

The Comets of 1995

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A Report of the Comet Section (Director: J. D. Shanklin)

This report is the sixth in the annual series^{1,2,3,4,5} which gives for each comet: the discovery details, orbital data and general information, magnitude parameters and BAA comet section observations. Further details of the analysis techniques used in this report are given in an earlier paper⁶. Ephemerides for the comets predicted to return during the year can be found in the BAA or ICQ Handbooks^{7,8}.

The reports of DC have become more consistent and it is hoped that the widespread use of the Section guide⁹ will improve this aspect of reporting further. The observation that some periodic comets do not follow the standard magnitude law should make predictions of the magnitude of these comets at future returns more accurate.

At the beginning of 1995 the IAU introduced a new numbering scheme for comets with newly discovered or returning comets allocated a letter and number depending on the half month of discovery. Periodic comets with well known orbits are now allocated a sequential number based on the date of determination of the orbit. This report follows previous practice and describes all comets allocated a discovery or recovery letter and number during the year, together with previously numbered periodic comets reaching perihelion during the year.

Table 1. Orbital data for the comets of 1995^{8,10}

Comet		T	q	e	P	ω	Ω	i
6P/d'Arrest		1995 7	27.3186	1.345815	0.614045	6.51 178.0475	138.9885	19.5236
15P/Finlay		1995 5	5.0418	1.035564	0.710306	6.76 323.5402	42.0480	3.6739
18D/Perrine-Mrkos		1995 12	6.0517	1.293160	0.638484	6.77 166.5301	240.6306	17.8323
29P/Schwassmann-Wachmann 1		1989 9	13.5043	5.757565	0.043305	14.8 46.6924	312.8212	9.3818
30P/Reinmuth 1		1995 9	3.3308	1.873605	0.502492	7.31 13.2906	119.7398	8.1292
41P/Tuttle-Giacobini-Kresak		1995 7	28.7984	1.065281	0.656364	5.46 61.6818	141.4964	9.2252
45P/Honda-Mrkos-Pajdusakova		1995 12	25.9845	0.532052	0.824243	5.27 326.0550	89.1545	4.2483
54P/de Vico-Swift		1995 4	9.4660	2.145450	0.430681	7.32 1.9290	359.0175	6.0961
58P/Jackson-Neujmin		1995 10	6.6057	1.381174	0.661418	8.24 200.3500	160.7184	13.4783
71P/Clark		1995 5	31.0972	1.552577	0.501967	5.50 208.8491	59.7232	9.5049
73P/Schwassmann-Wachmann 3		1995 9	22.8912	0.932733	0.694839	5.34 198.7713	69.9465	11.4234
77P/Longmore		1995 10	9.3201	2.398970	0.343060	6.98 195.7973	15.6559	24.4099
A1 P/Jedicke		1993 8	17.3790	4.082675	0.308139	14.3 295.9357	116.0167	19.8755
M1 118P/Shoemaker-Levy 4		1997 1	12.1152	2.021112	0.420517	6.51 301.9808	152.0967	8.4735
M2 119P/Parker-Hartley		1996 6	24.8017	3.045217	0.290596	8.89 181.0985	244.2260	5.1858
O1 Hale-Bopp		1997 4	1.1372	0.914144	0.995079		130.5886	282.4707
O2 120P/Mueller 1		1996 4	24.6661	2.739482	0.337378	8.41 29.9207	4.5613	8.7956
Q1 Bradfield		1995 8	31.4185	0.436388	0.998022		331.1616	178.0544
Q2 Hartley-Drinkwater		1995 8	2.7271	1.889153	0.966518	424 314.0000	300.7506	168.0075
Q3 121P/Shoemaker-Holt 2		1996 8	20.0450	2.664304	0.336728	8.05 6.1268	99.7199	17.6967
S1 122P/de Vico		1995 10	6.0232	0.658889	0.962738	74.4 12.9755	79.6173	85.3898
S2 123P/West-Hartley		1996 5	12.8961	2.132957	0.447784	7.59 102.9725	46.6660	15.3463
S3 124P/Mrkos		1996 11	9.0781	1.412898	0.554249	5.64 180.5222	1.6528	31.4708
Y1 Hyakutake		1996 2	24.2874	1.054614	1.000242		46.3489	195.7612

The epoch of the elements for each comet is the Julian Date ending in zero and exactly divisible by 40, closest to the date of perihelion, except for those of 29P, which is for 1995 July 2.

Table 2. List of visual observers

John Aldridge,	Cambridge
Sandro Baroni	Italy
Alexandr R. Baransky	Ukraine
Sally Beaumont	Windermere, Cumbria
Stephan Beck	Germany
John E. Bortle	U.S.A.
Reinder Bouma	The Netherlands
Eric Broens	Belgium
Robert Bullen	Bognor Regis, Sussex
Paul Camilleri	Australia
Matyas Csukas	Romania
Haakon Dahle	Norway
Jose Guilherme de Souza Aguiar	Brazil
Alfons Diepvens	Belgium
Bjoern Haakon Granslo	Norway
Stephen Getliffe	Haverhill, Suffolk
Werner Hasubick	Germany
Roberto Haver	Italy
Trond Hillestad	Norway
Guy M. Hurst	Basingstoke, Hampshire
Albert F. Jones	New Zealand
Andreas Kammerer	West Germany
Graham Keitch	Manaton, Devon
Attila Kosa-Kiss	Romania
Martin Lehky	Czech Republic
Romualdo Lourencon	Brazil
Oernulf Midtskogen	Norway
Herman Mikuz	Slovenia
Giannantonio Milani	Italy
Stewart Moore	Fleet, Hampshire
Charles S. Morris	U.S.A.
Brian O'Halloran	Co Tipperary, Ireland
R. M. Owens	Cardiff, South Wales
Alexei Pace	Malta
Roy W. Panther	Walgrave, Northampton
Mieczyslaw L. Paradowski	Poland
Jonathan D. Shanklin	Cambridge
Oddleiv Skilbrei	Norway
Christopher E. Spratt	Canada
David Storey	Carterton, Oxfordshire
Tony Tanti	Malta
Melvyn D. Taylor	Wakefield, Yorkshire
Steinar Thorvaldsen	Norway
Alex Vincent	Worthing, Sussex
Graham W. Wolf	New Zealand
Mauro Vittorio Zanotta	Italy

Observers who only contributed observations of 1995 O1 are listed in the report for that comet.

