar Schmidt on 1991 October 6.50 at photographic magnitude 16.5<sup>1</sup>. The first visual observations were not made until 1992 May when the comet emerged from solar conjunction. It moved to high northern declination, reaching 78°N at the end of June, before rapidly moving south. The brightness peaked at 7.8 in late July just before it reached perihelion. The last observations were made in early August after which it was too close to the sun for further observation. A photograph by Martin Mobberley appeared in the Journal<sup>2</sup>.

Table 1.

Orbital elements for Comet Shoemaker Levy 1992 XIX from 124 observations 1991 October 6 - 1992 July 21<sup>3</sup>.

Epoch 1992 August 6

T 1992 July 24.5069	w 145.2402 }	145.2344 }
q 0.836250	W 49.0506 } 2000.0	48.3499 }
1950.0		
e 0.999862	i 113.4979 }	113.4941 }

# Figure 1 #  
Orbital diagram

Table 2

Ephemeris for Comet Shoemaker-Levy 1991 a<sub>1</sub>

Magnitudes calculated from  $m = 8.4 + 5.0 \cdot \text{Log}(d) + 5.3 \cdot \text{Log}(r)$

Station: Latitude: 53.0°N Longitude: 0.0°W

Day	R.A.	Dec	Mag	D	R	Observable	Elong
	hh mm.m	dd.mm		A.U.	A.U.	hh.mm to hh.mm	dd
		1950.0					

1992 May

7/ 8	0 58.5	42.06	11.2	2.29	1.59	2.09 to 2.24	36
17/17	1 8.5	46.03	10.8	2.07	1.46	0.46 to 1.55	41
27/27	1 21.2	51.07	10.3	1.83	1.33	22.32 to 1.27	45

1992 June										
6/ 7	1	40.1	57.49	9.8	1.57	1.20	22.55 to	1.02	50	
16/17	2	18.7	66.51	9.2	1.32	1.08	23.16 to	0.46	54	
26/27	4	39.0	77.20	8.5	1.09	0.98	23.16 to	0.50	55	
1992 July										
6/ 7	10	1.9	71.02	8.0	0.93	0.90	22.57 to	1.13	55	
16/17	11	29.8	47.47	7.8	0.90	0.85	22.31 to	1.41	52	
26/27	11	54.2	25.11	8.1	1.01	0.84	22.03 to	22.49	49	
1992 August										
5/6	12	3.4	8.35	8.5	1.21	0.87	Not Observable		45	
15/16	12	7.4	-2.53	9.1	1.45	0.94	Not Observable		40	
25/26	12	9.7	-11.07	9.6	1.67	1.03	Not Observable		35	

# Figure 2 #  
Observing circumstances

Observations

One hundred and thirty four visual observations were received from 19 observers. The observers who contributed material are listed in Table 3.

# Figure 3 #  
Observed light curve

Table 3.

List of Visual Observers

John E. Bortle,	NY, U.S.A.
Robert Bullen,	Bognor Regis, West Sussex
Haakon Dahle,	Norway
Francisco Garcia Diaz,	Spain
Steve Evans,	Towcester, Northants
Werner Hasubick,	Germany
Guy M. Hurst,	Basingstoke, Hampshire
Jost Jahn,	Germany
Attila Kosa-Kiss,	Romania
Martin Lehky,	Czech Republic
Jose Carvajal Martinez,	Spain
Herman Mikuz,	Slovenia
Roy W. Panther,	Walgrave, Northampton
Mieczyslaw L. Paradowski,	Poland
Alfredo Jose Serra Pereira,	Portugal
Jose Ripero Osorio,	Spain

Jonathan D. Shanklin,  
David Storey,  
Tony Tanti,

Cambridge  
Witney, Oxfordshire  
Malta

### Magnitude observations

The variation in the brightness of the comet was analysed using the procedures described by Shanklin<sup>4</sup>. The initial analysis gave:

$$m_1 = 8.4 \pm 0.1 + 5.0 \cdot \log(d) + 5.3 \pm 0.7 \cdot \log(r)$$

The corrections applied to remove systematic observer variations are shown in Table 4. When the analysis is repeated with these corrections the variation in the brightness of the comet becomes:

$$m_1 = 8.4 \pm 0.1 + 5.0 \cdot \log(d) + 4.8 \pm 0.4 \cdot \log(r)$$

For this comet the computed aperture correction ( $0.0008 \pm 0.0004 \text{ mm}^{-1}$ ) was not statistically significant and it has not been applied to the light curve.

One hundred and eight of the observations also gave a coma diameter. A similar coma correction to that found for comet Levy<sup>5</sup> was found ( $-0.027 \pm 0.032 \text{ minute}^{-1}$ ), but again this was not statistically significant and has not been applied to the light curve.

Insufficient observations were obtained after perihelion to determine if the light curve changed significantly after closest approach to the sun.

