SECTION NEWSLETTER 1991/1

JANUARY 1991. EDITORIAL D.G.BUCZYNSKI

This COMET SECTION NEWSLETTER, the first issued for some time, is intended to fulfill two purposes 1) to inform BAA members known to the COMET SECTION of up to date information about currently observable comets, 2) to inform those same members of the SECTION'S various activities.
I offered to issue the SECTION NEWSLETTERS after an appeal from our current Director at the recent COMET SECTION meeting at Cambridge. I have felt for some time now that there has been a distinct lack of up to date information available to SECTION members, and that if as a SECTION we wish to receive regular observations from observers we need to rectify that situation. My belief is that the more we encourage observers, by providing a comprehensive information service, the more observations we would receive. By extending this service to observers other than our known participants we should increase the number of observers and consequently the number of observations.
As a member of THE ASTRONOMER early warning and cable team I am in a position to obtain news of comet discovery and recovery almost as soon as such information is issued by the IAU Circular Service. I am willing to act speedily to pass this information on to any SECTION member who requires it. The information could be forwarded by a number of means:
a) electronic mail b) telephone c) GPO mail d) this newsletter.
I would be prepared to arrange with any interested members a method suitable to each party on an individual basis. I hope that members will take up this offer. This service is not intended to undermine the BAA circular service but would be complimentary to it. Also the service would be devoted entirely to comet news.
Whilst our SECTION is able to publish information and observational results in the Associations' journal (JBAA) and discuss our mutual interest at meetings, I feel that we could also provide a unique forum for observational comment,illustration and reports, for preliminary analysis and cometary research review. This could be achieved by publishing a new SECTION magazine on a biannual basis. I hope to be able to bring about the publication of this magazine (THE COMET PERIODICAL) during the coming year. I will of course need the help and cooperation of the whole SECTION and would welcome constructive input from any interested member.

The new year has begun with two discoveries, details of which are to found within this NEWSLETTER.
Enclosed is a copy of The 1991 Prospects for Comets compiled for the SECTION by HAROLD RIDLEY.

I look forward to hearing from you.

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From the Director J.SHANKLIN

The New Year has opened with the discovery of two comets. The first, by Howard Brewington from the States, seems to be a return of comet P/Metcalf last seen in 1906. As it has a period of 7.8 years it is surprising that this is only the second observed return. The bright absolute magnitude (5.5) suggests that the comet may be experiencing a rare outburst; currently it is ninth magnitude and slowly fading.

The second comet, discovered in Japan by Masaru Arai is also slowly fading but being around eleventh magnitude and very diffuse it is much harder to observe.

All of you should by now have received copies of the new visual observation report forms; if not please send me an A5 size sae. The forms allow you to include all the information required by the ICQ, to whom we submit observations for archiving. I have appointed Guy Hurst as assistant director and he will collate all visual observations, forward them to the ICQ and publish them in TA where appropriate. Other section appointments are Denis Buczynski, who as you see is in charge of the section newsletter and Harold Ridley who will look after the photographic side of our work. Harold is also preparing a section report on comet Austin for the Journal. The long awaited memoir on comet Halley, written by Michael Hendrie, is with the publishers and should be finished later in the year. I also hope to produce a section guide to comet observing in the form of an A5 pamphlet.

Let us hope for many more discoveries during the year and perhaps the long awaited return of P/Swift-Tuttle which may reach perihelion in 1992. Good observing, Jonathan Shanklin, Director.

CHIRON (2060)

K. J. Meech, University of Hawaii, writes: "CCD observations made on 1990 Dec. 16 and 17 with the University of Hawaii 2.2-m tel-escope on Mauna Kea indicate that the coma of Chiron is more exten-sive than has been seen before. A composite 540-s exposure through the R filter shows an extended coma/tail at p.a. about 293 deg. This closely agrees with the anti-solar direction, 292.3 deg, at the time of the observation. The coma extends out to at least 2 x [illegible] km and is visible in exposures as short as 90 s. The absolute magni-tude, H = 6.2, is significantly brighter than observations obtained during 1990 September with the same system. April and September ob-servations showed that Chiron was continuing the trend of decreasing brightness seen since 1989 January. The December observations (r = 10.65 AU) suggest another possible outburst." (IAUC [illegible])

COMET ARAI (1991b)

Preliminary parabolic orbital elements by S. Nakano, Sumoto, Japan, from 9 observations Jan. 6-8:

T = 1990 Dec. 12.084 ET	Peri. = 338.639		
	Node = 114.852	1950.0	
q = 1.44128 AU	Incl. = 71.354		

1991 ET	R.A. (1950)	Decl.	Delta	r	m1
Jan. 4	8 58.03	+ 8 41.1	0.552	1.478	10.4
6	8 53.68	+12 56.5			
8	8 48.88	+17 20.0	0.537	1.492	10.4
10	8 43.62	+21 47.4			
12	8 37.88	+26 13.9	0.538	1.507	10.4
14	8 31.68	+30 34.6			
16	8 25.02	+34 45.4	0.555	1.525	10.6
18	8 17.92	+38 42.4			
20	8 10.42	+42 23.0	0.587	1.544	10.7
22	8 02.56	+45 45.6			
24	7 54.40	+48 49.5	0.633	1.565	11.0
26	7 46.00	+51 34.7			
28	7 37.44	+54 01.9	0.688	1.588	11.2

(IAUC 5157)

PERIODIC COMET METCALF-BREWINGTON (1991a)

B. G. Marsden, Center for Astrophysics, notes that preliminary orbital elements from recent observations strongly resemble those of P/Metcalf (1906 VI). An unpublished prediction for P/Metcalf made in 1975 by R. J. Buckley, Malvern, England, represents the recent observations within 1 deg. Adjustment by Delta(T) = -1.8 days reduces the residuals to 1'.

Rob McNaught, Australia e-mails:
"1991 Jan 08.486 UT Uppsala Southern Schmidt.
10 minute exposure on hypered 4415 Technical Pan.
Comet shows a diffuse 2' diameter coma with a very pronounced 1' dia central condensation. A 1' length bright narrow tail lies in PA 70, with a much fainter narrow tail to 1.0 degrees in the same PA.
The comet was slowly fading at discovery, according to the orbit, so the circumstance of 3 discoveries in 8.5 hours clearly indicated an outburst. This is also clear from the H(10) of around 5 to 6.
With this the 11th return since discovery, and with searches for the comet in the first few returns, and in 1983, it is clear that the comet is usually quiescent and rather faint. According to Carrusi et al, during its next orbit it will have a close approach to Jupiter, increasing the perihelion distance from 1.6 AU to 2.5 AU. Clearly the discovery at this point was fortuitous. With the greater perihelion distance and increasingly unreliable orbit, recovery would have become rather difficult." (TAEC475)

PERIODIC COMET METCALF-BREWINGTON 1991a

Brian Marsden supplies the following elements

T = 1991 Jan. 5.099 ET   Peri. = 207.717
e = 0.59340   Node = 187.037   1950.0
q = 1.59376 AU   Incl. = 13.046
a = 3.91975 AU   n = 0.127004   P = 7.76 years

1991 ET	R.A. (1950)	Decl.	Delta	r	m1
Jan. 4	23 57.99	- 6 49.8	1.547	1.594	8.5
9	0 11.19	- 5 56.0			
14	0 24.51	- 4 59.1	1.617	1.596	8.6
19	0 37.95	- 3 59.5			
24	0 51.46	- 2 57.7	1.691	1.606	8.7
29	1 05.03	- 1 54.4			
Feb. 3	1 18.64	- 0 50.2	1.770	1.622	8.8

IAUC 5160

PERIODIC COMET METCALF-BREWINGTON (1991a)

R. H. McNaught, University of Adelaide, reports that a 10-min exposure taken Jan. 8.486 UT with the Uppsala Southern Schmidt telescope shows the comet with a bright, narrow 1' tail and a much fainter, narrow, 1.0 deg tail, both in p.a. 70 deg. C. Grillmair and McNaught note that this comet was situated within the field of a U.K. Schmidt Telescope plate taken by M. Hartley on 1990 June 4.8; nothing appears near the position predicted from the elements on IAUC 5160, to a limiting magnitude of R about 19 for an asteroidal image with the expected motion of comet 1991a. (IAUC5162)

BRITISH ASTRONOMICAL ASSOCIATION - COMET SECTION.

PROSPECTS FOR 1991

There are not many left-overs from 1990 for us, but three long-enduring stalwarts will be available during the first six months.There are 19 short-period comets known to be at perihelion in 1991; the bette ones will keep us occupied during the latter half of the year,together with P/Chernykh prior to its 1992 perihelion.There are bound to be some discoveries, and we owe a great debt to those dedicated searchers who face the bleak statistics of comet-sweeping (and the even bleaker cold nights) and keep up the supply of new comets to be observed.

P/Schwassmann-Wachmann 1 This perennial object is well placed for observation during the second half of the year, slowly looping in northern Aries.It is at its best in November, but its visibility is more dependent on outbursts than on orbital position.Surges were recorded in 1990 September, October and November, magnitudes of 12 - 13.5 being reported.Continuous surveillance is important and observers with adequate instruments are urged to make routine checks whenever possible.

Tsuchiya-Kiuchi, 1990i Had this intrinsically bright comet arrived at perihelion five months later it would have been a spectacular object, as at that point the orbit lies only 0.1 A.U. outside that of the Earth Even so, it was 7^m in October, and will fade quite slowly as it departs At the beginning of 1991 it will be 9^m, in Fornax, moving northwards into Cetus by the end of March, when its magnitude will be down to 13.

Levy, 1990c After lingering long at declination -40°, this fine object makes its way slowly northwards again, leaving Centaurus and travelling almost the entire length of Hydra before entering Cancer, ending the year near the Sickle of Leo.By the end of June the initial 7^m will have faded to 13^m, following which the elongation will be less than 30° till mid-September.At the year's end the comet will still be within range of large instruments at 15th magnitude.

P/Wild 2, 1989t During the first half of the year this comet moves through Libra into Ophiuchus, fading as it does so from 11^m to 13^m.

P/Russell 1 Favourable circumstances in 1979 enabled the discovery of this faint and distant comet, but neither then nor in 1985 was it brighter than 17^m.An encounter with Jupiter in 1988 has shifted q out from 1.61 A.U. to 2.17 A.U., and with less favourable circumstances the magnitude will be only 19 - 20 during the current return.The comet has not been recovered yet, and if missed this time may well be lost, as the 1998 return is even less propitious.

P/Swift-Gehrels Following its discovery in 1889, this comet was lost for more than eighty years until its chance rediscovery by Gehrels in 1973.Although reasonably bright (10^m) and well-observed for three month in 1889, the derived orbit was none too good and this, combined with several unfavourable returns, led to its loss.The 1981 return was a good one and the comet reached 11^m, but this time things are rather worse; the brightness is unlikely to exceed 13^m and may well be a magnitude or two fainter.Recovery has not yet been announced, which may indicate the latter possibility.
During the first half of the year, the comet moves from Aquarius through Pisces and Aries, passing the Pleiades in mid-April and going on to Gemini, with the elongation decreasing to less than 30° in May.

P/Wolf-Harrington, 1990e Discovered by Wolf in 1924, this comet was subsequently lost until rediscovered by Harrington in 1951. There was disagreement as to the identity, but with the 1957 recovery the question was settled. The chaotic orbit has resulted in close encounters with Jupiter, that in 1841 being only 0.003 A.U., and resulting in q being reduced from 4.8 A.U. to 1.3 A.U., with the inclination doubled and the nodes reversed. A further approach in 1853 pushed q out to 2.4 A.U., and after its discovery the comet encountered Jupiter again, bringing q back to 1.6 A.U., where it has since remained.
At a good return the magnitude can reach 12, but this time is unlikely to be better than 14 - 15. The comet follows almost the same path as P/Swift-Gehrels: Aquarius, Pisces, Aries and Taurus, passing through the Hyades in mid-April, but from June to October the elongation is less than 30°.

P/Haneda-Campos This is one of the few short-period comets discovered by amateurs in recent years. The circumstances at discovery were most favourable, and it seems it was aided by an outburst, for although 10^m in early September, two months later it was down to 17^m.
The 1984 return was rather less favourable, and the comet was not recover - this time things could hardly be worse, with perihelion passage occurri near conjunction with the Sun. There is little prospect of a recovery, with maximum brightness at best 17^m and probably much fainter.
The comet librates around the 1/2 resonance with Jupiter, and experiences fairly frequent encounters with that planet - there is a strong possibili that it will be lost.

P/Van Biesbroeck, 1989h1 Making its fourth observed apparition, this comet is faint and distant, but is not without interest. The discovery orb was none too well determined, and several workers produced predictions for the 1966 return; those of Milbourn and Lea proved nearest the mark, with T =+0.3 day. Subsequent investigations showed that a moderately close approach to Jupiter in 1850 reduced q from 2.7 A.U. to 2.4 A.U. and reversed the nodes. More important, it was found that the pre-1850 orbit was virtually identical with that of Comet P/Neujmin 3, which also encountered Jupiter in 1850 and was even more severely perturbed. It has been concluded that the two comets are fragments of the same parent. No great change in the orbit is expected before 2025, when q will be reducec to 2 A.U.
The comet has never been estimated brighter than 15^mpg - what this would be visually is uncertain because no such observations have been made On previous form, we may expect 15^mpg again at the present return, recovery having been made by Gibson at Palomar on 1989 Dec.9.

P/Hartley 1 Discovered in 1985, this comet is intrinsically faint, and although the circumstances are optimum, there being a near-perihelic opposition, unfortunately the brightness is unlikely to exceed 15^m- 16^m q having increased from 1.5 A.U. to 1.8 A.U. In late April - early May the comet will be in southern Virgo, not far from Spica, but there is little chance of a visual sighting.

P/Arend As in the previous case, discovery was made at a very favourable apparition, but later returns have been much less so. The original maximu brightness of 14^m in 1951 decreased to 15.5 in 1959, though the latter appears to have been due to a brief outburst. Subsequently the magnitude has been around 18, and there is no reason to expect anything better this time.
The comet librates around the 2/3 resonance with Jupiter, but the high inclination keeps the encounters shallow and no drastic perturbations occur, a slight progressive increase in q and decrease in i being the main effects.

P/Harrington-Abell, 1990m This is one for the professionals - it was only 17^mpg at its discovery apparition in 1954, and at the four subsequent returns the magnitude has varied from 18 - 20pg.This year is particularly unfavourable, perihelion occurring near solar conjunction. A sharp encounter with Jupiter in 1974 reversed the nodes and nearly halved the inclination, but had little effect on e and q.Further changes will be only minor, as the comet has crossed the 2/3 resonance with Jupiter.

P/Kowal-Mrkos After this comet was discovered by Kowal in 1984 it was identified with an object observed by Mrkos and designated as a minor planet: 1984JD.The comet was faint, 15^m - 16^m, and only eight positions were secured over a period of 26 days - not the best basis for a good orbit.The difficulty has been compounded by a close approach to Jupiter during 1987 - 1990 which among other things will have moved q out from 1.95 A.U. to 2.67 A.U. With maximum brightness about 18^m and T uncertain within a month, the most likely outcome is loss of the comet.

P/Maccholz This is a most interesting and unusual comet. Discovered in 1986 May, it was only observed visually for four weeks as a rather badly-placed object of 10^m - 12^m.What makes it unique is its orbit: the smallest q of any known short-period comet (or of any asteroid),0.1255 A.U., near-parabolic eccentricity (0.958), high inclination ($60^o.15$) and very short period - only 5.25 years.It is unlikely that a small comet could remain active for many revolutions in such an orbit, but we need a well-observed second apparition to put the question on a sounder basis.In spite of the high inclination the comet can make moderate aphelic approaches to Jupiter, but again we need a better orbit for long-term evolutionary integrations.
The orbit and the intrinsic faintness (m_0=13) make the favourable observing periods brief and difficult.With so little to go on,forecasts of brightness are speculative and can only be based on the scanty data from the first apparition.
During June the comet, starting at around 14^m - 15^m, moves northwards from Sculptor through Fornax at mid-month and into Lepus at the end, perhaps having brightened to 11^m - 12^m as it does so.Meanwhile, the elongation steadily diminishes so that by mid-July, when the comet has moved into Monoceros, it is down to 20^o and it remains less than that till the end of the month, by which time the scene has shifted to the Sickle of Leo, and the brightness maybe improved to 9^m.
It is during the first half of August that northern observers will have their best observing chances.During this period the elongation increases to 45^o while the magnitude drops from 9 to 12.New Moon is on August 10, so there will be little inteference on that account.By the end of August the brightness falls to 14^m as the comet enters eastern Virgo close to the celestial equator, which it crosses southwards on Sept.2. By then, most of us will have said goodbye to it, provided that we ever said "Hullo!".
In spite of the difficulties and uncertainties involved, observers are urged to make every effort to observe this strange object, which may well be a comparatively transient phenomenon.

P/Takamizawa This, like the previous object, is one of the few short-period comets discovered by amateurs in recent years.Most of the bright ones of course were found long ago, but perturbations and outbursts can always bring previously faint and inaccessible objects within our range

The latter mechanism seems to have operated in this case; pre-discovery images show a 16^m - 17^m object in early July, but a photograph on July 26 showed a surge to 6.5, which had subsided to 9 when the comet was discovered on July 30.During the remainder of August the brightness followed a steady decline indicating m_0 = 8.5, and by mid-September the visual magnitude had sunk to 11.5 - 12.
The 1991 apparition is quite favourable, but the failure to recover the comet yet may indicate that it has reverted to its previous inconspicuous brightness, and estimates of the expected magnitude this year must be very tentative.Anything from 10^m - 11^m to 16^m at best is possible; the question can only be settled by actual observations.
During the first half of the year the comet loops slowly in Virgo, 10° - 15° N of Spica, perhaps brightening from 15th to 11th magnitude.In the latter half, it moves rapidly eastwards and south through Libra and on into Capricornus, fading to 14^m as it does so.

P/Tsuchinshan 1 This is one of a pair of faint short-period comets discovered at Purple Mountain Observatory, Nanking, in 1965 January. The comet's name derives from that of the observatory. Photographed at 15^m, the comet was none too well observed, but recovery followed at the next return in 1971.Then and in 1978, circumstances were poor and only 20^m images were recorded.The 1985 return was near optimum,and during January the comet was observed visually at 11^m.This time, things are rather worse, the elongation being less than 30°from March to October. Prior to that the brightness should be 16^m, and afterwards perhaps 14. A close approach to Jupiter in 1960 reduced q from 2 A.U. to 1.5 A.U., resulting in the 1965 discovery.During the coming century there will be a slow decrease of q and a sharp decrease of i, accompanied by rapid regression of the node and rotation of the line of apsides.

P/Skiff-Kosai Originally designated as asteroid 1977DV3 when discovered by Kosai, this object was shown by Marsden to be a comet when Skiff found an image on a 1977 Palomar plate in 1986.The orbit turned out to be of short period, but by then the 1984 return had been missed, though it was favourable.Based on eight observations over a period of a month, the present prediction of T is uncertain within a week.Brightest magnitude in 1977 was 17.5.
Not yet recovered, the comet may be picked up this year as it remains around 18^m and is reasonably well-placed for observation, but it will not be of concern to amateurs.

P/Hartley 2 This comet was not discovered until it was ten months past perihelion, which had been very unfavourably timed.Although only 17^m-18^m it possessed a short faint tail and was kept under observation for nearly three months.The present return is very favourable and the comet should be widely observed.We have no knowledge of the photometric behaviour of the comet around perihelion, and can only base our estimates on the few distant measures of 1986.Assuming conformity to the magnitude law (which is more often honoured in the breach rather than the observance) we may hope for 10th magnitude in August, when the comet will be fairly well placed in the morning sky - see the ephemeris in the 1991 BAA Handbook. Preliminary investigation indicates a close approach to Jupiter in 1982, to which we no doubt owe the subsequent discovery.
Interestingly, the orbit makes possible the production of an associated meteor shower, but since the orbit is new and the Earth will be six weeks behind the comet at the descending node, there is little prospect of anything yet, but it should be borne in mind for the future.

P/Wirtanen Discovered in 1948, the comet has been observed at every return since, except that of 1980. Until 1986, the comet had never been seen brighter than 15^m, but in March of that year it experienced an outburst, brightening to 10^m - 11^m, a reminder that even the steadiest seeming comets may occasionally make a bid for glory. The present return is quite favourable, but unless there is a recurrence of the outburst it will be no brighter than the usual 15^m. It will be in the same part of the sky as P/Hartley 2 in August-September and not far from that object. The orbit is generally chaotic, with moderate approaches to Jupiter; one such in 1972 reduced q from 1.6 A.U. to 1.25 A.U., and another in 1984 reduced the period to 5.5 years. During the coming century, the orbit remains comparatively stable.

P/Arend-Rigaux Discovered during its best-ever apparition in 1950, when it reached 11^m, this comet has been observed at every return since then, though most have been unfavourable until the last in 1984, when 12^m was achieved. At the two best returns a faint coma and short faint tail have been reported, but at large distances the images are virtually stellar. This latter characteristic was responsible for many people considering that the comet was on the verge of extinction and due to become an asteroidal-looking object. However, there seems to be no real evidence for its imminent demise.
The present return is only moderately favourable, and the magnitude is unlikely to be better than 14 - 15 as during the last four months of the year the comet moves slowly from Canis Minor through Cancer into Leo, keeping at about 10°N declination.
In 1984, Wisniewski & Fay determined a rotation period of 27^h 12^m for the nucleus, with a lower-limit variation of 0.6 magnitude.
Although the comet moves in 4/7 commensurability with Jupiter, the approaches are shallow and the orbit is very stable, the main change being a steady increase of i.

P/Faye Discovered in 1843, this is an old-stager still going strong, in spite of past predictions of its impending extinction which, like Mark Twain's premature obituary, were grossly exaggerated. Although the exceptional 5th magnitude brightness of 1843 has never been repeated, the comet still attains a respectable 10^m - 12^m whenever the circumstance are reasonably good, as in 1965 (10.5, with 15' tail), 1977 & 1984.
The current return is the best ever, with a near-perihelic opposition at the start of November. As the comet moves slowly ESE through Pisces into Cetus, it should reach a maximum brightness of 9^m - 10^m.
Since a close approach to Jupiter in 1816, the orbit has been rather chaotic, with frequent but shallow approaches to that planet. These will continue, but with little effect on e and a, though there will be a steady change of the angular elements, with i decreasing.

P/Shoemaker 1 A close (0.3 A.U.) approach to Jupiter in 1980, which reduced q from 3.8 A.U. to 2.0 A.U., combined with very favourable circumstances, led to the discovery of this comet in 1984, when the Shoemakers were raking them in like casino croupiers. The comet was well observed for three months, during which it peaked at 11^m. This time the conditions are rather less good, but during the latter half of the year the comet will be in Sagittarius at 12^m in September, moving northwards into Capricornus and Aquarius, fading to 13^m as it does so.
The orbit remains stable for several revolutions before entering a more disturbed period towards the end of next century.

P/Kowal 2 Although, following its discovery in 1979, this comet was missed at the 1985 return, alternate apparitions are favourable, and the present one could hardly be better. This is a faint object, however, and is unlikely to be brighter than $15^m - 16^m$ as it moves through Aries during November and December.
Since a moderately close encounter with Jupiter in 1936, the comet has steered clear of that planet, and a shallow approach in 1995 will do little more than reduce i somewhat.

P/Chernykh Discovered in 1977, this distant comet is intrinsically bright and was widely observed at $13^m - 15^m$ during the six months after the first observations in August. That apparition was fairly favourable and the present one is rather better, leading to an expectation of 12^m as the comet moves through southern Aquila during October. A 2' tail was noted in 1977.
This is one of the rare cases where a comet of short period experiences perturbations by both Saturn and Jupiter. Approaches to the former are, howeber, shallow, and the Jupiter encounters are not very effective because of the high relative velocity. An approach at 0.35 A.U. in 1980 reduced q slightly, but no great changes are in immediate prospect.

H.B.Ridley,
Eastfield Observatory,
1990, December 18

Sources

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Thanks are due to S.W.Milbourn for supplying predicted orbital elements of returning periodic comets.

Comets in 1991

Comet	Prov. desig.	T	Brightest Mag.	Brightest Month	Brightest Elong. °	Moon New	Moon Full
P/Schwassmann-Wachmann 1	-	1989 Oct. 26.7	18(12)	Nov.	165E	Jan.15	
Tsuchiya-Kiuchi	1990i	1990 Sept.28.7	9-10	Jan.	100E		Jan.30
Levy	1990c	Oct. 24.7	7	Jan.	90W	Feb.14	
P/Wild 2	1989t	Dec. 16.9	11	Jan.	65W		Feb.28
P/Russell 1		1991 Jan. 4.5	19-20	May	148W	Mar.16	
P/Swift-Gehrels		Feb. 22.7	13-15	Feb.	40E		Mar.30
P/Wolf-Harrington	1990e	Apr. 4.8	14-15	Feb.	55E	Apr.14	
P/Haneda-Campos		Apr. 9.5	17?	Apr.	5		Apr.28
P/Van Biesbroeck	1989h1	Apr. 24.7	15	July	150W	May 14	
P/Hartley 1		Apr. 28.7	15-16	May	170W		May 28
P/Arend		May 26.0	18	June	20W	June12	
P/Harrington-Abell	1990m	July 6.9	19-20	July	10E		June27
P/Kowal-Mrkos		July 19.1	18	Mar.	160W	July11	
P/Maccholz		July 22.6	4?(9)	July	5		July26
P/Takamizawa		Aug. 18.4	10?(16)	June	120E	Aug.10	
P/Tsuchinshan 1		Aug. 30.5	13-14	Sep.	25W		Aug.25
P/Skiff-Kosai		Sep. 14.9	17-18	Dec.	110W	Sep. 8	
P/Hartley 2		Sep. 17.2	10	Aug.	65W		Sep.2
P/Wirtanen		Sep. 20.7	15	Sep.	50W	Oct. 7	
P/Arend-Rigaux		Oct. 2.7	14-15	Oct.	65W		Oct.2
P/Faye		Nov. 16.2	9-10	Oct.	155E	Nov. 6	
P/Shoemaker 1		Dec. 18.8	12	Sep.	120E		Nov.2
P/Kowal 2		Dec. 28.4	15-16	Nov.	140E	Dec. 6	
P/Chernykh		1992 Jan. 27.8	12	Oct.	140E		Dec.2

Short-Period Comets at Perihelion in 1992

P/Comet	T 1992	q A.U.	P yrs	N	Previous Apparitions First	Last
Chernykh	Jan.27.82	2.36	13.97	1	1978 IV	-
Giacobini-Zinner	Apr.13.23	1.03	6.61	11	1900 III	1985 XIII
Tsuchinshan 2	May 20.09	1.78	6.82	4	1965 II	1985 X
Kowal 1	June12.88	4.67	15.08	1	1977 III	-
Grigg-Skjellerup	July22.14	0.99	5.10	16	1808 III	1987 X
Smirnova-Chernykh	Aug. 5.93	3.57	8.57	3	1967 XV	1984 V
Shoemaker 2	Aug. 6.88	1.33	7.87	1	1984 XVIII	-
DuToit-Hartley	Aug.27.61	1.20	5.21	3	1945 II	1987 IX
Wolf	Aug.28.13	2.43	8.25	13	1884 III	1984 XXII
Daniel	Sep. 1.67	1.65	7.06	7	1909 IV	1985 XI
Schuster	Sep. 6.39	1.54	7.26	1	1978 I	-
Giclas	Sep.13.09	1.85	6.96	2	1978 XXII	1985 XV
Singer-Brewster	Oct.28.15	2.03	6.43	1	1986 XI	-
Gale	Dec.18.23	1.21	11.24	2	1927 VI	1938 (I)

N = Number of previously observed apparitions.

An unconfirmed observation of a comet by Pons in 1808 was identified by Kresák as referring to Comet P/Grigg-Skjellerup, and designated as 1808 III.

Figures in the above table have been rounded off to two decimal places. Complete precise elements for any of these comets will be provided on request.

Comet P/Neujmin 2 is nominally at perihelion in 1992, but as it has not been observed since 1927, it must be regarded as lost.

THE BRITISH ASTRONOMICAL ASSOCIATION:COMET SECTION

SECTION NEWSLETTER 1991/2

MAY 1991 EDITORIAL D.G.BUCZYNSKI

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Cometary dust also figures in a number of other recent papers. Zahnle & Grinspoon (Nature 348, 8 Nov 90) suggest that anomalous levels of amino acids in the KT boundary layer could have been caused by the slow (104 - 105 years) deposition from cometary dust released from another giant comet. The boundary layer may have been caused by the impact of fragment of the comet perhaps 10 km in diameter, and the subsequent side effects may have killed off the dinosaurs. There is also some evidence for a number of other impacts, spread over several thousand years. If these all came from the same giant comet it would obviate the need for a 'comet shower' from the Oort cloud. Chyba, Thomas, Brookshaw and Sagan (Science, Vol 249, 27 Jul 90) investigate the possibilities of comets providing organic material to the Earth early in its history. They conclude that only small comets less than 100 metres in radius could do this, however there are a lot of unknowns in their arguments so that the amount of material deposited is still an open question.

Jonathan Shanklin

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BAA COMET SECTION - SUBMISSION OF VISUAL OBSERVATIONS G.M.HURST

There has, in recent years, been a dearth of visual observations of comets from UK-based observers, even in a period when record numbers of discoveries are being recorded.

Of course many of these discoveries (or recoveries) are of very faint comets but there remain many objects during the course of the last few years which could be seen visually in modest-aperture telescopes as has been evidenced by a considerable increase in contributions by other European observers.

As a section, we are very keen to rekindle interest in comet observing. I have undertaken the role of Assistant Director of the Section and, as you will know, also act as Editor of 'The Astronomer' and its comet section. In an effort to promote further cooperation between the two groups, we are setting up a system whereby observers, whatever their membership, should send visual observations of comets to myself and I would prefer this is on a monthly basis. If, however, you detect sudden unexpected activity in a comet, such a flare in brightness or a tail disconnection, please feel free to ring me on (0256) 471074 as I will wish to circulate news of this type to other section members.

As a prelude to the longer term analysis of comet observations by our Director (and any volunteers for this task which are welcomed!), results will be published in 'The Astronomer'. Thereafter computer files of the results will be passed to both our Director, Jonathan Shanklin and also to Dan Green who supervises the International Archive of comet observations on behalf of 'International Comet Quarterly'.

The report forms, which have already been distributed to those on our membership list, comprise:

1) Visual Observation Report Form (to be submitted monthly)
2) Telescope Record (to be submitted once annually or where a change of telescope details occurs)
3) Site Record (to be submitted annually or when details change).

If any prospective observer does not have the forms, please send a large SAE to me and I will send you a supply.

To assist you in completion of the report forms, guidance notes are also enclosed.It is very important that as many columns are completed as possible, especially the basis of the magnitude estimate (ie method=MM and sequence used=Source).

If anyone needs help with completion of the forms or any advice on 'how to get started' please ring. We need your help both to rejuvenate the section and to obtain much needed data on comets. I am sure Harold Ridley would also agree that we need more photographic material as well and if guidance is needed in that area please refer to Harold for help.

Guy M Hurst
Assistant Director.