Table 3. List of astrometric, CCD and Photographic Observers

Observer	Site	IAU Station No
R F Blay	Ramsgate, Kent	
Bev Ewen-Smith	Portugal	965
Maurice Gavin	Worcester Park, Surrey	
Francisco Hernandez	Tenerife	
Nick James	Chelmsford, Essex	970
Stephen Laurie	Church Stretton, Salop	966
Steven Lee	Australia	
Terry Lovejoy	Australia	
Brian Manning	Stakenbridge, Worcs	494
Herman Mikuz	Slovenia	106
Martin Mobberley	Galleywood, Essex	477
	Cockfield, Suffolk	480
David Strange	Worth Matravers, Dorset	
Alex Vincent	Worthing, West Sussex	

Table 4a. Standard magnitude parameters of comets observed by the comet section.

Comet	No	ΔR AU	H1	dev	K1	H10	dev	H15	dev
O1 Hale-Bopp	(734)	0.9 - 8.1	-0.69±0.03	0.4	7.66±0.06				
Q1 Bradfield	119	0.4 - 2.2	7.1±0.0	0.5	7.1±0.3	7.1±0.1	0.6	7.0±0.1	1.3
Q2 Hartley-Drinkwater	1	1.9				9.3		7.9	
Q3 121P/Shoemaker-Holt 2	2	2.9				6.3±0.2	0.3	4.0±0.2	0.3
S1 122P/de Vico	327	0.7 - 1.9	7.1±0.0	0.4	10.6±0.3	7.1±0.0	0.4	7.7±0.0	0.5
S2 123P/West-Hartley	5	2.1 - 2.2				7.8±0.1	0.2	6.1±0.1	0.3
Y1 Hyakutake	99	1.1 - 1.4	7.3±0.1	0.4	4.6±1.4	7.1±0.0	0.4	6.9±0.1	0.5
6P/d'Arrest	139	1.3 - 1.9				9.0±0.1	1.6	8.3±0.1	1.6
29P/Schwassmann-Wachmann 1	9	6.2 - 6.3				1.0±0.2	0.5	-3.0±0.2	0.5
41P/Tuttle-Giacobini-Kresak	5	1.1				7.2±0.4	0.9	7.0±0.4	0.9
45P/Honda-Mrkos-Pajdusakova	49	0.5 - 1.3	10.7±0.1	0.8	11.1±0.8	10.7±0.1	0.8	11.0±0.1	1.0
58P/Jackson-Neujmin	20	1.4 - 1.6				11.1±0.4	1.7	10.3±0.4	1.8
71P/Clark	16	1.6 - 2.0				9.6±0.1	0.5	8.6±0.1	0.4
73P/Schwassmann-Wachmann 3	108	0.9 - 2.1	5.5±0.1	0.7	7.0±0.7	5.2±0.1	0.8	4.8±0.1	1.0

The magnitude of the comets can be calculated from the standard equation:

$$m = H1 + 5.0 * \log(\Delta) + K1 * \log(r)$$

For most comets there are insufficient observations to calculate K1 accurately and so a value of 10 or 15 is assumed, which gives the constant H10 or H15 respectively. Some comets do not follow the standard equation and are best fitted with a linear equation:

$$m = H1 + 5.0 * \log(\Delta) + K1 * \text{abs}(t - T + \Delta t)$$

where t is the Julian Date, T the Julian Date of perihelion and Δt an offset.

Some well documented CCD V observations have been used to augment the visual light curves. A correction for aperture of 0.0033 mm^{-1} and the observer corrections derived in previous papers^{11,12} have been applied and the H values are reduced to zero aperture. With a large aperture telescope a comet will appear fainter than the magnitude given by the equation. No comet had a sufficiently large coma to warrant including a coma correction. For Hale-Bopp the number of observations is the number of days with observations.

Table 4b. Linear magnitude parameters of comets observed by the comet section.

Comet	No	Days	H1	K1	ΔT	Dev
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6P/d'Arrest	139	-60 - 118	8.3±0.1	0.0563±0.0031	-52.8±1.9	0.8
58P/Jackson-Neujmin	20	-63 - 77	9.9±0.5	0.0415±0.0060	-72.9±11.1	0.8

The comets with recovery letter designations

P/1995 A1 (Jedicke)

Robert Jedicke of the Lunar and Planetary Laboratory, discovered comet 1995 A1 on January 8.4 with the 0.9-m Spacewatch telescope at Kitt Peak [IAUC 6124, 1995 January 9]. At discovery the comet was 19^m and it turned out to be a distant comet, with a period of 14.3 years, some 17 months past perihelion. When discovered it was retrograding on the border of Gemini and Cancer and nearing opposition; it would only have been a little brighter at the previous opposition. It has made no close approaches to Jupiter in the last 100 years.

118P/1995 M1 (Shoemaker-Levy 4)

James V Scotti of the Lunar and Planetary Laboratory, recovered comet Shoemaker-Levy 4 (P/1991 C2 = 1990 XII = 1991f) with the 0.9-m Spacewatch telescope at Kitt Peak on June 22.45 [IAUC 6180, 1995 June 28]. The comet was of stellar appearance and around 22^m. After recovery it was given the permanent number 118. Details of the discovery are given in the report for 1991.

119P/1995 M2 (Parker-Hartley)

The next night Scotti also recovered comet Parker-Hartley (P/1989 E1 = 1986 TF = 1989 XXXVI = 1989i). Confirming images were obtained by Jedicke two nights later [IAUC 6180, 1995 June 28]. After recovery it was given the permanent number 119. The comet was discovered after a close approach to Jupiter in 1984 put it into its present orbit.

C/1995 O1 (Hale-Bopp)

Alan Hale and Thomas Bopp discovered this celebrated comet in July 1995 [IAUC 6187, 1995 July 23]. It was one of the most spectacular comets in recent years and a full report will be published separately once it becomes too faint for amateur observation. At the time of writing there are 734 days with observations, spread over 1349 days and magnitude parameters over this interval are given for completeness.

Current information on the comet is available on the CBAT (<http://cfa-www.harvard.edu/cfa/ps/HaleBopp.html>), ESO (<http://www.eso.org/comet-hale-bopp/comet-hale-bopp.html>) or Section web pages. A preliminary report on the comet appeared as a TA Special Publication¹⁴.

