

The Comets of 1992

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

This report is the third in the annual series which gives for each comet: the discovery details, orbital data and general information, magnitude parameters and BAA comet section observations. It continues the series which last appeared in the Journal in 1950¹, with irregular notes appearing until the early 60s. Observational reports were published in the comet section newsletter *Isti Mirant Stella* from 1973 to 1987 and a couple of papers were published in the Journal in the early 1980's^{2,3}. Further details of the analysis techniques used in this report are given in an earlier paper⁴. Ephemerides for the comets predicted to return during the year can be found in the ICQ Handbook⁵.

Table 1. Orbital data for the comets of 1992⁶

Comet		T	q	e	P	ω	Ω	i		
a A1	Helin-Alu	1992 XVI	92 July	8.8654	3.012318	1.004405	239.9719	288.8777	39.2101	
b B1	Bradfield	1992 VII	92 Mar	19.5392	0.500157	1.0	15.3368	275.3503	20.2378	
c	88P/Howell	1993 II	93 Feb	26.0960	1.409143	0.552065	5.58	234.7570	57.7438	4.3997
d F1	Tanaka-Machholz	1992 X	92 Apr	22.6902	1.261498	0.995966	65.4746	300.5082	79.2924	
e G1	105P/Singer Brewster	1992 XXVI	92 Oct	27.2349	2.026662	0.413766	6.43	46.6455	192.6170	9.1929
f G2	P/Shoemaker-Levy 8	1992 XV	92 June	13.4840	2.710664	0.290688	7.47	22.3971	213.3969	6.0537
g G3	P/Mueller 4	1992 IV	92 Feb	16.3566	2.636951	0.389315	8.97	43.5926	145.4255	29.8014
h J1	Spacewatch	1993 XV	93 Sep	5.5485	3.006991	0.999966	83.4012	203.3237	124.3185	
i J2	Bradfield	1992 XIII	92 May	25.7940	0.592305	1.0	299.7170	159.9981	158.5644	
j	47P/Ashbrook-Jackson	1993 XIII	93 July	14.0517	2.316284	0.394905	7.49	348.6895	2.6657	12.5009
k N1	Machholz	1992 XVII	92 July	10.8186	0.819198	1.0	162.6392	235.1287	57.6407	
l	84P/Giclas	1992 XXV	92 Sep	13.0919	1.846795	0.493212	6.96	276.4863	112.5257	7.2835
m	14P/Wolf	1992 XXII	92 Aug	28.1290	2.427704	0.405599	8.25	162.2855	204.1451	27.4777
n O1	106P/Schuster	1992 XXIV	92 Sep	6.4225	1.539240	0.589521	7.26	355.7334	50.6019	20.1341
o	33P/Daniel	1992 XXIII	92 Sep	1.6710	1.649451	0.551964	7.06	11.0098	69.0515	20.1358
p Q1	P/Brewington	1992 XIV	92 June	7.8006	1.601036	0.670833	10.7	47.8401	343.7375	18.0578
q Q2	Helin-Lawrence	1993 V	93 Mar	15.1220	2.038386	0.965209	268.8572	194.6661	106.8462	
r	8P/Tuttle	1994 XV	94 June	25.2907	0.997732	0.824089	13.5	206.7030	270.5485	54.6923
s S1	108P/Ciffreo	1993 I	93 Jan.	23.0649	1.708765	0.543173	7.23	358.0335	53.7092	13.0894
t S2	109P/Swift-Tuttle	1992 XXVIII	92 Dec	12.3241	0.958220	0.963589	135	153.0014	139.4444	113.4265
u	40P/Vaisala 1	1993 VIII	93 Apr	29.1751	1.783024	0.634715	10.8	47.3852	135.0770	11.5962
v	82P/Gehrels 3	1993 XIV	93 July	25.4208	3.427002	0.150748	8.11	231.5652	243.3433	1.1000
w	56P/Slaughter-Burnham	1993 X	93 June	22.4252	2.543058	0.503566	11.6	44.1133	346.4437	8.1557
x	24P/Schaumasse	1993 III	93 Mar	3.9608	1.202158	0.704849	8.22	57.4820	81.0530	11.8458
y U1	Shoemaker	1993 VI	93 Mar	25.6787	2.313667	0.999402	54.8635	55.2994	65.9859	
z	70P/Kojima	1994 VI	94 Feb	17.9949	2.399070	0.392645	7.85	348.5362	154.8033	0.8780
al W1	Ohshita	1992 XXVII	92 Nov	1.5889	0.664134	0.991721	310.0665	138.3753	115.1232	
	26P/Grigg-Skjellerup	1992 XVIII	92 July	22.1380	0.994689	0.664325	5.10	359.2650	213.3404	21.0990
	74P/Smirnova-Chernykh	1992 XXI	92 Aug	5.9350	3.572144	0.147314	8.57	88.9943	77.4812	6.6291

The epoch of the elements for each comet is the Julian Date ending in zero closest to the date of perihelion. New style designations for the comets are also given.