Address for reports:
16, Westminster Close,
Basingstoke,
Hants,
RG22 4PP
E-mail STARLINK/JANET: GMH @
UK.AC.CAMBRIDGE.ASTRONOMY.STARLINK
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E. Helin, K. Lawrence, and P. Rose (Palomar). 0.46-m Schmidt telescope films. Measured by Lawrence. Comet image extremely dense, with a tail fanning to the north-northeast.
R. H. McNaught (Siding Spring). Uppsala Southern Schmidt telescope. Comet strongly condensed; comatic images. IAUC 5213

Orbital elements from MPC 18082:

T = 1992 Jan. 20.2520 ET	Peri. = 271.1233		
	Node = 11.1285	1950.0	
q = 1.519618 AU	Incl. =95.4743		IAUC 5248

1991m P/GIACOBINNI-ZINNER
K. J. Meech, Institute for Astronomy, University of Hawaii; and W. Weller, Cerro Tololo Interamerican Observatory, report the recovery of this comet on CCD images obtained using the Hawaii 2.2-m telescope (Feb. 16) and with the prototype wide-field CCD camera being developed by Weller for use on the CTIO Schmidt telescope (Mar. 14 and 15). The February data were reduced by B. Mueller and K. Meech, and the March data were reduced by K. Meech and T. Farnham. The comet appeared stellar with a Mould r magnitude near 22. The indicated correction to the prediction on MPC 14592 is Delta(T) = -0.01 day. IAUC5225

1991n P/FAYE
S. Nakano, Sumoto, Japan, reports the recovery of this comet by T. Seki, Geisei, as given below. The comet has a small coma. The indicated correction to the prediction on MPC 13042 (ephemeris on MPC 17840) is Delta(T) = -0.01 day.

1991 UT		R.A. (1950)	Decl.	m1
Apr.	16.79861	21 59 22.99	- 4 36 56.3	18.5
	19.80816	22 04 06.88	- 4 08 44.5	18.0

IAUC5246

(2060) CHIRON
C.I.Lagerkvist,Uppsala Observatory;A.Fitzsimmons,Queens University of Belfast;and P.R.Magnussen,Queen Mary and Westfield College,communicate: "With regard to the possible cometary outburst of (2060) Chiron reported by Meech on IAUC 5159, we observed this object on the night of 1990 Dec.11-12 with he Faint Object Spectrograph on e 4.2m William Herschel Telescope at La Palma. Four 20 min exposures were obtained through cirrus.Preliminary inspection of the individual spectra (range 350-960nm, resolution 1.0nm,S/N about 40 at 388.3 nm) yields no sign of cometary CN(0-0) emmision." IAUC 5163

(2060) CHIRON
J. Luu, Harvard-Smithsonian Center for Astrophysics; and J. Annis, University of Hawaii, report: "We obtained JHK imaging of Chiron on Mar. 7-8 UT with the University of Hawaii 2.2-m telescope (+ 256x256 NICMOS array) in 0".7 seeing. The images show Chiron to have magnitude J = 15.22 and colors J-H = +0.26 +/- 0.04, H-K = +0.08 +/- 0.04 inside a 3".0-diameter aperture. Within the uncertainties, these colors are consistent with solar colors (J-H = +0.31, H-K = +0.06) and are the same as those determined before activity. Preliminary analysis shows that Chiron has a very faint extended coma in the infrared, with surface brightness 21 mag/arcsec2 at 2".5 from the nucleus. These are believed to be the first infrared images of the coma of Chiron."

IAUC 5211

CRAF AND PERIODIC COMET TEMPEL 2

A. Cochran, University of Texas at Austin, reports: "The Comet Rendezvous/Asteroid Flyby (CRAF) mission has recently changed target comets from P/Kopff to P/Tempel 2. For mission planning purposes, various types of data from previous apparitions (especially 1988) are needed. There will be a special workshop at the Asteroid, Comets, Meteors 1991 meeting in Flagstaff in June to present and discuss these data. If you have relevant P/Tempel 2 data, please inform me (anita@astro.as.utexas.edu), M. A'Hearn (ma@astro.umd.edu) or P. Feldman (feldman@jhuvms.bitnet). Indicate the type of data, the dates of observations and whether you will attend the workshop in Flagstaff. We also encourage observers to continue to obtain data on P/Tempel 2 when possible."

IAUC 5230

PERIODIC COMET HALLEY (1986 III)

R. M. West, European Southern Observatory, reports: "CCD images totalling more than 26 hr exposure were obtained in Johnson V under good conditions during seven consecutive nights (Mar. 12.2-18.2 UT) with the Danish 1.54-m telescope at La Silla. The magnitude of the central condensation remains about the same as in mid-February (IAUC 5189, 5196, 5202): Mar. 12.2, 21.9; 13.2, 22.1; 14.2, 22.0; 15.2, 22.1; 16.2, 22.2; 17.2, 21.9; 18.2, 21.8 (5" circular diaphragm); some short-term variation is seen. The total magnitude is about 20. The overall size of the coma is > 30" and the outer contour still resembles a 'bow-shock' parabola, with the same general orientation as reported earlier. However, there are important morphological changes from night to night; e.g., on Mar. 13.2 a condensation was seen extending toward the southwest from the nucleus. On other nights, bands of enhanced surface brightness are present within the coma. It is therefore evident that the current outburst is continuing and observers with access to large telescopes are urged to monitor this unique event." IAUC5175

PERIODIC COMET HALLEY (1986 III)

K. Meech, Institute for Astronomy, University of Hawaii, reports: "Observations of P/Halley obtained on Apr. 12 UT with the UH 2.2-m telescope and the new TEK 1024 CCD system show that the comet has faded considerably. The Mould R magnitude within an aperture of radius 5", centered on the central condensation, is now about 21.5. Coma is visible out to a projected distance of at least 180 000 km. Although the coma shape still appears approximately hemispherical, oriented towards the southeast, the southwest quadrant has faded considerably, creating a wedge-shaped appearance, brightest toward p.a. 90 deg." IAUC 5241

COMPILED BY D.G.BUCZYNSKI

Comet Section Report forms

Laser printed master copies of the forms are sent out, and you should use photocopies of these to submit your observations.

1. Visual Observation Report Form

Record your name, the name and year identifier of the comet you have observed (eg Levy 1990 c) and the year at the top of the form.

Month Month (letters)

Day.dd (UT) Day and decimal in UT. eg 18.00 UT (GMT) on the 2nd would be 02.75

MM Method used for magnitude estimate. It is very difficult to make accurate, consistent estimates. The same technique as for variable stars is used, however it is necessary to compare like with like, so the in focus comet is compared with out of focus stars, the stars being defocussed till they appear the same size as the comet. This is the sidgwick (S) method; experienced observers may choose to use other methods.

Total Mag Reduced total magnitude of the entire coma. If you do not have an atlas or catalogue then identify the comparison stars with a field sketch on an attached sheet.

Nuclear mag Magnitude of the nucleus, if present. This time use in focus stars.

Source Source for comparison stars. AAVSO star atlas (AA), BAA chart (VB), Sky catalogue 2000 (SC), SAO catalogue (S), Atlas Coeli catalogue (SP), or other source.

Inst code Instrument used as a letter - The full details - type, aperture, magnification and f number are recorded on a separate form.

Coma diam Coma diameter in minutes of arc. Diameter = 0.25 x (time of transit across a wire) x cos(dec)
or estimate relative to 2 field stars
or estimate relative to eyepiece field width.

DC Degree of condensation. from 0 (completely diffuse) to 9 (completely stellar nucleus).

Tail length Tail length in degrees or minutes of arc

Tail PA Position angle of tail or coma elongation. North is 0°, East is 90°, South is 180°, West is 270°.

Tail type Type 1 (narrow gas tail), Type 2 (wide, fan like, possibly curved, dust tail), Type 3 (strongly curved, dust tail, narrower than type 2)

Sky val Observing conditions. 0 (impossible) to 9 (Milky way visible down to the horizon.

Rel Reliability 1 (good) to 3 (poor)

LM Naked eye limiting mag near comet to 0.5

ZLM Naked eye limiting mag at zenith to 0.5

Site Number or the name of the town or village nearest your observing site. The latitude and longitude are recorded on a separate form.

Comments Put a tick here if any other details are recorded on a separate sheet. eg. drawing, magnitude estimate, description etc. The sheet should be clearly labelled with the observers name, comet and date and time of observation.

2. Telescope Record

Only one copy of this form need be submitted each year. The instrument letter should be that used for the magnitude estimate, generally you should use as small an aperture as possible, though a light curve will be more consistent if the same instrument and magnification is used throughout the apparition. If you use the same telescope but different magnifications a different letter should be assigned to each.

Type Naked Eye (E), Binoculars (B), Newtonian Reflector (L), Cassegrain Reflector (C), Schmidt-Cassegrain (T), Schmidt-Newtonian (S), Refractor (R).

Aperture In centimetres, only give the decimals if it is significant eg 7x35B would be 3.5, whilst a 6" reflector would be 15.

f no Again only give the decimals if is significant, ie probably when it is faster than f5. This is not given for binoculars or the naked eye.

Magnification As determined from the focal lengths of telescope and eyepiece. Above 20 it can be rounded to the nearest 5.

3. Site Record

Only one copy of this form need be submitted each year and it only needs to be completed by mobile observers. If you stay put at one site then the details can be recorded on the form for each comet. Sites less than a degree apart can be called the same, and should take the name of the main observing site. It is only necessary to record the latitude and longitude to the nearest 0.1°. The SAO code need only be entered by those whose observatory has an official SAO code, these are normally people engaged in astrometric work.

PRESS RELEASE

PR 03/91 22 February 1991

For immediate release

Dramatic Eruption on Comet Halley Surprises Astronomers

A most unexpected observation

It was early in the morning of Tuesday, February 12, and ESO astronomers Olivier Hainaut and Alain Smette[1] did not know what to believe. Observing with the Danish 1.54-m telescope at the La Silla observatory, they had just finished a one-hour exposure of a small sky field in the constellation of Hydra (the Water Snake). This work was part of the ESO monitoring programme of famous Comet Halley and the astronomers felt that something was quite wrong.

When this comet passed near the Sun in early 1986, it was a bright, naked-eye object with a spectacular tail. Now, 5 years later, it has moved more than 2140 million kilometres away from the Sun and the sunlight reflected from the 15-kilometre "dirty snowball" nucleus has become so faint that it can hardly be seen, even with large, modern telescopes.

The astronomers were surprised because instead of the faint, tiny spot of light which was all the same telescope could see of Halley in 1990[2], there was now a rather bright and extended "nebula" in the middle of the picture on the computer screen. In fact, this object was almost 300 times brighter than the image of Halley's nucleus was predicted to be.

Could it perhaps be another celestial body, a nebula in the Milky Way or even another comet which happened to be seen in exactly the same direction as Comet Halley ? Or maybe it was just a reflection from a bright star in the telescope optics ?

But a second, shorter exposure confirmed that this nebula was not an artifact and additional images obtained during the following nights showed that this

[1]Both astronomers are on long-term assignment to ESO from Institut d'Astrophysique, Liège, Belgium

[2]see ESO Press Photo 02/90 (26 July 1990), or ESO Messenger **61**, page 18 (September 1990)

nebula moved in the same direction and with exactly the same speed as Comet Halley. There was no longer any doubt: *it is indeed Halley which has undergone a tremendous outburst !*

This observation has caused a certain upheaval among cometary scientists, because no comet has ever been found to have an outburst this far from the Sun. Nor is such an event predicted by any current theory. So whatever happened to Comet Halley ?

What does a cometary nucleus look like ?

Close-up observations of Comet Halley's nucleus by several spacecraft took place in March 1986, in particular by the European Space Agency's Giotto, and it is now known that a cometary nucleus mainly consists of water ice, mixed with dust grains of different sizes. Some of these grains are mineral, but chemical analysis by Giotto's instruments clearly showed that many of them are carbon-rich and therefore contain organic compounds. The amazingly dark surface of Halley's nucleus (it reflects only 4 % of the infalling sunlight) most probably harbours a lot of organic material in the form of a thin crust of dust grains. The structure of Halley's nucleus has sometimes been likened with a chocolate-covered ice cream of avocado-shape, albeit 15 kilometres long and 6 kilometres across. Another frequently used picture is that of a dirty snowdrift in springtime, slowly melting at the wayside.

As the orbital motion of a comet brings it nearer to the Sun, the dark surface on its nucleus increasingly absorbs the Sun's rays and the temperature steadily rises. The ices on the surface and below the crust begin to sublimate and a cloud of gas is formed around the nucleus; at the same time dust grains begin to fall out. A dense cloud (the "coma") soon shrouds the nucleus. Shortly thereafter one or more tails are formed when the gas molecules are pushed outwards by the fast particles in the solar wind and the dust grains are lost behind as the comet moves on in its orbit.

Close to the Sun, a comet's brightness may change from time to time, due to the sudden, explosive release of large quantities of gas and dust from the nucleus. Such outbursts take place from big vents on the surface, in the form of fast-flowing jets of dust and gas. But this activity gradually ceases, as the comet moves away from the Sun and the temperature of the surface decreases. After a while, everything freezes, no more gas and dust is lost and the remaining material in the surrounding cloud soon disperses into space, leaving the "naked" nucleus behind.

How can Halley's recent outburst be explained ?

Until the present event, Comet Halley behaved exactly as described above. Already in 1988, there was only a thin cloud left around the nucleus, in 1989 the cloud was still there, but even fainter, and in 1990, only the nucleus could be seen. And so, Halley was declared asleep and few astronomers, if any, believed that anything different from a tiny light point would be observed before the time of its next return in the year 2061.

Because of their extreme faintness, it has so far been possible to observe only two other comets at more than 2000 million kilometres from the Sun[3], and Halley is the only comet which has ever been observed to have an outburst at this large distance. Moreover, a preliminary analysis of the structure of the cloud around the nucleus (see the photo which accompanies this Press Release) indicates that the current outburst must have lasted a certain time. Since there is no obvious difference between the images obtained over a 5-day period, the surrounding cloud must be continuously replenished with new material from the nucleus. We see the comet and its surrounding cloud "from behind", as it moves away from us, towards the outer reaches of the solar system.

At the time of the observation, Halley was about midway between the planets Saturn and Uranus. At this large distance, the sunlight is very faint and the temperature on the surface of the nucleus is only around −200 °C, so cold that the snow, ice and dust must be frozen solid. It is therefore not a simple matter to explain the outburst of Halley.

There appear to be three possibilities: 1) a collision with another small, unknown body, 2) the release of a large amount of energy, stored in some way in the interior of the nucleus, or 3) the interaction with highly energetic particles in the solar wind.

Concerning the first possibility, very little is known about the population of small bodies in the outer solar system. There may be more than now thought, but the chance of hitting the relatively small nucleus of Halley seems extremely remote. Moreover, it is not clear how such a catastrophic event could lead to the apparently steady outflow, observed at this moment.

[3] Comets Cernis (1983 XII) and Bowell (1982 I), both of which are "new" comets and therefore, contrary to Comet Halley, move in open orbits and will not again visit the inner solar system.

In a similar way, virtually nothing is known with certainty about the inner structure of cometary nuclei. About half a dozen theories have been proposed about the chemical and physical properties of the ice-dust mixture, but none of them can easily explain how large quantities of heat or mechanical energy can be stored during the approach to the Sun and then released after such a long time.

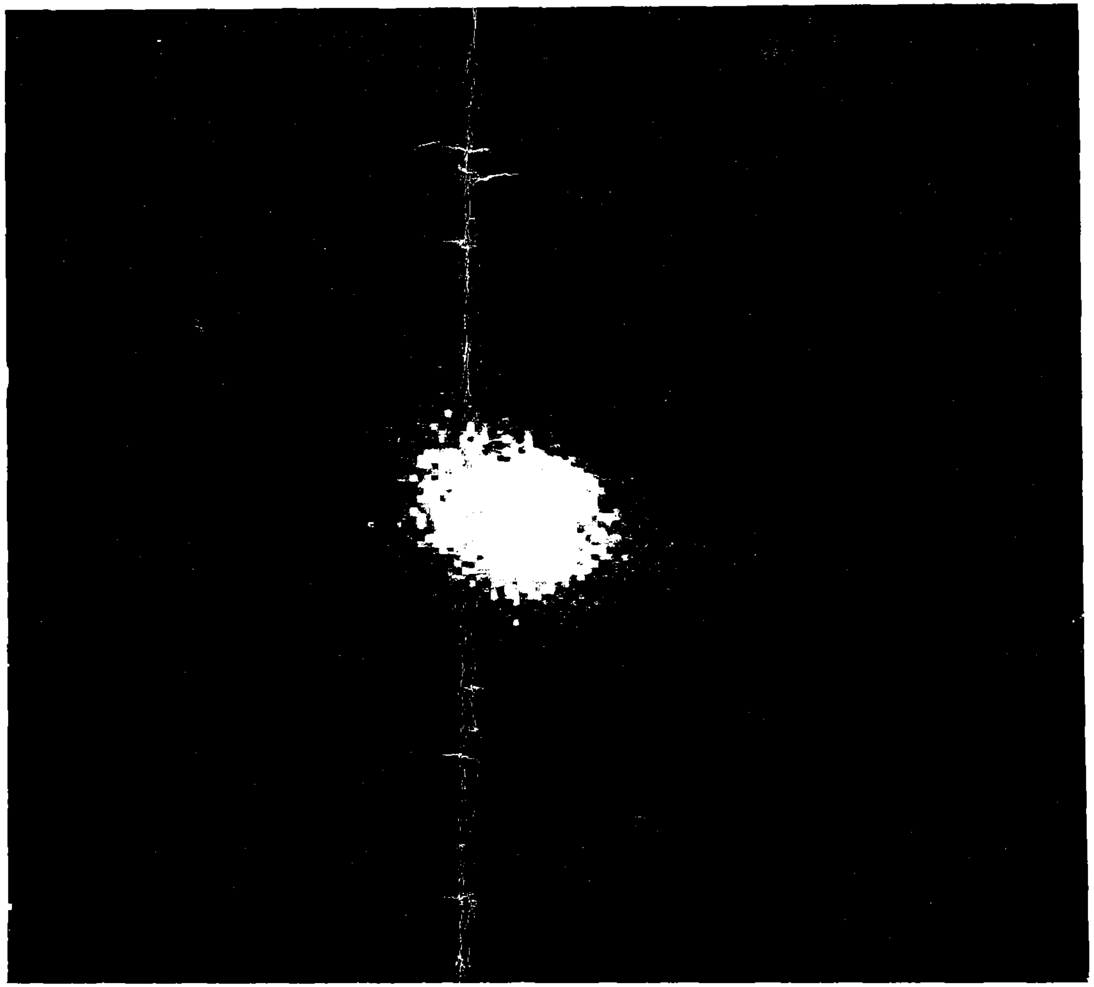
And thirdly, even though the Sun is presently in a phase of maximal activity and emits large amounts of energetic particles at frequent intervals, it is very doubtful whether they would carry enough energy to heat the surface of Halley's nucleus to produce the observed, spectacular effect at this large distance from the Sun.

Observations of Halley will be intensified

Two things are clear, however. Astrophysicists with special interest in comets will now have to rethink their theoretical models of cometary nuclei. And Halley has once again shown that it deserves to be the most famous comet of them all.

An intensified Halley observing schedule is being implemented at ESO and the comet is now monitored as often as other telescope commitments allow. Photometric observations by ESO astronomer Edmond Giraud with the ESO/MPI 2.2-m telescope have shown that the colour of Halley's coma is very similar to that of the Sun. This strongly indicates that the cloud mostly, if not exclusively, consists of dust grains that reflect the sunlight. This was confirmed by Alain Smette, who obtained a spectrum of Halley with the 3.5-m New Technology Telescope in the early morning of February 22; a first inspection did not show any emission lines which could be attributed to gas in the coma. This NTT observation constitutes an absolute record in cometary astronomy: never before has a spectrum been successfully obtained of a comet at such a large distance from the Sun.

ESO has officially announced the discovery of Halley's surprising outburst in Circular 5189 of the International Astronomical Union and other observatories will soon join in the watch.



The Dramatic Eruption on Comet Halley

The Dramatic Eruption on Comet Halley

The photo shows the enormous outburst of Comet Halley, as observed by ESO astronomers Olivier Hainaut and Alain Smette with the Danish 1.54-m telescope at La Silla on February 12 - 14, 1991. At this moment the comet was about 2140 million kilometres from the Sun and 2002 million kilometres from the Earth. The image is a combination of eight individual exposures with a total exposure time of just over 7 hours.

Comet Halley's nucleus is completely hidden within a diffuse dust cloud (the "coma") that is seen as a bright light point at the centre. From here, dust is dispersed into surrounding space; the parabolic shape of the faint, outer contour and the arc-like structure are thought to result from the complex motions of the individual dust particles. The central part of the dust cloud measures more than 30 arcseconds (300,000 km projected) across, but faint contours can be followed much further out.

Technical information: Johnson-V filter; composite of eight CCD frames with total exposure time 7h 2m 58s; North is up and East is to the left; 1 pixel = 0.464 arcsecond; field size: 153 × 153 pixels, i.e. 71 × 71 arcseconds or ~ 700,000 × 700,000 km at the distance of Halley. The telescope was set to follow the comet's motion (directed at 72° West of North) and several star trails crossed the image of Halley. The projected direction to the Sun is 15° West of South. To produce this photo, the frames were individually cleaned with the ESO IHAP image processing system.

This photo accompanies ESO Press Release 03/91 and may be reproduced, if credit is given to the European Southern Observatory.

EUROPEAN SOUTHERN OBSERVATORY

INFORMATION AND
PHOTOGRAPHIC SERVICE

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Cometary dust also figures in a number of other recent papers. Zahnle & Grinspoon (Nature 348, 8 Nov 90) suggest that anomalous levels of amino acids in the KT boundary layer could have been caused by the slow (104 - 105 years) deposition from cometary dust released from another giant comet. The boundary layer may have been caused by the impact of fragment of the comet perhaps 10 km in diameter, and the subsequent side effects may have killed off the dinosaurs. There is also some evidence for a number of other impacts, spread over several thousand years. If these all came from the same giant comet it would obviate the need for a 'comet shower' from the Oort cloud. Chyba, Thomas, Brookshaw and Sagan (Science, Vol 249, 27 Jul 90) investigate the possibilities of comets providing organic material to the Earth early in its history. They conclude that only small comets less than 100 metres in radius could do this, however there are a lot of unknowns in their arguments so that the amount of material deposited is still an open question.

Jonathan Shanklin

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BAA COMET SECTION - SUBMISSION OF VISUAL OBSERVATIONS G.M.HURST

There has, in recent years, been a dearth of visual observations of comets from UK-based observers, even in a period when record numbers of discoveries are being recorded.

Of course many of these discoveries (or recoveries) are of very faint comets but there remain many objects during the course of the last few years which could be seen visually in modest-aperture telescopes as has been evidenced by a considerable increase in contributions by other European observers.

As a section, we are very keen to rekindle interest in comet observing. I have undertaken the role of Assistant Director of the Section and, as you will know, also act as Editor of 'The Astronomer' and its comet section. In an effort to promote further cooperation between the two groups, we are setting up a system whereby observers, whatever their membership, should send visual observations of comets to myself and I would prefer this is on a monthly basis. If, however, you detect sudden unexpected activity in a comet, such a flare in brightness or a tail disconnection, please feel free to ring me on (0256) 471074 as I will wish to circulate news of this type to other section members.

As a prelude to the longer term analysis of comet observations by our Director (and any volunteers for this task which are welcomed!), results will be published in 'The Astronomer'. Thereafter computer files of the results will be passed to both our Director, Jonathan Shanklin and also to Dan Green who supervises the International Archive of comet observations on behalf of 'International Comet Quarterly'.

The report forms, which have already been distributed to those on our membership list, comprise:

1) Visual Observation Report Form (to be submitted monthly)
2) Telescope Record (to be submitted once annually or where a change of telescope details occurs)
3) Site Record (to be submitted annually or when details change).

If any prospective observer does not have the forms, please send a large SAE to me and I will send you a supply.

To assist you in completion of the report forms, guidance notes are also enclosed. It is very important that as many columns are completed as possible, especially the basis of the magnitude estimate (ie method=MM and sequence used=Source).

If anyone needs help with completion of the forms or any advice on 'how to get started' please ring. We need your help both to rejuvenate the section and to obtain much needed data on comets. I am sure Harold Ridley would also agree that we need more photographic material as well and if guidance is needed in that area please refer to Harold for help.

Guy M Hurst
Assistant Director.

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****

COMET NEWS FROM THE IAUC's 5164-5248
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DISCOVERIES,RECOVERIES,ELEMENTS ETC.

1991a P/METCALF-BREWINGTON
ELEMENTS MPC 17596
EPOCH=1991 Jan 24.0 ET

T= 1991 Jan 5.7531 ET	Peri.=208.1401
e= 0.593667	Node =187.0616 1950.0
q=1.592142 AU	Incl.=13.0335
a=3.918315 AU	n =0.1270735
p=7.756 years	

Prediscovery images found by M.Tanaka (Fukushima-ken,Japan) on photographs taken on 1991 Jan 5.5 UT,showing the comet at mag about 15,thereby suggesting that a significant outburst took place within two days of Brewington's discovery. IAUC 5168

Astrometry by H.B.Ridley (Eastfield Observatory 984)
1991 01.13.76389 00 23 53.76 -05 01 54.6
1991 01 17.76667 00 34 39.00 -04 14 26.5

1991b COMET ARAI
Prediscovery images of this comet (m1 about 10) were found on films exposed 1990 Dec. 23 by T. Ohtsuka and T. Kojima, Tatebayashi, Gunma, Japan. IAUC 5170

Astrometry by H.B.Ridley (Eastfield Observatory 984)
1991 01.14.89028 08 28 49.45 +32 25 44.8
Orbital elements by S. Nakano, Sumoto, Japan, from 59 observations 1990 Dec. 23-1991 Feb. 13, taken from MPC 17791:

T = 1990 Dec. 10.8829 ET	Peri. = 337.6292
e = 0.990387	Node = 114.8257 1950.0
q = 1.434119 AU	Incl. = 70.9787

1991c P/SWIFT-GERHELS
S. Nakano, Sumoto, Japan reports the recovery of this comet by T.Seki, Geisei. The comet was diffuse with a central condensation, m1 =16.5. The indicated correction to the prediction on MPC 13045 (ephemeris on MPC 16449) is Delta(T) =+0.06 day. IAUC 5164

1991d SHOEMAKER-LEVY
Carolyn S. Shoemaker, Eugene M. Shoemaker, and David H. Levy report their discovery of a comet, as follows:

1991 UT	R.A. (1950)	Decl.	m1	Observer
Jan. 22.42569	9 38 45.73	- 2 01 18.2	15.5	Shoemaker
22.45469	9 38 44.45	- 2 01 01.1		"
28.76094	9 34 05.39	- 0 53 19.4	15.5	McNaught

C. S. Shoemaker, E. M. Shoemaker, and D. H. Levy (Palomar). 0.46-m Schmidt telescope films. Comet diffuse with strong condensation and possible hint of a tail.

R. H. McNaught (Siding Spring). Uppsala Southern Schmidt telescope. Comet strongly condensed. IAUC 5175

Preliminary parabolic orbital elements by S. Nakano, Sumoto, Japan, from 8 observations Jan. 13-29:

T = 1991 Dec. 29.106 ET	Peri. = 74.500	
	Node = 144.461	1950.0
q = 2.24936 AU	Incl. = 77.082	IAUC 5177

1991e P/SHOEMAKER-LEVY

C. S. Shoemaker, E. M. Shoemaker, and D. H. Levy report their discovery of a comet, with the following positions available:

1991 UT	R.A. (1950)	Decl.	m1	Observer
Feb. 7.34149	9 20 10.76	+13 28 17.8	16.5	Shoemaker
8.26041	9 19 28.22	+13 29 53.0		"
8.33216	9 19 24.04	+13 30 00.6		Larson

C. S. Shoemaker, E. M. Shoemaker, and D. H. Levy (Palomar). 0.46-m Schmidt telescope films. Comet moderately diffuse, with hint of a tail to the northwest. Measured by J. Mueller.

S. Larson (University of Arizona, Catalina Station). 1.5-m telescope encoders. Cousins R CCD images show a 1′ tail in p.a. 298 deg.

Preliminary orbital elements by B. G. Marsden, Center for Astrophysics, from 11 observations Feb. 7-11:

T = 1991 Feb. 26.886 ET		Peri. = 199.128	
e = 0.23326		Node = 303.295	1950.0
q = 2.87363 AU		Incl. = 5.155	
a = 3.74787 AU	n = 0.135840	P = 7.26 years	IAUC 5184

1991f SHOEMAKER-LEVY

C. S. Shoemaker, E. M. Shoemaker, and D. H. Levy report their discovery on Palomar 0.46-m Schmidt films of yet another comet, as given below. The object is diffuse with a faint tail in p.a. about 280 deg. IAUC 5185

1991 UT	R.A. (1950)	Decl.	m1
Feb. 9.455	12 09.5	+ 2 31	17
11.272	12 08.8	+ 2 43	

T = 1990 Oct. 8.420 ET	Peri. = 312.435	
	Node = 146.434	1950.0
q = 1.61325 AU	Incl. = 6.594	IAUC 5187

1991g McNAUGHT-RUSSELL

Robert H. McNaught, University of Adelaide, reports his discovery of a comet on a U.K. Schmidt Telescope plate taken by Kenneth S. Russell. The object is moderately condensed with a 1′ tail in p.a. 185 deg. The confirmation on Feb. 13 is by McNaught with the Uppsala Southern Schmidt.

1991 UT	R.A. (1950)	Decl.	m1	
Feb. 12.66106	11 09 35.31	-22 53 42.8	16.5	
12.70273	11 09 33.08	-22 53 15.7		
13.62034	11 08 41.87	-22 43 05.1		IAUC 5187

Preliminary parabolic elements from 8 observations, Jan. 26-Feb. 15:

T = 1990 Oct. 14.427 ET   Peri. = 320.384
                                   Node = 161.034   1950.0
q = 4.77030 AU   Incl. = 113.386   IAUC 5188

1991h P/TAKAMIZAWA

J. V. Scotti, University of Arizona, reports his recovery of this comet with the Spacewatch telescope at Kitt Peak. There is a tail about 30" long in p.a. 285-290 deg. The observations indicate a correction of Delta(T) = -0.5 day to the prediction on MPC 13045:

Orbital elements by B. G. Marsden, Center for Astrophysics, from 117 observations 1984-1991, mean residual 1".2:

```
                    Epoch = 1991 Aug. 12.0 ET
    T = 1991 Aug. 17.88914 ET          Peri. = 147.64304
    e = 0.5746123                      Node  = 124.25069 1950.0
    q = 1.5896944 AU                   Incl. =   9.48335
      a =  3.7370488 AU   n = 0.13643033   P =   7.224 years
```

IAUC5192

1991i P/KOWAL

J. V. Scotti, University of Arizona, reports his recovery of this comet with the Spacewatch telescope at Kitt Peak. On Feb. 21 UT, there was a 15" coma and a 29" tail in p.a. 297 deg; on Feb. 21.428, m2 = 21.1. On Feb. 22, there was a 40" tail in p.a. 295 deg; on Feb. 22.391, m2 = 20.7. The comet is some 3 deg from the predicted elements on MPC 14593, which require substantial corrections in both T and omega.

The following orbital elements by B. G. Marsden, Center for Astrophysics, are from 15 observations 1977-1991, mean residual 0".6:

```
                    Epoch = 1977 Jan. 17.0 ET
    T = 1976 Dec. 29.87462 ET          Peri. = 172.07929
    e = 0.2355957                      Node  =  28.46465 1950.0
    q = 4.6563967 AU                   Incl. =   4.38877
      a =  6.0915364 AU   n = 0.06555621   P =  15.035 years

                    Epoch = 1992 Feb. 28.0 ET
    T = 1992 Mar. 10.35418 ET          Peri. = 174.42915
    e = 0.2328662                      Node  =  28.11994 1950.0
    q = 4.6691224 AU                   Incl. =   4.38495
      a =  6.0864516 AU   n = 0.06563837   P =  15.016 years
```

IAUC5195

1991j P/HARTLEY 1

Carolyn and Eugene Shoemaker and David Levy discovered another comet on a pair of films obtained with the 0.46-m Schmidt at Palomar on Mar. 12. The object was diffuse but condensed with a tail > 1' long in p.a. 285 deg. Bad weather at Palomar prevented convincing follow-up there, but observations elsewhere are shown below:

1991 UT		R.A. (1950)	Decl.	m1	Observer
Mar.	12.48888	14 16 12.59	+12 46 06.8	16.5	Shoemaker
	12.51893	14 16 11.92	+12 45 55.8		"
	16.050	14 14.9	+12 20	17	Dintinjana
	16.70903	14 14 30.59	+12 16 34.7		McNaught

C. S. Shoemaker, E. M. Shoemaker, and D. H. Levy (Palomar).

B. Dintinjana and H. Mikuz (University of Ljubljana). 0.25-m f/12 telescope. 15" coma. Three CCD frames show expected motion.
R. H. McNaught (Siding Spring). Uppsala Southern Schmidt telescope. Poor focus.