120P/1995 O2 (Mueller 1)

James Scotti recovered comet Mueller 1 (P/1987 U2 = 1987 XXXI = 1987 a1) with the 0.9-m Spacewatch telescope at Kitt Peak on July 30.4 [IAUC 6199, 1995 August 3]. The comet was slightly diffuse and around 22^m. The prediction by S Nakano on MPC 22030 required a correction of -0.75 day. The comet, which was subsequently given the permanent number 120, made a moderately close approach to Jupiter in 1958. It is intrinsically quite faint and does not approach closer to the Earth than 1.7 AU.

C/1995 Q1 (Bradfield)

William A. Bradfield of Dernancourt, near Adelaide discovered his seventeenth comet, a 6^m object with a tail over 1° long, on August 17.4 [IAUC 6206, 1995 August 18]. The comet was in Crater, two weeks from perihelion, and was well placed for some time prior to discovery. The ephemeris suggests that it would have been within easy reach of amateur telescopes from June onwards, and could have been dimly seen with the naked eye in July.

Section observations span the period T-11 to T+115 days (ie 11 days before to 115 days after perihelion) running from August to December 1995. After moving into solar conjunction in early September, the elongation rapidly increased as the comet moved nearly due north through Leo and Ursa Major, then into Camelopardalus and Cassiopeia.

It was initially a Southern Hemisphere object and Albert Jones reported the first Section observation, making it 5.8 in 11x80B on August 20.32. It slowly brightened over the next 10 days until it was lost in the sun's glow, Graham Wolf making it 5.3 in 7x50B on August 30.28. Jonathan Shanklin recovered it after perihelion, making it 6.7 with a strongly condensed coma in 14x100B on September 23.19. It slowly faded and became less condensed, with Chris Spratt making the last observation on Christmas Eve, when it was 10.5 in his 0.20-m Schmidt-Cassegrain.

There is nothing unusual in the light curve to suggest why the comet was not discovered earlier, and this perhaps just suggests the lack of active comet seekers in the Southern Hemisphere. The coma diameter increased from around 3' at discovery to 13' at the time of closest approach to Earth in mid November. There is little significant change to the true diameter, which remained at around 300,000 km. The DC decreased from around 7 at the time of discovery and shortly after perihelion to around 1 when last seen.

Table 5. Ephemeris for comet Bradfield (1995 Q1)

Magnitudes calculated from $m = 7.1 + 5.0 * \text{Log}(\Delta) + 7.1 * \text{Log}(r)$

Latitude: 53.0°N Longitude: 0.0°W

Day	R.A.		Dec	Mag	Δ	R	Observable	Elong
	hh	mm.m	°mm		A.U.	A.U.	hh.mm to hh.mm	°
(2000.0)								
1995 May								
2/ 3	0	4.8	-9.47	12.0	2.91	2.32	Not Observable	46
12/13	0	14.9	-9.55	11.6	2.63	2.18	Not Observable	53
22/23	0	25.9	-10.19	11.1	2.33	2.03	Not Observable	60
1995 June								
1/ 2	0	38.0	-11.09	10.6	2.01	1.87	Not Observable	68
11/12	0	52.3	-12.37	9.9	1.68	1.72	Not Observable	74
21/22	1	10.5	-15.10	9.1	1.35	1.55	Not Observable	81
1995 July								
1/ 2	1	37.4	-19.45	8.1	1.02	1.39	Not Observable	86
11/12	2	28.0	-28.25	7.0	0.71	1.21	Not Observable	87
21/22	4	42.1	-42.25	5.7	0.49	1.03	Not Observable	78
31/32	8	45.3	-38.34	5.1	0.51	0.85	Not Observable	57
1995 August								
10/11	10	34.1	-21.50	5.2	0.74	0.67	Not Observable	41
20/21	11	9.1	-10.24	5.1	1.05	0.51	Not Observable	29
30/31	11	17.6	-1.04	5.2	1.33	0.44	Not Observable	14
1995 September								
9/10	11	15.4	7.22	5.9	1.51	0.50	Not Observable	2
19/20	11	12.2	14.32	6.8	1.56	0.65	Not Observable	16
29/30	11	10.6	20.57	7.5	1.54	0.83	3.40 to 4.37	30
1995 October								
9/10	11	9.9	27.24	8.0	1.49	1.02	2.28 to 4.55	43
19/20	11	8.8	34.30	8.4	1.41	1.20	1.03 to 5.12	57

29/30	11	5.7	42.51	8.7	1.32	1.37	17.59 to 23.03	18.05 to 5.29	71
1995 November									
8/ 9	10	56.7	52.48	8.9	1.25	1.54	17.42 to	5.45 to	86
18/19	10	32.3	64.09	9.1	1.21	1.70	17.29 to	6.01 to	101
28/29	9	15.6	75.14	9.4	1.22	1.86	17.21 to	6.15 to	115
1995 December									
8/ 9	5	30.4	79.33	9.8	1.30	2.01	17.17 to	6.27 to	123
18/19	2	53.9	73.17	10.3	1.44	2.16	17.18 to	6.35 to	125
28/29	2	9.2	65.35	10.8	1.64	2.31	17.24 to	6.39 to	121
1996 January									
7/ 8	1	55.6	59.15	11.2	1.88	2.45	17.34 to	6.39 to	114
17/18	1	52.9	54.24	11.7	2.14	2.59	17.47 to	3.30 to	106
27/28	1	55.3	50.47	12.1	2.42	2.73	18.02 to	1.39 to	98

Note: The observable period is defined for the given location as the time when the sun is below -13° altitude and the comet above an altitude that depends on its magnitude. The comet may be visible outside this period under good conditions or from a different location.

Fig 1 ###
Orbit Diagram

Fig 2 ###
Light curve

Fig 3 ###
Coma diameter

Fig 4 ###
DC

Fig 5 ###
Photograph by Alex Vincent

Fig 6 ###
Image by Martin Mobberley

C/1995 Q2 (Hartley-Drinkwater)

Malcolm Hartley discovered comet 1995 Q2 in Aquarius on a film taken by Michael J. Drinkwater with the 1.2-m U.K. Schmidt at Siding Spring on August 29.5 [AUC 6217, 1995 August 30]. The comet was at its brightest, a month past perihelion and at opposition on the border of Aquarius and Piscis Austrinus. Visually 13^m , the comet faded after discovery as it receded from the earth and sun. Only Charles Morris was able to view the comet, making it 12.9 in his 0.26-m reflector on September 3.2.