Table 2. List of visual observers

James Abbott	Witham, Essex
Karl-Gustav Andersson	Sweden
Sally Beaumont	Windermere, Cumbria
Luis Bellot	Tenerife, Spain
Hans Bengtsson	Sweden
Andrea Boattini	Italy
John E. Bortle	U.S.A.
Nigel Bradbury	Matlock, Derbyshire
Per-Jonny Bremseth	Norway

Robert Bullen	Bognor Regis, Sussex
Paul Camilleri	Australia
Mike J. Collins	Everton, Beds
Haakon Dahle	Norway
Jorgen Danielsson	Sweden
Grzegorz Duzanowicz	Sweden
Anders Ekloef	Sweden
Steve Evans	Towcester, Northants
James Fraser	Alness, Rossshire
Jesus Gallego Maestro	Spain
Bjoern Haakon Granslo	Norway
Werner Hasubick	Germany
Roberto Haver	Italy
Lars Trygve Heen	Norway
Michael J. Hendrie	Colchester, Essex
Guy M. Hurst	Basingstoke, Hampshire
Albert F. Jones	New Zealand
Graham Keitch	Manaton, Devon
Mark Kidger	Canary Islands
Attila Kosa-Kiss	Romania
James Lancashire	Cambridge
Martin Lehky	Czech Republic
S. McCann	Southampton, Hampshire
Richard McKim	Oundle, Northants
Oernulf Midtskogen	Norway
Herman Mikuz	Slovenia
Roy W. Panther	Walgrave, Northampton
Mieczyslaw L. Paradowski	Poland
Santos Pedraz	Spain
Alfredo Jose Serra Pereira	Portugal
Gavin Ramsay	Holmbury St Mary,
Patrick Schmeer	Germany
Paul Schlyter	Sweden
David A. J. Seargent	Australia
Jonathan D. Shanklin	Cambridge
Oddleiv Skilbrei	Norway
Olaf Skjaeraasen	Norway
David Storey	Witney, Oxfordshire
Tony Tanti	Malta
Melvyn D. Taylor	Wakefield, Yorkshire
Steinar Thorvaldsen	Norway
Maura Tombelli	Italy
Frank Ventura	Malta
Johan Warell	Sweden
Graham W. Wolf	New Zealand
Mauro Vittorio Zanotta	Italy

Table 3. List of astrometric, CCD and photographic observers

Observer	Site	IAU Station No
Andrea Boattini	Italy	108/552
Maurice Gavin	Worcester Park, Surrey	

Werner Hasubick	Germany	
Roberto Haver	Italy	
Michael Hendrie	Colchester, Essex	502
Nick James	Chelmsford, Essex	970
Brian Manning	Stakenbridge, Worcs	494
Herman Mikuz	Slovenia	106
Martin Mobberley	Cockfield, Suffolk	480
Terry Platt	Bracknell, Berks	
Jonathan Shanklin	Cambridge	503
Maura Tombelli	Italy	108/552

Table 4. Magnitude parameters of comets observed by the comet section.

A correction for aperture of 0.0033 mm^{-1} and the observer corrections derived in previous papers^{4,6,7,8,9} have been applied and the H1 value is reduced to zero aperture. No comet had a sufficiently large coma to warrant including the coma correction.

Comet	No	ΔR AU	H1	K1	H10	H15
b Bradfield	2	0.9			9.1	9.2
c 88P/Howell	1	2.1			9.3	7.7
d Tanaka-Machholz ^a	153	1.3-1.5	2.6 ± 0.3	29.9 ± 2.8	5.0 ± 0.1	4.4 ± 0.1
j 47P/Ashbrook-Jackson	1	2.4			7.6	5.7
l 84P/Giclas	2	2.1			10.3 ± 0.6	8.7 ± 0.5
p P/Brewington	8	1.9-2.4			6.5 ± 0.4	5.0 ± 0.4
r 8P/Tuttle	4	1.1			7.5 ± 0.1	7.3 ± 0.1
s 108P/Ciffreo	1	1.7			10.4	9.2
t 109P/Swift-Tuttle ^b	599	1.0-2.0	4.4 ± 0.1	16.1 ± 0.3	4.8 ± 0.1	4.5 ± 0.1
u 40P/Vaisala 1	11	1.8-1.9			10.2 ± 0.1	8.9 ± 0.1
x 24P/Schaumasse	125	1.2-1.8	7.6 ± 0.2	24.2 ± 1.9	9.1 ± 0.1	8.6 ± 0.1
y Shoemaker	1	2.6			7.7	5.7
a1 Ohshita	8	1.0-1.9	11.0 ± 0.3	8.1 ± 1.6	10.7 ± 0.2	9.8 ± 0.3
29P/Schwachmann-Wachmann	13	5.9-6.0			1.8 ± 0.3	-2.1 ± 0.3

a. Comet Tanaka-Machholz outburst by 1.1^m around 1992 May 9.5. The magnitude parameters quoted here were determined using pre outburst magnitudes increased by this amount.

b. The light curve of P/Swift-Tuttle is slightly asymmetric, with the comet fading less rapidly than it brightens.

The magnitude of the comets can be calculated from the 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.

The comets with year letter designations

a Helin-Alu (1992 A1, 1992 XVI)

The first comet of 1992 was discovered by Eleanor F Helin and Jeff Alu on a plate taken with the 0.46-m PS on January 9 during the course of the near-Earth asteroid survey [IAUC 5432, 1992 January 21]. At discovery the comet was 16.5^m and moving slowly SSW (ie decreasing

right ascension and declination) in Hydra as it neared opposition. It was a distant comet and never become much brighter than at discovery.

b Bradfield (1992 B1, 1992 VII)

William Bradfield of Dernancourt, near Adelaide, Australia, discovered his 15th comet on January 31.74 [IAUC 5442, 1992 February 2]. It was found moving ESE in the morning sky, on the borders of Scorpius, Lupus and Norma as it was brightening on its way to perihelion. Of 10th magnitude, it was diffuse and without condensation. Paul Camilleri of Cobram, Victoria, Australia found images of it on pre-discovery Kodak T-Max 400 plates taken with an 85 mm lens on Jan 30.7 [IAUC 5445, 1992 February 6].

Albert Jones observed the comet on 1992 February 13.7, making it 10.1 in his 0.32-m reflector. Two days later Paul Camilleri made it 10.3 with his 0.20-m reflector.