B. G. Marsden, Harvard-Smithsonian Center for Astrophysics, notes that the object is located some 16 deg from the nominal prediction for P/Hartley 1 (1985 VII) on MPC 13045. A correction of Delta(T) approximately +20 days reduces the residuals to no better than 12', and there is a differential residual of more than 1' between Mar. 12 and 16. However, the comet made a close approach to Jupiter in 1988 Feb., and a new linkage by Marsden eliminates this discordance and satisfies 15 observations 1985-1991 with mean residual 1".1. The minimum separation from Jupiter was 0.36 AU.

```
                    Epoch = 1985 June 24.0 ET
     T = 1985 June 11.6526 ET             Peri. = 174.1332
     e = 0.512079                         Node  =  40.3750   1950.0
     q = 1.539774 AU                      Incl. =  24.9278
       a =   3.155786 AU     n = 0.1758097     P =     5.606 years

                    Epoch = 1991 May  24.0 ET
     T = 1991 May   17.6839 ET            Peri. = 178.7489
     e = 0.450686                         Node  =  38.2600   1950.0
     q = 1.818390 AU                      Incl. =  25.7201
       a =   3.310291 AU     n = 0.1636458     P =     6.023 years
```

IUAC5209

1991k P/MRKOS

On Mar. 17 Antonin Mrkos, Klet Observatory, reported his discovery of a rapidly moving object. Films taken at Palomar by E. Helin et al. show the object to be somewhat diffuse, and Mrkos later described the object as diffuse with central condensation. Available observations:

1991 UT		R.A. (1950)	Decl.	m1	Observer
Mar.	16.95628	12 44 29.36	- 2 47 07.9	15	Mrkos
	16.97017	12 44 27.13	- 2 48 00.8		"
	17.03753	12 44 16.12	- 2 52 20.0	15	"
	17.04517	12 44 14.79	- 2 52 52.2		"
	17.98406	12 41 43.03	- 3 53 58.3		"
	17.99170	12 41 41.72	- 3 54 28.3		IAUC 5212

Improved orbital elements from MPC 18081:

```
     T = 1991 Mar. 18.9902 ET             Peri. = 180.4239
     e = 0.550370                         Node  =   0.9778   1950.0
     q = 1.408729 AU                      Incl. =  31.3609
a =  3.133087 AU     n = 0.1777237       P =  5.546 years     IAUC 5248
```

1991l HELIN-LAWRENCE

Eleanor F. Helin and Kenneth J. Lawrence report their discovery of a comet, as follows:

1991 UT		R.A. (1950)	Decl.	m1	Observer
Mar.	17.40191	13 32 10.92	+ 8 52 13.4	15	Helin
	17.42483	13 32 08.94	+ 8 52 15.7		"
	19.69248	13 29 19.55	+ 8 56 41.2	15	McNaught

THE BRITISH ASTRONOMICAL ASSOCIATION:COMET SECTION

SECTION NEWSLETTER 1992/1

1992 JANUARY D.G.BUCZYNSKI

The past year has seen many discoveries of faint periodic comets, mainly by the active team at Palomar headed by the Shoemakers and David Levy. These discoveries are important as they add to the total number of objects to study.

It is however, a sobering thought that the comets discovered by this team are merely by products of a larger programme to discover fast moving asteroids. One wonders how many comets would be discovered if an exclusive search for them were made. The search methods used in this programme seem straightforward, relying on traditional photographic procedures combined with simple stereoscopy.What could be easier? Providing that you have access to a 48 inch Schmidt camera and hundreds of clear nights per year and a determination to do the job, then nothing!

Most of the comets discovered by this team remain faint and unobservable for observers with small to medium sized telescopes, however Comet Shoemaker-Levy 1991a1 holds out a little better promise. With perihelion occuring in July and the comet near the north celestial pole we should be in position to make a good number of observations of this comet. Indeed I propose that we make this comet our primary target during 1992.

There has been concern voiced of late, that cometary observations by amateurs in this country are now at an all time low. This contrasts with the large number of cometary observations being submitted by European observers. Perhaps we in the UK have just got out of the habit! Observers who decided to take a break from cometary observing after P/Halley in 1985/86 must now be "well rested". The time to get back to work has now come! As a Section we must restablish an active observational base. This coming year gives us that opportunity.

The value of visual and photographic observations of comets is a high now as it has ever been. Due to the transitory nature of comets the observational windows are very limited and planning is required to ensure the best return for our efforts. Our coordinators Guy Hurst (visual) and Harold Ridley (photographic) are ready to recieve your observations.Please contact them for advice regarding the Section's observing programmes.Indeed in the absence of the Director until March (Antartic duties) any general enquiries should be forwarded to Guy Hurst.

COMET ZANOTTA-BREWINGTON (1991g1)

Guy Hurst, Assistant Director of the Comet Section reports:

Mauro Vittorio Zanotta, Milan, Italy has telexed details of his discovery of new comet on 1991 Dec 23 and, in response to an alert, confirmation was obtai by Martin Mobberley and Herman Mikuz:

		(2000)		(1950)		m1	Observer
1991 Dec	23.84375UT	20h 44.5m	+19 10′	20h 42.2m	+18 59	9	Zanotta
	23.86806	20 45.0	+19 05	20 42.7	+18 54	9	Zanotta
	24.719	20 47.5	+18 48	20 45.2	+18 37	9	Mobberley
	24.740	20 48.1	+18 45	20 45.8	+18 34	10	Mikuz

Additional Notes:
Mauro Zanotta (Milan, Italy) 0.15-m reflector.
Martin Mobberley (Cockfield, Bury St Edmunds, England)

0.36-m reflector visual. x55, x95. Coma diameter 4′.
Herman Mikuz (Slovenia, Yugoslavia).
0.20-m reflector x40. Coma diameter 4′, DC 6.
Dense approx 2′ diameter central condensation.

Brian Marsden, Central Bureau for Astronomical Telegrams, informs us that th new comet was independently found by H.J.Brewington of Cloudcroft, CN, USA:

	RA (2000)	DEC	m1	Observer
1991 Dec 24.12847	20 47	+18.5	10	Brewington

The following preliminary elements have been obtained from the CBAT Computer Service:

T 1992 Jan 31.8870 TDT   w 197.71903)
e 1.00000000   O 255.10030) 2000.0
q 0.6442588 A.U.   i 49.96385)
Source: Positions are geocentric

The following daily ephemeris was calculated using a computer program developed by N.James:

m1 = 9.0 + 5.0 log R + 10.0 log r

Date	R.A. (2000)		Dec.	R	r	Elong	m1	Motion	
	h	m	o ′	(AU)	(AU)	o		"/hr	P.A.
1991 Dec									
29.00	21	3.56	+17 1.6	1.065	0.950	55.1	8.9	151	116
30.00	21	7.39	+16 35.0	1.052	0.936	54.6	8.8	154	116
31.00	21	11.30	+16 7.4	1.039	0.922	54.1	8.7	158	116
1992 Jan									
1.00	21	15.28	+15 38.7	1.025	0.908	53.7	8.6	162	117
2.00	21	19.33	+15 8.7	1.012	0.894	53.2	8.5	166	117
3.00	21	23.45	+14 37.5	0.999	0.881	52.7	8.4	171	118
4.00	21	27.65	+14 5.0	0.986	0.867	52.3	8.3	175	118
5.00	21	31.93	+13 31.0	0.973	0.854	51.8	8.3	179	119
6.00	21	36.27	+12 55.6	0.960	0.841	51.3	8.2	184	119
7.00	21	40.69	+12 18.5	0.947	0.828	50.8	8.1	189	120
8.00	21	45.18	+11 39.7	0.934	0.816	50.3	8.0	193	121
9.00	21	49.75	+10 59.1	0.921	0.804	49.8	7.9	198	121
10.00	21	54.38	+10 16.6	0.908	0.792	49.3	7.8	203	122

11.00	21 59.07	+9 32.1	0.896	0.780	48.8	7.7	208	123
12.00	22 3.83	+8 45.6	0.883	0.769	48.3	7.6	214	124
13.00	22 8.65	+7 56.9	0.871	0.758	47.8	7.5	219	125
14.00	22 13.54	+7 5.9	0.859	0.747	47.2	7.4	224	125
15.00	22 18.47	+6 12.6	0.848	0.737	46.7	7.3	229	126
16.00	22 23.46	+5 16.9	0.836	0.727	46.2	7.2	235	127
17.00	22 28.49	+4 18.7	0.825	0.718	45.7	7.1	240	128
18.00	22 33.57	+3 18.0	0.814	0.709	45.2	7.1	246	129
19.00	22 38.68	+2 14.7	0.804	0.700	44.7	7.0	251	130
20.00	22 43.82	+1 8.9	0.794	0.692	44.2	6.9	256	131
21.00	22 48.99	+0 0.4	0.784	0.685	43.8	6.8	261	132
22.00	22 54.18	-1 10.7	0.775	0.678	43.3	6.8	266	133
23.00	22 59.38	-2 24.3	0.766	0.672	42.9	6.7	270	134
24.00	23 4.59	-3 40.4	0.758	0.666	42.5	6.6	274	135
25.00	23 9.79	-4 58.9	0.750	0.661	42.1	6.6	278	136
26.00	23 14.99	-6 19.7	0.743	0.656	41.8	6.5	281	137
27.00	23 20.17	-7 42.6	0.736	0.653	41.5	6.5	284	137
28.00	23 25.33	-9 7.5	0.730	0.650	41.3	6.4	287	138
29.00	23 30.46	-10 34.2	0.725	0.647	41.1	6.4	289	139
30.00	23 35.56	-12 2.5	0.720	0.646	40.9	6.4	290	140
31.00	23 40.61	-13 32.1	0.716	0.645	40.8	6.4	291	141
1992 Feb								
1.00	23 45.62	-15 2.9	0.712	0.644	40.8	6.4	291	142
2.00	23 50.58	-16 34.4	0.709	0.645	40.8	6.3	290	142
3.00	23 55.49	-18 6.5	0.707	0.646	40.9	6.3	289	143
4.00	0 0.33	-19 39.0	0.705	0.648	41.0	6.4	287	144
5.00	0 5.12	-21 11.4	0.704	0.650	41.2	6.4	285	144
6.00	0 9.84	-22 43.6	0.703	0.653	41.4	6.4	282	145
7.00	0 14.50	-24 15.3	0.703	0.657	41.7	6.4	278	145
8.00	0 19.09	-25 46.3	0.704	0.662	42.1	6.4	274	146
9.00	0 23.63	-27 16.3	0.705	0.667	42.5	6.5	270	146
10.00	0 28.09	-28 45.2	0.706	0.673	43.0	6.5	265	147
11.00	0 32.50	-30 12.7	0.708	0.679	43.5	6.6	260	147

Recent observations received by electronic-mail from our group of European observers:

Date	m1	Coma dia	Instrument	Observer
1991 Dec 26.78UT	9.3	3'	0.15-m reflector	A.Pereira (Portugal)
1991 Dec 26.81UT	9.1	2.5'	0.15-m reflector	C.A.Silva (Portugal)
1991 Dec 28.73UT	9.8	4'	0.20-m reflector	H.Mikuz (Yugoslavia)
1991 Dec 28.74UT	9.6	3.5'	20x60 binoculars	H.Mikuz (Yugoslavia)

The comet should be visible rather low in the northern sky during the next few weeks and is best observed as soon after dark as possible.

Please submit your observations by post to:

Guy M Hurst,
16 Westminster Close,
Basingstoke,
Hants,
RG22 4PP

or they can be submitted via:
UK.AC.RUTHERFORD.STARLINK.ASTROPHYSICS
FAX to (0256) 471074

>

PHOTOGRAPHIC COMET SEEKING **M.J. Hendrie**

I photographed my first comet on 1952 Jan 16 with a Government surplus f/5.6 aeroplane lens of 350mm (14 inches) focal length on a very primitive home-made equatorial with only slow motions. That was comet P/Schaumasse then about 6 mag in the constellation Lynx. In those days I used to guide for an hour or so using only rudimentary slow-motions but later I built a heavier equatorial for a 150mm (6 inch) reflector and had the luxury of a drive in RA driven by an old electric gramophone motor through a tangent arm and screw.

About 1960 I borrowed from the BAA a 125mm (5 inch) refractor by Newton of Fleet Street, London built in 1880. This was of long focal length, about f/17, and mounted on a cast iron German equatorial and driven by a Cooke weight powered clock. Also about this time I started testing a rather faster lens covering a wider field than the f/5.6, a Wray f/4.5 wide angle of 300mm (12 inches) focal length. This was built into a box camera made to take whole plates 163 x 212mm (6.5 x 8.5 in) covering 30 x 40 degrees at each exposure.

The camera was therefore about 500mm long by 300mm square, too heavy to mount anywhere but near the point of balance, but to mount it near the declination axis would have meant offsetting it a great deal in order to avoid photographing the end of the refractor. The best solution seemed to be to revert to the 150mm f/8 reflector, mounting the f/4.5 Wray above the reflector and the f/5.6 to balance it below. The telescope was then housed in a run-off wooden building 3.6 metres (12 ft) square with walls 1.5 metres high. The roof had a door in the south gable and ran off on rails towards the north. A 3 metre diameter dome would have needed a 1.8 metre wide slit with this wide-angle lens, not very practical.

The Wray lens was designed for wide-angle aerial photography and would have been used with 225mm (9 inch) wide panchromatic roll film, possibly with a yellow filter for haze cutting. The clear aperture at the stop of the lens is only about 67mm (2.7 inches) but the front element is strongly curved and nearly 110mm (4.5 inches) in diameter, while the rear element is large too. This gives a wide field with full illumination.

I tried the lens out using HP3 plates and found that with careful focussing and squaring on it gave good, small, hard star images. Although the brighter stars off the axis were not circular but more diamond shaped they were very sharp. Bright stars away from the axis produced images with tangential wings but the central part of the image was very sharp and contained most of the light.

I had sought the views of a number of comet observers on photographic comet seeking, including some professionals, and received the more or less pessimistic view that with small scale photography the problem of spurious images would be so great as to make the method ineffective in practice. Having used a variety of lenses, including portrait lenses and Aero Ektars, I was well aware of the difficulties and was of much the same opinion myself, but I believed that it might be worth experimenting further.

About this time Dr. Marsden suggested that I use the lens to search for the lost comet P/Temple-Tuttle 1866 1. This was a very long shot, the chances of finding a new comet were probably greater, but it was worth trying; one could find new comets at the same time! In 1962 the position of the comet in its orbit was so ill-defined that the year of perihelion passage was uncertain and the plan was to search along the tracks on the sky for a range of perihelion dates where the comet would probably be about the date of observation. Exposures made over 1962 to 1965 were unsuccessful (the comet was eventually recovered by M.J. Bester at the Boyden Observatory close to the position predicted by Schubart after linking the observations of 1366, 1699 and 1866. The comet passed perihelion on 1965 Apl 30. It was 16 mag at recovery, much fainter than expected and well below the limit of the Wray lens.) Some further search plates were taken in 1966/1967 when this lens made way temporarily for a 100mm aperture Cooke f/4.5, with a narrower field but able to reach fainter comets. It could also be mounted on the 125mm refractor.

This gives the background to my experiments which failed to find any comets that were bright enough for this lens, but did not miss any either so far as we know. It did I believe teach me quite a lot about the pros and cons of photographic comet seeking and the ways of overcoming the difficulties. I may well have another attempt when time allows because as with visual comet seeking, given the right tools it is, in the end, a matter of hard work and luck. The rest of this note describes in more detail how I went about it and what I learnt as a result in the hope that it may be of some use to others who may wish to try their luck in this direction. The methods described here are those finally adopted, which I consider to be the best with the equipment available, and which I should use again.

* * * * * * * * * * *

The amateur astronomer, and no doubt many a professional, has to make use of such equipment as comes to hand and this often falls far short of the ideal requirements. Clearly the sole use of a moderate size Schmidt for comet seeking would be preferable to the Wray lens, but a small Schmidt of about the same focal length might lose in the smaller area of sky covered more than would be gained by the higher speed, because of the greater number of exposures and film changes. The question of sky covered in a given observing time and faintness of comets recorded is second only (and not entirely independent of) the most important requirement which is to recognise any comets photographed as comet-like objects.

Having previously used several different f/2.5 and f/3 portrait lenses of nineteenth century vintage, all of which gave good star images within 3 degrees of the optical axis but larger, softer images often oval or drawing-pin shaped away from the axis I knew that none would cover even a quarter plate (81 x 106mm) although because of their simple construction they were very fast. A 175mm (7 inch) focal length Kodak Aero Ektar gave soft images at full aperture (f/2.5) even on the axis and would have had to be stopped down at least to f/5.6 to have given reasonable images for this purpose. Experiments with 300mm (12 inch) Ektars showed that they were unsuitable for the same reason, which was a pity because a 125mm aperture camera lens would have been very useful for comet photography.

The 300mm Wray on the other hand gave small hard images near the axis and while the images away from the axis were increasingly deformed they all had a small sharp centre containing most of the light. At 15 degrees off the axis the images of bright stars looked rather like sycamore seeds, but the wings were not visible on faint stars, and it is the faint stars that are the problem. The star images near the optical axis were no larger than 0.04mm, in quite good agreement with Whipple and Rubenstein's experimental value of 0.03mm for a system of about this focal length and f/ratio.

Small, sharp star images are important for several reasons, the light is focussed on to a smaller area of emulsion and fainter stars are recorded, or the same stars in a shorter exposure time; more doubles, clusters etc. are resolved; images of non-stellar objects stand out more clearly from the stars, and comet-like objects of smaller diameter can be identified by inspection. Given good optics, adjustment and guiding, the size of star images increases only slowly with focal length for small cameras. This leads on to the next point of plate scale.

Plate scale is directly proportional to focal length and for a 300mm lens or mirror is about 1.9 degrees per cm or 1 arcmin is equal to 0.09mm approximately. The smallest star images are about 0.04mm or about 25 arcsec across, while the same images with a 50mm focal length lens would be about the same linear size but about five times the angular size, say about 2 arcmin.

Trials with an f/2.8 Tessar of 80mm focal length showed that 9 mag comets could be photographed in a few minutes and identified, but the images were small and difficult to pick out even when one knew where to look as a comet of diameter 2 arcmin was little larger than the fainter star images. There is, of course, more photograph not covered with star images with the larger scale and less chance that the comet suspect will be involved with the images of stars or other objects.

Returning to the search for new comets, clearly it would be possible to search with a short focus lens for comets of up to 9 mag but it would hardly be worthwhile to try to compete directly with visual observers for comets in the brightness range up to 10 mag. The photographic method is more cumbersome and expensive than the visual and if it is to be worthwhile its advantages must be exploited. Very few comets are discovered visually that are fainter than 10/10.5 mag at discovery; I believe that none are discovered photographically as a result of a deliberate search for new comets only. Thus the photographer should aim to go fainter than $10\frac{1}{2}$ mag; the fainter the better, but how faint will depend on the equipment available. In the end it is a trade-off against aperture (faintness reached) and field (sky searched in the time available). The 300mm aperture paraboloid is too restricted in sky coverage, and the 35mm format camera by not being able to reach faint comets and the smallness of the cometary image. Somewhere in between one has to reach a compromise.

I believe that the minimum focal length is 250mm (10 inches), minimum speed f/4.5 and minimum field 20 x 20 degrees. But a faster system could operate with a smaller field as exposures would be shorter and if you can afford a longer focal length and the time to take more exposures, then you can reach fainter comets. The 48 inch Schmidt is perhaps the ultimate comet seeker, but most of us have to make do with somet ng less expensive.

To keep exposures reasonably short the fastest plates were used. In this case, in the search for P/Temple-Tuttle, it was expected that the comet if found would be within 1 and 2 AU from the Sun. At this distance most periodic comets show fairly strong emission bands of C_2 at 4737 Å and 5165 Å in the green part of the spectrum. Although the CN band at 3883 Å is often stronger, the Wray lens was known to absorb rather heavily at shorter wavelengths, so Kodak Oa-J plates were used. These recorded 12 mag galaxies in 15 minutes. Exposures were usually of 40 or 30 minutes. As only a single camera lens was available, double exposures were made on each plate, the second being half that of the first, i.e. 30 minutes followed by 15 minutes. The telescope was moved 3 arcmin in RA between exposures. In practice it was found that the shorter exposure was long enough to confirm any suspect picked up with the longer exposure. Any object without a twin was a fault. The shorter exposures were always made to the west of the brighter one so that plates could be compared more easily.

It is impractical to search very near the horizon because of increasing absorption, fogging and rotation of field due to differential refraction. Exposures were therefore never started or ended within about 2 hours in hour angle from the horizon.

Plates must be examined as soon after exposure as possible in case any suspects are found. To eliminate most suspects reference plates were taken on very good nights with longer exposures on the same plate centres. Bright stars were used to guide on to improve accuracy and to minimise the chance of picking up the wrong star. They were all brighter than about 4 mag. These plates with double exposures were all checked very carefully for spurious objects and comet-like objects all of which were checked against the catalogues where there was any doubt about the identity of the object.

Finding the celestial co-ordinates of objects on small scale plates is very time consuming. To overcome this difficulty two identical transparent grids were made from developed unexposed plates ruled with a fine point to give 1200 roughly 1 degree squares. These were numbered along the edges, and objects were recorded giving these co-ordinates.

Plates were examined by placing side by side in front of a diffuse screen the reference plate of the area and the search plate, each covered by its identical grid with the same stars in each corresponding numbered square.

Plates and grids were clamped together with small bulldog clips to obtain exact register. A powerful magnifier or eyepiece was used to examine in turn each square, all 1200 of them. This could take 4 to 8 hours to do properly in a difficult area; near the denser parts of the Milky Way there could be fifty pairs of stars in a square. It was found to be worthwhile to have a quick look first in case there were any bright suspects, but in the end the only way is to go over every square.

Conclusions

1. To be worthwhile a wide angle camera of 250mm focal length or more and f/4.5 or faster, covering at least 400 square degrees per hour is needed. The Wray covered 1200 square degrees per hour of observation.

2. Star images must be sharp and small over a wide field, requiring a well adjusted and suitable system, accurate polar adjustment, good guiding and photography away from the horizon and pole.

3. To reach 12 mag or fainter in a reasonable time suitable emulsions are desirable, with careful processing to yield comparable plates.

4. Plates should be taken on standard centres, reference plates being used to check search plates. Searching needs to be done soon after exposure if any comets are to be recovered. If plate checking is not done really thoroughly it is probably not worth bothering at all because with any system an amateur is likely to be using the margin between success and failure is very small anyway.

5. Areas bordering the Milky Way are difficult because of the crowding together of stars but on the other hand areas rich in galaxies are much easier than for visual observers because the images are quickly eliminated by comparison with the reference plates. The Wray showed the shapes of 12 mag galaxies so that spirals at least could be eliminated at once.

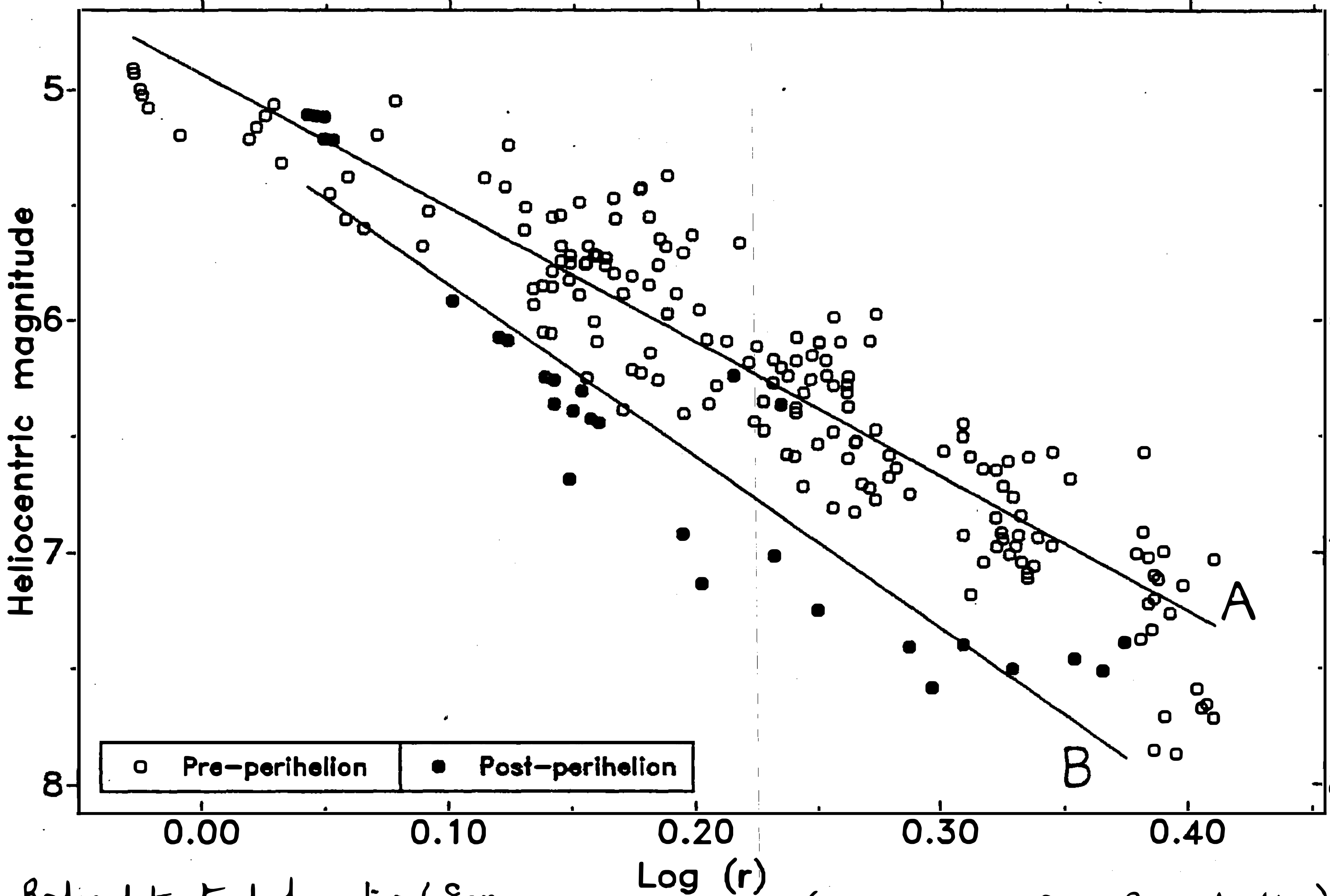
6. Photographic comet seeking can be complementary to visual work if one concentrates on fainter comets. I would not recommend photography over visual comet seeking because of its added complexity, the time lag between finding a suspect and being able to check it out and the greater cost. But it is feasible with fairly small equipment if enough attention is paid to exploiting the advantages of the method rather than competing directly with most visual comet searchers. Whether it is quicker or better than visual searching with a larger instrument away from the twilight areas is probably a matter for the individual, some may feel they can examine plates but are not very likely to see a faint comet in the telescope.

7. However, anything that increases the number of comets discovered or discovers them earlier is worthwhile. Photography carefully applied could do that.

MICHAEL J. HENDRIE

BASED ON 181 observations (Pre-perihelion)
29 (post)

Comet Levy 1990c



Reduced to standard aperture 6.8cm.

LINE A (Pre-perihelion $M = 4.93 \pm 0.04 + 5 \log(\text{Earth}) + 5.80 \pm 0.17 \log(\text{Sun})$

LINE B (Post-p) $M = 5.10 \pm 0.12 + 5 \log(\text{Earth}) + 7.42 \pm 0.55 \log(\text{Sun})$

(Submitted by Peter Birtwhistle)

GUY M HURST
BAA COMET SECTION Assistant Director.

PROSPECTS FOR 1992

Scope of these Notes All comets known to be at perihelion in 1992 are included irrespective of brightness. Of the comets with earlier perihelia, only those of possible observational interest to us are mentioned. The general limit of our magnitude range is taken to be 12 - 14, according to instrumentation and circumstances. The viewpoint is that of northern hemisphere observers in latitudes 30°- 60°.

General Most of the comets inherited from 1991 will be on the way out and fading, but two are quite promising: Helin-Lawrence, 1991l, which will be a southern object fairly bright at perihelion, and Shoemaker-Levy, 1991a1, which promises to be quite bright in June-July, well placed in the northern sky. However, long-range forecasts of the brightness of long-period comets are notoriously risky.
The returning short-period comets are a pretty dismal lot, either through intrinsic faintness or unfavourable circumstances; even P/Chernykh, which was doing quite nicely, has fallen apart.

P/Schwassmann-Wachmann 1 During the first quarter of the year this annual comet will move slowly through the northeastern part of Aries until it enters the twilight zone, from which it emerges in late July. It will then retrograde through southern Auriga till the end of the year, when it will be well-placed and at its quiescent brightest. It has been less active in 1991, the only reported outbursts being in August and September when it reached its disturbed maximum of 12th mag. The only way to be sure of not missing these unpredictable surges is to keep the comet under regular surveillance, taking a look at the ephemeris position whenever the opportunity arises.

P/Levy, 1991q Though not rivalling its long-period namesake 1990c, this comet has been reasonably bright at 8½ mag. in June-July, but fading now and starting 1992 nearer 14th, still reluctant to leave the morning sky, but at least getting into northeastern Cancer. Its period of about 50 years means that many of us will never see it again.

P/Hartley 2, 1991t Thought at first to be a new discovery by Kryachko, the object was identified by Nakano as P/Hartley 2, nearly six days early and well off the ephemeris. Having reached 8th magnitude in the autumn, though obstinately keeping in the early morning sky, it has since faded slowly, but will be with us for a while in 1992, fading from 12th mag. as it moves through Sextans.

P/Wirtanen, 1991s Another of the little group of comets infesting the morning sky, this object reached 10th magnitude in late September, thus exceeding expectations and suggesting that we should revise our ideas about its normal brightness, remembering its good performance in 1986. At the beginning of 1992 it will be in mid-Virgo, 12th magnitude and fading.

P/Shoemaker-Levy 6, 1991b1 The multiplicity of comets bearing the names of these indefatigable discoverers makes it essential to refer to the numerical designations in order to avoid confusion. This one, found on 1991 Nov.7 in Pisces, was 13th mag. and had a 1' tail. It has since been reported visually at 10th mag., indicating a post-perihelion flare. This may explain why the comet was not discovered early in October, when it made a close approach to the Earth. Rapid fading will bring the magnitude down to 14 - 15 at the beginning of 1992, when the comet will be in Triangulum, moving on into Andromeda.

P/Faye, 1991n Making one of its most favourable apparitions, this comet has kept more sociable hours and has been very widely observed. At 10th magnitude in October, it had a nice little tail, visually about 20' but more than 1° reported by CCD observers. Well placed in Cetus at the start of 1992, it moves slowly East and North, fading from 12th to 14th mag. by the end of March.

Shoemaker-Levy, 1991d Discovered on 1991 Jan.22, this rather distant object with high inclination just scrapes into a 1991 perihelion.From its original 15th mag. it has brightened slowly to its present 12, and will start 1992 at about 11½.It fades slowly to 14th magnitude by the end of September, as it moves from Hercules into Cygnus and down the Milky Way into Sagitta.