121P/1995 Q3 (Shoemaker-Holt 2)

Also on August 29, James Scotti of the Lunar and Planetary Laboratory recovered comet Shoemaker-Holt 2 (P/1989 E2 = 1988 XI = 1989j) with the 0.9-m Spacewatch telescope at Kitt Peak. The comet was of stellar appearance at 21^m [AUC 6219, 1995 September 1]. The prediction by Dan Green on MPC 22032 required a correction of -1.2 days. The comet was subsequently given the permanent number 121. It made a moderately close approach to Jupiter in 1984 and does not approach closer to the Earth than 1.7 AU.

Werner Hasubick made a couple of observations of the comet in early March 1997 when it was 14th magnitude in his 0.44-m reflector.

122P/1995 S1 (de Vico)

Three Japanese observers, Yuji Nakamura (Suzuka, Mie), Masaaki Tanaka (Iwaki, Fukushima), and Shougo Utsunomiya (Minamioguni, Kumamoto) made independent visual discoveries of a comet on September 17, which turned out to be the lost comet P/de Vico. All were using large binoculars of between 120 and 150 mm aperture. [IAUC 6228, 1995 September 18]. The comet was subsequently numbered 122. A prediction in the Journal by Richard J Buckley¹³ had given a predicted perihelion date of 1996 July 3 with an uncertainty of several years. The comet should have returned on 1922 April 8, but was not seen, despite the circumstances being relatively favourable.

Section observations cover the period T-18 to T+104 days. When discovered the comet was brightening rapidly towards perihelion, though would have been visible to Southern Hemisphere observers for a couple of months earlier. Generally it was at poor solar elongations, moving NW from its discovery in Hydra, through Leo and Coma, reaching its most northerly position in Canes Venatici. It then began to drift south, moving through Bootes and Corona Borealis and was last seen in Hercules.

The comet was initially an early morning object, and TA contributor Charles Morris reported the first observation on September 18.5, soon after discovery, when it was 6.5 in 20x80B, highly condensed with a 1° tail. As it moved north, UK observers were able to pick it up and Jonathan Shanklin sighted it on September 23.17 in 20x80B at 5.9. It was imaged by Nick James on 1995 September 29.19¹⁵. By perihelion on October 6 it was at its brightest and becoming widely observed. Roy Panther made it 5.4 in 7x50B on October 5.19 and observers in more favourable locations were estimating tail lengths of several degrees. By early November it was fading, but becoming visible in the evening sky, Robert Bullen estimating it at 6.7 in his 0.21-m reflector x64 on November 2.76. Visual observers lost the comet at the end of the month, Attila Kosa-Kiss making the last observation on November 27.72 when it was 9.2 in his 0.06-m refractor x52, with a weakly condensed coma. Herman Mikuz made a final CCD observation in mid January 1996 when it had faded to 14.6. Several images of the comet were published in TA^{16,17}.

The coma diameter increased from around 4' at discovery to around 6' a week after perihelion, decreasing back to 4' when last observed visually two months later. Some estimates were larger than this, over 10' in diameter being reported. The true diameter increased from around 200,000 km at discovery to perhaps 300,000 km in late October, before shrinking back again. The DC increased a little between discovery and perihelion from around 7 to 8. It then became steadily less condensed until it was around 2 when last observed visually. Tail development was maximum around the time of perihelion, with a maximum reported length of 5° – 6°, corresponding to a real length of between 10 and 15 million km.

Table 6. Ephemeris for comet de Vico (1995 S1)

Magnitudes calculated from $m = 7.1 + 5.0 * \text{Log}(\Delta) + 10.6 * \text{Log}(r)$

Latitude: 53.0°N Longitude: 0.0°W

Day	R.A.	Dec	Mag	Δ	R	Observable	Elong
	hh mm.m	° .mm		A.U.	A.U.	hh.mm to hh.mm	°
	(2000.0)						

1995 June

1/ 2	4	47.9	-53.56	12.6	2.25	2.24	Not Observable	76
11/12	5	17.0	-50.05	12.2	2.16	2.10	Not Observable	73
21/22	5	43.8	-46.09	11.8	2.08	1.97	Not Observable	70
1995 July								
1/ 2	6	8.6	-42.10	11.4	2.00	1.83	Not Observable	66
11/12	6	31.7	-38.12	10.9	1.92	1.69	Not Observable	61
21/22	6	53.4	-34.13	10.4	1.85	1.55	Not Observable	57
31/32	7	14.1	-30.10	9.9	1.76	1.41	Not Observable	53
1995 August								
10/11	7	34.1	-25.54	9.3	1.67	1.26	Not Observable	49
20/21	7	54.2	-21.13	8.6	1.56	1.12	Not Observable	45
30/31	8	15.4	-15.47	7.8	1.44	0.97	Not Observable	43
1995 September								
9/10	8	39.7	-9.02	6.9	1.30	0.84	Not Observable	40
19/20	9	11.5	-0.19	6.0	1.16	0.74	3.59 to 4.18	39
29/30	9	58.3	10.44	5.3	1.03	0.67	3.02 to 4.37	39
1995 October								
9/10	11	9.7	22.27	5.1	0.96	0.66	2.24 to 4.55	40
19/20	12	43.3	30.10	5.6	1.00	0.72	18.18 to 19.16	
							2.26 to 5.12	42
29/30	14	13.0	31.29	6.4	1.12	0.82	17.59 to 20.06	
							3.17 to 5.29	45
1995 November								
8/ 9	15	20.2	29.08	7.4	1.31	0.95	17.42 to 20.00	
							4.18 to 5.45	46
18/19	16	7.3	25.58	8.4	1.51	1.09	17.29 to 19.30	
							5.03 to 6.01	46
28/29	16	41.4	23.07	9.2	1.71	1.23	17.21 to 18.52	
							5.32 to 6.15	45
1995 December								
8/ 9	17	7.5	20.51	10.0	1.91	1.38	17.17 to 18.09	
							5.47 to 6.27	44
18/19	17	28.4	19.10	10.6	2.09	1.52	17.18 to 17.25	
							5.54 to 6.35	43
28/29	17	45.7	18.00	11.2	2.25	1.66	5.54 to 6.39	43
1996 January								
7/ 8	18	0.2	17.18	11.7	2.38	1.80	5.49 to 6.39	44
17/18	18	12.4	16.58	12.1	2.50	1.94	5.40 to 6.34	46
27/28	18	22.7	16.58	12.5	2.59	2.08	5.26 to 6.24	49
1996 February								
6/ 7	18	31.1	17.16	12.9	2.66	2.21	5.08 to 6.10	53