Alan C Gilmore and Pamela M Kilmartin at the Mount John Observatory, New Zealand failed to detect it with a short exposure on the 0.6-m reflector on March 3.7. Faint images were detected with longer exposures on March 4.7 and 7.7 [IAUC 5469, 1992 March 10]. Cometary activity evidently decreased rapidly as the comet approached perihelion as it should have been around 7^m at this time.

c 88P/Howell (1993 II)

Recovered by Steve Larson and James V Scotti on CCD images taken on March 5 with the Steward Observatory's 2.3-m reflector and the University of Arizona's Spacewatch Telescope (SWT) at Kitt Peak on March 6 and 7. At recovery it was 21^m and close to opposition in Leo. The comet was perturbed into a new orbit in 1585 when an encounter with Jupiter reduced q from 4.7 to 2.4 AU; in 1978 another encounter reduced it to 1.6 AU, leading to its discovery in 1981 and in 1990 it was reduced further to 1.4 AU. This return was not a favourable one, and the comet never approached the earth closer than 1.6 AU. The next return in 1998 will be more favourable.

Herman Mikuz made a CCD observation of the comet using his 0.20-m f2 Baker Schmidt and ST-6 camera with V filter on 1993 July 29, when it was 14.9.

d Tanaka-Machholz (1992 F1, 1992 X)

Don Machholz of Colfax, California, USA, reported the discovery of a probable 10^m comet to the CBAT on March 31 and the estimated daily motion indicated a possible identity with another object reported to the bureau on March 27th. This object had been discovered by Zenichi Tanaka of Yodoe, Tottori, Japan on March 24, but an incorrect daily motion was given [IAUC 5487, 1992 April 1]. At discovery it was moving north in the morning sky in Pegasus and passed through Andromeda in mid April on its way to perihelion on April 22. Passing through Cassiopeia (May), Camelopardalus and Lynx (June), the solar elongation remained between 40 and 50°.

The comet was quite well observed with 153 observations spanning the period 1992 April 5 - 1992 June 12. Martin Mobberley was able to photograph the comet as early as April 5th¹⁰. At this time it was around 8^m, Werner Hasubick making it 8.2 on April 10 in 25x100B. The comet changed little during April, and was still 8.3 when seen by Robert Bullen on May 7 with his 0.21-m reflector x89. He noted that the coma was elongated in pa 160. Between May 9.0 and 9.9, when it was low in the north for UK observers and the moon was full, the comet brightened by just over a magnitude; Tony Tanti observing on May 11 with 7x20B made it as bright as 6.7, with a 10.5' coma. The outburst seems to have had little effect on the appearance of the comet, most observers making it DC4 throughout the apparition. Observations suggest that the coma diameter increased in size by a few arc minutes during the outburst, though there is much scatter in the data. Surprisingly the outburst seems to have been ignored by a few observers who continued estimating the comet at the previous brightness. Thereafter it slowly faded, reaching 9^m by mid June. Roy Panther was amongst the last UK observers to view it, making it 8.9 on May 27, with a 5' diameter, DC4 coma in his 0.25-m reflector x50.

Table 5. Ephemeris for comet Tanaka-Machholz 1992d

Magnitudes calculated from $m = 2.6 + 5.0 * \text{Log}(\Delta) + 29.9 * \text{Log}(r)$
 Latitude: 53.00N Longitude: 0.00W

Day	R.A.		Dec	Mag	Δ	R	Observable	Elong
	hh	mm.m	\circ .mm		A.U.	A.U.	hh.mm to hh.mm	\circ
			(1950.0)					
1992 February								
7/ 8	20	34.6	-15.09	11.4	2.64	1.68	Not Observable	11
17/18	20	49.9	-10.24	10.6	2.50	1.59	Not Observable	17
27/28	21	5.8	-5.02	9.8	2.36	1.51	Not Observable	23
1992 March								
8/ 9	21	22.6	1.06	9.0	2.22	1.43	Not Observable	29
18/19	21	40.8	8.09	8.2	2.07	1.37	4.18 to 4.43	34
28/29	22	1.3	16.13	7.6	1.94	1.32	3.07 to 4.17	39
1992 April								
7/ 8	22	25.3	25.18	7.1	1.83	1.28	1.51 to 3.50	42
17/18	22	55.0	35.11	6.9	1.75	1.26	0.19 to 3.22	45
27/28	23	33.9	45.14	6.8	1.72	1.26	21.02 to 2.53	47
1992 May								
7/ 8	0	27.3	54.26	7.0	1.73	1.28	21.29 to 2.24	47
17/18	1	41.2	61.28	7.5	1.79	1.32	21.57 to 1.55	47
27/28	3	13.4	65.05	8.1	1.89	1.37	22.27 to 1.27	45
1992 June								
6/ 7	4	45.5	65.07	8.8	2.01	1.44	22.55 to 1.02	42
16/17	5	58.9	62.45	9.6	2.15	1.51	23.16 to 0.46	40
26/27	6	51.7	59.21	10.5	2.29	1.60	23.16 to 0.50	36
1992 July								
6/ 7	7	29.9	55.44	11.3	2.44	1.69	22.57 to 22.59	33
16/17	7	58.5	52.14	12.2	2.57	1.78	Not Observable	31
26/27	8	20.8	49.01	13.0	2.70	1.88	Not Observable	30

Fig 1

Orbital diagram

Fig 2 ###
Light curve

e 105P/Singer Brewster (1992 G1, 1992 XXVI)

Recovered when a month past opposition in Sextans at mag 20.5, by James Scotti with the 0.91-m Spacewatch telescope (SWT) on April 1.3 [IAUC 5490, 1992 April 4]. It was not predicted to get much brighter than this. The comet was discovered in 1986 after a close approach to Jupiter a decade earlier had reduced the perihelion distance to 2 AU.