Helin-Lawrence, 1991l First of the comets known to be at perihelion in 1992, this object, discovered in 1991 March, has been observed at 13th-14th mag. during April, but brightens rapidly during the latter part of 1991 and starts the New Year at 8½.It will, however, be a southern hemisphere object, about 10° from the south celestial pole, moving rapidly northwards towards the Sun, passing about 25° south of it in April.It fades slowly, and when in June it reaches northern declination in Cetus, it will still be 12th magnitude, fading to 14th by mid-Nov.

P/Chernykh, 1991o Making its first return since discovery in 1978, this comet was recovered in 1991 June, with the indicated T 2.4 days early. All went well for a while, and 12th magnitude was reached at the end of August.Then disaster struck and the comet was reported on Sept.15 - 16 as having split into two components, both of which were very faint - Mould R magnitudes of 16.1 & 19.1 .Little has been reported since then, except that the components have separated further, and that the fainter one is unlikely to survive perihelion.

Helin-Alu, 1991r This is a very distant object, with q not far inside the orbit of Jupiter, and it is correspondingly faint.Even at its closest to us at the end of June it will only be 15th - 16th magnitude,though not too badly placed in Sagitta, but the Milky Way together with solsticial twilight will make things more difficult.

P/Kowal 1, 1991i Discovered in 1977, this comet has an interesting orbit with q=4.7 A.U. and e= 0.23, the period being 15 years.The prediction for its first return was uncertain by two weeks either way, but when the comet was recovered by Scotti on 1991 Feb.21, it was 3° off the ephemeris and the indicated correction to T was -94 days!
The comet will be of mainly professional interest,as it is unlikely to be brighter than 17½ mag. when at its best in April 1992, though well placed near Spica.
Future development of the orbit takes the form of a progressive expansion of e & a, q not changing much, though the angular elements are drastically altered.

P/Giacobini-Zinner, 1991m This comet has two claims to fame: it is the parent of the Giacobinid (October Draconid) meteor stream, which gave major displays in 1933 & 1946, and it was the first comet to be encountered by a spacecraft - the ICE (ISEE) satellite in 1985.
Unfortunately this is one of the least favourable apparitions possible; in similar circumstances the comet was completely missed in 1953, but happily it was recovered on 1991 Feb.16 at 22nd magnitude.Perihelion occurs in 1992 at the opposite side of the Sun from the Earth, and the elongation is too small for observation until August, when the magnitude will be only 15, fading to 16½ by the end of the year, while the comet moves southwards through Hydra.
Prospects for a meteor display are equally gloomy - the Earth will be at the descending node 173 days after the comet.

McNaught-Russell, 1991v This is a distant and faint object, discovered at Siding Spring on 1991 Aug.3 . It remains in the southern sky all the year, brightening slightly from 16½ mag. to 15½ in May, and sinking back to 16½ in December.

P/Tsuchinshan 2 This is one of a pair of comets discovered at Purple Mountain Observatory,Nanking,in 1965.Never very bright, it will be around 15th magnitude during the first half of the year, fading to 17th by the end of 1992.Throughout the year it moves steadily eastwards and southwards, beginning in Aries and ending in southern Hydra.
The other member of the pair, Tsuchinshan 1, 1991c1,was recovered on 1991 Nov.8 at mag.17 - 18.It may reach 14th mag. in 1991 December, moving southeastwards in Virgo and fading.

P/Grigg-Skjellerup This intrinsically faint comet has an interesting history; lost for three revolutions after its 1902 discovery, it was rediscovered in 1922.Since then it has been well observed, and has been traced back to an 1808 observation made by Pons.
The orbit is somewhat chaotic owing to encounters with Jupiter, the one in 1820 reversing the nodes.A slow increase of q has resulted in the present situation in which the orbit almost grazes that of the Earth at the node, the separation being only 0.01 AU and the line of apsides being only 0.7° distant.Two consequences follow from this configuration: the comet could make a very close approach to the Earth, when it would be about 3rd magnitude and moving across the sky faster then IRAS-Araki-Alcock did in 1983.The second consequence is the possibility of a meteor shower, and in 1977 a respectable 40 meteors per hour were seen coming from the expected radiant in Puppis.
The 1992 apparition is quite unfavourable;during the year the comet moves from Eridanus through Virgo and into Aquila,keeping close to the celestial equator.It reaches its brightest in late July, when it will be 13th - 14th magnitude, low in the western sky.
Finally, P/Grigg-Skjellerup is scheduled to join the select band of comets investigated by spacecraft, for Giotto is being directed to an encounter on 1992 July 10.In this connection an appeal for prompt and precise astrometry has been made, and a special catalogue of reference stars produced.

Shoemaker-Levy,1991a1 This is one of the brighter prospects for 1992. It is always difficult to judge from the early photographic results what the eventual visual brightness will be, but using the only data available the prognosis is 6 - 7 mag. at perihelion in July.The comet will be well placed in the evening sky, moving rapidly from Cassiopia through Camelopardalis into Ursa Major, passing about 13°South of Polaris.By September it will have faded to 9 -10 mag., well down in Corvus and too close to the Sun for observation.

P/Smirnova-Chernykh The small eccentricity (0.147) of the orbit of this faint comet enables it to be observed at aphelion, and it is not given a provisional designation.Close encounters with Jupiter in 1955 and 1963 changed the orbit drastically and led to the subsequent discovery in 1975. Nakano later showed the comet to be identical to an object previously designated as a minor planet (1967EU).Never bright at the best of times, the comet remains at 20 - 21st magnitude throughout the year.
Next century, in 2019 and again in 2073-2080, the comet will experience temporary satellite capture by Jupiter.

P/Shoemaker 2 Intrinsically this is a very faint comet, and although this apparition is only moderately unfavourable, the magnitude is unlikely to be better than 15½.In July and August the comet will move from Cetus into Taurus, in the morning sky.
Apart from a slow increase of inclination, the orbit remains stable in other respects.

P/DuToit-Hartley Discovered in 1945, this comet was lost for the next six revolutions until rediscovered in 1982, when it was found to have split into two components.Only the fainter one survived, and was recovered in 1986 at 19th mag. The present apparition is unfavourable, the comet being extremely faint during the first five months of the year, and at too small elongation for observation during the remainder.

P/Wolf During its discovery apparition in 1884 this comet was fairly bright, magnitudes from 6 to 8 being recorded; in 1891 the magnitude again reached 8.Since then a rapid progressive decline has occurred, and since 1925 nothing better than 18th magnitude has been reported. Close approaches to Jupiter are responsible for these changing fortunes. In 1875 q was reduced from 2.7 AU to 1.6, and in 1922 q was restored to 2.4 AU. Future years will see a steady increase of q, probably removing the comet from observational range.The present apparition offers no better than 17th magnitude in Sept. - Oct., when the comet will be well placed in Pisces.

P/Daniel This is another comet that has fallen on hard times after a promising start.An approach to Jupiter in 1901 reduced q from 1.52 to 1.36 AU, and the very favourable apparition of 1909 led to discovery as a 9th magnitude object.The next three perihelia were unfavourable and the comet was not recovered until 1937, by which time another joust with Jupiter had increased q to 1.54 AUand at that and the following apparition it was seen at 12 - 13th mag. All subsequent returns have been poorly timed and brightness has been in the 15 - 20 mag. range.The present appearance is no exception, with maximum brightness around 17 - 18 mag. when in late summer the comet will be in the early morning sky in Gemini.
A further encounter with Jupiter will make things worse and possibly lead to loss of the comet, as the outward trend of q will continue from 1995 onwards.

P/Schuster Discovered in 1977 at La Silla, the cometary nature of this object was in doubt until it developed a 1' tail - in fact it had been recorded earlier as an asteroid.Circumstances were fairly good and it reached 15½ magnitude.The following return was poor and the comet was missed, but this time is similar to 1977 and16th mag. may be reached in the autumn when it will be in Gemini in the morning sky.
Future orbital changes will be slow and of a minor nature.

P/Giclas Discovered at Lowell in 1978, this comet reached 15½ magnitude at its brightest.At the slightly less favourable apparition of 1985, visual magnitudes of 13½ were recorded.This is another instance of the disparity between photographic and visual magnitudes, which often amounts to two or more magnitudes, even though the former are given as 'total' rather than 'nuclear' (m_1 rather than m_2).
The present return is a little less favourable than that of 1985, but we may hope for 14th mag. when the comet is in Taurus in late summer. The orbit is fairly stable until 2300 AD, when a tangle with Jupiter will shift it right outside that of the planet.

P/Singer-Brewster A close approach to Jupiter in 1976 was probably responsible for the discovery of this comet a decade later, but even so it is still a faint and distant object.Given this year's unfavourable return there seems little prospect of the comet being brighter than 18th magnitude, and as such it will be of little concern to users of modest instruments.

P/Swift-Tuttle,1862III and Kegler (or Kögler), 1737II

P/Swift-Tuttle was the first comet to be shown to be associated with a meteor shower - the Perseids.It was a fine object in its own right, second magnitude with a 30° tail.It also exhibited an anti-tail and considerable jet activity.The indicated orbital period was 120 years, which would have resulted in a 1982 return.The strong Perseid shower of 1980 raised speculation that the parent comet was not far off, but later displays were back to normal and the comet was not recovered.
It has long been thought that a comet observed from Peking by Kegler in 1737 might have been the previous apparition of that of 1862.Only eight observations over a seven-day arc were obtained, and treatment of them by Hind in 1874 and Marsden in 1973 yielded elements roughly similar to those of the well-observed 1862 object, with the notable exception of the inclinations, which were 63° and 113° respectively, corresponding to direct and retrograde motion.However, ignoring this slight difference, the general position was consistent with the proposed identity.
Assuming that the identification is correct leads to a prediction of T = 1992 November 26, give or take a couple of months. The orbit of P/Swift-Tuttle is remarkably stable gravitationally, and deviation from formal prediction would be due to non-gravitational forces, which are probably quite strong in this case owing to the active nature of the comet.
If the comet does indeed return to perihelion in 1992/3, all will hinge on the date, for the uncertainty encompasses all scenarios from the spectacular to the disappointing.We can only 'wait and see' (or wait and not see),aa recovery will entail systematic searching with wide-field instruments along the predicted track.
Although controversy has attended the discussion of the 1991 return of the Perseids, two facts emerge as beyond reasonable doubt: the maximum was stronger than normal, and the proportion of very bright meteors was unusually high.Whether or not this is related to an imminent return of the parent comet, only time will tell.

Elements from IAUC 5330, 1991 August 28.

T = 1992 Nov.25.85, $\omega = 153^{\circ}.05$, $\Omega = 138^{\circ}.74$, $i = 113^{\circ}.45$, $q = 0.9582$ AU, $e = 0.9633$.

P/Gale This comet has been living dangerously for the past two centuries making numerous encounters not only with Jupiter but with Saturn too, that of 1798 with the latter being unique at a distance of only 0.17 AU, while even closer approaches to Jupiter occurred in 1801 & 1917. In spite of all this, only the angular elements have been strongly affected q and e remaining fairly stable.The apparitions of 1927 and 1938 were the only favourable ones this century and the comet has not been seen since the latter date.At discovery the magnitude was 8, and in 1938 a brief outburst was noted at $8\frac{1}{2}$, the comet being more diffuse than previously, but all subsequent attempts to recover the comet have failed There is little chance of success this time, as the circumstances could hardly be worse, perihelion occurring close to superior conjunction. With only 18th magnitude indicated, this one will be of purely academic interest to us.

Two of the 1993 comets should be available to us in the latter part of 1992.

P/Ciffréo This was discovered in 1985 not far from P/Halley, and might have received more attention had we not been preoccupied with the latter. The present return is moderately favourable but the comet never gets closer than 1 AU to us and will remain in the 13 - 14 magnitude range from 1992 September until 1993 February, moving northeast from near Delta Aquarii into Aries.

P/Schaumasse Some of us will remember the optimum apparition of 1952 when this comet attained naked-eye brightness at 5 - 6th magnitude. Not so good this time, but from 1992 September until 1993 March it should brighten from 14th to $8\frac{1}{2}$ mag. as it moves slowly back and forth near the Hyades.

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H.B.Ridley,
Eastfield Observatory.
1991, November 30

Comets in 1992

Comet	Prov. desig.	T	Brightest Mag.	Brightest Month	Brightest Elong.	Moon New	Moon Full
P/Schwassmann-		1989					
Wachmann 1	-	Oct.26.7	18(12)	Dec.	170N	Jan. 4	
		1991					
P/Levy	1991q	July 8.2	14	Jan.	165W		Jan.19
P/Tsuchinshan 1	1991c1	Aug.30.5	14-15	Jan.	60W	Feb. 3	
P/Hartley 2	1991t	Sept.11.7	11-12	Jan.	130W		Feb.18
P/Wirtanen	1991s	Sept.20.7	12-13	Jan.	95W	Mar. 4	
P/Shoemaker-Levy 6	1991b1	Oct.13.9	14-15	Jan.	130E		Mar.18
P/Faye	1991n	Nov.16.2	11	Jan.	90E	Apr. 3	
Shoemaker-Levy	1991d	Dec.31.2	11-12	Jan.	70N		Apr.17
		1992					
Helin-Lawrence	1991l	Jan.20.3	8-9	Jan.	60SE	May 2	
P/Chernykh	1991o	Jan.25.4	?	Jan.	70E		May 16
Helin-Alu	1991r	Feb.20.1	15-16	June	130W	June 1	
P/Kowal 1	1991i	Mar.10.4	17-18	Apr.	180		June15
P/Giacobini-Zinner	1991m	Apr.13.2	14-15	Aug.	35W	June30	
McNaught-Russell	1991v	May 3.3	15-16	May	75S		July14
P/Tsuchinshan 2		May 20.1	14-15	Jan.	115E	July29	
P/Grigg-Skjellerup		July22.1	13-14	July	45E		Aug.13
Shoemaker-Levy	1991a1	July23.8	6-7	July	50E	Aug.28	
P/Smirnova-Chernykh	-	Aug. 5.9	20	Feb.	165E		Sep.12
P/Shoemaker 2		Aug. 6.9	15-16	Aug.	75W	Sep.26	
P/DuToit-Hartley		Aug.27.6	18	Sep.	25E		Oct.11
P/Wolf		Aug.28.1	16-17	Oct.	180	Oct.25	
P/Daniel		Sep. 1.7	17-18	Oct.	65W		Nov.10
P/Schuster		Sep. 6.4	16	Oct.	95W	Nov.24	
P/Giclas		Sep.13.1	14	Nov.	160W		Dec. 9
P/Singer-Brewster		Oct.28.2	18	Apr.	75E	Dec.24	
P/Swift-Tuttle (Kegler?)		Nov.26 ?	?	?	?		
P/Gale		Dec.18.2	18	Aug.	35E		
		1993					
P/Ciffréo		Jan.22.5	13	Nov.	120E		
P/Schaumasse		Mar. 4.1	10	Dec.	160E (8½ in1993Feb.)		

Elongations are for approx. mid-month, and are rounded to nearest 5°.

Short-Period Comets at Perihelion in 1993

P/Comet	T 1993	q A.U.	P yrs	Previous Apparitions N	First	Last
Ciffréo	Jan.22.48	1.71	7.23	1	1985XVI	-
Howell	Feb.26.10	1.41	5.58	2	1981X	1987VI
Schaumasse	Mar. 4.10	1.20	8.22	8	1911VII	1984XXII
Forbes	Mar.14.63	1.45	6.13	7	1929II	1987I
Holmes	Apr.10.75	2.18	7.09	7	1892III	1986V
Väisälä 1	Apr.29.18	1.78	10.78	5	1939IV	1982V
Lovas 2	June 2.40	1.46	6.76	1	1986XIII	-
Wiseman-Skiff	June 4.39	1.51	6.53	1	1986XV	-
Slaughter-Burnham	June22.43	2.54	11.59	3	1958VI	1981XVIII
Urata-Niijima	July13.33	1.46	6.64	1	1986XVI	-
Ashbrook-Jackson	July14.05	2.32	7.49	6	1948IX	1986II
Gehrels 3	July25.42	3.43	8.11	2	1977VII	1985IV
Neujmin 3	Nov.13.04	2.00	10.63	3	1929III	1972IV
Shajn-Shaldach	Nov.15.98	2.34	7.49	4	1949VI	1986X
West-Kohoutek-Ikemura	Dec.25.31	1.58	6.41	3	1975IV	1987XV

N = Number of previously observed apparitions.

Complete precise orbital elements for any of these comets are available on request.

COMET NEWS FROM THE IAUC's 5249-5426
****
DISCOVERIES,RECOVERIES,ELEMENTS ETC.

1991e P/SHOEMAKER-LEVY 3

Improved orbital elements from 21 observations Feb.7 - Apr.15

T=1990 Dec.26.7758	Peri.=185.2002
e=0.248508	Node.=302.9169 (1950.0)
q=2.814337 AU	Incl.= 4.9820
a=3.744999 AU	n =0.1359961
p=7.247 years	

IAUC 5249

1991f P/SHOEMAKER-LEVY 4
Orbital elements from MPC 18081:

T=1990 July 14.5431	Peri.=302.2295
e=0.422300	Node =151.4066 (1950.0)
q=2.017506 AU	Incl.=8.4785
a=3.492310 AU	n =0.1510202
p=6.526 years	

IAUC 5260

1991n P/COMET FAYE
On Oct 10 D.Rabinowitz, using the Spacewatch telescope at Kitt Peak, detected a very diffuse band of light, some 1'-2' wide and 2 deg long, extending beyond the field of view of the scan. J.Scotti confirmed the band with the same telescope the following night and noted that band could be traced to the head of P/Faye, e for > 10 deg; the band had a uniform width of about 2'. The earth crossed the plane of the comet's orbit on Oct 13.3 ET.

IAUC 5366

1991o P/CHERNYKH
J.V.Scotti,Lunar and Planetary Laboratory,reports the recovery of this comet on Spacewatch images by himself and D.Rabinowitz.On June 10.460 there was a coma about 8 minutes across and a faint tail extending more than 8" in pa 252 deg. The indicated correction to the prediction on MPC 14592 (ephemeris on MPC 17841) is delta T= -2.4 days.

Improved orbital elements from 240 observations 1977-1991:
Epoch= 1992 Jan.19.0 ET

T=1992 Jan.25.4417	Peri.=263.1948
e=0.593637	Node =129.7432 (1950.0)
q=2.356269 AU	Incl.=5.0821
a=5.798435 AU	n =0.0705891
p=13.963 years	

IAUC 5285

J.Luu,Harvard Smithsonian Center for Astrophysics; and D.Jewitt,Institute for Astronomy, University of Hawaii, communicate: "We have discovered that P/Chernykh has split. Observations with the 2.4-m telescope of the Michigan-Dartmouth-MIT bservatory on Sept. 15 and 16 show that the secondary nucleus is separated from the primary by 56".6 +/-0".7 in p.a. 71 +/- 1 deg. Both the primary and seconda y objects appear extended. The Mould R magnitudes of the primary and secondary re 16.1 and 19.1, respectively, measured within an 11".7 diameter diaphram. Hei her separation nor the difference in magnitudes changed between nights."

IAUC 5347

Further observations of the splitting of the nucleus (cf. IAUC 5347) have been reported by S. M. Larson (Sept. 7, 9, Oct. 7, 8), J. V. Scotti and T. Gehrels (Sept. 17, Oct. 2, 15, 16, Nov. 5), J. Luu and D. Jewitt (Oct. 4-6), and R. H. McNaught (Oct. 5).

Z. Sekanina, Jet Propulsion Laboratory, California Institute of Technology, reports: "A solution based on 29 positional observations of the two nuclei between Sept. 7 and Nov. 5 indicates that the companion (the fainter nucleus) separated from the primary at 3.3 AU from the sun, on 1991 Apr. 14.7 +/- 4.1 UT. The separation velocity is found to be higher than that for any other split comet: 15.00 +/- 0.93 m/s along the radius vector in the direction of the sun, 0.60 +/- 0.15 m/s in the direction perpendicular to the radius and toward the direction from which the comet has come, and 0.23 +/- 0.03 m/s in the direction of the comet's north orbital pole. The secondary has been subjected to a differential nongravitational deceleration of 189 +/- 17 units of 10E-5 solar attraction and, in the terminology introduced elsewhere for the split comets (Sekanina 1982, in Comets, ed. L. L. Wilkening, Univ. Arizona, p. 251), it represents a minor companion. The solution satisfies the observations with a mean residual of +/- 0".33. The correlation between the deceleration and the endurance that applies to most other split comets suggests that the companion should disappear shortly. The ephemeris shows no major change in the configuration until around perihelion, by which time the probability of the companion's survival is virtually nil."

IAUC 5391

1991p P/SHOEMAKER 1

P.M.Kilmartin, Mount John Observatory,reports that this comet has been recovere by A.C.Gilmore and herself. The images are diffuse, and the last one is very w ak. The indicated correction to the prediction on MPC 13046 (ephemeris on MPC 1 271) is delta T= -0.6 day.

Improved orbital elements from observations 1984-1991:

Epoch = 1991 Dec. 10.0 ET

T=1991 Dec.18.2230	Peri.= 18.7733
e=0.470347	Node = 339.2496 (1950.0)
q=1.985757 AU	Incl.= 26.2367
a=3.749162 AU	n = 0.1357697
p=7.259 years	

IAUC 5286

1991q LEVY

David.H.Levy,Tucson,AZ, reports his discovery of a comet with a 0.41m f/5 refle tor,as given below. The object is spmewhat condensed with a 3' coma and no evid nce of tail.

1991 UT	RA (1950)	DECL.	m1
June 14.448	1.42.2	+13 32	8
14.465	1 42.4	+13 34	

IAUC 5291

Orbital computations show that this comet has a revolution period of some 35-60 years and that when perihelion passage is in September a close approach to the earth is possible. S. Nakano and D. W. E. Green have independently suggested identity with comet 1499, but the numberof intervening revolutions is uncertain.

```
T = 1991 July 8.185 ET              Peri. =  41.472
e = 0.92728                         Node  = 328.693   1950.0
q = 0.98217 AU                      Incl. =  19.182
  a = 13.50559 AU     n = 0.019858      P =  49.63 years
```

IA) 5306

Orbital elements from MPC 18773:

```
                     Epoch = 1991 July  3.0 ET
T = 1991 July  8.1927 ET            Peri. =  41.4772
e = 0.928814                        Node  = 328.7224  1950.0
q = 0.982515 AU                     Incl. =  19.1845
  a = 13.802108 AU    n = 0.0192214     P =  51.276 years
```

IAUC 5375

1991r HELIN-ALU
Eleanor Helin and Jeff Alu report their discovery of a comet on films taken by Helin,K.Lawrence,P.Rose, and C.Brewer with the 0.46m Schmidt telescope at Palomar. The object is diffuse with no apparent tail.

1991 UT	RA(1950)	DECL.	m1
Ju) 13.32257	16 35 54.60	-22 25 54.7	16
14.32899	16 35 23.58	-22 18 26.4	

IAUC 5291

Orbital elements from MPC 18773
T=1992 Feb. 20.0741 Peri.= 30.8133
Node = 252.9525 (1950.0)
q=4.850069 AU Incl.= 49.3134

IAUC 5374

1991s P/WIRTANEN
S.Nakano,Sumoto,Japan reports that T.Seki, Geisei, has recovered this comet(m1= 17). The object is diffuse with condensation, and the indicated correction to the prediction on MPC 13046 (ephemeris on MPC 18148) is delta T= -0.05 day.

IAUC 5303

1991t P/HARTLEY 2
G. R. Kastel', Institute for Theoretical Astronomy, reports the following rough positions of a comet discovered by T. V. Kryachko at

Majdanak. The object was diffuse and condensed with a coma 15′ across.

1991 UT	R.A. (1950)	Decl.	m1
July 9.854	1 01.5	+20 15	11
9.938	1 02.0	+20 05	
10.875	1 06.2	+20 40	11

S. Nakano, Sumoto, Japan, has suggested that this is P/Hartley 2, a correction of delta T = −5.6 days being necessary to his prediction on MPC 13046. As a result, R. E. McCrosky and C.-Y. Shao were able to confirm the comet and its identification with the 1.5-m reflector at Oak Ridge Observatory, as follows:

1991 UT	R.A. (1950)	Decl.
July 12.31995	1 12 48.80	+21 21 05.9
12.32387	1 12 49.88	+21 21 12.4
12.32899	1 12 51.28	+21 21 20.8
12.33093	1 12 51.82	+21 21 23.9

IAUC 5304

Improved orbital elements from MPC 18598:
Epoch = 1991 Sept.21.0 ET

T=1991 Sept.11.6542	Peri.= 174.9337
e=0.719489	Node = 226.0539 (1950.0)
q=0.953285 AU	Incl.= 9.2561
a=3.398382	n = 0.1573243
p=6.265 years.	

IAUC 5324

1991u P/AREND
S.Nakano,Sumoto,Japan reports the T.Seki,Geisei, has recovered this comet (m1=18). The comet is diffuse and somewhat condensed. The indicated correction to the prediction on MPC 13042 (ephemeris is on MPC 18469) is delta T= +0.01 day.

IAUC 5322

1991v McNAUGHT-RUSSELL
R.H.McNaught,Anglo Australian Observatory,reports his discovery of a comet on a 60 minute R exposure by K.S.Russell with the UK Schmidt on Aug 30 Subsequently he also found it on an Aug.3 plate.

Parabolic orbital elements

T=1992 APR.24.445	Peri.= 253.599
	Node = 120.155 (1950.0)
q=3.32276 AU	Incl.= 91.576

IAUC 5333

1991w McNAUGHT-RUSSELL
R.H.McNaught,Anglo Australian Observatory,reports his discovery of another comet (m1=18), this time on an R plate taken by K.S.Russell with the U.K. Schmidt on Sept 3.

IAUC 5335

The following parabolic orbital elements, from nine observations Sept3-8, are rather uncertain, but they suggest this comet may have a near record large perihelion distance:

T=1991 Jan.12.975 Peri.= 154.056
Node = 149.352 (1950.0)
q=7.11258 Incl.= 104.876

IAUC 5339

1991x SPACEWATCH
J.V.Scotti,Lunar and Planetary Laboratory reports the discovery of a comet(m2=21) from observations with the 0.91m Spacewatch telescope on Kitt Peak by T.Gehrels.

IAUC 5341

The following parabolic and elliptical orbits satisfy 15 observations Sept.8-12comparably well.

T=1991 Dec.8.446 ET Peri.= 45.403
Node =162.993 (1950.0)
q=0.52588 AU Incl = 44.626

T=1990 Dec.15.452 Peri.= 85.867
e=0.51223 Node = 152.956 (1950.0)
q=1.53500 AU Incl = 10.188
a=3.14701 AU n = 0.176546
p=5.58 years

IAUC 5343

Computations from 21 observations Sept.8-17 now make it clear that the comet is of short period:

T=1990 Dec.23.115 Peri.= 89.124e=0.48122 Node = 152.240 (1950.0)
q=1.58060 Incl.= 9.523
a= 304677 AU n = 0.185329
p=5.32 years

IAUC 5351

1991y P/McNAUGHT-HUGHES
R.H.McNaught reports his discovery of a comet(m1=16.5) on an R plate taken by S.M..Hughes with the U.K. Schmidt telescope at Siding Spring. The discovery plate showsthe comet as strongly condensed, with a diffuse 2' tail in pa 250 deg.

IAUC 5354

Improved orbital elements from 8 observations Sept.30 - Oct.12:

T=1991 June 16.320 Peri.= 224.450
e=0.40190 Node = 89.333(1950.0)
q=2.12527 Incl.= 7.299
a=3.55335 AU n = 0.147145

p=6.70 years

IAUC 5374

1991z P/SHOEMAKER-LEVY 5

E.Bowell, Lowell Observatory,communicates the following precise positions, measured by S.J.Bus, of a new comet discovered by C.S.Shoemaker,and D.H.Levy with the 0.46m Schmidt telescope at Palomar. The object is described as condensed.

1991 UT	RA.(1950)	Decl.	m1
Oct.2.30243	0 23 38.25	-7 29 11.2	16
Oct.3.30625	0 22 48.57	-7 25 13.8	

IAUC 5359

The following preliminary orbital elements from five observations Oct.2-6 indicate that this is a short period comet.

T= 1991 Dec. 1.533	Peri.= 0.430
e=0.48700	Node = 30.062(1950.0)
q=1.96464	Incl.= 11.057
a=3.82974 AU	n = 0.131507
p=7.49 years	

IAUC 5361

Improved orbital elements from 14 observations Sept.17-Oct.14

T=1991 Dec.13.2346	Peri.= 6.0372
e=0.529856	Node = 28.9889(1950.0)
q=1.984423 AU	n = 0.1136576
p=8.672 years	

IAUC 5376

1991a1 SHOEMAKER-LEVY
Carolyn S.Shoemaker,Eugene M.Shoemaker and David H.Levy report their discovery of another comet.

IAUC 5363

Orbital elements from MPC 19258

T=1992 July 23.7558	Peri.= 145.4157
	Node = 48.2948(1950.0)
q=0.829393	Incl.= 113.3739

IAUC 5380

1991b1 P/SHOEMAKER-LEVY 6
C.and E.Shoemaker and D.H.Levy report their discovery, on a 0.46m Schmidt films taken at Palomar,of a fast moving comet. Approximate positions follows:

1991 UT	RA(1950)	Decl.	m1
Nov.7.190	0 07.0	-1 35	13
9.193	0 11.5	+1 50	
10.156	0 14.3	+3 33	

The comet is strongley condensed on the films,with a coma of diameter about 30". On Nov.10.16,there was a tail about 1' long toward the east;at about this same time,Levy estimated m1= 12.7 visually ian 0.15m reflector.

IAUC 5382

Improved orbital elements from 9 observations Nov.3-Dec.4

T=1991 Oct.13.863 Peri.= 333.131
e=0.70631 Node =37.929(1950.0)
q=1.13245 AU Incl.= 16.863
a=3.85588 AU n = 0.130172
p=7.57 years

IAUC 5416

1991c1 P/TSUCHINSHAN 1
S.Nakano,Sumoto,Japan reports the recovery of this comet by T.Seki with the 0.60 m reflector at Geisei. The comet has a tail 30" long in pa 300 deg and is diffuse with central condensation. Seki's observations yield a correction to the prediction on MPC 13057 of delta T about +0.02 day.

IAUC 5383

1991d1 P/SHOEMAKER-LEVY 7
C.and E.Shoemaker and D.H.Levy report their discovery of another comet on films exposed with the 0.46m Schmidt telescope at Palomar. The comet is diffuse with condensation.

IAUC 5389

Orbital elements from 7 observations Nov.13- Dec.5:

T=1991 Oct.27.3096 Peri.= 91.7535
e=0.542469 Node = 312.3191(1950.0)
q=1.628858 AU Incl.= 10.2625
a=3.560102 AU n = 0.1467271
p=6.717 years

IAUC 5397

1991e1 P/TSUCHINSHAN 2
J.Scotti,Lunar and Planetary Laboratory,reports the recovery of this comet(m2=21)on images obtained with the 0.91m Spacewatch telescope by D.Rabinowitz and himself. The comet appears stellar, to the limits of seeing and the position is in close agreement with the prediction on MPC 14593 (ephemeris on MPC 18469).