Fig 7

Orbit Diagram

Fig 8

Light curve

Fig 9

Coma diameter

Fig 10

DC

Fig 11

Tail length

Fig 12

Drawing by Robert Bullen

Fig 13

Image by Denis Bucyzinski

Fig 14 ###
Tail drawings by Attila Kosa-Kiss

123P/1995 S2 (West-Hartley)

James Scotti and Tom Gehrels of the Lunar and Planetary Laboratory, recovered comet West-Hartley (P/1989 E3 = 1988 XVI = 1989k) with the 0.9-m Spacewatch telescope at Kitt Peak on September 21 [IAUC 6249, 1995 October 21]. The comet had a nuclear magnitude of 21, with a 10" diameter coma and tail around 30" long in pa 270. The prediction by S Nakano on MPC 22031 required a correction of 0.91 days. The comet has made no recent close approaches to Jupiter.

Werner Hasubick and Herman Mikuz were able to observe the comet in late February 1996, making it between 13th and 14th magnitude. Reinder Bouma estimated it at a similar magnitude in April. The poor spring weather and comet Hyakutake probably contributed to the lack of observations.

124P/1995 S3 (Mrkos)

C. W. Hergenrother and Warren Offutt made CCD recoveries of comet Mrkos (P/1991 F1 = 1991 IV = 1991k) on September 20 and 28 respectively [IAUC 6250, 1995 October 23]. The comet was identified and measured by C. W. Hergenrother on an image taken by Steven M. Larson (Lunar and Planetary Laboratory) using the 2.3-m f/2 Steward reflector, Kitt Peak. It had a stellar appearance and was nuclear magnitude 22 in the red. Offutt is an amateur astronomer from Cloudcroft, New Mexico and used a 0.6-m f/7 Ritchey-Chretien. The comet, which was discovered at a favourable return in 1991, was subsequently numbered 124.

C/1995 Y1 (Hyakutake)

Yuji Hyakutake of Hayato, Aira-gun, Kagoshima-ken, discovered an 11^m comet in twilight on December 25.9 using 25x150B [IAUC 6279, 1995 December 26]. It was confirmed the next day by other Japanese observers. The comet was two months from perihelion, but remained at a generally poor elongation.

Section observations span the period T-38 to T+58, and the combination of the poor spring weather of 1996, an early morning apparition and the attractions of the more spectacular comet Hyakutake 1996 B2 seem to have put off many observers. At discovery the comet was moving west in Hydra, but soon began moving north, passing through Libra, Ophiuchus, Aquila, Vulpecula and was last seen in April in Pegasus.

The comet was not observed from Europe until mid January, Victorio Zannota estimating it at 9.3 in 25x150B on January 18.19, with a moderately condensed coma of 4' diameter. Herman Mikuz imaged the comet the same night¹⁸. Martin Mobberley imaged the comet on 1996 February 1.26¹⁹. It was brightest in late February, near perihelion and Jonathan Shanklin made it 7.8 in 14x100B on February 27.21. Graham Wolf recorded at near 9th magnitude in March using a variety of instruments. The comet faded to around 10th magnitude in April according to estimates by Bjorn Granslo and Reinder Bouma. No later observations were received, although the ephemeris suggests that the comet should have been easily observable until at least May. It must have faded quite rapidly and this is borne

out by the few observations reported in the ICQ. The coma diameter was generally reported around 4' – 5' throughout the apparition, with a DC of 4.

Table 7. Ephemeris for comet Hyakutake (1995 Y1)

Magnitudes calculated from $m = 7.3 + 5.0 * \text{Log}(\Delta) + 4.6 * \text{Log}(r)$
 Latitude: 53.0°N Longitude: 0.0°W

Day	R.A. hh mm.m (2000.0)	Dec ° .mm	Mag	Δ A.U.	R A.U.	Observable hh.mm to hh.mm	Elong °
1995 October							
9/10	10 51.4	-22.57	11.4	3.07	2.33	Not Observable	35
19/20	11 12.2	-23.46	11.2	2.92	2.21	Not Observable	37
29/30	11 34.3	-24.34	11.0	2.76	2.09	Not Observable	39
1995 November							
8/ 9	11 57.9	-25.18	10.7	2.60	1.97	Not Observable	42
18/19	12 23.1	-25.54	10.5	2.42	1.86	Not Observable	45
28/29	12 50.5	-26.15	10.2	2.25	1.74	Not Observable	47
1995 December							
8/ 9	13 20.4	-26.14	9.9	2.07	1.63	Not Observable	50
18/19	13 53.2	-25.40	9.5	1.90	1.51	Not Observable	52
28/29	14 29.5	-24.19	9.2	1.73	1.41	Not Observable	55
1996 January							
7/ 8	15 9.5	-21.55	8.8	1.57	1.31	6.13 to 6.39	56
17/18	15 53.5	-18.10	8.5	1.43	1.22	5.23 to 6.34	57
27/28	16 41.0	-12.51	8.2	1.32	1.15	4.41 to 6.24	57
1996 February							
6/ 7	17 31.1	-6.05	8.0	1.26	1.09	4.03 to 6.10	57
16/17	18 22.2	1.32	7.9	1.24	1.06	3.30 to 5.53	56
26/27	19 12.4	9.05	7.9	1.27	1.06	3.01 to 5.33	54
1996 March							
7/ 8	19 59.8	15.44	8.1	1.34	1.08	2.36 to 5.10	52
17/18	20 43.2	21.07	8.3	1.44	1.12	2.14 to 4.46	51
27/28	21 21.9	25.17	8.6	1.55	1.19	1.54 to 4.20	50
1996 April							
6/ 7	21 55.9	28.27	8.9	1.67	1.27	1.35 to 3.53	49
16/17	22 25.6	30.52	9.2	1.78	1.36	1.15 to 3.25	50
26/27	22 51.2	32.47	9.4	1.88	1.46	0.55 to 2.56	51
1996 May							
6/ 7	23 13.1	34.18	9.7	1.96	1.57	0.33 to 2.27	53
16/17	23 31.6	35.33	9.9	2.03	1.69	0.09 to 1.58	56
26/27	23 47.0	36.34	10.1	2.09	1.80	23.43 to 1.30	60
1996 June							
5/ 6	23 59.4	37.24	10.2	2.12	1.92	23.15 to 1.04	65
15/16	0 8.7	38.02	10.4	2.14	2.04	23.15 to 0.47	70
25/26	0 14.9	38.29	10.5	2.15	2.16	23.17 to 0.48	77
1996 July							
5/ 6	0 18.0	38.41	10.6	2.14	2.28	22.59 to 1.10	84
15/16	0 17.8	38.36	10.7	2.13	2.39	22.34 to 1.38	92
25/26	0 14.5	38.10	10.8	2.11	2.51	22.06 to 2.07	101
1996 August							
4/ 5	0 8.3	37.17	10.8	2.10	2.63	21.37 to 2.35	110
14/15	23 59.7	35.55	10.9	2.09	2.74	21.08 to 3.01	120
24/25	23 49.3	33.59	11.0	2.10	2.86	20.39 to 3.25	130