f P/Shoemaker-Levy 8 (1992 G2, 1992 XV)

Discovered by the team of Carolyn S and Eugene M Shoemaker and David H Levy (SLT) with the 0.46-m Schmidt on Mt Palomar (PS) during the search for near earth asteroids on April 5.5 at photographic magnitude 17, when it was a month from opposition and two months from perihelion, slowly moving NW in Leo. [IAUC 5493, 1992 April 9]. It was a distant comet and never got much brighter than at discovery. It is in a Jupiter approaching orbit and had an encounter with the planet four years before discovery.

g P/Mueller 4 (1992 G3, 1992 IV)

Discovered by Jean Mueller on a 90 minute exposure with the 1.2-m Oschin Schmidt on Mt Palomar during the course of the 2nd Palomar Sky Survey (PSSII) on April 9 at photographic magnitude 17.5 [IAUC 5495, 1992 April 13]. The comet was at opposition and two months past perihelion, moving slowly NW in Bootes and faded after discovery. The comet is in a Jupiter crossing orbit and had a close encounter with the planet in 1976.

h Spacewatch (1992 J1, 1993 XV)

David Rabinowitz, of the Lunar and Planetary Laboratory, University of Arizona, reported that the moving object detection software on the SWT discovered a comet on May 1.2 [IAUC 5509, 1992 May 2]. The comet was moving slowly NW in Virgo, shortly after opposition. At 19^m, it was another distant comet and even at perihelion was just beyond visual observation range.

i Bradfield (1992 J2, 1992 XIII)

William Bradfield discovered his 16th comet, a 10th magnitude diffuse object without central condensation on May 3.81 [IAUC 5514, 1992 May 4]]. The comet was in the morning sky, moving east in Cetus, and brightening towards perihelion on May 25th. Its solar elongation decreased and few observations of it were made. Only 10 astrometric positions were obtained, the last taken on June 4th.

j 47P/Ashbrook-Jackson (1993 XII)

A plate taken by Alan C Gilmore and Pamela M Kilmartin with the 0.6-m reflector at the Mount John Observatory, New Zealand on May 4.6 at photographic magnitude 18 confirmed a single night detection at 21.5^m made by Mats Lindgren and G Tancredi at La Palma with the 2.5-m Nordic Telescope on 1991 April 24 [IAUC 5546, 1992 June 16]. Nearing opposition in Scorpius, it remained at mid southern declination all year, not crossing the celestial equator until June 1993.

The comet was discovered in 1948 following an approach to Jupiter in 1945 which reduced the perihelion distance from 3.8 to 2.3 AU. Although intrinsically relatively bright, the large perihelion distance keeps it faint.

The comet was predicted to be brightest in 1993 September, when it was at a near perihelic opposition. An observation of the comet was made by Bjoern Granslo on September 19 when it was 13^m in his 0.20-m Schmidt, with a small, slightly condensed coma 2' in diameter.

k Machholz (1992 N1, 1992 XVII)

Don Machholz discovered his sixth comet, a diffuse 9^m object with condensation, using 27x120B on July 2.46 [IAUC 5553, 1992 July 3]. The comet was in the morning sky, moving SE on the Perseus/Auriga border and had been brightening on its way towards perihelion. The comet was possibly within discovery range for most of the previous month. No section observations were received as the solar elongation was poor and it faded after discovery.

l 84P/Giclas (1992 XXV)

Recovered by Tsutomu Seki at Geisei, Japan with his 0.6-m reflector at photographic magnitude 18 on June 30.8 on the Pisces - Cetus border as the comet emerged from conjunction [IAUC 5561, 1992 July 10]. This was the comet's third observed return since its discovery in 1978 by Henry Giclas of the Lowell Observatory. The perihelion distance is fairly constant at present and Jupiter encounters only make significant changes to the angular elements. However around 2300, a low velocity close encounter with Jupiter will transfer the comet to an orbit outside that of the planet.

Predicted to be brightest in late October, two CCD observations of the comet were received, both by Mikuz; on 1992 December 30 it was 14.3 and on 1993 January 19 it was 16.0.

m 14P/Wolf (1992 XXII)

Recovered by Tsutomu Seki at photographic magnitude 20 on July 10.8 as the comet neared morning quadrature on the Pisces - Andromeda border [IAUC 5567, 1992 July 27]. The comet was fairly bright (7^m) at its

discovery apparition in 1884, which occurred after a close approach to Jupiter in 1875 reduced the perihelion distance from 2.7 AU to 1.6 AU. A further encounter in 1922 put q back to 2.4 AU and apart from in 1925 the comet has not been brighter than 18^m since then.

n 106P/Schuster (1992 O1, 1992 XXIV)

Recovered by Tsutomu Seki at photographic magnitude 18 on July 28.7 in Taurus as the comet was nearing perihelion after emerging from conjunction [IAUC 5570, 1992 July 30]. The recovery magnitude was a little fainter than the predicted m_2 and it was not expected to brighten much further.

The comet was discovered in 1977 October at La Silla, though a month earlier it had been recorded as an asteroid. It was not seen at the last return, which was unfavourable. The orbit is relatively stable.

o 33P/Daniel (1992 XXIII)

Recovered by Tsutomu Seki at photographic magnitude 19 on July 29.8 in Taurus as the comet emerged from conjunction [IAUC 5581, 1992 August 10]. It was predicted to get little brighter than at recovery.