IAUC 5403

1991f1 P/KOWAL 2
H. Kosai and T. Hirayama, National Astronomical Observatory, Tokyo, report that Masao Ishikawa has discovered a comet, and they provide the following precise positions:

1991 UT	R.A. (1950)	Decl.	m1	Observer
Dec. 12.70336	8 32 29.59	- 0 30 54.6	14.0	Ishikawa
12.80011	8 32 29.28	- 0 32 48.8		"
13.72775	8 32 42.18	- 0 56 07.9		"
13.76373	8 32 42.29	- 0 57 04.4		"
13.79457	8 32 42.64	- 0 57 48.1		"
15.79330	8 32 59.91	- 1 47 08.1		"
16.72291	8 33 06.03	- 2 09 38.7	14.0	Kushida
16.74930	8 33 06.05	- 2 10 13.9		"
16.79861	8 33 06.41	- 2 11 34.1		"

M. Ishikawa (Fukaya, Saitama). 0.16-m hyperboloid astrograph.
¦¦[7m¦¦--More--¦[m¦¦
Tech-Pan film without filter. Image diffuse without condensation. Measurer S. Hayakawa.

Y. Kushida (Yatsugatake South Base Observatory). 0.20-m f/4 hyperboloid reflector. Comet images diffuse and difficult to measure, especially in right ascension.

B. G. Marsden (Harvard-Smithsonian Center for Astrophysics) and T. Kobayashi (Oizumi, Gunma, Japan) have identified the comet with P/Kowal 2 (1979 II), the prediction for which on MPC 13046 requires correction by Delta(T) = -54 days. Marsden provides the following improved orbital elements, which satisfy 16 observations 1979-1991 with mean residual 1".2:

Epoch = 1979 Jan. 7.0 ET
T = 1979 Jan. 13.6774 ET　　Peri. = 189.3294
e = 0.560490　　Node = 247.2065　1950.0
q = 1.519722 AU　　Incl. = 15.8032
a = 3.457766 AU　　n = 0.1532889　　P = 6.430 years

Epoch = 1991 Oct. 31.0 ET
T = 1991 Nov. 4.3598 ET　　Peri. = 189.5235
e = 0.564287　　Node = 247.0738　1950.0
¦¦[7m¦¦--More--¦[m¦¦
q = 1.499650 AU　　Incl. = 15.8359
a = 3.441834 AU　　n = 0.1543544　　P = 6.385 years

IAUC 5406

1991g1 ZANOTTA-BREWINGTON

Mauro Zanotta and Howard Brewington have independently reported the discovery of a comet. The following observations are available:

1991 UT	R.A. (2000)	Decl.	m1	Observer
Dec. 23.76042	20 44.5	+19 10	9	Zanotta
23.78473	20 45.0	+19 05		"
24.07639	20 45	+19.5		Levy
24.12847	20 47	+18.5	10	Brewington
24.36146	20 46 44.04	+18 53 06.9	10	Kojima
24.36510	20 46 44.71	+18 52 58.7		"
24.37222	20 46 46.24	+18 52 55.6		"
24.37650	20 46 47.18	+18 52 42.2		"

M. V. Zanotta (Milan, Italy). 0.15-m reflector. Comet diffuse with condensation.

D. H. Levy (Tucson, AZ). 0.4-m reflector. Only a brief confirmation

of the comet through a gap in the clouds. Position uncertain.
H. J. Brewington (Cloudcroft, NM). 0.4-m reflector. Comet rather diffuse and no longer observable after moonrise.
T. Kojima (YGCO Chiyoda Station). Communicated by S. Nakano.

IAUC 5412

Further precise positions have been reported as follows:

1991 UT	R.A. (2000)	Decl.	Observer
Dec. 26.38681	20 53 53.82	+18 06 31.2	Sugie
26.39306	20 53 55.18	+18 06 22.7	"
26.77569	20 55 18.67	+17 57 11.7	Vagnozzi
26.78993	20 55 21.63	+17 56 50.9	"
28.37589	21 01 13.02	+17 17 35.7	Kobayashi
28.38878	21 01 15.80	+17 17 15.0	"

A. Sugie (Dynic). 0.25-m Schmidt. Communicated by S. Nakano.
A. Vagnozzi (Stroncone). 0.5-m Ritchey-Chretien. Comet very diffuse.
T. Kobayashi (Oizumi). 0.16-m reflector + CCD. Communicated by Nakano.

Parabolic orbital elements from 9 observations Dec. 24-28:

T = 1992 Jan. 31.887 TT   Peri. = 197.719
                                 Node = 255.100   2000.0
q = 0.64426 AU   Incl. = 49.964

IAUC 5419

1991h1 MUELLER

On 1991 Dec. 18 Jean Mueller reported her discovery of a probable comet on a single exposure on Dec. 13 by C. Brewer, D. Mendenhall and herself with the 1.2-m Oschin telescope in the course of Palomar Sky Survey II. The object was diffuse with a possible faint tail to the southwest. The discovery has now been confirmed on a film obtained on Dec. 31 by E. M. Shoemaker, C. S. Shoemaker and D. H. Levy with the 0.46-m Schmidt. The following measurements are all by Mueller:

1991 UT	R.A. (2000)	Decl.	m1	Observer
Dec. 13.48264	9 38 56.16	+42 31 23.9	17.5	Mueller
13.52778	9 38 53.58	+42 31 53.0		"
31.35486	8 58 02.50	+47 38 09.3	16	Shoemaker
31.39444	8 57 52.55	+47 38 58.2		

IAUC 5420

Parabolic orbital elements from 8 observations Dec.13-Jan.2

T=1992 Mar.21.196   Peri.= 307.011
q=0.19871   Node = 288.795 (2000.0)
Incl.=95.524

IAUC 5421

PERIODIC COMET D'ARREST = COMET LA HIRE (1678)

Although the possibility of the identity of P/d'Arrest with a comet observed by La Hire in 1678 was suggested shortly after its 1851 discovery (Valz 1851, Comptes Rend. No. 2, p. 155) and promptly forgotten, this has recently been independently considered by A. Carusi, and G. B. Valsecchi, Istituto Astrofisica Spaziale, Rome, and L. Kresak and M. Kresakova, Slovak Astronomical Institute, Bratislava,and proven to be correct. Although four approaches within 0.5 AU of Jupiter during the 26 revolutions 1678-1851 complicate the linkage,Carusi et al. have ascertained that the nongravitational effects on the comet, while relatively large, seem to be extraordinarily stable.

The following orbital elements established by them for the 1678 epoch satisfy three of La Hire's four observations within 0.2 deg: T = 1678 Aug. 23.395 ET, Peri. = 159.377, Node = 168.939, Incl. = 2.811 (equinox 1950.0), q = 1.16285 AU, e = 0.67008. A preliminary attempt by G. Sitarski,Center for Space Research, Warsaw, to incorporate the 1678 observations (with a difference of some two hours in the times at which they are assumed to have been made; see Pingre 1784, Cometographie 2, 24) directly into a nongravitational solution covering 3.1 centuries gives (for the epoch 1678 July 3.0) T = 1678 Aug. 23.444 ET, Peri. =159.564, Node = 168.811, i = 2.827 (equinox 1950.0), q = 1.16277 AU, e= 0.67001, A1 = +0.41, A2 = +0.0985. Contrary to a statement in the recent orbit catalogues, Douwes' (1753, Vervolg Beschr. Staartsterren) parabolic orbit should have T = 1678 Aug. 28.085. Leverrier's (1848,A.N. 26, 383) solution, computed on the incorrect assumption of identity of the 1678 comet with P/de Vico-Swift, is inconsistent with the observations but can be made to fit with a mean-anomaly adjustment corresponding to T approx. 1678 Aug. 21.5.

IAUC 5283

PERIODIC COMET GRIGG-SKJELLERUP

T. Morley and H. Bohnhardt, European Space Operations Centre, write: "The European Space Agency has approved the mission known as Giotto Extended Mission (GEM) for a spacecraft encounter with P/Grigg-Skjellerup on 1992 July 10. High-quality astrometry of the comet is needed at ESOC to determine the most accurate cometary orbit possible for the flyby. Since there will be no Pathfinder Project' using observations of other cometary missions, the importance of ground-based astrometry for orbit improvement is even higher than during the P/Halley campaign. We would appreciate receiving high-quality astrometric data of P/Grigg-Skjellerup within two days of observation; astrometry will be of highest priority during the two months prior to encounter. We can be reached at ESOC/ECD/OAD, Robert-Bosch-Str. 5, D-6100 Darmstadt, Germany; e-mail TMORLEY@ESOC.BITNET or HBOEHNHA@ESOC.BITNET."

IAUC 5315

PERIODIC COMET SCHWASSMANN-WACHMANN 1

The following visual magnitude estimates indicate that this comet is currently undergoing an outburst: Aug. 6.4 UT, 15 or brighter (R. E. McCrosky, Oak Ridge Observatory, 1.5-m reflector + CCD); 8.06,11.8: (H. Mikuz, Ljubljana, Yugoslavia, 0.36-m reflector); 8.41, 12.1 (A. Hale, Las Cruces, NM, 0.41-m reflector); 9.08, 12.3 (Mikuz).

A. Cochran, Astronomy Department, University of Texas, informs us that, in view of this outburst, she will be obtaining observations of the comet with the International Ultraviolet Explorer satellite late on Aug. 10 UT. She would appreciate any support observations, especially colors or spectra, that can be obta ined and communicated to her (e-mail anita@astro.as.utexas.edu, telephone 512-471-1471).

IAUC 5321

PERIODIC COMET SCHWASSMANN-WACHMANN 1

H. Mikuz, Ljubljana, Yugoslavia, reports that a 1-min exposure with a 0.19-m f/4 flat field camera (+ CCD) taken on Dec. 11.853 UT shows a starlike central condensation of diameter 40" and a round delicate coma extending out to about 6'.

Total visual magnitude estimates (cf. IAUC 5349, 5396): Dec. 5.21 UT, 12.6 (A. Hale, Las Cruces, NM, 0.41-m reflector); 5.77, 13.4 (S. Garro, Merlette, France, 0.20-m reflector); 5.85, 13.7 (Mikuz, 0.36-m reflector); 6.22, 12.7 (Hale); 6.80, 13.6 (Garro); 9.83, 14.0 (Mikuz); 11.87, 13.2 (Mikuz).

IAUC 5404

PERIODIC COMET SWIFT-TUTTLE (1862 111)

Although it is generally presumed that this comet passed perihelion unobserved around 1981 +/- 2, the possibility that P/Swift-Tuttle was identical with comet 1737 11 Kegler and that it may return in late 1992 is perhaps enhanced by this years very strong Perseid display. The nominal prediction (Marsden 1973,AJ.78,662) is:

T=1992 Nov.25.85	Peri.=153.05
e=0.9633	Node =138.74(1950.0)
Incl.=113.45	q=0.9582 AU

Because of nongravitational effects the uncertainty in T could be as much as +/- 2 months.

B.G.Marsden

IAUC 5330

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>

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First Announcement

Meeting of European (and International) Planetary and Cometary Observers

M E P C O '92

in Violau, Germany (Bavaria)
in the International Space Year 1992
September 18 – 21, 1992

For ten years we, the **Arbeitskreis Planetenbeobachter** (Working Group of Planetary Observers of Germany), have been arranging the Planeten– und Kometen–Tagung (meeting of Planetary and Cometary Observers), which brings together more than 100 amateur observers from German-speaking regions every year.

For the first time, in 1992 we want to invite planet and comet observers from **all over Europe** and also the rest of the world, to open up new European and international perspectives in amateur astronomy as well.

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We offer:

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For pre-registration and further information, please contact
Wolfgang Meyer, Martinstr. 1, D–(W)1000 Berlin 41, Germany

SECTION NEWSLETTER 1992/2

1992 NOVEMBER D.G.BUCZYNSKI

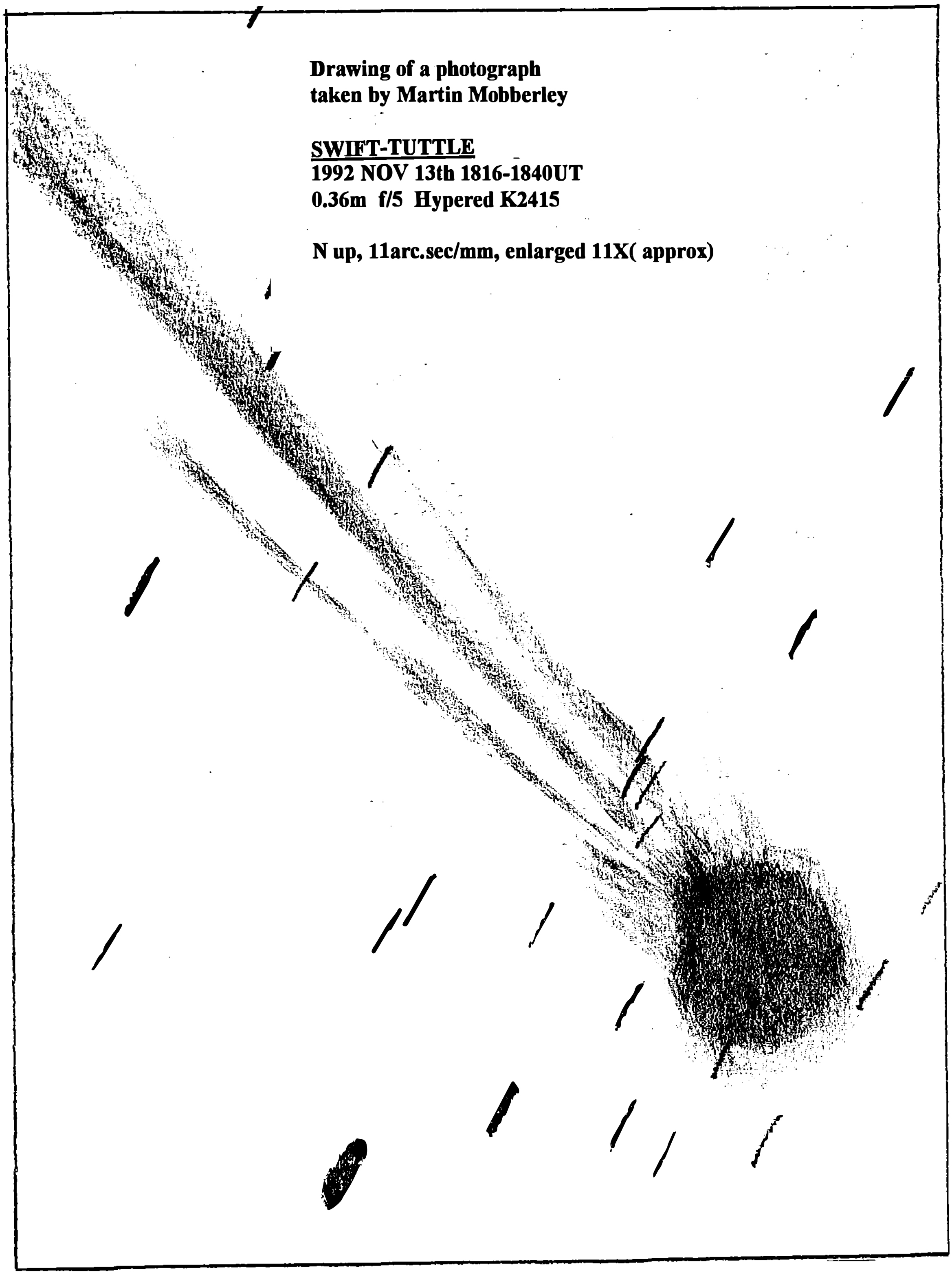
The recovery and return to perihelion of Periodic Comet Swift-Tuttle has been the main focus of interest in recent weeks. Not least for the speculation in the media of a possible collision with the earth by this comet at its next perihelion passage in 2126. Mostly this speculation has been somewhat premature as will be seen overleaf. However the special nature of this comet (its association with the annual Perseid meteor shower, and its "lost" status) has heightened interest amongst the active Section members and has resulted in a significant number of observations being made. Section members have been recording the appearance of the comet by means of drawing,photography and CCD imaging.This is most encouraging and I hope will result in further observations being made of other comets by our Section members.

I hope to be able to publish a preliminary report of the apparition of this comet as recorded by members of this Section. If you wish to have your observations included in this report then forward them to myself, Harold Ridley or Guy Hurst.

Drawing of a photograph taken by Martin Mobberley

SWIFT-TUTTLE
1992 NOV 13th 1816-1840UT
0.36m f/5 Hypered K2415

N up, 11arc.sec/mm, enlarged 11X(approx)



P/SWIFT-TUTTLE 1992t

The following text (written by G.Waddington)has been extracted from TA e circular No 685.

"The previous integrations of P/Swift-Tuttle's orbit were based on the osculating elements given on IAUC 5636 (dated October 15). These elements satisfied the existing 1992 observations and those of October 1862 very well.
Now, as noted by Brian Marsden (A.J. vol 78, 654 ; 1973), a number of the October 1862 observations appear to contain large systematic declination residuals. Integrating the orbit based on these elements resulted in a perihelion passage in 2126 of July 6.5 and not July 11 as given on IAUC 5636 (the July 6.5 date was independently confirmed by Nick James). In order to fit the published perihelion times for 1737 and 1862, using the IAUC 5636 elements, I found it necessary to include a nongravitational term of A2 = -0.035. Use of this term brought the perihelion time forward to 2126 June 29.
The orbit has now been re-solved by Don Yeomans. His current solution for the orbital elements (MPC 21081) uses 237 observations from 1737 to 1992 and explicitly omits the October 1862 measurements. Integrating this orbit forward results in a perihelion passage of 2126 July 12.22 -- on this basis the closest that P/Swift-Tuttle will get to the Earth is 0.156 au on 2126 August 5/6 when it will have an elongation from the sun of 95 degrees and so should present a good observing prospect to anyone around in 2126! (it will be around magnitude zero if it's light curve remains similar to that of the current apparition).
From these new orbital elements I find the times of perihelion passage during the telescopic era to be,

1610 Feb. 6.31
1737 June 16.07
1862 Aug. 23.50
1992 Dec. 12.33
2126 July 12.22

For the (unobserved) 1610 apparition the comet would have been at its brightest around the middle of Jan 1610 with a magnitude of around 5.3. At this time it would have been only about 30 degrees from the sun in the sky.
Integrating the orbit backwards in time yields favourable naked-eye apparitions in August 195 BC, August 188 and August 442. Hasegawa (Vistas in Astronomy, vol 24, 59 ; 1980) lists comets being seen in all three years. For the great winter comet of 442 enough information is given for its orbit to have been determined - it's recorded motion does not appear to be compatible with it being P/Swift-Tuttle, even when we take into account the likely error in predicted perihelion passage. Of the two comets recorded in 188 the second one was seen in Corona Borealis on 28/29 July 188 and may be compatible with it being Swift-Tuttle - especially if there has been an error of one lunar month in converting the date of observation into the western calendar (in which case it would fit the current gravitational integration almost exactly)".

Notes and News - Comets

There has been something of a lull in the number of research papers on comets appearing in the scientific journals, but there has been quite a spate in recent weeks. If the current abundance of interplanetary dust is typical of the steady state, there must be a source of dust replenishing the amount lost annually. Short period comets are the most likely source, but there is a considerable difference in the estimated dust production rate between ground based coma spectrophotometry and observations by IRAS. M Fulle of the Osservatorio Astronomico in Trieste, Italy [Nature, Vol 359, pp 42-44, 1992 Sep 3] has used a mathematical model to analyse an image of the dust tail of P/Schwassmann-Wachmann 1 and has deduced that it could supply around 6% of the dust required to maintain the steady state. His derived mass index is higher than that for comets P/Encke and P/D'Arrest, suggesting that there may be differences in the size distribution of dust depending on the comet's distance from the sun.

Dust is also the subject of a paper by Fomenkova et al [Science, Vol 258, pp 266-269, 1992 Oct 9] who look at the results from the Vega flybys of comet P/Halley. The PUMA mass spectrometers show that most particles are a mixture of silicates of variable magnesium-iron composition and 'organic' material, generally of a chondritic composition. The authors caution that it is unwise to generalise their findings as the mass involved in the analysis is less than that of a single interplanetary dust particle recovered from the stratosphere, and also assumes that the composition of the smallest particles is representative of the bulk composition. Differences between the two flybys possibly reflect inhomogeneities in the nucleus. Some grains seem to be enriched in magnesium and this element is observed in the spectra of Orionid meteors, but not seen in meteor spectra from other showers. These grains are probably magnesium carbonate, possibly implying the presence of aqueous activity at some time in the comet's history. There are also some iron rich particles, but few are in the metallic form, again pointing to aqueous alteration.

An allied paper on the flyby dust observations comes from Lawler and Brownlee of the University of Washington [Nature, Vol 359, pp 810-812]. They also show that virtually all the particles detetected are a mixture of CHON and silicate material, which is well mixed down to very small sizes. They further show that there is evidence for the sublimation of voltile material from the grains as they leave the nucleus and that many grains could start with a common silicate/CHON ratio.

Comet Yanaka 1988 r (an intrinsically faint comet, which was 9^m when discovered at the end of December after perihelion at 0.4 AU in mid December, but which faded rapidly and was poorly observed) seems to have had an unusual composition. Observations by Uwe Fink of the University of Arizona [Science, Vol 257, pp 1926-1929, 1992 Sep 25] show that it has very little carbon. It shows no trace of C_2 or CN emission, which are usually clearly seen in cometary spectra, and so must have less than 1% and 4% respectively of the typical amount of each species. Only one other comet, P/Wilson-Harrington, has been observed to show such low amounts of molecular carbon, though it had normal amounts of CN. By contrast there are strong lines of NH_2 and also OI ^{1}D which imply strong water outgassing. There are two possibly explanations: either comet Yanaka formed outside the solar system and has been captured either by itself or during encounter with a giant molecular cloud, or there were considerably inhomogeneities in the primordial solar nebula from which the comets formed.

Some new simulations of the solar system by George Wetherill of the Carnegie Institution of Washington suggest that we may be lucky to be here. Jupiter and Saturn were responsible for ejecting the majority of comets from the solar system during its formation. If they had been of similar size to Uranus and Neptune there would be about 1000 times more comets entering the inner solar system than are presently seen, with the potential for collisions with the Earth every 100,000 years or so. The fact that so far no comets with convincing hyperbolic orbits have been seen might mean that there are few solar systems with Jovian sized planets, on the other hand it might mean that we haven't been looking for long enough.

Jonathan Shanklin

Strange comet that came in from the cold

Jeff Hecht, Boston

AFTER last month's discovery of a mysterious body orbiting beyond Pluto, astronomers have found another strange interloper in the Solar System: a comet which is unique in having no detectable carbon. The deficiency may indicate that the comet formed around another star and was captured by the Sun.

According to Uwe Fink of the University of Arizona, Comet Yanaka (initially called Comet 1988r) contains less that 1 per cent of the molecular carbon (C_2) of typical comets and less than 4 per cent of cyanide (CN), which is common in comets. Comet Yanaka has normal levels of dust, water and the NH_2 molecule, however.

Standard models hold that comets are dirty snowballs, or icy mud balls—a mixture of volatile ices and carbon-rich solids. They formed a long way from the Sun where all water is frozen. In a comet's normal orbit beyond Neptune and Pluto it remains frozen, but if it is pulled towards the Sun some of the ice boils off into space.

Fink took the spectra of about 20 comets. But the spectrum of Comet Yanaka was so unusual that he decided to analyse it first. He found spectral bands due to hydrogen, oxygen and NH_2. But he did not find the usual bands due to cyanide, which are in the red region of the spectrum, or the bands due to molecular carbon, which are in the yellow-green. Fink concluded that Comet 1988 XXIV has very little carbon. The comet is so faint that Fink could not check its spectrum for ultraviolet bands due to carbon monoxide (CO), the most common carbon-containing molecule in comets.

A few other comets have been found with little molecular carbon, notably one called Wolf-Harrington with only about 5 per cent the usual molecular carbon. But all these comets had normal levels of cyanide.

Fink says there are several possible explanations for the comet's composition (*Science*, 25 September, p 1926). If it formed in the Solar System, it must have been in a part in which materials were not mixed as well as current theories expect. Alternatively, it could have formed from an external cloud of molecular gas in a region with a different chemical history from that which produced most comets. Or the comet might have formed in a different gas cloud, and later been captured by the Solar System.

The comet was observed for less than a month, so its orbit is known only approximately and gives no clue to its origin, says Dan Green of the Harvard-Smithsonian Astrophysical Observatory. □

Meeting of the Comet Section
held on 1992 October 17 at the Institute of Astronomy, Cambridge

Cambridge is becoming a popular venue for astronomical meetings and this is the third time that members of the comet section have met together in the Hoyle building of the Institute of Astronomy. Although the meeting was scheduled to begin at 2.00 pm, the first members had arrived before the Director started his lunch! This gave an opportunity to renew aquaintenances and peruse displays covering section work and plans for comets P/Swift-Tuttle and P/Schaumasse over a welcoming cuppa and biscuits.

Numbers steadily increased and shortly after the scheduled start nearly forty participants were persuaded to enter the lecture theatre. The Director, Jonathan Shanklin, welcomed them to the Institute and on finding that there were many beginners present gave a brief introduction to observing techniques and the section reporting procedures. A computer simulation of the coma of a comet helped to illustrate the degree of condensation and demonstrated that it appeared to vary with the magnification used. He explained section plans to follow comets P/Swift-Tuttle and P/Schaumasse over the coming months and introduced some ideas for a membership survey designed to help the Director serve the Section. Questioned on the recent discovery of asteroid 1992 QB1, he said that the orbit was still quite uncertain, but that it could be a Kuiper belt comet. It was unlikely to be observed by the Section as it is a very faint object.

Graham Keitch, a former Director of the section, had found that his former home at Wrington near Bristol had become increasingly affected by light pollution. He decided that the most effective solution was to move, and was now living on Dartmoor, though not at Her Majesty's Pleasure! Here there was only one street light within five miles, quite a contrast with most of our sites. He used a range of binoculars, aiming to obtain a 5mm exit pupil. In response to a question he said that it was important to thoroughly check binoculars before purchasing, some did not utilise the full aperture or had internal aperture stops, others had poorly coated optics and some even used plastic lenses internally.

Harold Ridley had studied the prospects for the forthcoming apparition of comet P/Schaumasse. It was discovered in 1911, with a 0.4 m equatorial refractor - evidently a chance discovery. This was its ninth return, two had been missed and at one only a single observation had been obtained. At its 1919 return it was 6° off the predicted track and in 1943, 7°, showing that it experienced quite large non-gravitational forces. This would make good astrometric measurements of considerable value to those studying such forces. The comet's perihelion was just outside the Earth's orbit and in 1952 it had reached perihelion when at opposition, reaching fifth magnitude. This apparition was not quite so good, but was the second best this century. The comet seemed to have long lasting outbursts after perihelion of up to two magnitudes and so might get to sixth magnitude. There probably wouldn't be much of a tail - in 1952 it had a 1.5° plasma tail, though there might be jet activity in the coma.

Professor Chandra Wickramasinghe was currently working at the Institute (one of the few people there with solar system interests) and gave a brief talk on his latest ideas about comet Halley. After the Giotto mission to Halley, our ideas of a comet nucleus changed from a white snowball to a very dark, dirty snowball with jets from a few active areas. If it really was a snowball the coma should be rich in simple molecules such as methane, water and ammonia, but was actually rich in complex molecules, with the simple molecules being secondary. Giotto measured about 20 - 25% of dust as being CHON material. The IR spectrum was best fitted by a curve corresponding to a bacterial model. UV processing of the crust would give a dark, mostly inert crust, with active sites (about 10% in the case of Halley) being produced by collisions with meteoroids. There had been two outbursts on Halley at large solar distances; these couldn't be impacts as the outward motion was too slow (about 30 ms^{-1}). There could be a region at around 100 m depth where liquid water existed and as this froze it cracked the crust at the jet site, leading to the outburst of material.

The recovery of comet P/Swift-Tuttle gave added spice to John Mason's talk, particularly as it had won him a bottle of whiskey. The comet was discovered in 1862 by Lewis Swift (who thought it was an already discovered comet), and a few nights later by Tuttle who recognised it as a new comet. The comet reached 2^m and had a 30° tail. When Brian Marsden made a prediction in 1973 for its return in 1981/82, he finished with a get out clause which suggested a return in 1992 if it was also Kegler's comet of 1737. A link between the three returns can be forced, but the residuals are very large, particularly in October 1862. Marsden had originally assumed that this was because these observations were poor, but it now seems that it is due to non-gravitational forces. These must be very large as they normally only make a difference of days or weeks to the period, compared to ten years in this case. The exact mechanism by which such large changes can occur still remains uncertain. If the orbit is used to predict the next return, it will be very favourable and could lead to a 'close encounter'. Previous favourable returns occurred in August 1213 and in September 1348, for which there is a Japanese account.

Schiaparelli, in 1866, recognised that the comet's orbit was very similar to those of the Perseid meteors. Determinations of the meteoroid's periods gave values in the range 105 - 135 years. There were many historical records of the Perseids from AD 36 until the 12th century, but then few until 1835. There was an enhancement of the rates at the last return, but not to storm proportions. In 1911 rates had dropped as low as 4 hr^{-1} and in 1912 12 hr^{-1}. Since then they have risen, reaching 120 hr^{-1} in 1980. Although the material has spread completely round the orbit, the distribution is not uniform, giving rise to the variation in the rates. Radio observations by John this year implied an enhancement of 5 - 10 times over the background, implying visual hourly rates in the 100s.

Our next speaker was Dr Neil McBride, who is now part of the DIDSY team at the University of Kent at Canterbury, having done a PhD with

David Hughes at Sheffield. One of his first tasks at Kent was to reactivate the DIDSY system for the Grigg-Skjellerup encounter. This turned out to require a complete rewrite of the system software. Unlike the Halley encounter, there was a certain element of blind shooting in the targeting, as there was no pathfinder concept (ie good astrometry from Earth and space), though the final miss distance was a few hundred kilometres on the tailward side and the cometary region was apparently bigger than expected. During the encounter the comet was moving faster than the spacecraft, and because the main radio antenna had to be pointed at the Earth, the spacecraft was inclined at an angle of 69°. This gave less sensitivity to the dust experiment, because the bumper shield was designed for vertical incidence, and also the comet is about 100 times less active than Halley. At this point a model of the shield was passed round; this had been used in an experiment with a high velocity nylon projectile, which had blown a hole in the outer shield, but barely dented the inner one. The system detected three 'big' particles, weighing 100, 2 and 20 fg, all after closest approach. The system can locate where the particle hit the shield and assigns a probability for the mass determination, so that the 100 fg mass has a probable error of ±50 fg. Although three point statistics are a bit arbitrary the results are consistent with a mass distribution which has most of the mass in the largest particles.

The final speaker was Professor Colin Humphreys, who is a materials scientist at Cambridge, though he is making a study of the Star of Bethlehem as a sideline. The Star is an almost universal symbol for Christmas, though Christmas Day has only been December 25th since AD 336 in the West and the calendar was not fixed until even later. The story of the Star is told in Matthew's Gospel. The Magi were well known in the near East at the time as a group of priests and probably travelled to Jerusalem by camel. Possible theories for the Star include the triple conjunction of 7 BC, a supernova or a comet. The movement of a comet ties in well with the likely journey time of the Magi to Jerusalem. The phrase 'stood over' is only used in historical texts to refer to comets, and for a long time they were thought to be phenomena of the Earth's atmosphere. Many authors have rejected a comet as being the star because they were thought to be bad omens, however Chinese texts for example, refer to broom stars sweeping away evil. The Roman historian, Justinus, also thought comets were favourable to Mithridates. There are three comets in the relevant time period, but only that of 5 BC had a tail and appeared during the lambing season of March to April when shepherds would be out in their fields. A possible scenario is that the triple conjunction of 7 BC alerted the Magi that an important event was to take place. The massing of three planets (Saturn, Jupiter and Mars) in 6 BC would reinforce the idea and the comet of 5 BC was the Star.

To finish the day's events a short tour of some of the telescopes at the Cambridge Observatories was arranged for those who wanted to see them. By now, dusk was falling and as the evening happened to be clear, the Thorrowgood 0.20 m refractor and a pair of 10 x 80 binoculars were pointed at comet P/Swift-Tuttle which showed an asymmetric coma and a short fan tail.