Fig 15 ###
Orbit Diagram

Fig 16 ###
Light curve

The numbered comets at perihelion in 1995:

6P/d'Arrest

The comet made its 17th observed return, which was a good one with the comet reaching perihelion when near opposition. It was first observed by La Hire in 1678 and only three other periodic comets (Halley, Swift-Tuttle and Tempel-Tuttle) have a longer observational interval. At a good return it can reach naked eye brightness, but orbital perturbations have increased its perihelion distance over the past few returns and predictions suggested that it was unlikely that it would get brighter than 11^m at this return.

Section observations covered the apparition very well and it was observed from 1995 May until November, which covers the period from T-60 to T+118. Beginning the apparition in Delphinus it reached its most northerly declination in mid June and then moved quickly SW through Pegasus, Pisces, Aquarius and Cetus during July and August. Its motion slowed and it reached its most southerly point in Sculptor in early October before slowly moving north again.

Herman Mikuz made early CCD observations of the comet with his 0.36-m Schmidt-Cassegrain and ST6 combination with V filter, first recording it on May 28.07 when it was 17.2. An image taken two days later was published in TA²⁰. Werner Hasubick made an early visual observation on June 30.95 estimating it at 13.0 in his 0.44-m reflector. By mid July it had brightened considerably, and Jonathan Shanklin made it 9.8 in 14x100B on July 22.00, with a quite diffuse, 2.5' diameter coma. The comet was imaged by David Strange on July 21/22²¹ and by Martin Mobberley on 1995 August 5.05²². Peak brightness was reached in late August, though by this time it was low in the sky for UK observers, giving quite large scatter in the magnitude estimates. John Bortle made it as bright as 6.8 in 10x50B on August 29.30 with a 16' diameter coma, while Shanklin made it only 8.6 in 14x100B on August 30.03 with a 10' diameter coma. It slowly faded, though generally only Southern Hemisphere observers could follow it. Albert Jones made it 9.3 in his 0.08-m refractor x30 on September 22.47 and the last observation was made by Paul Camilleri on November 22.44 when it was 11.5 in his 0.20-m reflector x56, with a totally diffuse, 3' diameter coma.

Conventional wisdom suggested that the comet flares in brightness post perihelion, which was in late July, though analysis of the light curve paints a different picture. The standard form of light curve gives a very poor fit, and a better one is obtained using a linear fit to the reduced magnitude. This suggests that the comet's intrinsic brightness peaked about 50 days after perihelion, explaining what has previously been reported as a flare. The coma diameter increased from a few tenths of an arcminute in early June and seems to have peaked at around the time of maximum brightness in late August, with observers reporting it to be around 20' in diameter at this time. The real diameter of the coma appears to have continued increasing until October, peaking at around 600,000 km. The DC observations suggest a general decline from around 6 two months prior to perihelion to 0 four months after perihelion.

Fig 17 ###
Observed light curve

Fig 18 ###
Fitted light curve

Fig 19

Coma diameter

Fig 20 ###
DC

15P/Finlay

P/Finlay had a very unfavourable apparition with closest approach being just under 2 AU. The comet can approach Mars quite closely and passed 0.06 AU from the planet in 1814 and 1834 and 0.09 AU in 1960.

18P/Perrine-Mrkos

The comet was not observed at this return, and it has not been seen since 1968. When discovered in 1896 it was 8th magnitude, the next return was unfavourable but it was only 13^m in 1909. It was then lost between 1909 and 1955 when it was rediscovered at 9^m. It only reached 17^m in 1962 and 13^m in 1968, and was fainter than 19^m in 1975. It seems that the comet is subject to occasional outbursts, so it would be worth keeping an eye on the predicted ephemeris position at future returns.

30P/Reinmuth 1

Karl Reinmuth discovered this comet during the course of a minor planet survey at Heidelberg Observatory in 1928. This was its best return and it reached 12^m, however an encounter with Jupiter in 1937 increased the perihelion distance and it was missed in 1942/43. Since then it has not become brighter than 17^m. The comet was recovered in 1994 and was discussed in the report for that year⁵.

41P/Tuttle-Giacobini-Kresak

P/Tuttle-Giacobini-Kresak had an unfavourable apparition, with the solar elongation not exceeding 50°. Its peak magnitude is a little variable and at most good apparitions it normally reaches 10^m though in 1973 it experienced an outburst and reached 4^m. It was not expected to do very well at this return, with a predicted maximum of around 12th magnitude. There are however suggestions of some sort of outburst as several observers recorded it at 9th magnitude between August 22 and 27, after which it dramatically faded reaching 11.6 only three days later according to Alexandr Baransky observing with his 0.35-m reflector x70. Unfortunately there are insufficient observations to draw any meaningful conclusions about the light curve.

45P/Honda-Mrkos-Pajdusakova

This comet made its 9th observed return since discovery in 1948 (it was missed in 1959). The comet was at perihelion on Christmas Day and in conjunction 20 days later. A few observers managed to see it before perihelion, under near impossible conditions with the comet only a few degrees above the horizon during evening twilight. More observers managed to locate it as it pulled away from the sun after conjunction, though conditions were still difficult. It was observed by the coronagraphs of the SOHO satellite near perihelion. During December the comet moved west through Sagittarius, reaching conjunction in Capricornus. After conjunction it moved rapidly NE back into Sagittarius and through Scutum, Ophiuchus, Serpens, Bootes and reached Coma in late February. Section observations span the period between T-17 and T+65.