This is another comet that has had its perihelion distance changed by encounters with Jupiter. It was discovered in 1909 as a 9th magnitude object after q changed from 1.5 to 1.4 AU. It was next seen in 1937 after q had been increased to 1.5 AU again and although it has reached 12^m at a favourable apparition, most have been unfavourable. An encounter with Jupiter in 1995 has increased q to 2.1 AU, so it may not be seen again.

p P/Brewington (1992 Q1, 1992 XIV)

Howard J Brewington of Cloudcroft, New Mexico, reported the discovery of a 10^m , small diffuse comet on August 28.41 using a 0.40-m reflector x55. The comet was in the morning sky, slowly moving east on the Gemini - Auriga borders. This was his fourth discovery and his second periodic one. It could potentially have been discovered earlier as it was similarly placed at the previous lunation. The comet is in a Jupiter crossing orbit, but has not approached the planet for several revolutions. At a favourable return it could reach 7^m .

Mikuz was able to observe the comet on 1992 September 3 when it was 10.9 in his 0.20-m reflector. No other visual observers followed the comet and it steadily faded as it continued moving very slowly west, reaching 14^m on October 9 according to a CCD observation by Mikuz using his Wright CCD camera. Hasubick photographed it on November 24 with his 0.14-m f1.65 camera and Kodak 2415 film and estimated the magnitude was then about 13.5.

q Helin-Lawrence (1992 Q2, 1993 V)

Discovered by Eleanor Helin and Kenneth J Lawrence on a plate taken with the 0.46-m PS on August 29.43 at magnitude 15 a month before opposition, moving SSW in Cetus. [IAUC 5597, 1992 August 30]. At brightest it reached around 13^m, but it was at far southern declinations and no section observations were received.

r 8P/Tuttle (1994 XV)

Mats Lindgren and G Tancredi using a CCD camera on the 2.5-m Nordic Optical Telescope at La Palma recovered the comet on 1992 July 29.1 at mag 21 when the comet was at opposition in Cygnus [IAUC 5604, 1992 September 4].

The comet was discovered by Pierre Mechain in January 1790 from Paris, but the available observations were insufficient to compute an elliptical orbit and it was lost until a comet was discovered by Horace Tuttle at Harvard, USA in February 1858. When an accurate orbit was computed it was found to be identical to Mechain's comet and it has been observed at every return since 1871 except for a very unfavourable one in 1953. The most favourable returns are those with a perihelion in December, January or February. The orbit is quite stable, due to the high inclination and the value of the argument of perihelion, and it intersects the earth's producing the Ursid meteor shower which peaks on December 23. Rates at maximum are usually only 10 - 15 per hour, but strong displays of around 100 per hour occurred in 1945 and 1986; in both cases the parent comet was near aphelion.

When brightest in 1994 it was south of the ecliptic and at small solar elongation, but Graham Wolf observed the comet on two occasions with his 0.21-m reflector, making it 10.0 on both July 22 and July 28.

s 108P/Ciffreo 1992 S1, 1993 I)

Recovered at mag 18 shortly after opposition on the Aquarius - Sculptor border by James Scotti with the SWT on September 24.3 [IAUC 5618, 1992 September 25]. Though predicted to have changed little in brightness, Werner Hasubick photographed the comet on December 16, estimating it at 14^m.

The comet was discovered in 1985, not far from 1P/Halley in the sky, following a close approach to Jupiter in 1983.

t 109P/Swift-Tuttle (1992 S2, 1992 XXVIII)

In August very high Perseids rates were again reported, with a maximum on August 11.81 [IAUC 5586, 1992 August 14; IAUC 5621, 1992 September 27]. Comet Swift-Tuttle itself was recovered by Tsuruhiko Kiuchi of Usuda, Nagano, Japan with 25x150B as a diffuse, 4' diameter object of 11.5^m on September 27 [IAUC 5620, 1992 September 27]. Papers

describing the apparition¹¹ and associated meteor activity¹² have appeared in the Journal.

u 40P/Vaisala 1 (1993 VIII)

Recovered shortly after opposition in Aquarius by James Scotti with the SWT on September 26.5 at mag 22 [IAUC 5623, 1992 September 28]. At present the orbit is relatively stable, but an encounter with Jupiter early in the 22nd century will reduce the perihelion distance from 1.8 to 1.4 AU.

No visual observations of this comet were obtained, but Mikuz and Hasubick were able to follow it with CCD and camera respectively from 1993 February 14 to 1993 June 20 as it faded from around 13.5 to 15.0. The comet was small and nearly star-like in appearance, with the coma diameter 1' or less and DC 8-9. It had a similar appearance at its discovery apparition in 1939, when it was originally designated asteroid 1939 CB. Brian Manning secured a CCD image on May 6¹³, which shows three faint tails in pa 90, 120 and 160°.

v 82P/Gehrels 3 (1993 XIV)

Recovered just after morning quadrature in Taurus by James Scotti with the SWT on September 26.5 at mag 22, some 3^m fainter than predicted [IAUC 5624, 1992 September 28].

The comet's discovery in 1975 followed an extremely close encounter with Jupiter in 1970 when it passed 0.001 AU from the planet and was temporarily captured as a satellite. After the encounter, the perihelion distance was reduced from 5.7 to 3.4 AU and the eccentricity decreased to 0.15. Next century another series of encounters with Jupiter will push the perihelion distance back to 4 AU.

w 56P/Slaughter-Burnham (1993 X)

Recovered a couple of months past opposition in Capricornus by Steven M Larson and Charles D Slaughter with a CCD camera on the 1.5-m reflector at the Lunar and Planetary Laboratory Catalina Station on September 24.2 at 21.5 [IAUC 5626, 1992 October 2]. The comet was discovered in January 1959 by Slaughter whilst he was blinking a plate taken in December 1958 in the course of a proper motion survey with Robert Burnham at Lowell Observatory. Although a fairly favourable return, the comet is a distant one and it was not expected to get brighter than 16^m.

The orbit is relatively stable at present, but an encounter with Jupiter late next century will push the perihelion distance out to 3.0 AU.