Comet P/Schaumasse, 1992x

Schaumasse discovered this comet on 1911 November 30, using the 40cm Coude refractor at Nice Observatory - not, one would think, the best instrument for such a purpose, though at least the observer could search in comfort.He discovered two other comets, 1913 II and 1917 II, both of long period, but the instruments used are not mentioned.

At discovery, the comet was a 12th mag. object with a diffuse coma of about 2' diameter; it brightened a little, and was followed until February 18.When recovered by Schaumasse on 1919 October 29, it was $10\frac{1}{2}$ mag., but 6^{o} off the ephemeris.It was observed until 1920,January 1. Recovered by van Biesbroeck at 12 mag. on 1927 October 4, in accordance with Merton's ephemeris, it was a difficult object, close to the Sun, but was observed until 1928 January 22.

The 1935 return was completely missed owing to very unfavourable circumstances, but when recovered again in 1943 March by Giclas, it was once more well off the ephemeris: 7^{o} this time.Since the orbit was well determined the discrepancy can only be attributed to non-gravitational forces.(c.f.P/Brorsen-Metcalf, 1989 X.)Being four months past perihelion the comet was only 15th mag.,but was followed until July 20, when it was only 19th magnitude.

Conditions in 1952 were ideal, with perihelion only two days later than the best possible date.Recovered by Cunningham at mag. 18.6 on 1951 September 30, the comet brightened rapidly and just achieved naked-eye visibility in late January and early February.Gordon Taylor estimated it as 4.9 mag., at Herstmonceux, and I glimpsed it with the unaided eye at Barnes.Although I observed the comet telescopically on fifteen nights, I was not a regular comet observer then, and my results were not very useful.The comet was of course very extensively observed world-wide, and at its best had a narrow ion tail about $1\frac{1}{2}^{o}$ long, the coma being nearly 10' in diameter.The brightness seems to have been boosted by a perihelic outburst, but low-dispersion spectra secured with objective prisms showed no unusual features.It was last observed on 1952 June 24, at mag. 17.

The 1960 apparition was quite good, the comet being recovered on 1959 September 30, later brightening to 9.5 mag. 1968 was another poor return, and the comet was not recovered.It was originally thought that the 1976 return has also been missed,but it was later possible to identify a single 18.5 mag. image secured by Elizabeth Roemer on 1976 December 27 as being that of the comet.When recovered on 1984 September 5,the comet was but mag.19, but as before it brightened quickly and was 9.5 at its best.

Circumstances for the 1993 apparition are the second best this century - we may confidently expect to see the comet at 8th mag.,and if there is an outburst as in 1952 perhaps one or two magnitudes brighter.The important thing will be to get the best possible sequence of magnitude estimates so that the photometric formula can be determined with some confidence.Recovery by Seki on 1992 September at mag.20 indicated a correction to T of -0.14 days.Non-gravitational forces are evidently at work, and astrometry will be important, particularly at the larger solar distances.

Observers are urged to respond to our Director's appeal for a vigorous observing campaign, which could well add to our knowledge of this interesting but erratic object.

H.B.Ridley.

P/Schaumasse, 1992x

Return	T	T-Feb 8 days	Brightest mag.	Closest	Δ A.U.	1st Obsn.	1st - T days	Mag.	Δ A.U.	Remarks
1911 VII	Nov 13	- 87	11	1912 Apr 23	1.397	Nov 30 1911	+ 17	12	1.68	Discovery
1919 IV	Oct 21	-110	10.5	1920 May 3	1.649	Oct 29 1919	+ 8	10.5	1.55	6° off ephem.
1927 VIII	Oct 1	-130	12	1928 May 9	1.837	Oct 4 1927	+ 3	12	1.98	
1935	Sep 15	-146	-	1936 May 13	1.989	-	-	-	-	Missed
1943 V	Nov 26	- 74	15	1944 Apr 16	1.246	Mar 24 1944	+114	15	1.26	7° off ephem.
1952 III	Feb 10	+ 2	5	1952 Jan 28	0.269	Sep 30 1951	-133	18.6	1.46	Best ever
1960 III	Apr 18	+ 70	9.5	1959 Dec 8	1.189	Sep 30 1959	-201	19	1.76	
1968	July 4	+147	-	1967 Nov 10	2.001	-	-	-	-	Missed
1976 XV	Sep 5	-156	18.5	1977 May 14	2.055	Dec 27	+113	18.5	1.85	Single obsn.
1984 XXII	Dec 6	- 64	9.5	1985 Apr 9	1.100	Sep 5	- 92	19	1.70	
1993 (92x)	Mar 4	+ 24	8?	1993 Jan 26	0.559	Sep 25	-160	20	1.63	Second best

February 8 is the optimum date for perihelion to occur. The comet was not observed pre-perihelion until 1952.

Orbital Evolution

Year	q A.U.	e	ω °	Ω °	i °	P Yrs
1588	1.59	0.621	41.8	107.5	26.1	8.61
1724	1.46	0.644	42.0	103.4	24.6	8.35
1800	1.29	0.682	41.8	99.7	19.0	8.18
1850	1.29	0.683	44.8	96.4	18.5	8.21
1900	1.23	0.693	44.0	94.4	17.7	8.02
1950	1.20	0.706	51.4	86.6	12.0	8.21
1993	1.20	0.705	57.5	81.1	11.8	8.22
2000	1.20	0.706	57.9	79.2	11.8	8.23
2134	1.23	0.704	77.8	58.8	8.4	8.53
2267	1.21	0.703	108.8	24.9	10.0	8.46
2408	1.21	0.704	124.5	8.7	12.0	8.30

The orbit is remarkably stable, occasional moderate approaches to Jupiter affecting mainly the angular elements. However, the advance of the argument of perihelion is compensated by the regression of the ascending node.

Comet P/Schaumasse 1992x

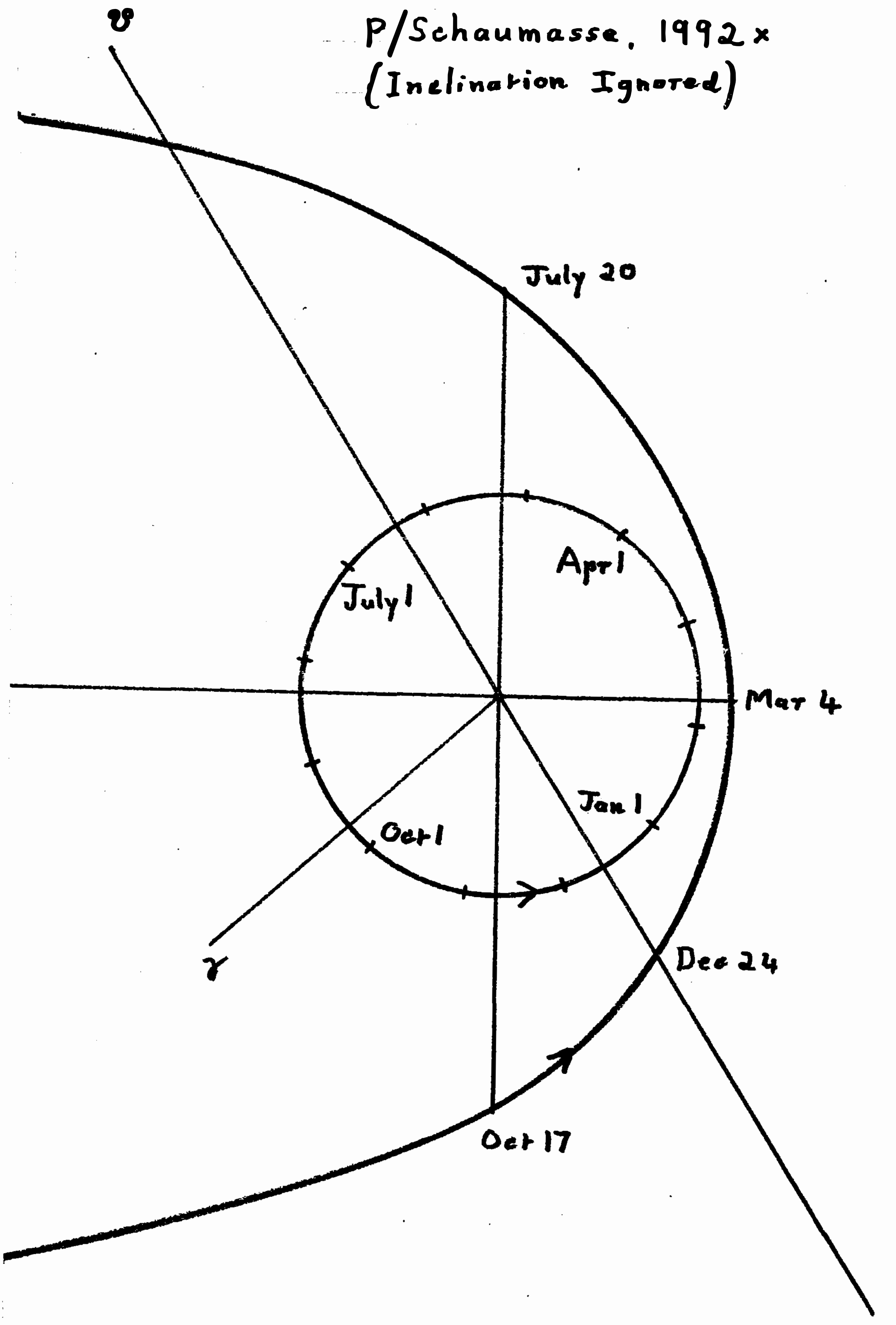
T 1993 Mar 3.96335 TDT. Epoch 1993 Mar 7.0 TDT.

Peri	57.48270	e	0.7048715
Node	81.05383 2000.0	a	4.0733639 A.U.
Inc	11.84605	n	0.11988760
q	1.2021658 A.U.	P	8.221 yrs

Date	R.A. (2000.0)		Dec.		d	r	Motion "/hr	P.A.	Elong	Mag
1992	h	m	°	'			"	°	°	
Nov 24	4	24.44	+13	21.4	0.750	1.732	44	293	170.7	+10.8
Nov 29	4	18.71	+13	59.9	0.708	1.691	51	294	172.5	+10.5
Dec 4	4	12.31	+14	46.3	0.672	1.651	56	297	169.6	+10.3
Dec 9	4	5.46	+15	41.0	0.641	1.611	60	299	164.3	+10.1
Dec 14	3	58.45	+16	44.3	0.615	1.573	62	303	158.3	+9.9
Dec 19	3	51.60	+17	55.0	0.595	1.535	62	308	152.1	+9.7
Dec 24	3	45.25	+19	15.7	0.579	1.498	60	314	145.9	+9.6
Dec 29	3	39.79	+20	43.1	0.567	1.463	58	321	139.9	+9.4
1993										
Jan 3	3	35.48	+22	17.5	0.558	1.429	55	331	134.1	+9.2
Jan 8	3	32.63	+23	58.6	0.552	1.396	54	343	128.7	+9.2
Jan 13	3	31.41	+25	45.6	0.548	1.365	55	357	123.7	+9.0
Jan 18	3	31.97	+27	37.9	0.545	1.337	58	9	119.1	+8.9
Jan 23	3	34.48	+29	35.0	0.544	1.310	63	20	114.9	+8.9
Jan 28	3	39.06	+31	36.0	0.544	1.286	70	30	111.2	+8.8
Feb 2	3	45.81	+33	39.9	0.544	1.265	79	38	108.0	+8.7
Feb 7	3	54.84	+35	45.3	0.545	1.246	87	45	105.2	+8.6
Feb 12	4	6.24	+37	50.3	0.546	1.230	96	51	102.9	+8.6
Feb 17	4	20.18	+39	52.5	0.548	1.218	106	56	101.1	+8.5
Feb 22	4	36.78	+41	48.8	0.550	1.209	115	61	99.6	+8.5
Feb 27	4	56.19	+43	35.5	0.552	1.204	123	66	98.6	+8.5
Mar 4	5	18.37	+45	8.0	0.556	1.202	131	72	98.0	+8.5
Mar 9	5	43.24	+46	21.6	0.561	1.204	138	77	97.7	+8.6
Mar 14	6	10.44	+47	11.2	0.568	1.209	145	83	97.7	+8.6
Mar 19	6	39.42	+47	32.2	0.577	1.218	150	89	98.0	+8.7
Mar 24	7	9.42	+47	21.8	0.589	1.231	154	95	98.5	+8.8
Mar 29	7	39.55	+46	38.9	0.603	1.246	156	101	99.2	+8.9
Apr 3	8	8.94	+45	24.9	0.621	1.265	157	107	100.0	+9.0
Apr 8	8	36.89	+43	43.3	0.642	1.286	157	111	100.8	+9.1
Apr 13	9	2.95	+41	38.7	0.667	1.310	155	116	101.5	+9.3
Apr 18	9	26.92	+39	16.5	0.696	1.337	152	120	102.2	+9.5
Apr 23	9	48.81	+36	42.1	0.730	1.366	148	123	102.7	+9.7
Apr 28	10	8.75	+34	0.4	0.767	1.397	144	125	103.0	+9.9
May 3	10	26.92	+31	15.6	0.809	1.429	138	127	103.1	+10.1
May 8	10	43.53	+28	31.0	0.856	1.463	133	128	103.1	+10.3
May 13	10	58.79	+25	49.0	0.906	1.499	127	129	102.8	+10.5
May 18	11	12.90	+23	11.3	0.961	1.535	121	130	102.2	+10.8
May 23	11	26.04	+20	39.0	1.019	1.573	116	130	101.5	+11.0
May 28	11	38.37	+18	12.8	1.082	1.612	111	130	100.6	+11.2
Jun 2	11	50.01	+15	53.1	1.148	1.651	106	130	99.4	+11.5
Jun 7	12	1.07	+13	40.1	1.217	1.691	102	130	98.2	+11.7

Mag = 9 + 5 log d + 10 log r

P/Schaumasse, 1992x
(Inclination Ignored)



BAA Comet Section

Winter/Spring project 1992/93

Comets P/Swift-Tuttle and P/Schaumasse

Comet P/Swift-Tuttle has just been recovered and viewing conditions are reasonably good from now until mid December. It could peak at around 4.5^m and already has a short tail. This winter and spring, comet P/Schaumasse has a very favourable apparition and it will be visible in the evening sky throughout. It should become visible to amateur instruments in December and remain visible till May 1993, peaking at around 8th mag, with the possibility of an outburst to 6th mag.

The section will concentrate on the following aspects:

1. Visual magnitude estimates. Use the standard section techniques, the IHW manual gives good guidance. Don't check on the ephemeris magnitude prior to making the observation - it may be wrong and can bias observation! When the comets are faint use BAA Variable Star section fields and when brighter use the AAVSO atlas charts (or other standard sources).

2. CCD imaging. Little work has been done on how the observed (or reported) DC relates to the distribution of light within the coma. CCD imaging should enable an accurate measurement of the form of the light distribution and its correlation. For more serious study it is important to use filters to isolate a given wave-band. Most CCDs are more sensitive in the infra-red than the human eye.

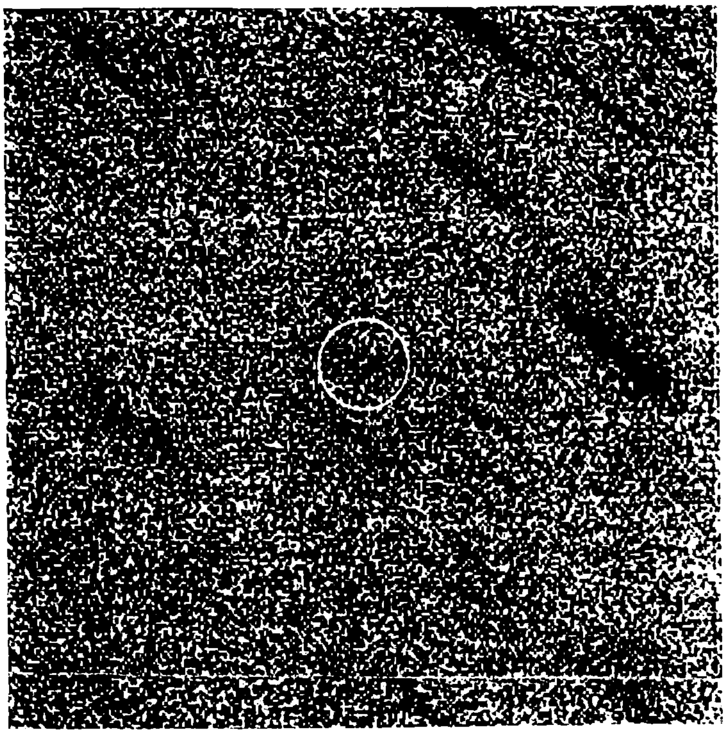
3. Coma and tail detail. Comet P/Swift-Tuttle could develop a significant tail, and at its last return much detail was seen in the inner coma. Comet P/Schaumasse is unlikely to develop much of a tail and it is uncertain what features will be seen in the coma. Beware of seeing what isn't there; some observers seem to see features which reflect conditions in their own eyes rather than in the coma as features drawn by them are not confirmed by professional imaging. There may be physiological factors playing a part.

4. Photography. P/Swift-Tuttle may well show significant plasma events in its tail. Photos taken as little as an hour apart may show significant changes which will enable solar wind velocities to be derived. P/Schaumasse on the other hand is unlikely to develop much of a tail so photos won't be spectacular. Astrometric measurements will improve the orbits as both comets show significant non-gravitational effects.

Jonathan Shanklin

Halley Back to Normal

O. HAINAUT, A. SMETTE and R.M. WEST, ESO



This photo shows a small sky area in the direction of Comet Halley, obtained with the ESO 3.5-metre New Technology Telescope (NTT) in the morning of April 6, 1992.

It is a composite of 10 individual exposures in the standard V-band, obtained between UT 2:33 and 4:58 with a total integration time of 130 minutes. They were combined in such a way that the image of the moving comet remains at the same position and the stars are therefore seen as trails. The position of Comet Halley is at the centre of the circle and is located only 2 arcmin north-west of a magnitude-7 galactic star. Its strong light introduced a very skew background illumination which was removed by fitting a 3rd-degree and subtracting.

At the time of the observations, Comet Halley was 15.67 AU (2343 million km) from the Earth and 16.22 AU (2424 million km) from the Sun. The predicted mean magnitude of the nucleus alone is V = 25.95, with variations from about 25.5 to 26.5 due to the rotation. A careful analysis indicates that there may be a very faint image near the limit of the combined frame at the predicted position, and with magnitude V = 25.8 ± 0.4. However, it is hardly visible and this value must rather be considered an upper limit of the present brightness of the comet. But in any case, the magnitude cannot be much brighter than what is expected from the nucleus alone.

This observation therefore shows that the large dust cloud which was ejected during a dramatic eruption in late December 1990 and first observed at La Silla in mid-February 1991, has now effectively disappeared. At the present time, 16 1/2 months after the 19-mag outburst, there is very little, if any dust left near the nucleus.

The ESO observations of comet Halley will continue.

The photo covers an area of 85 × 85 arcseconds; north is up and east is to the right.

Another Chiron-type Object

R. M. West, ESO

The Discovery of 1992 AD

The announcement on January 23, 1992 (IAU Circular 5434) of a new "slow-moving" object in the solar system has been met with great enthusiasm by minor-planet and cometary astronomers alike. It was first found by Dave L. Rabinowitz at the 91-cm Spacewatch camera on January 9 and then observed with the Arizona-based telescope during the following nights. More observations were made by Eleanor Helin at Palomar and Robert McNaught at Siding Spring and when an earlier image was found on a January 1 Palomar plate, it became possible for Gary Williams of the IAU Minor Planet Bureau to compute the first, reasonably accurate orbit (IAUC 5435).

To everybody's surprise, *1992 AD* – as it was now baptized – turned out to have the most extreme orbit of all known minor planets: with a semi-major axis of 20.5 AU and an orbital eccentricity of 0.58, it reaches aphelion at 32.4 AU, i.e. beyond the orbit of Neptune! The orbital period is no less than 92.5 years, and the inclination is rather high, almost 25°. 1992 AD passed through its perihelion at a heliocentric distance of 8.7 AU in late September 1991, only half a year before the discovery. This corresponds to the orbit of Saturn.

After the discovery of (2060) Chiron in 1977, 1992 AD is only the second minor planet to have been found in an orbit that is almost entirely beyond that of Saturn. Its existence strengthens the belief held by some astronomers that there is a whole group of objects out there, waiting to be discovered with the more powerful observational techniques now becoming available.

The magnitude of 1992 AD was measured on January 9 as V = 16.9 and David Tholen at the NASA Infrared Telescope Facility on Mauna Kea (Hawaii) commented on the unusually red colour of the object. Preliminary values of the diameter and the albedo (ability to reflect the sunlight) were measured by a group of astronomers in Arizona, headed by E. Howell. Comparing infrared and visual observations, obtained simultaneously with the MMT and the 1.5-m Catalina telescopes, they found about 140 km and 0.08, respectively; the latter is not all that different from the presently accepted value for Chiron, about 0.10. Thus 1992 AD and Chiron resemble each other, at least what concerns these parameters.

→ p17*

Figure 1.

Meeting of European Planetary and Cometary Observers (MEPCO) 92
1992 September 18 - 21

Outline details of the meeting can be found in TA or the BAAJ. This report gives my recollections of the talks involving comets, a report of the planetary talks will be published elsewhere. A formal volume of the proceedings will be published later this year and this will have more accurate versions of the various talks.

My main reason for attending the meeting was to try and improve links with foreign societies and I met up with individuals and groups from Belgium, Bulgaria, Germany, Netherlands, Poland and Sweden. All were keen to exchange information and I hope to exchange newsletters with them. Highlights from newsletters that we receive will be reported in our newsletter.

Guiseppe Canonaco described observations of comet Levy 1990 c made by the Belgian VVS comet section. They have a junior branch and he compared magnitude estimates reported on IAUC with observations by the senior and junior groups. There was good agreement and values for H_0 and n of 4.5 and 2.45 were found (these compare to 4.3 and 2.50 from my preliminary reduction of BAA data). He found a mean coma diameter of 3 x 10^5 km, and lengths of 9 x 10^6 km for the dust tail and 7 x 10^6 for the plasma tail. He made use of contours to represent intensity in drawings of the coma and tail.

Svetoslav Minkov from Bulgaria described facilities in his country - they have access to the national observatory which has a 2m telescope that can be used by amateurs.

Jorgen Danielsson of the Swedish SAAF comet section gave a poster display of coloured drawings of comet Halley that he had made. He makes use of these to show beginners what comets actually look like.

A poster from Daniel Fischer (Germany) described a hyperspeed event in the plasma tail of comet Okazaki-Levy-Rudenko (OLR). A fortunate clear interlude had coincidently enabled a number of amateurs in central and eastern Europe to make a regularly spaced series of photos of the comet. Daniel collected them together and by measuring the position of a prominent tail feature was able to demonstrate accelerations of nearly 2g. He advocated setting up a national or international database of comet photographs in order to make tracking down such exposures more easy in the future.

Ryszard Siviec (Poland) described how his group improved their magnitude estimates: 1. Don't cheat by checking the ephemeris magnitude first. 2. Allow dark adaptation and record the faintest star seen (naked eye or telescopic). 3. Don't stare directly at the comet. 4. Use the standard Sidgwick or Morris method. 5. Measure the DC. 6. Take precautions to maximise the seeing conditions.

Andreas Kammerer (German APB comet section) wanted to compute tail lengths for a computer graphics display and initially he had used a constant 0.01 AU tail length. He decided that he wanted something more realistic and set about analysing the tails of all comets with more than 5 tail observations reported in the ICQ (he acquired an optical character reader to read in the data). He decided to assume that the tail length would vary as m_0, and by plotting the reduced magnitude against the reduced tail length obtained the relation: log (tail length) = 2.09 - 0.22 H_1, where the tail length is in units of 10^6 km and H_1 is the comet's magnitude if it was 1 AU from the Earth. This is similar in form to Festou's relationship for OH production rate and reflects the underlying physical process.

He also gave a poster paper showing the work of the German comet section. They publish a bi-monthly newsletter and carry out visual and photographic observations. Analyses of observations are also published in Sterne und Weltraun.

Mark Kidger had faxed a paper which discussed the possibilities of P/Swift-Tuttle returning this year. He looked at the orbit derived at the last return and possible linkages with other comets. Evidence from Perseid observations seemed to suggest that recently released material from the comet was now being encountered and there was the possibility of very rates at the next August maximum, which is favourable for Europe. However, the situation may have to be reassesed if the comet is not recovered soon.

An unscheduled talk was given by Martin Patzold of the Giotto Radio Science team. They measure the change in velocity of the spacecraft by looking at the Doppler change in frequency of the transmitted signal and can also measure the distance to the spacecraft by measuring the time delay. The encounter with P/Grigg-Skjellerup was at a relative speed of 14 kms^{-1} at a distance of a few hundred km, compared to 68 kms^{-1} at 600 km in the case of P/Halley. At Halley, Giotto was slowed by 230 mms^{-1}, corresponding to an impacting mass of 1932 mg; by contrast at P/G-S the spacecraft only slowed by 1 mms^{-1}, corresponding to 42 mg. Only three particles were detected by the DIDSY experiment, with the largest being around 90 µg, however a particle of around 30 mg, with others around 3 mg are required to explain the changes in nutation and the deceleration. The real time tracking of the spacecraft actually shows a sudden red shift (corresponding to an <u>increase</u> in speed), followed by a gradual blue-shift, which might be explained by a shift in the frequency of the local quartz oscillator, caused by the dust impact. There is no fuel left for another comet flyby, but the moon might be targeted when Giotto next returns to the vicinity of the Earth.

The comet workshop discussed a number of visual observing techniques and attempted to get some standardisation. For reference star sources the AAVSO atlas or star charts were widely used, though it was noted that same of the charts have approximate magnitudes only. The SAO catalogue was generally not favoured, though magnitudes marked as H or T were usually OK. Recent BAA charts usually have photoelectric magnitudes. More high tech sources include the Hubble Guide Star catalogue and the Hipparcos input catalogue; the Tycho catalogue which gives the results from Hipparcos should be published in 1995 and will have accurate magnitudes for stars down to 12^m. The Sidgwick or Morris methods were to be used for magnitude estimates, using the minimum possible magnification; the Bobrovnikoff method was not recommended. Measuring the DC was a difficult problem, as the form of the brightness distribution within the coma varies considerably from comet to comet. Some observers might give the same comet a value of 1 or 9! It might be possible to produce some form of simulation for training, either using a mechanical model or computer simulation. The Belgian comet section use a form which has a mandatory part and an optional part, and this seems an excellent idea.

Andreas Kammerer present a further paper on analysis techniques, using as an example the recent outburst of comet Tanaka-Machholz. Magnitude variations were difficult to follow in the raw data, so he used a weighted running three day mean, with weights of 1+2+1. This clearly showed that the outburst took place on May 9th and the brightness increased by around 1.5 mags. He used the same technique on observations of P/Halley, first reducing the estimates to H_{10}. This showed a number of possible outbursts, though none were particularly convincing.

A comment was made that the French SIF handbook has a good comet section. The PC program 'StarGaze' is apparently one of the better ones for viewing star fields and I will be obtaining a copy to help reduce observations from the section archives. Collaboration was voted by all to be a good idea, though I suspect that a European federation of comet observers is probably a few years off.

Jonathan Shanklin

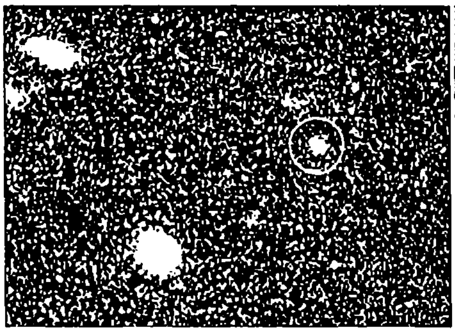
Planetesimal Found Beyond Neptune

Not since the 1801 discovery of the first member of the asteroid belt have planetary astronomers garnered this kind of prize. The 30 August detection of a 200-kilometer object 1.6 billion kilometers beyond Neptune offers the first direct evidence for a belt of dark, icy bodies lying in cold storage on the fringes of the solar system—surplus materials from the formation of the planets. If this discovery proves to be the first of many similar objects, says codiscoverer David Jewitt of the University of Hawaii, astronomers could study "the primordial building blocks of the planets; that would be really neat."

The discovery would be a posthumous triumph for the late planetary astronomer Gerard Kuiper, who predicted the belt of icy bodies, and a feather in the cap of celestial mechanicians who 4 years ago gave quantitative support to Kuiper's gut feeling (*Science*, 18 March 1988, p. 1372). In 1951 Kuiper surmised that when a disk of gas and dust condensed to form the sun and planets, some icy debris could have survived just beyond Neptune. And 30 years later, Kuiper's debris belt was just what theorists needed to explain the origin of comets with relatively short orbital periods—200 years or less.

Comets had all been thought to wander in from a much more distant dumping ground: the spherical Oort cloud, populated by debris flung outward by Neptune and Uranus. But in 1988, theorists Martin Duncan of Queens University in Kingston, Ontario, and Thomas Quinn and Scott Tremaine of the University of Toronto argued that short-period comets had to come from a close-in ring of planetesimals, orbiting the Sun at just 30 to 100 times the Earth-Sun distance (30 to 100 astronomical units, or A.U.)—the same icy belt that Kuiper had predicted. Duncan and his colleagues envisioned a belt of perhaps a billion potential comets, still adding up to a total mass much less than that of Earth.

With the 14 September announcement by Jewitt and Jane Luu of the University of California, Berkeley, that their on-and-off 5-year search had revealed a smallish object at about 41 A.U., the theorists seemed to have just what they were looking for. But the excitement is being tempered by the remaining uncertainties. The only thing known for certain about the object, temporarily named 1992 QB1, is that it's reddish, at least to the sharp eye of astronomical instruments. The



D. JEWITT AND J. LUU

First of a multitude? The new planetesimal *(circled)* appears as a faint spot near two distant galaxies.

reddish tint suggests that its surface is rich in the kinds of primordial organic matter that to the human eye stain comet nuclei as black as coal. With so dark a surface, the object would have to be something like 200 kilometers across—huge by comet standards—to account for its measured brightness.

But a single body doesn't amount to a Kuiper Belt. Indirect evidence that QB1 is just one of a multitude should come from the shape of its orbit, something that isn't known yet because the object's apparent motion against the stars is so slow. If the orbit is roughly circular and lies near the orbital plane of the planets, the body could be a representative of the Kuiper Belt, but an inclined, highly elliptical orbit could mark it as a lone interloper from the distant Oort Cloud. Observations of the object's motion during the next few months should decide the question. "I'm reserving judgment until we get a better orbit," says Tremaine. But if it is reasonably circular, "I'll bet there are a lot more of these out there and this is the Kuiper Belt."

Even before then, more direct support for the existence of the Kuiper Belt could come in the form of additional planetesimals. Using the 2.2-meter telescope on Hawaii's Mauna Kea and the latest in charged-coupled-device detectors, Jewitt and Luu searched 1 square degree of the sky—the area of four full moons—with enough sensitivity to detect objects as faint as 25th magnitude. According to earlier estimates, such a search should turn up between one and five of the largest Kuiper Belt planetesimals. Jewitt and Luu got their one, but they have not yet fully inspected their images, leaving the possibility that more planetesimals are lurking in the data.

In the meantime, there is the matter of a permanent name for 1992 QB1. The first asteroid to be discovered was named Ceres, after the patron saint of Italy. Jewitt and Luu may take a different tack with the first member of the secretive Kuiper Belt. "We want to call it Smiley, after George Smiley, the spy in John Le Carré's books," says Luu. "We both like the character and were talking about him at the telescope." If, as astronomers suspect, the Kuiper Belt includes thousands of planetesimals as big as this one, many a stealthy character may yet be immortalized.