Graham Wolf picked the comet up on December 9.40, making it 8.7 in his 0.18-m reflector x23, with a DC of 5. It brightened to reach a broad peak, Charles Morris recording it at 6.8 in 20x80B on December 28.09. Prior to conjunction it was generally reported as being well condensed with a coma diameter of 4'. After conjunction it was very diffuse and much larger. John Bortle recovered it on January 26.45 estimating it at 7.4 in 20x80B with a diffuse coma of diameter 8'. It faded quite rapidly, and on February 19.14 Jose Aguiar made it 8.2 in 11x80B. By the end of the month it was very difficult to observe, Jonathan Shanklin making it 10.9 with a large diffuse coma in 14x100B on February 29.20.

Despite the dramatic change in appearance, the actual coma diameter changed little across the apparition, remaining at around 100,000 km. The apparent change in appearance reflects what was a relatively close approach to the earth of 0.17 AU on February 5. The comet will make further much closer approaches in 2011 (0.06 AU) and 2017 (0.08 AU). At present the MPC only lists eight approaches closer than 0.06 AU, and five of these are by periodic comets.

The HST imaged the comet in 1996 February²². The observations suggest an elongated body with a mean nucleus radius of about 300 metres. About 11% of the surface is active and it produces 86 tons of dust per day.

Fig 21 ###
Light curve

Fig 22 ###
Coma diameter

Fig 23 ###
DC

54P/de Vico-Swift

P/de Vico-Swift was 7^m when discovered in 1844, but has been severely perturbed by Jupiter and in its present orbit won't get brighter than 17^m. It was not observed at this apparition and indeed has only been observed once this century.

58P/Jackson-Neujmin

This comet made its 5th observed return having been missed at returns between discovery in 1936 and 1970. The circumstances were similar to the discovery apparition when it reached a photographic magnitude of 12. The comet was near opposition at perihelion and remained at a good elongation throughout its period of visibility. Section observations cover the period from T-63 (August 4) to T+77 (December 22). The comet was moving SW from August to October, passing through Aquarius and Capricornus. It reached its most southerly point in late October in Sculptor and then moved NW through Cetus.

The comet was imaged by Martin Mobberley on 1995 July 22.99^{23,24}. This observation, together with others made by Japanese and Czech observers showed that the old orbit was in error by 100", mostly in right ascension. Visual observations began on August 4.93 when Werner Hasubick sighted the comet at 15.0 in his 0.44-m reflector. Brian Manning imaged it on September 2.9²⁵. It steadily increased in brightness and peaked in late November. Paul Camilleri estimated it at 10.3 on November 21.43 in his 0.20-m reflector x56. Charles Morris was the last to observe it, making it 11.0 in his 0.26-m reflector x67 on December 22.12. Generally the coma was recorded as being a few arcminutes in diameter with a DC of around 2.

The standard form of light curve gives a very poor fit, and a better one is obtained using a linear fit to the reduced magnitude. This suggests that the comet's intrinsic brightness peaked about 70 days after perihelion.

Fig 24 ###
Light curve

71P/Clark

Michael Clark of Mount John Observatory, New Zealand discovered this comet on a variable star patrol plate in June 1973. At discovery the magnitude reached 13, but alternate returns are unfavourable and it is then 5 magnitudes fainter, though it hasn't been missed. An encounter with Jupiter in 1954 put it into its present orbit, which is such that it can approach quite closely to Mars, passing within 0.09 AU in 1978. This was the comet's 5th return since discovery and it was a relatively favourable apparition, but was too far south for observation from the UK. The comet was recovered in 1994 and was discussed in the report for that year⁵, though since then additional data has come to light and revised magnitude parameters are given here.

73P/Schwassmann-Wachmann 3

Professor A Schwassmann and A A Wachmann of Hamburg Observatory discovered this, their 3rd periodic comet, on minor planet patrol plates taken on 1930 May 2. Initially of magnitude 9.5 it brightened to nearly 6^m, thanks to a very close approach to Earth (0.062 AU) on June 1. The initial orbit was a little uncertain and the comet wasn't found at this or succeeding apparitions until 1979. The comet passed within 0.9 AU of Jupiter in 1953, and 0.25 AU in 1965. In August 1979, Michael Candy reported the discovery of a comet on a plate taken by J Johnston and M Buhagiar while searching for minor planets; this had the motion expected for P/Schwassmann-Wachmann 3, but with perihelion 34 days later than in a prediction by Brian Marsden. Missed again at the next return, it has been seen at the last two returns. The comet wasn't expected to become brighter than 12th magnitude at this return, but much to most astronomers surprise the comet was found to be exceptionally bright with a tail in September and October 1995. The comet was recovered in 1994 and was discussed in the report for that year⁵, though again some later observations have come to light and slightly revised magnitude parameters are given here.

77P/Longmore

Andrew Longmore discovered the comet as a 17^m object on a UK Schmidt plate taken by P R Standen in June 1975. The comet was put into its discovery orbit by a close encounter with Jupiter in 1963. With a perihelion distance of 2.4 AU it has not become brighter than at discovery. The comet was recovered in 1994 and was discussed in the report for that year⁵.

Other comets under observation

29P/Schwassmann-Wachmann 1

This annual comet has frequent outbursts and seems to be more often active than not, though it rarely gets brighter than 12^m. It was at opposition in Cancer in early February and observable until June. It was then in conjunction until October, and observable for the rest of the year in Sextans. This comet is an ideal target for those equipped with CCDs and it should be observed at every opportunity. Herman Mikuz was alone in continuing with his program of observation and recorded outbursts to 13th magnitude in January, March and October.

32P/Comas Sola

The comet was observed by James Scotti with the Spacewatch telescope on August 2.4 when it was near 20th magnitude, with a coma diameter of 6" and had a tail 36" long. [IAUC 6199, 1995 August 3]. The comet was nearing opposition, but did not reach perihelion until June 1996.