Recovered by Tsutomu Seki with his 0.60-m f3.5 reflector at photographic magnitude 20 on September 25.7 in Taurus in the morning sky [IAUC 5627, 1992 October 2]. The comet was discovered at Nice, France in 1911 as a 12^m diffuse object and reaches a similar magnitude at average returns. The 1952 return was very favourable and the comet reached 5^m, though there may have been an outburst. The orbit is relatively stable.

The comet was closest to the Earth around a month prior to perihelion but was at a similar distance for several months. Retrograding in Taurus in December it resumed prograde motion in mid January when on the Taurus - Aries border. Moving westwards it passed into Perseus at the end of January, reaching Auriga at the end of February and perihelion in early March. Westward motion continued, the comet reaching Lynx in mid March, Leo Minor in mid April and Leo in mid May.

The comet was chosen as a winter project for the comet section and 127 observations, spanning 1992 December 17 to 1993 June 20, were made by 18 observers. Werner Hasubick photographed the comet at 11.5 on December 17. Brian Manning was unable to observe the comet visually on December 22, but was able to secure a photograph, which showed it at around 14.5. The next day Atilla Kosa-Kiss observed it visually at 10.8 in his 0.16-m reflector x54, showing the large difference between photographic and visual magnitudes. The comet steadily brightened and James Lancashire observing with the Thorrowgood 0.20-m refractor at the University of Cambridge Observatories made it 10.5 on January 26. By mid February it was visible in binoculars with Sally Beaumont estimating it at 9.0 in 8x50B on February 20. A photograph by Martin Mobberley taken near the same time (19.90) appeared in the Journal¹⁴. Peak brightness was reached at the end of the month, Roy Panther estimating it at 8.5 in his 0.25-m reflector x36 on the 28th. Martin Mobberley secured a further image on March 9¹⁵. It rapidly became more difficult to observe; Guy Hurst observing on March 27 estimated it at 10.9 in his 0.44-m reflector x165, though observers using smaller apertures and magnifications made it up to a magnitude brighter. The last section observation was made by Jonathan Shanklin on April 22 when he estimated it at 10.4 in the Thorrowgood refractor. The final observation received was one by Herman Mikuz, who used his CCD camera on June 20 to capture the comet at 14.7.

The apparent coma diameter increased from around 1' when first recovered to around 10' at opposition and had decreased to 1' again when finally observed. When corrected for distance from the Earth, the diameter shows a small increase from about 1' (44,000 km) when the comet was 1.6 AU from the Sun to about 3' (130,000 km) at perihelion. The degree of condensation showed a decrease throughout the apparition declining from about 4 in December to about 1 in April. The very diffuse nature of the comet explains the difficulty in observing it late in the apparition. No observers reported tail development on the comet during this apparition.

Table 6 Ephemeris for comet 24P/Schaumasse 1992x

Magnitudes calculated from $m = 7.6 + 5.0 * \text{Log}(D) + 24.2 * \text{Log}(r)$

Latitude: 53.00N Longitude: 0.00W

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

(1950.0)

1992 November

3/ 4	4 34.8	11.42	14.3	0.97	1.90	23.21 to 4.05	151
13/14	4 29.9	12.15	13.5	0.85	1.81	21.41 to 4.17	161
23/24	4 21.0	13.10	12.7	0.75	1.73	20.09 to 4.13	171

1992 December										
3/ 4	4	8.8	14.34	12.0	0.67	1.65	18.39	to	3.59	169
13/14	3	54.9	16.32	11.3	0.61	1.57	17.17	to	3.39	158
23/24	3	41.7	19.03	10.6	0.58	1.50	17.21	to	3.18	146
1993 January										
2/ 3	3	31.9	22.05	10.1	0.56	1.43	17.29	to	3.00	134
12/13	3	27.8	25.34	9.5	0.55	1.36	17.41	to	2.49	124
22/23	3	30.8	29.25	9.1	0.54	1.31	17.55	to	2.46	115
1993 February										
1/ 2	3	42.1	33.33	8.7	0.54	1.26	18.11	to	2.55	108
11/12	4	2.5	37.46	8.4	0.54	1.23	18.28	to	3.19	103
21/22	4	33.1	41.48	8.3	0.55	1.21	18.46	to	4.01	100
1993 March										
3/ 4	5	14.7	45.12	8.2	0.55	1.20	19.04	to	5.03	98
13/14	6	7.0	47.19	8.4	0.57	1.21	19.22	to	4.56	98
23/24	7	6.4	47.33	8.6	0.59	1.23	19.42	to	4.31	99
1993 April										
2/ 3	8	6.3	45.38	9.0	0.62	1.26	20.03	to	4.04	100
12/13	9	0.7	41.52	9.6	0.66	1.31	20.25	to	3.37	102
22/23	9	46.8	36.56	10.2	0.73	1.37	20.49	to	3.08	103
1993 May										
2/ 3	10	25.0	31.29	10.9	0.81	1.43	21.14	to	2.28	103
12/13	10	56.8	26.02	11.6	0.90	1.50	21.42	to	1.25	103
22/23	11	24.1	20.52	12.4	1.02	1.57	22.11	to	0.18	102
1993 June										
1/ 2	11	48.0	16.07	13.2	1.15	1.65	22.41	to	23.04	100
11/12	12	9.6	11.47	13.9	1.29	1.73	Not Observable		97	
21/22	12	29.5	7.53	14.7	1.44	1.82	Not Observable		94	

Fig 3 ###
Orbital diagram

Fig 4 ###
Light curve

Fig 5 ###
Coma diameter

Fig 6 ###
Photograph by Nick James

y Shoemaker (1992 U1, 1993 VI)

Carolyn S Shoemaker discovered a 15.5^m comet on a film taken by Eugene M Shoemaker, David H Levy and Henry Holt with the 0.46-m PS on October 25.5 [IAUC 5644, 1992 October 27]. The comet was moving NW in Taurus a month before opposition.