—Richard A. Kerr

Rare outburst of a burnt-out comet

OLD photographs of an asteroid whose orbit brings it near to the Earth have revealed that it was once a comet. Asteroid 4015 (also known as 1979VA) was "discovered" in 1979. Since then, the 5-kilometre-diameter asteroid has been spotted on three occasions: in 1988, 1989 and this year.

Edward Bowell of Lowell Observatory in Arizona decided to see if he could find any earlier images of the object in photographic plates made during the Palomar Sky Survey, carried out in 1949. He was successful, finding one on a plate taken on 19 November of that year. To his surprise, he saw that the object had a small tail.

The object did not go unnoticed in 1949: it was named Comet Wilson-Harrington. But its cometary nature was not clear cut. One observer, L. E. Cunningham, noted that images taken between 20 and 25 November 1949 showed no tail at all.

The "comet" was lost for 30 years. On its rediscovery in 1979, no one noticed the match between asteroid and the comet of 1949.

The discovery confirms something that many astronomers have suspected—that many "near-Earth" asteroids are burnt-out comets. After passing many times through the inner Solar System, sunlight evaporates the ices that produce the cometary tails.

Asteroid 4015 has shown a tail only once, which indicates the object is a largely inactive comet which has rare outbursts. Astronomers will be watching for signs of cometary activity early next month when the object is well positioned in the sky.

***Jeff Hecht*, Boston**

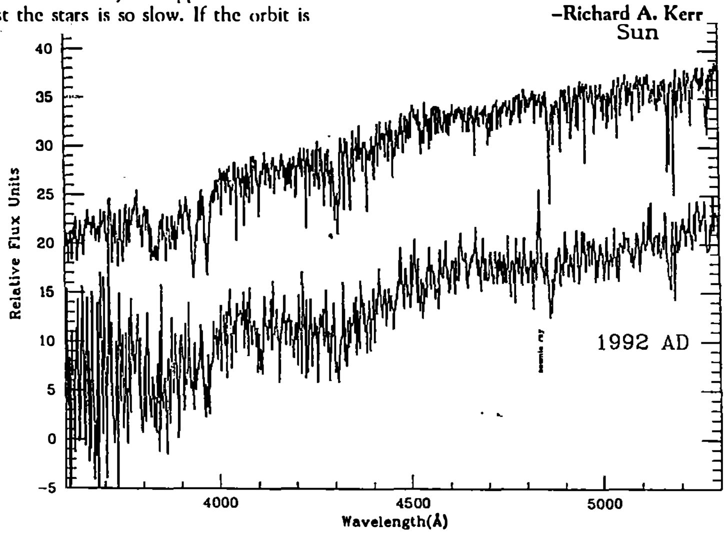


Figure 2.

ESO Observations

At ESO, three lines of investigations were initiated immediately after the announcement of the discovery.

With the Danish 1.54-m telescope, Olivier Hainaut and Alain Smette obtained deep CCD frames on February 2. In addition to measuring an accurate position, useful for improving the orbital computations, they checked whether 1992 AD has an atmosphere like is the case for Chiron since 1988. A 30-minute exposure is shown here (Fig. 1) and as can be seen, there is no sign of any diffuse "coma" around 1992 AD. In fact, by adding several CCD frames, the ESO astronomers were able to put quite low limits on any dust or gas above the surface of 1992 AD. It certainly looks completely inactive.

At the ESO/MPI 2.2-m telescope, Olivier Hainaut and Werner Zeilinger obtained a spectrum of 1992 AD, covering most of the visible region. A raw version of this spectrum is shown in Figure 2, together with the corresponding solar spectrum. Despite the rather poor response of the CCD in the UV-blue part of the spectrum, it seems clear that the overall forms of the spectra are similar, except that there may be some broad absorption structures in the spectrum of 1992 AD. No emission lines were found, so there is no indication of a gaseous atmosphere.

Thus, at least at the present time 1992 AD is dissimilar to Chiron in that it has no perceptible atmosphere.

Finally, a search was made for earlier images of 1992 AD, possibly visible on photographic plates available at the ESO Headquarters. Three ESO plates from 1977–78 and one UK Schmidt plate from 1982 were identified. A very faint trail was seen on the UKS plate.

However, when in February 1992 prediscovery images were found on Palomar plates dating from January 1991 and November 1989, a backward orbital extrapolation showed that the object on the 1982 UKS plate was not 1992 AD. But fortunately Robert McNaught from the UK Schmidt team in Coonabarabran found the right object, of magnitude ~ 20 and about 10 arcminutes distant from the other one, and he also identified 1992 AD on a 1977 UKS plate. A further verification of two ESO QBS plates from 1977 and 1978, now more accurate with the improved orbital data, still did not show the object, most certainly because the predicted blue magnitudes were 21.7 and 21.5, i.e. at the formal limiting magnitude of the ESO Quick Blue Survey.

The Importance of 1992 AD

The new minor planet moves a part of the solar system that is largely unexplored. Only a few comets have been followed out to these distances, but the observations are very difficult and not very detailed. However 1992 AD and Chiron are bright enough to be observed over much of their orbits, especially when the new large telescopes enter into operation. They are most likely to represent the first (the brightest?) of a new class of minor planets which move in orbits beyond Saturn. Already at the time of the discovery of Chiron, it was inofficially decided that they will be given the names of mythological Centaurs, so they will supposedly be known in the future as the *Centaurs*, just like the Atens, Apollos, Amors, Hildas, etc. Now that 1992 AD has been observed in 1977, 1982, 1989, 1991 and 1992, the orbit is sufficiently well known to allow the assignment of a number and a name. No doubt the discoverers are now busy studying mythology!

In this connection, speculations have already been started about possible similarities between Chiron and 1992 AD on one side and some of the outer moons, like Triton at Neptune and Charon at Pluto, as well as Pluto itself. Are they perhaps all objects of the same basic type, but of different sizes and with different evolutionary histories? Only further observations will tell.

BRITISH ASTRONOMICAL ASSOCIATION - COMET SECTION

Prospects for 1993

Highlights of the past year were undoubtedly the Giotto fly-by of P/Grigg-Skjellerup, and the recovery of P/Swift-Tuttle, both of which were triumphs for all concerned.The latter gave us our brightest comet since Levy in 1990, and will continue to interest southern observers during the first part of 1993.Apart from that, only P/Schaumasse promises to be reasonably bright, and as usual we must depend on the searchers to find something out of the ordinary.

Another interesting development in 1992 was the identification of P/Wilson-Harrington with an object previously designated as an asteroid. The former, 1949III, was originally assigned the very short period of 2.3 years, but it seems that a timing error led to a false orbit solution, and re-working has enabled the comet to be identified with asteroid 1979 VA, which has been re-observed in 1988/89 and 1992, still of asteroidal appearance.The cometary nature of the original object has been definitely confirmed by re-examination of the plates, and it seems that we have here another quasi-asteroidal comet (Quack?) to add to a few others that spend most of their time looking like minor planets.This one appears to be two magnitudes fainter as an asteroid than it was as a comet, and will be down to 18^m by the end of 1992.

All comets known to be at perihelion in 1993 are included in these notes, together with a few previous ones that may continue to be of interest, and a couple of early ones from 1994 that should be within range before the end of the year.The increasing use of larger appeetures in conjunction with CCD's should extend our magnitude limit to somewhat lower levels than in the past.

<u>P/Schwassmann-Wachmann 1</u> This perennial and eruptive object has been fairly quiet in 1992, only one major outburst, in February, having been noted.Lesser brightenings occurred in August and at the end of November. Surveillance of the comet to detect unusual activity continues to be required, though even at best the outbursts rarely exceed 12^m.The comet is near to Beta Tauri in January and then moves eastwards for the rest of the year, ending it near Pollux.During May to early August the elongation is too small for observations to be made, but otherwise the comet is well-placed.

<u>Helin-Lawrence, 1991 l</u> This long-enduring comet is now on the way out, perhaps never to return.Having reached 13th mag. at its best, it starts 1993 at 15th, fading as it moves slowly in the Square of Pegasus.

<u>Shoemaker-Levy, 1991a$_1$</u> At one time it seemed that this comet might be quite bright in the summer sky, but it was disappointing, barely reaching 7^m. It is now a southern object, fading at 14^m in Carina.

<u>Oshita, 1992a$_1$</u> Discovered with large binoculars on 1992 November 24 at 11th magnitude, this comet would have been much brighter had we not been prevented from seeing it by its proximity to the Sun.It is moving away now and fading,starting the year at 13^m in Ursa Major, then moving across into northern Draco and on into Cassiopia during March, by which time it will be down to 18th mag.

<u>P/Swift-Tuttle,1992t</u> Recovery of this long-sought comet reflects great credit on Kiuchi for finding it and Brian Marsden for predicting it.The sceptics (who included myself) have been confounded, and the identity with Comet Kegler, 1737 II, established, though problems still attend the reconciliation of the three orbits, mainly because of the large non-gravitational forces involved.With a peak brightness between 4th and 5th magnitude, this has been the best comet of the year, though it is a pity that perihelion was not at a more favourable time.During 1993 the comet moves rapidly across the southern sky, from Sagittarius through Grus and into Hydrus, fading quickly to 15^m by the end of June.It ends the year in Carina, at 20th magnitude.

P/Ciffreo, 1992s When recovered by Scotti with the Spacewatch telescope on 1992 Sept.24, the comet was 18^mpg., with a 15" coma and a 25" tail. At discovery in 1985 November it was 10^m visually, though photographic estimates were one or two magnitudes fainter.There may have been some intrinsic fading, but if the original brightness is maintained the comet will start the year at 13^m, fading to 16^m by the end of May.During this period it moves from Pisces into Auriga, passing the Pleiades in the latter half of March.

P/Howell, 1992c Discovered in 1981, the maximum brightness was 15^mpg. The 1987 return, similar to that of 1981, yielded visual magnitudes of 12 - 13.The circumstances of the current return are a little less favourable, and between January and May the brightness will probably vary through $13\frac{1}{2}$ - 13^m and back, fading to 15^m by the end of October. However, the elongation and the south declination are both unfavourable for us until the end of March,when the comet will be in the morning sky moving from Aquarius through Pisces and on into Aries.
The main disturbance of the orbit occurred in 1585, when the line of apsides was reversed and q reduced from 4.7 to 2.4 AU.Subsequent encounters with Jupiter reduced q again to 1.4 AU, and the comet is now librating smoothly about the 1/2 resonance.

P/Schaumasse, 1992x This comet has been dealt with in detail in the recent C.S.Newsletter.Since that was published, Denis Buczynski has photographed the comet at 12- 13^m. It is usually rather slow to brighten on the approach to perihelion and may require a larger coefficient of log r in the magnitude formula than the standard value of 10.It is hoped that the observations at the present apparition will enable a reliable formula to be derived.

P/Forbes At its best this comet can be a 10th mag. object; during its first six observed apparitions, 1929 - 1980, it ranged at brightest from 10^m to $14\frac{1}{2}^m$, with a short tail on each occasion.Missed in 1935 1955 and 1967 owing to unfavourable circumstances, the comet was a difficult object in 1987.The present return is only moderately good, and we may expect the comet to be about 12 - 13^m during the first half of the year.Badly placed at first in Scorpius - Capricornus, during the second half of the year it moves northeast into Pisces, fading to 16^m. The orbit has been fairly stable for some time, librating around the 1/2 resonance but after the next return in 1999 more severe changes occur and it will become progressively more difficult to observe.

Helin-Lawrence, 1992q This southern object starts the year at 14^m in Grus, brightens slowly to 13^m during April as it passes through Hydrus, then fades as it crosses into Hydra and Corvus, when it will be down to 17th - 18th mag.

Shoemaker, 1992y Faint and distant, this comet starts the year at 14^m and fades steadily to 18^m by December.As it does so, it loops in Aries-Pisces, then moves northeastwards into Camelopardus and through Ursa Major into Bootes.

P/Holmes Discovered in 1892 November, this comet was close to M31 and was brighter than that object.Various estimates gave it as 3rd - 5th magnitude, about 5' in diameter.Evidently it was in outburst, otherwise it would have been discovered sooner.It kept up its brightness during November, produced a $\frac{1}{2}^o$ tail, and a nebulous knot was recorded just beyond the end - perhaps a disconnection event.One photograph showed a double nucleus, but this was not repeated.By the end of the month the coma was 30' across, but the comet faded during the next six weeks until another major outburst increased the brightness by 4 to 5 magnitudes. The returns of 1899 and 1906 showed nothing unusual, the magnitude being 14 - 15 at best.The next seven returns were missed, and the comet was regarded as lost until a re-examination of the orbit by Brian Marsden (who else?) enabled Roemer to recover it in 1964. At that and the next two returns the brightness was 18 - 19^m, and does not look like being better than 17 - 18^m this time.However, there might be another blow-up,and we should keep an eye on the position. After the end of May the comet moves northeast through Pisces, Aries and into Perseus, and is well placed from August onwards.

P/Vaisala 1, 1992u This small,faint and rather distant comet has been observed at every return since its discovery in 1939, but on no occasion has it distinguished itself in any way.The orbit is stable and the brightness reliable.At discovery it was designated as Asteroid 1939 CB, but soon revealed its cometary nature by showing a small coma and a 1' tail.This apparition is very similar to that of 1939, and during the first part of the year the comet will be well placed in Leo, around opposition and $14^m - 15^m$.By October it will have moved into Libra, close to the Sun, and fading to mag. 18 - 19.

P/Lovas 2 Discovered on 1986 November 28, at 14^m, this comet had a short tail, but quickly faded; its periodic nature remained uncertain for some time.Intrinsically faint, and rather distant, it is unlikely to be observed visually.At its poor best during the middle months of the year it will move northeastwards from Pisces into Aries, and is not expected to be brighter than 16^m.

P/Wiseman-Skiff This is another new short-period comet, discovered a month later than P/Lovas 2, and similar to it in many ways.The first apparition was very favourable and the comet was seen visually at 13^m-14^m but the $6\frac{1}{2}$ year period means that alternate returns are unfavourable, and the present one could hardly be worse.The elongation at perihelion is 6^o, dropping to 2^o at the end of June.When available, the comet will be no brighter than 17 - 18 mag., and will not be of great interest to us. A close approach to Jupiter in 1984 evidently diverted the comet into its present orbit.

P/Slaughter-Burnham, 1992w Although making its fourth observed appearance this faint and distant object has never been recorded as brighter than 16^m, and it is unlikely that even that modest level will be reached this time.The apparition is not a good one, and the comet does not emerge into the morning sky until July, still 3 AU from the Earth. The peak brightness will probably be $17^m - 18^m$ in October.

P/Urata-Niijima This is another of the six new short-period comets found in 1986, and like most of the others it is very faint, owing its discovery to a particularly favourable apparition.Brian Manning managed to record it on three negatives at 16^m, but even he will be hard put to it to repeat his success this time, for it is a poor return and the maximum brightness is unlikely to exceed $19^m - 20^m$.Even its recovery is by no means certain, as at perihelion it is still 2.1 AU from the Earth, with an elongation of only 30^o.

P/Ashbrook-Jackson, 1992j This comet was discovered in 1948 following a close approach to Jupiter in 1945 which reduced q from 3.8 to 2.3 AU. Although it is one of the intrinsically brightest of the short-period comets, the still-large perihelion distance keeps its observed magnitude at a modest level.At all except the worst of its six previous returns it has been recorded at $11^m - 12^m$, and occasionally sports a short tail. The present return is quite favourable; after emerging from conjunction with the Sun, the comet will in April be in the morning sky in Aquarius at about 13^m. During the following months it moves northeastwards, attaining maximum brightness around 11^m at opposition in late September while retrograding in Pisces.

P/Gehrels 3 This very faint and distant comet was discovered in 1975, $2\frac{1}{2}$ years before perihelion.However, the near-circular orbit and the large perihelion distance of 3.4 AU means that Earth-distance is the determining factor for the brightness.Discovery followed an extremely close pass of Jupiter in 1970 at only 0.001 AU from that planet, which resulted in temporary capture into a satellite orbit, at the same time reducing q from 5.7 to 3.4 AU . Starting at the middle of next century, a series of four further close encounters will change the orbit again, eventually shifting q out to 7 AU. The current return is a least-favourable one, the magnitude ranging from 18 to 20.When recovered on 1992 September 26, as 1992v by Scotti with the Spacewatch telescope it was 22^m

Spacewatch, 1992h So called because it was detected by computer-based inspection of a plate taken with the Spacewatch telescope at Kitt Peak, this comet, although fairly bright intrinsically, remains observationally faint because of its large (3.16 AU) perihelion distance. During 1993 it stays in the 16^m- 17^m range most of the time, but at the end of the year is a little brighter as it passes, at declination +88°, close to Polaris.

P/Neujmin 3 This faint object is unlikely to have been discovered but for a close approach to Jupiter in 1850, which reduced q from 2.7 AU to 2.1 AU. Even so, it was not found until 1929, and has been missed at alternate returns since then. Interestingly, the pre-1850 orbit is found to be almost identical to that of P/van Biesbroeck, and it is considered that the two comets are fragments of a parent that split. This is by no means a good return, and the magnitude is unlikely to exceed 18 - 19 at best in July-August. The comet remains in south declination throughout the year.

P/Shajn-Shaldach This comet has a turbulent orbital history involving close encounters with Jupiter. The last of these, in 1946, reduced q from 4.2 to 2.2 AU, reversed the nodes, and the previous perihelion became the aphelion of the new orbit. This led to discovery in 1949, at 12^m. The comet was then lost for two returns until a new prediction by Brian Marsden enabled recovery to occur in 1971. On that return and th subsequent ones the brightness has been rather less than expected, and the present estimates are based on the fainter performance. When the comet emerges into the morning sky in April, in Aquarius, it will probably be about 17^m, brightening to 14^m as it moves into Pisces in October. The orbit will remain largely unchanged for the next century.

P/West-Kohoutek-Ikemura Considerable confusion attended the discovery of this comet: not only were three observers involved, but Kohoutek found another comet nearby at the same time; its motion was undetermined and it was not clear as to which of the comets the various observations referred. Eventually the mess was sorted out, and it transpired that both objects were new short-period comets. As in the previous case, discovery followed an extremely close encounter with Jupiter, completely changing the original orbit, but only minor changes are now expected for the next couple of centuries. The 1993 return is just about as favourable as it can be - a very nearly perihelic opposition. The comet was 12^m at discovery in 1975, in rather less good circumstances, and if that is any guide we may hope for 11^m this time. However, the comet was fainter than expected at the last two, rather poor, apparitions, and the original brightness may be non-recurrent, as is often the case with newly-diverted comets. In the latter half of the year the comet moves northeastwards through Cetus into Taurus and at opposition in December will be well-placed, a little north of the Hyades.

P/Schwassmann-Wachmann 2 Since discovery in 1929, every return of this comet has been observed; in a good year, it reaches 11^m. The present return is the most favourable possible - an almost precisely perihelic opposition, and perhaps it will be a little brighter than its previous best. Reaching 12^m by November, it will be well-placed near Pollux, from whence it moves into Cancer at opposition in 1994 January at 10^m - 11^m, after which it continues into Leo, fading to 13^m as it does so. This will be our last chance to see the comet reasonably bright as it is due for a shake-up by Jupiter in 1997 that will shift q out to 3.35 AU, returning to the low-eccentricity orbit it had before a deep encounter in 1921 - 1928 brought it closer in.

P/Encke This frequent but elusive visitor, making its 56th observed return, is moderately well-placed this time. During November it should be around 12^m, moving southwards from Pegasus into Aries, brightening to 10^m at the end of the year, after which it dives rapidly into the evening twilight as it reaches 8^m - 9^m in mid-January. How bright one sees it subsequently depends on how far one can follow it towards perihelion on February 9, when the elongation will be a scant 3°.

Comets in 1993

Comet	Prov. desig.	T	Brightest Mag.	Brightest Month	Brightest Elong.
P/Schwassmann-Wachmann 1	-	1989 Oct.26.7	18(12)	Jan.	145E
Helin-Lawrence	1991l	1992 Jan.20.0	15	Jan.	65E
Shoemaker-Levy	1991a1	July24.5	14	Jan.	85W
Oshita	1992a1	Nov. 1.6	13-14	Jan.	100E
P/Swift-Tuttle	1992t	Dec.12.3	6	Jan.	13E
P/Ciffréo	1992s	1993 Jan.22.5	13-14	Jan.	80E
P/Howell	1992c	Feb.26.1	12-13	Feb.	25W
P/Schaumasse	1992x	Mar. 4.0	8-9	Feb.	100E
P/Forbes		Mar.14.6	12-13	Apr.	48W
Helin-Lawrence	1992q	Mar.15.1	13	Apr.	80CS
Shoemaker	1992y	Mar.25.7	14	Jan.	105E
P/Holmes		Apr.10.7	17-18	Oct.	125E
P/Väisälä 1	1992u	Apr.29.2	14-15	Mar.	145E
P/Lovas 2		June 2.4	16	June	50W
P/Wiseman-Skiff		June 4.4	17-18	Oct.	35W
P/Slaughter-Burnham	1992w	June22.4	17-18	Oct.	120E
P/Urata-Niijima		July13.3	19-20	July	36W
P/Ashbrook-Jackson	1992j	July14.1	11-12	Sep.	150W
P/Gehrels 3	1992v	July25.4	18-19	Jan.	135E
Spacewatch	1992h	Sep. 7.6	15-16	Dec.	110CN
P/Neujmin 3		Nov.13.0	18-19	July	110E
P/Shajn-Shaldach		Nov.16.0	14-15	Oct.	165E
P/West-Kohoutek-Ikemura		Dec.25.3	11-12	Dec.	165E
P/Schwassmann-Wachmann 2		1994 Jan.23.9	11-12	Dec.	135W
P/Encke	-	Feb. 9.5	10-11	Dec.	75E

Moon New	Moon Full
	Jan. 8
Jan.22	Feb. 6
Feb.21	Mar. 8
Mar.23	Apr. 6
Apr.21	May 6
May 21	June 4
June20	July 3
July19	Aug. 2
Aug.17	Sep. 1
Sep.16	Sep.30
Oct.15	Oct.30
Nov.13	Nov.29
Dec.13	Dec.28

Elongations are for approx. mid-month. CS/CN = Circumpolar South/North

Short-Period Comets at Perihelion in 1994

P/Comet	T 1994	q AU	P yrs	Previous Apparitions N	First	Last
Schwassmann-Wachmann 2	Jan.23.9	2.07	6.39	10	1929 I	1987 XIX
Encke	Feb. 9.5	0.33	3.28	55	1786 I	1990 XXI
Kojima,1992z	Feb.18.0	2.40	7.85	3	1970 XII	1986 VII
Tempel 2	Mar.16.8	1.48	5.48	18	1873 II	1988 XIV
Maury	Mar.19.1	2.03	8.74	1	1985 VI	-
Hartley 3	May 20.4	2.46	6.84	1	1987 XII	-
Tuttle, 1992r	June27.0	1.00	13.51	10	1790 II	1980 XIII
Bus	June28.1	2.18	6.52	2	1981 XI	1987 XXXIV
Reinmuth 2	June29.7	1.89	6.64	7	1947 VII	1987 XXVI
Kohoutek	June29.9	1.78	6.67	3	1975 III	1987 XXVII
Tempel 1	July 3.3	1.49	5.50	8	1867 II	1989 I
Wild 3	July21.2	2.30	6.91	2	1980 VII	1987 XX
Harrington	Aug.23.2	1.57	6.78	4	1953 VI	1987 XXVIII
Brooks 2	Sep. 1.1	1.84	6.89	13	1889 V	1987 XXIV
Russell 2	Oct.27.4	2.28	7.38	2	1980 III	1987 XI
Borelly	Nov. 1.5	1.37	6.88	11	1905 II	1987 XXXIII
Whipple	Dec.22.4	3.09	8.53	9	1926 VIII	1986 XII

Complete precise elements for any of these comets can be provided on request.

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Thanks are due to S.W.Milbourn for providing orbital data in connection with these notes.

H.B.Ridley,
Eastfield Observatory,
1992, December 29

Comet Section Survey

In order to help meet members needs I am carrying out a survey of members interests and observing equipment etc. Please fill in the questionnaire in block letters so that I can read it! Some of the questions may seem irrelevant, but they do give me additional help in serving your needs. The information won't be recorded on computer. Please return the completed questionnaire to the Director.

Name:

Date of birth

Address:

Telephone nos home: work:

Observing site information:
Eg Light pollution, normal limiting mag (zenith and at 10° altitude), % of clear nights.
Repeat the details for a second site if you use one frequently.

How long have you been interested in comets (years) ?

How would you describe your level of interest?

Casual	[ ]	Keen	[ ]	Lapsed	[ ]
Beginner	[ ]	Intermediate	[ ]	Experienced	[ ]

Other (please specify)

How long have you been observing comets (years) ?

Visually | Photographically | CCD

What are your comet interests?

Historic articles	[ ]	Current research articles	[ ]
Visual observation	[ ]	Photographic observation	[ ]
Comet seeking	[ ]	Other (please specify)	

When do you observe?

In the evening	[ ]	In the morning	[ ]
At weekends	[ ]	Anytime	[ ]

What instruments do you have

Small binoculars (<60mm)	[ ]	Large binoculars	[ ]
Small refractor (<100mm)	[ ]	Large refractor	[ ]
Small reflector (<150mm)	[ ]		
Medium reflector (<300mm)	[ ]	Large reflector	[ ]

Other (please list)

What is the faintest comet that you regularly observe?

8^m	[ ]	10^m	[ ]
12^m	[ ]	fainter than 12^m	[ ]

What atlases do you use for finding comets?

What sources do you use for magnitude estimates?

Do you take comet photographs?

Unguided	[ ]	Piggy back	[ ]	Prime focus	[ ]
Wide field	[ ]	CCD	[ ]		

Do you have access to a PC?
Give details of discs, type (Eg 386 AT) etc

From what other sources do you receive comet information?

Please rate the following in order of importance to you:

A: Comet section contact

Newsletter	[ ]	Section meetings	[ ]	BAA meetings	[ ]
Correspondence	[ ]	E-mail	[ ]	Phone	[ ]

B: Journal publications

Observation reports	[ ]	Notes and news	[ ]
Meeting reports	[ ]		

C: Comet ephemeris information

BAA Handbook	[ ]	BAA Circulars	[ ]	TA Circulars	[ ]
IAU circulars	[ ]	ICQ Handbook	[ ]	Section newsletter	[ ]

What should the newsletter contain?

IAUC news	[ ]	General news	[ ]	Historical items	[ ]
Research news	[ ]	Observations	[ ]	Ephemerides	[ ]
Charts	[ ]	Orbital elements	[ ]	Other (please specify)	

Do you want to continue receiving the newsletter?
(A small charge may be made in the future).

What astronomical societies do you belong to?

What other BAA sections do you belong to?

What (if any) help or training could the section give to help you make more observations (Eg Observing manual, finder charts, ephemerides, etc)

Any other information, requests or suggestions

Jonathan Shanklin
Director
1992 October 22

THE BRITISH ASTRONOMICAL ASSOCIATION

COMET SECTION

NEWSLETTER FEBRUARY 1994

Recently, there have only been two comets available to observers, P/Schwassmann-Wachmann 2 and the newly-discovered P/Kushida 1994a. Both of these objects have been well-placed for observation around midnight. Although faint for visual observers, they have been well-suited for CCD imaging. Observations made at Conder Brow during the past few weeks have proved the value of this new technology to Glyn Marsh and myself.

P/Kushida 1994a was imaged using a Starlight Xpress camera and a 5" Celestron Comet-Catcher. The resulting frames enabled Nick James to produce accurate astrometry using the Hubble Space Telescope Guide Star Catalogue.

Electronic imaging and measurement is easy when compared to conventional photography and plate measurement. Observation, identification, measurement and data transmission are virtually push-button procedures. I now understand how Japanese observers produce numerous astrometric results so quickly. This seems to be the way forward for UK observers interested in cometry astrometry.

P/Schwassmann-Wachmann 2 has proved very interesting. The predicted magnitude of the comet for the past few weeks has been around 10 - 11. However, our CCD observations seem to show a brighter and more developed comet, complete with tail, than we expected. We are attempting some photometry to see if we have witnessed this comet in outburst. We would be interested to hear from any other observers who have also been following this object during the past few weeks.

The CCD appears to be an ideal detector for comet observers. More sensitive than photography, more reliable than visual observation, and it combines with an ease of data handling. I see a bright future for our chosen field amongst amateurs. We have already seen a CCD image and astrometric position of P/Spitaler by Martin Mobberley published in TA. This is by far the faintest comet observed and reported by an amateur in this country.

Of course, a potential irony is that the "next bright comet" which we have all eagerly anticipated for so long, may prove <u>too</u> bright for our new technology!!

Denis Buczynski
Editor

BRITISH ASTRONOMICAL ASSOCIATION - COMET SECTION

Prospects for 1994

The past year has been a quiet, not to say dull, one, with no bright comets and, remarkably, no discoveries by amateurs*. However, the year has not been without interest, the highlight being the discovery of P/Shoemaker-Levy 9, the "string of pearls" comet torn apart by Jupiter's gravity. The final collision with the planet in July will be of intense interest; although hidden from us, the aftermath may well be visible as some disturbance of the cloud-patterns on Jupiter's disc. The other item of interest was the rediscovery of P/Spitaler, not seen since its original discovery nearly a century ago.

Apart from the forthcoming collision, there is nothing spectacular in prospect. Two or three of the returning short-period comets may be fairly bright, but none are likely to reach naked-eye visibility. Once again we must urge the patient seekers not to lose heart, but to increase their efforts to find us something worth looking at. * See Late News

P/Schwassmann-Wachmann 1 Three outbursts of this comet were reported in 1993: in February, April and November, magnitudes between $12\frac{1}{2}$ - $13\frac{1}{2}$ being recorded. Continued surveillance is required to ensure that no outbursts are missed. The comet spends the first five months of 1994 in Gemini; after conjunction with the Sun, from September onwards it will be moving slowly in Cancer. Throughout the year, the basic magnitude stays around 18.

P/West-Kohoutek-Ikemura It looks as though the fading noted at the last two apparitions was not entirely due to unfavourable circumstances, but was partly of intrinsic origin. During the first quarter of the year the comet will be well placed in Auriga, but probably no brighter than 12 - 14 magnitude.

Mueller, 1993a This comet, in a retrograde orbit, has been with us for a year, slowly brightening from 15^m to 9^m in November, since when it has faded a little and perhaps become more diffuse; recent estimates are in the $9\frac{1}{2}$ - $10\frac{1}{2}$ range. It begins the year in western Pegasus, but by February it will be too close to the Sun for observation. After crossing the celestial equator in April, it moves steadily southwards; by September it will be in Telescopium, probably no brighter than 15^m.

P/Schwassmann-Wachmann 2 Although it is never very bright this comet has been observed at every return since its discovery in 1929, and at its best may reach 11^m. The present apparition could hardly be more favourable: a perihelic opposition. Well placed, it moves from Gemini into Cancer, later passing into Leo, fading from its peak of 11^m in January to 13 by the end of May. A close encounter with Jupiter in 1997 is due to enlarge the orbit, shifting q out to 3.35 AU and thus putting the comet beyond the range of small instruments. This reverses the changes made in 1921 - 1928 which led to its discovery.

P/Spitaler, 1993r Recovery of this comet after nearly a century in the wilderness is of considerable interest. Discovered in 1890 when Spitaler was looking for Comet Zona, it was making a very favourable apparition, and was rated as 12^m. However, the recovery magnitude of 17.2 given by Scotti indicates that the comet may now be 4 magnitudes fainter than it was originally. If this fading is real, and occurred after the first appearance, it might help to explain the subsequent loss of the comet. The orbit is relatively stable, shallow encounters with Jupiter producing only minor changes; the original orbit was based on 22 observations over a two-month arc, and should have been good enough to ensure recovery. Later attempts to predict returns were well out: Marsden, Buckley and Nakano made predictions for the 1972, 1979 and 1994 returns respectively and were 59, 89 and 116 days early, according to recent calculations by Marsden. The comet is on its way out now, moving through Cetus and Aries, fading from 17^m to 19^m as it approaches Conjunction in July.