# Figure 4 #  
Analysed light curve

Table 4. Applied magnitude corrections

Observer	Correction	Observations	Standard Deviation
Bortle	-0.5	20	0.2
Bullen	-0.1	3	0.2
Dahle	-0.4	4	0.3
Diaz	0.2	6	0.2
Evans	-0.1	4	0.1
Hasubick	-0.1	3	0.2
Hurst	-0.2	1	0.0

Jahn	0.7	4	0.1
Kosa-Kiss	0.5	4	0.2
Lehky	-0.1	14	0.3
Martinez	0.4	1	0.0
Mikuz	0.5	13	0.2
Panther	0.4	3	0.1
Paradowski	-0.2	4	0.3
Pereira	-0.0	5	0.1
Osorio	0.4	8	0.2
Shanklin	0.3	7	0.2
Tanti	-0.4	4	0.2

### Coma observations

The coma become steadily more condensed as the comet approached the sun, increasing from DC2 at 1.5 AU to DC5 at perihelion (0.8 AU). The coma diameter increased from around 2' to 5', but the main factor governing the coma diameter seems to have been the distance from the Earth. The comparatively small coma diameter and the moderate condensation, noted by many observers, is probably the reason why the aperture and coma corrections are not significant for this comet. Two observers reported jet activity in the coma on separate occasions, but these were not confirmed.

# Figure 5 #  
Observed coma diameter v time

### Tail observations

Visual reports of a short tail were received from several observers in late June and early July. Kosa-Kiss reported one on July 7th which is confirmed in a photograph by Fletcher. This shows a thin ion tail extending some 3' in pa 045, with a faint fan of material extending in the same direction.

### Photographic and CCD Observations

Few photographic observations were received, but some were published in the Journal<sup>2</sup> and TA<sup>6</sup>. A CCD frame taken by Mikuz on July 21st showed a straight, thread like ion tail extending 0.6 degrees in pa 093 and a fan like tail of 0.4 degrees in pa 093 - 170.

# Figure 6 #

## Photograph

Table 4. Photographic and CCD Observers

John R Fletcher (Photo)  
Martin Lehky (Photo<sup>6</sup>)  
Herman Mikuz (CCD<sup>6</sup>)  
Martin Mobberley (Photo<sup>2</sup>)

### Astrometric observations

The only astrometric observations of the comet were made by Jonathan Shanklin using the Cambridge University 0.45-m Schmidt. Positions obtained on June 27.99 and June 28.96 were published in the Minor Planet Circulars<sup>7</sup>.

Table 5 Astrometric observers

Observer	Location	IAU No.
J D Shanklin	Cambridge	503

### Comet Section observations

1992 June

Roy Panther was the first section member to pick up the comet, making it 9.5, DC2 and 4' diameter with his 0.35-m reflector on June 17th. Observing four days later, Robert Bullen made it 8.7 in his 0.21-m reflector.

1992 July

By early July the comet had brightened further and was now visible in binoculars; Tony Tanti observing from Malta made it 7.9, DC5 and 5' diameter on the 4th with 20x70B and a couple of days later Guy Hurst made it 7.8 with 15x80B, with David Storey making it a little fainter at 8.6 with 20x80B. Steve Evans, observing two days before perihelion made it 7.7 and 3' diameter with 7x50B. Jonathan Shanklin made the final section observation on July 27th, making it 8.3, DC4 and 2' diameter with the Thorrowgood 0.2-m refractor x40.

### Acknowledgements

Thanks are due to Guy Hurst for collating the observations for TA magazine<sup>6</sup> and supplying them in machine readable format.

## References

1. IAUC 5363, 1991 October 10
2. Mobberley, M. P., *Observer's Forum*. JBAA, 102, p 280 (1992)
3. Marsden, B. G., *Catalogue of Cometary Orbits*, 9th edition, IAU CBAT, (1994).
4. Shanklin, J. D., Comet analyses. JBAA, [Submitted/In press]
5. Shanklin, J. D., Comet Levy 1990 c. JBAA, [Submitted/In press]
6. Hurst G. M., *Comet Notes*. TA, Vol 29, Nos 338 - 342. 1992 June - 1992 October.
7. MPC 20371, 1992 July 14, MPC 20545, 1992 August 13

## Figure captions:

Figure 1. The orbits of comet Shoemaker-Levy 1991 a<sub>1</sub> and the earth, with symbols representing the various orbital elements.

Figure 2. The observing circumstances of comet Shoemaker-Levy 1991 a<sub>1</sub>. The comet was discovered at opposition at T-292, observations used in the analysis cover the range T-73 to T+10, with section observations made between T-37 and T+3.

Figure 3. The observed magnitude of the comet. The tick marks indicate the first of each month.

Figure 4. The magnitude of the comet corrected for systematic differences between observers and reduced to a distance of 1 AU from the earth, plotted against distance from the sun.

Figure 5. The observed coma diameter of the comet. The tick marks indicate the first of each month.

Figure 6. The comet photographed by *J R Fletcher* on 1992 July 6<sup>d</sup> 23<sup>h</sup> 03<sup>m</sup> with 0.25-m f6 reflector; exposure 100 seconds on TMax 3200.