The comet never reached visual brightness, the only positive observation being a photographic one by Hasubick on 1992 December 16 when it was about 13.5.

z 70P/Kojima (1994 VI)

Recovered by James Scotti with the SWT on October 21.4 at mag 22 when the comet was near opposition in Aries [IAUC 5667, 1992 December 4].

The orbit of the comet is chaotic, oscillating between the 1:2 and 3:4 resonances with Jupiter. An encounter in 1962 reduced the perihelion distance to 1.6 AU and it was discovered in 1970. A further encounter in 1973 increased q to 2.4 AU, where it has remained. At this return the comet does not seem to have become brighter than 19^m, but things may improve following another encounter with Jupiter in 1996 which will reduce q to 2.0 AU.

a₁ Ohshita (1992 W1, 1992 XXVII)

Nobuo Ohshita of Furukawa-machi, Gifu, Japan, discovered an 11^m comet with 25x150B on November 24.85 and confirmed it with images taken with a telephoto lens on T-Max film on November 28.8 - 30.8 [IAUC 5668, 1992 December 4]. The comet was moving NE in Virgo as it emerged from conjunction in the morning sky and faded after discovery.

Again no visual observations of this comet were obtained, but Mikuz and Hasubick were able to follow it with his new ST-6 CCD and camera respectively from December 7 to 1993 February 9. During this time it faded from 11.9 to 15.5, with the coma shrinking from around 3' to 1' diameter and changing from nearly stellar to diffuse in appearance.

Other comets

1P/Halley (1982 U1, 1986 III)

Marginal observations with the ESO 3.5-m New Technology Telescope by A Smette and O Hainaut were reported on IAUC 5535 [1992 June 5]. Summed CCD frames taken in April suggested that the comet (at a distance of 16.2 AU) was about 25.8^m, close to the predicted nuclear magnitude and hence the dust outburst¹⁶ in 1990 must have dispersed.

26P/Grigg-Skjellerup (1992 XVIII)

The comet is one of the shortest period comets known and although intrinsically faint, can make close approaches to the Earth. It is associated with the Pi Puppis meteor shower which has a maximum around April 23. The 1992 apparition was rather unfavourable and no observations were received. The Giotto spacecraft made an encounter with the comet on July 10 and should return to the vicinity of the earth in 1999¹⁷.

The orbit only shows a slow increase in perihelion distance at the moment, but it is considered chaotic due to relatively frequent close approaches to Jupiter.

29P/Schwassmann-Wachmann 1 (1989 XV)

Mikuz photographed the comet in outburst in early February when it was 13^m photographically and 10.6 visually. By the end of the month it had faded to 14.5 mpg. Mikuz again observed the comet in August, this time with a new CCD system, making it around 15^m. In early August it was diffuse, but later in the month was starlike. It was not seen after the 26th, when it was fainter than 17^m, but had brightened to 16.3 on October 22nd. It outburst again in late November, reaching 13^m in early December and fading to 14.5 by mid month.

On IAUC 5692 [1993 January 19] Jane Luu and David Jewitt reported photometric observations made with the University of Hawaii 2.2-m telescope on 1991 November 17 and 1992 November 27. The lightcurve showed a range of around 0.5^m and a period of 10ñ1 hours. This is similar to the periods found in other short period comets using the same technique, but short compared to the approximately five day period found from morphological studies.

74P/Smirnova-Chernykh (1992 XXI)

Due to the low eccentricity of its orbit the comet is visible even at aphelion but it is faint at about mag 16, and no observations were received. Close encounters with Jupiter in 1955 and 1963 changed the orbit drastically and it was discovered in 1975, though it had been earlier given the minor planet designation 1967 EU. For a few years around 2025 it will be captured by Jupiter and then a further encounter with the planet at the end of the century will move the perihelion distance outside that of Jupiter.

95P/Chiron (Asteroid 2060)

Images by Steven Larson and R Marcialis of the Lunar and Planetary Laboratory using a CCD camera on the Steward Observatory 2.3-m telescope on November 30.4 showed a 50" tail in pa 288 [IAUC 5669, 1992 December 5].

107P/Wilson-Harrington (1949 III)

While examining PSS plates for pre-discovery images of minor planets Ed Bowell found trails of the Apollo object 1979VA=4015 on plates taken on 1949 November 19.1. Brian Skiff found a slight fanned tail on the images and Brian Marsden identified the object with comet 1949g = 1949 II which had originally been given a rather uncertain 2.3 year period; the improved orbit has a period of 4.3 years. No cometary activity has been seen on the object since this discovery apparition although it was well observed in 1979-80. [IAUC 5585, 1992 August 14].

McNaught-Tritton 1978 G2

IAUC 5471 [1992 March 10] reported a probable 17^m comet found by Robert McNaught on UK Schmidt plates taken by P R Standen on 1978 May 1.5. A further object reported on plates taken in 1979 March was found to be the same object and subsequently it was found on other plates taken at Siding Spring in 1978 April and 1980 January [IAUC 5866, 1993 September 18]. It has a large perihelion distance of 6.3 AU.

Comets not recovered

34P/Gale

The comet has made encounters with both Jupiter and Saturn in the past two centuries. It approached within 0.17 AU of Saturn in 1798 and even closer to Jupiter in 1801 and 1917. The favourable apparitions of 1927 and 1938, when the comet reached 8^m, have been the only ones this century when it has been seen. This return was another unfavourable one, with perihelion coinciding with superior conjunction.