81P/Wild 2

Alan FitzSimmons and M Cartwright imaged the comet with the 1-m Kapteyn telescope at La Palma at the end of August. It had an R magnitude of 22 and was near stellar in appearance. [IAUC 6217, 1995 August 30]. It was not due to reach perihelion until May 1997.

95P/Chiron

Maurice Gavin imaged Chiron on March 21.99 and March 23.03²⁶. CCD magnitudes of Chiron would be of particular interest as observations show that it's absolute magnitude varies erratically. V magnitudes are best for inter-comparisons, but even unfiltered estimates can be of use.

Other comets

Karen Meech uses large telescopes to image distant comets to see if they are still active. She managed to catch comet Shoemaker (1987 H1) twice in 1995 when it was over 18 AU from the sun. In January she used the 10-m Keck 1 telescope in collaboration with Olivier Hainaut, to take a series of exposures totaling nearly five hours. The exposure shows stars down to 29.5^m and when the frames are co-added to follow the comet's motion a faint tail, some 500,000-km long is visible. The tail probably consists of large dust particles emitted when the comet was at least 12 AU from the sun. The driving force could not have been water for the comet to be active this far out and something more volatile such as carbon monoxide seems likely²⁷.

A 15th magnitude comet announced as D/1931 R1 on IAUC 6161 [1995 April 13] was discovered to be an image of 84P/Giclas by Reinder Bouma [IAUC 6168 1995 May 5]. The images were found on Lowell Observatory archive plates by David Levy and measured by Brian Skiff in the late 1980's. The comet was discovered in 1978 by Henry Giclas of the Lowell Observatory and last returned in 1992³.

Acknowledgements

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Figure Captions:

Figure 1. The orbit of comet Bradfield (1995 Q1). a) Viewed from the north ecliptic pole. The orbits of the earth and Jupiter are shown for scale. The shaded part of the comet's orbital plane lies above the ecliptic. b) Viewed from the ascending node of the comet's orbit looking towards the sun. From this viewpoint the orbit appears as a straight line, showing the inclination of the comet's orbit. c) Viewed from a rotating reference frame, centred on the earth with the sun at top. In this frame the true distance to the comet is shown but the angular elongation from the sun is viewed from the ecliptic pole; the 6 o'clock position corresponds to the comet at opposition and the 3 o'clock position to the comet at morning quadrature. The path is shown dashed when it lies below the ecliptic. The comet was discovered at T-14; observations used in the analysis cover the range T-11 to T+115.

Figure 2. The observed magnitude of comet 1995 Q1. The curve is a best fit over the apparition, with no corrections applied. Tick marks indicate the first of each month from 1995 August.

Figure 3. The coma diameter of comet 1995 Q1. The lower panel shows the observed coma diameter in arc minutes and the upper panel the true diameter in 100,000 km.

Figure 4. The DC of comet 1995 Q1.

Figure 5. Comet Bradfield 1995 Q1 photographed by Alex Vincent on 1995 September 29.18. One minute exposure on Fujichrome 400 with 135-mm lens.

Figure 6. Comet Bradfield 1995 Q1 imaged by Martin Mobberley on 1995 September 28.19. 80 second exposure with 0.49-m f4.5 Newtonian. The field is 4' x 6'.

Figure 7. The orbit of comet 122P/de Vico (1995 S1). a) Viewed from the north ecliptic pole. b) Viewed from the ascending node of the comet's orbit looking towards the sun. c) Viewed from the rotating reference frame. The comet was discovered at T-19; observations used in the analysis cover the range T-18 to T+104.

Figure 8. The observed magnitude of comet 122P/de Vico. The curve is a best fit over the apparition, with no corrections applied. Tick marks indicate the first of each month from 1995 September.

Figure 9. The observed coma diameter of comet 122P/de Vico. The tick marks indicate the first of each month from 1995 September. The lower panel shows the observed coma diameter in arc minutes and the upper panel the true diameter in 100,000 km.

Figure 10. The DC of comet 122P/de Vico.

Figure 11. The observed tail length of comet 122P/de Vico. The tick marks indicate the first of each month from 1995 September. The lower panel shows the observed tail length in degrees and the upper panel the true length in 1,000,000 km.

Figure 12. Comet 122P/de Vico drawn by Robert Bullen on 1995 October 6.2. He used a 0.21-m f7 reflector x64.

Figure 13. Comet 122P/de Vico imaged in a 90 second integration by Denis Buczynski on 1995 October 5.19, using 0.125-m, f3.5, Celestron Comet Catcher and SX Framstore. The field is 45' x 30' with NE up and NW right.

Figure 14. The tail development of comet 122P/de Vico drawn by Attila Kosa-Kiss using 7x50 binoculars. A - October 2.11, B - October 3.13, C - October 5.12, D - October 6.11.

Figure 15. The orbit of comet Hyakutake (1995 Y1). a) Viewed from the north ecliptic pole. b) Viewed from the ascending node of the comet's orbit looking towards the sun. c) Viewed from the rotating reference frame. The comet was discovered at T-60; observations used in the analysis cover the range T-38 to T+58.

Figure 16. The observed magnitude of comet 1995 Y1. The curve is a best fit over the apparition, with no corrections applied. Tick marks indicate the first of each month from 1996 January.

Figure 17. The observed magnitude of comet 6P/d'Arrest. Tick marks indicate the first of each month from 1995 May.

Figure 18. The reduced magnitude of comet 6P/d'Arrest. The curve is a best fit over the apparition, with corrections for aperture and observer applied.

Figure 19. The coma diameter of comet 6P/d'Arrest. The lower panel shows the observed coma diameter and the upper panel the true diameter in 100,000 km. Tick marks indicate the first of each month from 1995 May.

Figure 20. The DC of comet 6P/d'Arrest.

Figure 21. The observed magnitude of comet 45P/Honda-Mrkos-Pajdusakova. The curve is a best fit over the apparition, with no corrections applied. Tick marks indicate the first of each month from 1995 December.

Figure 22. The coma diameter of comet 45P/Honda-Mrkos-Pajdusakova. The lower panel shows the observed coma diameter and the upper panel the true diameter in 100,000 km. Tick marks indicate the first of each month from 1995 December.

Figure 23. The DC of comet 45P/Honda-Mrkos-Pajdusakova.

Figure 24. The reduced magnitude of comet 58P/Jackson-Neujmin. The curve is a best fit over the apparition, with corrections for aperture and observer applied.