79P/du Toit-Hartley

The comet was discovered in 1945 by du Toit, but lost for six revolutions until accidentally rediscovered by Hartley in 1982 when he found two comets on a single plate, separated by 43' and given the designations 1982b and 1982c, with 1982b being the brighter. Syuichi Nakano identified them with the lost comet du Toit and Zdenek Sekanina calculated that they had probably separated at the last return to perihelion in 1976. He further predicted that 1982c was actually the major component and that 1982b would fade, which duly happened. At the next return in 1987 only the major component was seen. This return was unfavourable.

D/Shoemaker 2 1984 W1

Although predicted to reach perihelion in August, the apparition was rather unfavourable and the comet was not recovered. The orbit is fairly stable, with the perihelion distance slowly increasing over time.

Other objects

A slow moving 17^m asteroidal object was discovered by James Scotti with the SWT on January 1.4 [IAUC 5434, 1992 January 23] and given the preliminary designation 1992 AD. Subsequent observations showed it to be a distant object at 8.7 AU in an orbit with a period of 92 years which crosses that of Saturn, Uranus and Neptune. It was later numbered 5145 and named Pholus. It had no coma and an asteroidal light curve, but in many other ways is similar to Chiron.

Another slow moving object, of 23^m, was discovered by David Jewitt and Jane Luu with a CCD camera on the University of Hawaii 2.2-m telescope on Mauna Kea¹⁸ [IAUC 5611, 1992 September 14]. This was given the provisional designation 1992 QB₁ and the unofficial name of Smiley. It turned out to be the first member of the postulated Kuiper Belt and was at a distance of around 40 AU.

The SLT recovered asteroid 1984 WE₁ in November 1991 [IAUC 5484, 1992 March 30]. This asteroid is in a comet like orbit, but shows no sign of any coma.

Acknowledgements

Thanks are due to the late Harold Ridley for preparing the excellent series of prospects for comets, which were distributed with the section newsletters for many years. Some of the background material to this present series of papers comes from these and also from his unpublished work in the section archives. Thanks are also due to Guy Hurst for the long hours spent in preparing cometary material for publication in TA magazine.

References

1. Merton, G., 'Comet section report for 1949', *J. Brit. Astron. Assoc.*, **60** (8), 240 (1950)
2. Hendrie, M. J. & Keitch, G. S., 'Comet Kohler 1977 XIV', *J. Brit. Astron. Assoc.*, **91** (3), 251 (1981)
3. Hendrie, M. J. & Morris, C. S., 'Photometric Parameters of Comets: 1948 - 1954', *J. Brit. Astron. Assoc.*, **93** (1), 1 (1982)
4. Shanklin, J. D., 'Comet Analyses', *J. Brit. Astron. Assoc.*, **105** (6), 291 (1995)
5. Nakano, S. (Ed). ICQ Handbook 1992.
6. Marsden, B. G. *Catalogue of Cometary Orbits*, 9th and 10th editions, IAU CBAT, (1994, 1995)
7. Shanklin, J. D., 'Comet Levy 1990c', *J. Brit. Astron. Assoc.*, **105** (6), 295 (1995)
8. Shanklin, J. D., 'Comet Shoemaker-Levy 1991a₁', *J. Brit. Astron. Assoc.*, **106** (1), 19 (1996)
9. Shanklin, J. D., 'The Comets of 1990', *J. Brit. Astron. Assoc.*, **106** (2), [In Press] (1996)
10. Mobberley, M. P., 'Observers forum', (d), *J. Brit. Astron. Assoc.*, **102** (3), 167 (1992)
11. Mobberley, M. P., 'Comet Swift-Tuttle 1992t', *J. Brit. Astron. Assoc.*, **104** (1), 11 (1994)
12. Bone, N. M. & Evans, S. J., 'Visual and photographic observations of the Perseid meteor shower in 1993', *J. Brit. Astron. Assoc.*, **106** (1), 33 (1996)
13. Manning, B. Cover picture, 1992u, *The Astronomer*, **30** (351) (1993)
14. Mobberley, M. P., 'Observers forum - ... and welcome to Comet P/Schaumasse', *J. Brit. Astron. Assoc.*, **103** (2), 94 (1993)

15. Mobberley, M. P., Cover pictures, 1992x, *The Astronomer*, 29 (347) (1993)
16. Notes & News, 'Dramatic outburst on Comet Halley', *J. Brit. Astron. Assoc.*, 101 (3), 138 (1991)
17. O'Brien, R., 'The kamikaze strikes again - and survives', *J. Brit. Astron. Assoc.*, 102 (5), 241 (1992)
18. Bartusiak, M., 'The Remarkable Odyssey of Jane Luu', *Astronomy*, 24 (2), 46 (1996)

Figure Captions:

Figure 1. The orbit of comet Tanaka-Machholz 1992d. 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-27; observations used in the analysis cover the range T-18 to T+51.

Figure 2. The observed magnitude of comet Tanaka-Machholz. The curve is a best fit over the apparition, with no corrections applied. Tick marks indicate the first of each month from April 1992. The scatter between observers is accentuated by the scale of the magnitude axis.

Figure 3. The orbit of comet 24P/Schaumasse 1992x. 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. Observations used in the analysis cover the range T-77 to T+108.

Figure 4. The observed magnitude of comet 24P/Schaumasse. The curve is a best fit over the apparition, with no corrections applied. Tick marks indicate the first of each month from 1992 December.

Figure 5. The observed coma diameter of comet 24P/Schaumasse. The tick marks indicate the first of each month from 1992 December.

Figure 6. Comet 24P/Schaumasse photographed by Nick James on 1993 March 15^d 19^h 48^m with 0.3-m f5 reflector; exposure 6 minutes on hypered TP2415. The scale bar indicates 2.5'. [Note for Editor - at the original scale this should be 10 mm long; preferably crop to show North at the top.]