P/Encke This famous comet, discovered by Mechain in 1786 and with the shortest known period, is making its 56th observed apparition. Although this is a favourable return, the comet is never very easy to observe, as it stays fairly faint until its final dash to perihelion when it closes rapidly on the Sun and becomes lost in the twilight. There is some evidence of secular fading as it is now generally about a magnitude fainter than at corresponding times in its earlier appearances. At the start of the year the comet will be on the Aquarius-Pegasus border, about 10^m and moving westwards into Capricornus. How bright one sees it depends on how far it can be followed as it nears the Sun, but one cannot expect better than 7^m even when the elongation is down to 25°. This object is designated for special study by the Ulysses Comet Watch project, and it is hoped that observers will make every effort to follow it as far as possible.

P/Kojima, 1992z The orbit of this faint object is chaotic, oscillating between the 1/2 and 3/4 resonances with Jupiter. An encounter in 1962 reduced q to 1.6 AU and led to discovery in 1970, when the comet reached $13\frac{1}{2}^m$. A further perturbation in 1973 shifted q out to 2.4 AU, where it has remained. The subsequent two apparitions were poor, at 18^m and although the present one is optimum - a perihelic opposition - it will be unlikely to yield better than 15^m at that time. The comet moves slowly in Leo, near Regulus, during the first four months of the year, later moving eastwards into Virgo and fading to 17^m as it closes on the Sun. An encounter with Jupiter in 1996 will reduce q to 2.0 AU.

P/Tempel 2 This comet will be making its 19th observed apparition since its discovery in 1873. In a good year such as 1988 the comet gets to 8^m, but the $5\frac{1}{2}$-year period means that alternate returns are unfavourable, and such is the case this time. The light-curve is highly asymmetrical; after a late 'turn-on' there is a rapid rise in brightness to perihelion which continues more slowly for the next two or three weeks, followed by a slow decline until the 'turn-off' steepens the curve. In three of the four perihelia since discovery occurring within a month of the present one the comet has been missed completely and the other one produced a feeble 18^m maximum. Perhaps it would be better to play this one by eye and see what happens - probably on the monitor screen of a CCD camera. The orbit is very stable, one reason why this comet has been a favourite target for cancelled space missions. In 1983 the IRAS satellite detected an extensive dust trail behind the comet.

P/Maury This faint and distant object is unlikely to claim our attention. Discovered at Palomar in 1985, it never got brighter than 16^m. The present return is rather less favourable, and the comet will remain in the region of 17^m as it moves slowly from Capricornus through Aquarius into Pisces, keeping within a few degrees of the celestial equator.

Mueller, 1993p This high-inclination visitor has been brightening slowly since its discovery in 1993 August and will start the year in Aquarius at about 10^m. As it moves southwards, approaching its March perihelion it will enter Sculptor and Phoenix, reaching maximum brightness at about 7^m in April, but of course will then be for southern observers only. It then turns north again and moves rapidly eastwards into Leo in June and Virgo in August as it closes on the Sun, fading to 13^m - 14^m as it does so. This comet is a special target for the Ulysses Comet Watch, and southern-hemisphere observations will be particularly important.

P/Shoemaker-Levy 9, 1993e The story of this unique object is too well known to need repetition here. The comet will of course remain close to Jupiter until its demise. Opposition is on April 30, and the main fragments will collide with the planet during the period July 18 - 23, though the lesser components may extend those limits somewhat. Brightness is uncertain, but the integrated magnitude should be around 14 unless there is fading of some of the units. During the final days Jupiter will be in the southwestern evening sky at an elongation of 100°E, on the border of Virgo and Libra.

P/Hartley 3, 1993m Even more distant than P/Maury, and equally faint, this comet was discovered at Siding Spring in 1988. The best chance, if it can be called that, to observe it will be in the first quarter of the year when it will be moving eastwards through Aries, but no brighter than 17^m.

P/Tuttle, 1992r This interesting comet was discovered by Mechain in 1790 - poor Mechain seems to have lost out rather in the matter of comet nomenclature. At a good return it reaches 8^m, but unfortunately the present one - the eleventh observed since discovery - could hardly be worse: perihelion occurs on the opposite side of the Sun from the Earth. During the first quarter of the year the comet moves from Cygnus into Andromeda, brightening from 14^m to 12^m; after superior conjunction it moves in Hydra, fading from 11^m to 14^m.

The high inclination - $55\frac{1}{2}^{o}$ - gives the orbit considerable stability, and a moderate approach to Jupiter in 1995 will have little effect. The perihelion distance of 0.998 AU makes possible our encounter with meteoroids from the comet, and Denning originally identified a minor stream from this source. However, the stream made a strong return in 1945 (100 per hour) observed from Czechoslovakia, and became known for a time as Becvar's Stream, though he did not in fact observe it. Since Davies and Almond at Joddrell Bank subsequently determined the orbit and confirmed the association with P/Tuttle, the shower has been known as the Ursids. The 1945 outburst was not repeated until 1986, when once again 100 meteors per hour were recorded. In other years rates have been modest, around 10 - 15 per hour, and there appears to be no extra activity when the parent comet is at perihelion; indeed the two strong displays have occurred when P/Tuttle was near aphelion.

P/Bus, 1993b Another faint one. This apparition is quite favourable, very similar to the discovery apparition of 1981, when it was observed at Siding Spring at $16\frac{1}{2}^m$. The comet spends the first half of the year in southern Leo, close to the celestial equator, moving off into Virgo as it nears the Sun at the end of the year. It should peak at 16^m - 17^m in March. This comet lives dangerously; originally perihelion was beyond Jupiter, but subsequent encounters, particularly that of 1952, rediced q to its present value of 2.2 AU. In 2021 - 2028 a further close approach will increase q to 3.6 AU, possibly putting the comet out of observational range.

P/Reinmuth 2, 1993g Although seen at every return since its discovery in 1947, and now making its eighth appearance, this is not a bright comet and only occasionally gets within range of modest instruments. This is quite a good apparition, as was that of 1987, and once again we can expect a maximum of 13^m. During the first half of the year the comet moves up from Sagittarius into Pisces in the morning sky, later continuing into Aries where it achieves maximum brightness in September, subsequently retreating and fading. The comet librates around the 4/7 resonance with Jupiter and is in a relatively stable phase at present, but severe perturbations await it in the more distant future.

P/Kohoutek This is not the infamous object of 1973, but had its share of notoriety when discovered in 1975, being involved in the imbroglio with P/West-Kohoutek-Ikemura. The orbit is very similar to that of P/Reinmuth 2, and the two comets are at perihelion within a few hours of each other. It is also not very bright, managing at best to struggle up to 13^m. This is not a very good apparition, perihelion occurring close to conjunction, and by the time the comet is clear of the Sun in September it is unlikely to be brighter than 15^m. It will then be in Cancer, moving into Sextans and Crater and fading slowly during the remainder of the year. The orbit is chaotic, librating around the 1/2 resonance with Jupiter; a close encounter in 1972 reduced q from 2.5 to 1.6 AU, leading to discovery, but in 1983 a further perturbation increased q to its present value of 1.8 AU. Like P/Reinuth 2, it is due for drastic changes in the future.

P/Tempel 1, 1993c The discovery apparition in 1867, and the two following ones, were readily observed, but perturbations by Jupiter in 1881 enlarged the orbit and the comet was missed for the next thirteen returns.Further encounters in 1941 and 1953 restored the original value of q, and predictions by Marsden and Schubart enabled Roemer to secure a single image in 1967 which was provisionally assigned to the comet.This was confirmed by recovery in 1972, and all subsequent returns have been observed.The $5\frac{1}{2}$-year period gives perihelia in January and July, the latter being favourable and applying this year. As the comet moves eastwards through Virgo during the first half of the year it should brighten from 13 - 14^m to 9 - 10^m in May-June.Moving more rapidly southeast into Sagittarius, the cpmet fades to 14^m by the end of the year.As the comet librates around the 1/2 resonance with Jupiter the orbit remains fairly stable at present, but the previous cycle of changes will repeat after a few more revolutions.

P/Wild 3 Although this is a favourable apparition, the third observed, the comet is faint and distant and is unlikely to be brighter than 15^m as it moves from Libra into Virgo and back again during the middle months of the year, going south into Sagittarius as it closes with the Sun at the end of June.The orbit has been much modified by Jupiter; a close encounter in 1882 reversed the line of apsides and reduced q from 5.2 to 4.2 AU, and a further approach in 1977 reduced it further to 2.3 AU, leading to discovery in 1980.The orbit will be stable for the next 70 years.

P/Harrington At discovery in 1953 the comet was 15^m with a 3' tail, but the next four returns were poor and two of them were missed. In 1987 favourable circumstances enabled visual observations at 13^m to be made; this year things are slightly better and the comet may be a little brighter.During the first half of the year the comet will brighten from 17^m to 14^m as it moves from Sagittarius into Aquarius.Well placed in Cetus in September, it should be 12^m- 13^m, fading back to 14^m by the end of the year.The orbit is somewhat chaotic but is in a fairly stable phase at present; only minor changes should occur during the next half century.

P/Brooks 2 This well-known object will be making its 14th observed apparition.In 1886 it experienced a hair-raising encounter with Jupiter, passing inside the orbit of Io.Like the present P/Shoemaker-Levy 9, it was tidally disrupted and the orbit was drastically altered.It is not known how many fragments were originally produced, but at discovery in 1889 the nucleus was triple.The two fainter components soon fizzled out, the major one surviving as the present comet and becoming an 8^m object with a 15' tail.As is often the case, the first apparition after encounter was unusually bright, and since 1889 the comet has not been brighter than 10^m, with only a few minutes of tail.Circumstances this time are a little less favourable than in 1987, and the comet will probably be slightly fainter.Following a similar path to P/Tempel 1, it will move from Sagittarius through Aquarius into Cetus, reaching peak brightness of 13^m in October.The orbit is fairly stable now,remaining so for the next couple of centuries.

P/Russell 2 The discovery apparition of 1980 was favourable and the return of 1987 even more so, but nothing better than 16^m was recorded. This year is not too good,and 17^m is the probable maximum brightness when, in June, the comet is well south in Hydra.The orbit is pretty stable for longer than will concern us.

P/Borelly This reliable comet, discovered in 1905, will be making its 12th observed apparition - only two have been missed.At the optimum return in 1987 it was recorded at $7\frac{1}{2}^m$, with a tail 15' long.This time is rather less favourable, but still good, and we may expect $8\frac{1}{2}$ - 9^m when the comet reaches maximum brightness in November - December.During the first half of the year it moves from Sagittarius through Sculptor into Cetus, brightening from 18^m to 13^m.Continuing northeastwards it passes through Orion and Canis Minor into Cancer, coming to maximum near the Cancer-Lynx border as the year closes.It should be under observation well into 1995 as it moves into Ursa Major.In spite of

several moderate approaches to Jupiter, the orbit undergoes only minor changes, and the comet should be with us for a very long time yet.
P/Whipple, 1993n The orbital history of this comet is a good example of the chaotic nature of many cometary orbits.Originally much larger, lying between Jupiter and Saturn, successive perturbations by the former reduced q from 6.5 to 2.5 AU, its value at discovery in 1933.A further encounter in 1981 increased it again to 3.1 AU, and after a few more revolutions it will be extended to 3.8 AU.The comet has never been very bright; the discovery magnitude of 13 has not been bettered since, and is unlikely to be.The present apparition is unfavourable, and as the comet moves from Ophiuchus through Aquarius into Pisces during April to October, it will brighten slowly from 17-18^m to perhaps 15 - 16^m.
(2060) Chiron (P/Chiron) This ambiguous object is well placed during the first few months of the year, being at opposition at the end of February and moving slowly between northern Sextans and southern Leo.It should be close to 16^m, within range of observers with CCD cameras.As it is approaching perihelion there may well be a modest increase in brightness if the coma developes.Astrometry would not come amiss, as the orbit needs running update.

Late News A sudden flurry of discoveries has occurred just as these notes were ready for press.Nothing to get excited about, though - all faint,two of them getting fainter.
P/Mushida-Muramatsu, 1993t Discovered 1993 December 8, at 16^m. The comet is leaving both the Sun and the Earth now, and will slowly fade.
P/Mueller 5, 1993s Discovered 1993 November 20 at Palomar, 17^m - 18^m, and will remain in this range of brightness throughout 1994.
McNaught-Russell, 1993v A southern object in January, moves rapidly north.Brightest in March - April as it moves through Taurus and Gemini, but is intrinsically faint, and will only be 11^m - 12^m, even though it passes 0.5 AU from the Earth.Crosses northern circumpolar sky, quickly fading to 18^m in August.

H.B.Ridley,
Eastfield Observatory
1993, December 22

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Comets in 1994

Comet	Prov. desig.	T	Brightest Mag.	Brightest Month	Brightest Elong.	Moon New	Moon Full
P/Schwassmann-Wachmann 1	-	1989 Oct.26.7	18(12)	Jan.	170W	Jan.11	
P/Kushida - Muramatsu	1993t	1993 Nov. 4.5	16	Jan.	145W		Jan.27
P/West-Kohoutek-Ikemura	1993o	Dec.25.3	12-13	Jan.	130W	Feb.10	
Mueller	1993a	1994 Jan.12.9	11-12	Jan.	45W		Feb.26
P/Schwassmann - Wachmann 2	-	Jan.23.9	11	Jan.	170W	Mar.12	
P/Spitaler	1993r	Jan.28.2	17	Jan.	95W		Mar.27
P/Encke	-	Feb. 9.5	7	Jan.	45E	Apr.11	
P/Kojima	1992z	Feb.18.0	15	Feb.	150W		Apr.25
P/Tempel 2	-	Mar.16.8	12?	Apr.	35E	May 10	
P/Maury		Mar.19.1	17-18	July	105E		May 25
Mueller	1993p	Mar.26.2	7	Apr.	60E	June 9	
P/Shoemaker-Levy 9	1993e	Apr. 1.3	14?	Apr.	c180		June23
P/Hartley 3	1993m	May 20.4	17-18	Jan.	100W	July 8	
P/Tuttle	1992r	June27.0	11	Aug.	30E		July22
P/Bus	1993b	June28.1	16-17	Mar.	170W	Aug. 7	
P/Reinmuth 2	1993g	June29.7	13	Sep.	135W		Aug.21
P/Kohoutek		June29.9	15	Sep.	35W	Sep. 5	
P/Tempel 1	1993c	July 3.3	9-10	May	135W		Sep.19
P/Wild 3		July21.2	15	May	170W	Oct. 5	
P/Harrington		Aug.23.2	12-13	Sep.	135W		Oct.19
P/Brooks 2		Sep. 1.1	12-13	Oct.	150E	Nov. 3	
P/Russell 2		Oct.27.4	17	June	150W		Nov.18
P/Borelly		Nov. 1.5	8-9	Dec.	125E	Dec. 2	
P/Whipple	1993n	Dec.22.4	15-16	Sep.	160W		Dec.18
P/Mueller 5	1993s	1995 Feb. 8.1	17	Dec.	100E		
(2060)Chiron(P/Chiron)		1996 cFeb.12	15-16	Feb.	180		
McNaught-Russell	1993v	1994 Apr. 1.4	11-12	Mar.-Apr.	60E		

Short-Period Comets at Perihelion in 1995

P/Comet	T 1995	q AU	P yrs	Previous Apparitions N	First	Last
Mueller 5	Feb. 8.1	3.95	14.39	-	1993s	-
De Vico-Swift	Apr. 9.5	1.93	7.32	3	1844I	1965VII
Finlay	May 5.0	1.04	6.76	11	1886VII	1988IX
Clark	May 31.2	1.55	5.51	4	1973V	1989XX
d'Arrest	July27.4	1.35	6.51	16	1678	1989II
Tuttle-Giacobini-Kresak	July28.6	1.07	5.46	7	1858III	1990II
Reinmuth 1	Sep. 3.3	1.87	7.31	8	1928I	1988VI
Schwassmann - Wachmann 3	Sep.22.7	0.93	5.34	3	1930VI	1990VIII
Jackson-Neujmin	Oct. 6.6	1.38	8.24	4	1936IV	1987VIII
Longmore	Oct. 9.3	2.40	6.98	3	1974XIV	1988XVIII
Perrine-Mrkos	Dec. 6.0	1.29	6.77	5	1896VII	1968VIII
Honda- Mrkos - Pajdusakova	Dec.25.9	0.53	5.27	8	1948XII	1990XIV

N = Number of observed apparitions.

LOST PERIODICAL COMETS.

Alex Vincent.

A number of periodical comets are lost either due to disintegration or perturbations by a giant planet such as Jupiter and also other reasons. Some have only been seen once and others for a few returns before having been lost.

Lexell's comet is a classic example of a lost comet which came very close to the Earth in 1770. It had a period of 5.5 years, but a perturbation by Jupiter had put the comet in a different orbit and now comes nowhere near the Earth.

On the other hand Comet Biela which was discovered in 1772 has disintegrated and at its return in 1845, it was seen in two parts. In November 1872 when the comet was predicted to return, a splendid meteor shower was seen which was the debris of the dead comet. The shower is now weak.

Several lost comets have been found and one is Comet Taylor which was discovered in 1916 and had a period of 6.4 years. It was thought to have disintegrated because it divided into two parts and was regarded as lost. In 1976 it was recovered after 60 years and made nine revolutions of the sun (without being seen) since its discovery. Its period is seven years.

My main attention concerns two periodical comets "Pons-Gambart and De Vico" which were seen only on one appearence. Comet Pons-Gambart came to perihelion in June 1827 and has a period of 57.5 years and that of Comet De Vico in March 1846 and has a period of 76.3 years.

Comet Pons-Gambart should have come to perihelion twice since its last appearence in the years 1884/85 and 1942. That of Comet De Vico only the once in 1922. Neither of them were recovered at these returns at all.

These two comets are presumably lost, but perhaps they came and went unnoticed at their subsequent returns and are now making a comeback. I predict that they will be seen again towards the end of the century. I predict a perihelion for Pons-Gambart between 1999 and 2000 and that of De Vico between 1997 and 1999 (possibly 1998).

The orbital elements for both comets at their last recorded returns are as follows.

P/COMET PONS-GAMBART 1827 II

T = 1827 Jun 7.6376	Peri = 19.950
q = 0.806508	Node = 319.3346
e = 0.945838	Incl = 136.4548
P = 57.5	

P/COMET DE VICO 1846 IV

T = 1846 Mar 6.0446	Peri = 12.8995
q = 0.663802	Node = 79.0127
e = 0.963099	Incl = 85.1128
P = 76.3	

T = Perihelion date. q = Perihelion distance in Astronomical units (AU). e = eccentricity. P = Period of revolution. Peri = Argument of perihelion in degrees, equinox 1950.0. Node = Longitude of the ascending node in degrees, equinox 1950.0 and Incl = Inclination in degrees, equinox 1950.0.

SOME THOUGHTS ON THE FUTURE OF COMET V-Photometry - Giant binoculars or CCDs?

(G Keitch, Foxworthy Barn, nr Manaton, Dartmoor National Park, South Devon. 1993 Sep 30)

With an increasing number of amateurs in various observational fields now using CCD technology to good effect, I have spent some time of late pondering on the future of gathering visual or V magnitude data for comets. I have decided to continue with pure visual work and have acquired larger binoculars to extend the range over which faint comets can be observed without recourse to much higher magnification telescopes.

Giant binoculars

Not so long ago, giant binoculars sounded more attractive for astronomy than they really were. With a few exceptions, the only models that could be obtained with OGs greater than 80mm were ex-World War II. Although I have only occasionally used such an instrument, I would guess that most surviving examples are probably not much better than my modern pair of multi-coated Zeiss 10X50B. The optics of these old binoculars have generally deteriorated and are often etched with fungi and while they might be vaguely bloomed, the images will not compare in clarity with those obtainable with today's multi-coated instruments.

The modern and affordable 80mm binoculars which first became available in quantity during the early eighties were a great step forward and were quickly adopted by comet observers both here and in the States. The value of small binoculars in allowing brighter comets to be seen to best advantage was quickly recognised and the off-the-shelf 80mm models merely extended this capability. Whereas larger telescopes (and hence correspondingly higher magnifications) had to be deployed once the typical comet had dropped below 8m, the new 80mm binoculars meant that comets could now be followed down to 9m and below. This resulted in brighter and more accurate photometry.

While the first batch of 15 and 20X80B were far from perfect, they did the job and in recent years their quality has improved. Most are now multi-coated. More recently, Vixen 100mm binoculars have become quite readily available and while the purist would find fault with them, I must say I am very pleased with mine. They are optically far superior to my previous Swift 20X80B (which I hadn't expected) and are consistently good for comets down to 10.5-11.0m. The large binoculars tend to come in for some unfair criticism. True enough, my 20X100B would be pretty awful at X150 but as a comet observer, I would not choose any other power than X20 - at which magnification, they give quite acceptable images.

All this has led me to believe that a modern (as opposed to ex-war) 125 or 150mm binocular would be even better. Unfortunately, those extra few mm of glass if they come from the Nikon or Fujinon factories takes the price from around £1000 (the approximate cost of 20X100Bs) to something between £5000 and £12000!

A number of suppliers are predicting the availability of cheaper Russian 110, 130 and 150mm models but they appear to be stranded in the Russian ports. There are also other possibilities. Chris Garvey at Countryside Optics will do a 150mm mirror-binocular for around £2000 and he claims these to be better than the object-glass variety at this aperture. He might well be right, especially if one considers value for money.

As luck would have it, while preparing this note I got a call from Broadhurst Clarkson and Fuller to say they had just acquired a second hand pair of Fujinon 25X150B minus stand and "would I like them?". Once I was assured they were in good condition, I didn't hesitate; only later did I give due consideration to such practical matters as getting them insured and delivered to Devon and building a stand for them! However, things are quickly taking shape. The 0.3m reflector, which had just been refurbished and given a new lease of life, suddenly lost it's altazimuth mount which a neighbour is now modifying for the giant binoculars. I expect to turn them towards Comets Mueller and P/Ashbrook-Jackson within a week or so.

Giant binoculars do have their drawbacks for comet photometry. The lack of a central focusing wheel to enable both eyepieces to be defocussed to the same degree simultaneously is a particular problem. (Who else would want to do that apart from the visual comet observer carefully exercising the I-O, Bob or Mor methods!?) I am assured by an engineering friend that this is easily resolved by using a combination of gears and chains! I had rather hoped the eyepieces on the Fujinons would click as they are rotated so that by counting the clicks one could defocus each eyepiece by the correct amount and then return them to the original focus position. Unfortunately, this isn't the case so I shall have to read-off from the scales marked on each ocular. With a little thought, I'm sure there are a number of solutions to improve on this.

An unexpected problem is the lack of eyepiece travel which means the binoculars cannot be defocussed very far. They will cope with comets up to about 3' dia which is adequate for the majority of 10.5-12.5m objects although I would prefer not to have this limitation. This is more likely to be an occasional nuisance than a serious problem. Again, this could be solved although I would rather not attack the Fujinons with a hacksaw to insert a slender collar to separate the objectives and oculars by an extra few mm!

Despite these two limitations, I have no regrets in going down this route. I have yet to observe a comet with them but a brief scan of the sky the other night produced some amazing views. Numerous writers have commented on the fact that binocular is superior to monocular vision although most have attributed this to aesthetic rather than genuine physiological reasons. It may vary amongst individuals although for me, working at the extreme limits of light levels and contrast, I would use binoculars every time. I estimate that a 150mm binocular system would be good for comets down to around 12m and I hope to be able to confirm this before too long. For very small faint comets there is no doubt that larger telescopes come into their own although there is a distinct possibility that an object seen as being only 1' dia and 12m.5 in the 30cm reflector at x62 might appear nearer 2' dia and 12m in a 25X150B.

CCDs

In my quest to extend the magnitude range over which I am able to measure cometary brightness with low magnification binoculars (and by telescopic standards, I include the X25 giants in that category), I have also been watching developments in the use of CCDs.

An increasing but still very limited number of observers are turning their CCDs towards comets for photometry. Without wishing to cast doubt on the new technologies, there is still a long way to go. Results from one or two lone experimenters are very encouraging but the lack of data is probably not providing a true picture. If several dozen CCD observers all tackled the same comet, I strongly suspect we would see just as much scatter and inconsistency as has given visual comet work a bad name in the past. Properly defined standards for instrumentation, exposure, reduction and processing techniques could make all the difference.

I am hopeful that in the near future, good CCD photometry will prove that the best binocular observations were not too far off the mark! On a number of recent occasions I have detected a comet with my 20X100B (admittedly in very good skies) and found it to be very much brighter and bigger than reported by users of larger telescopes - and much closer to the occasional CCD V-mag I have seen reported.

Conclusion

I have decided to continue with the visual work as one could argue that in order to make the transition to CCDs (and I believe it will happen) there is an even greater need to make good visual estimates now. This will enable us to build up a clearer picture of the relationship between the two disciplines.

I would be keen to enter into discussions with CCD users to see if we can start to define standards and look at correlations between pure visual and electronic detection methods. This could form the basis of a project within the BAACS and I would be interested to hear the views of others. I would also be very pleased to hear of any ideas to overcome some of the defocussing limitations with the giant binoculars.

Alcock 1963 b: The third comet discovered by George Alcock, who still remembers the circumstances - it was all thanks to the Peterborough football club who switched on their new stadium floodlights and forced him to observe at 3 am the following morning. I typed in the observations from the section archives whilst on my latest trip to the Antarctic. Although magnitude parameters are given, the comet shows a dramatic outburst after perihelion.

Kobayashi-Berger-Milon 1975 h: A well observed comet which has not yet been fully analysed. This was a well behaved 'Oort' comet with magnitude parameters close to the average.

Levy 1990 c: I am in the process of analysing the observation and hope to produce a report for the Journal in due course. This was rather brighter than the average 'Oort' comet, and there is some evidence for it fading a little after perihelion.

Shoemaker-Levy 1991 a1: Fairly well observed from the UK in June and July 1992. The value for K1 is about half the average.

Zanotta-Brewington 1991 g1: Another comet with a rather flat light curve.

Tanaka-Machholz 1992 d: The comet had a major outburst in May 1992 during the full moon period. No magnitude parameters have been calculated.

P/Swift-Tuttle 1992 t: Brightens very rapidly as it approaches the sun. A full report for the Journal is being produced by Martin Mobberley.

P/Schaumasse 1992 x: Proved rather difficult to observe because of its very diffuse nature. The published values for the parameters are H1=7.0 and K1=30.0.

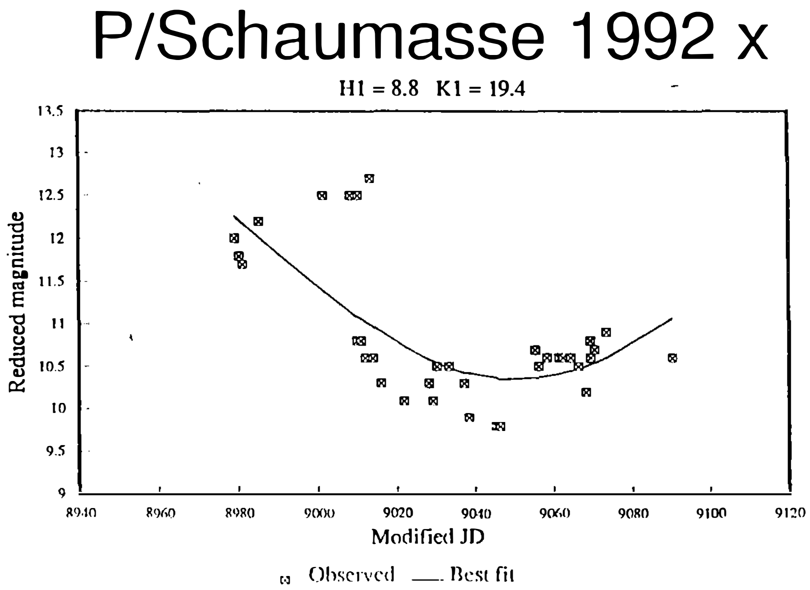
The Comet Section

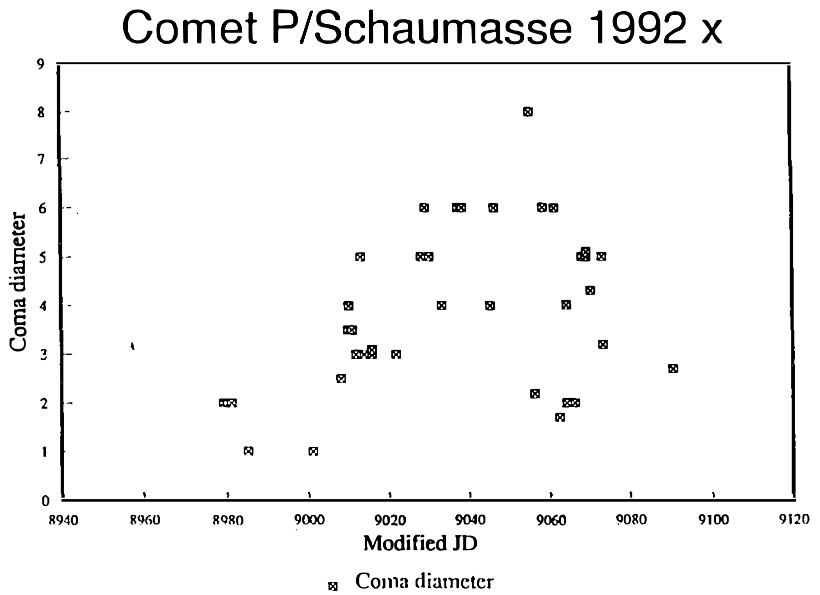
The light curves have been compiled from recent observations submitted by section members to the Director and TA and from the section archives. These observations have been sent to the ICQ, but there are still a lot more in the section archives which need entering onto computer. Volunteers please contact the Director!

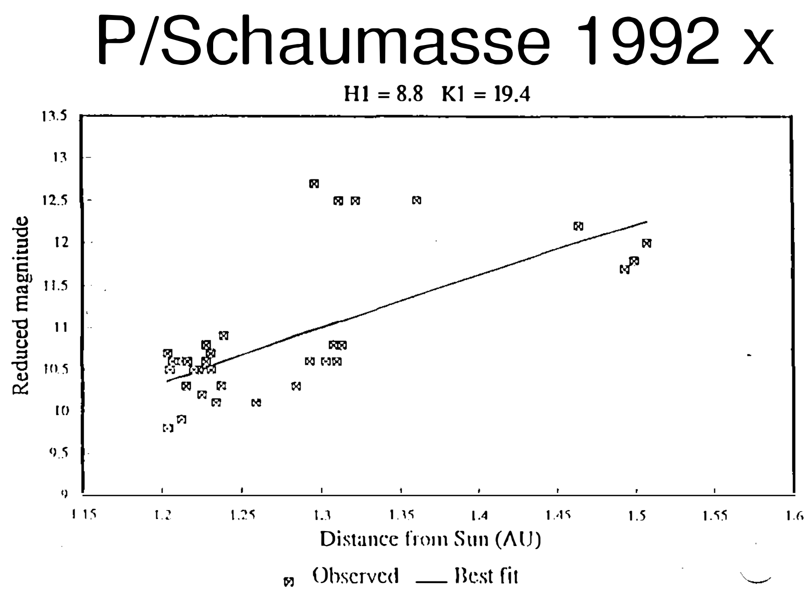
Magnitude parameters H1 and K1 have been derived by fitting the observations to the equation

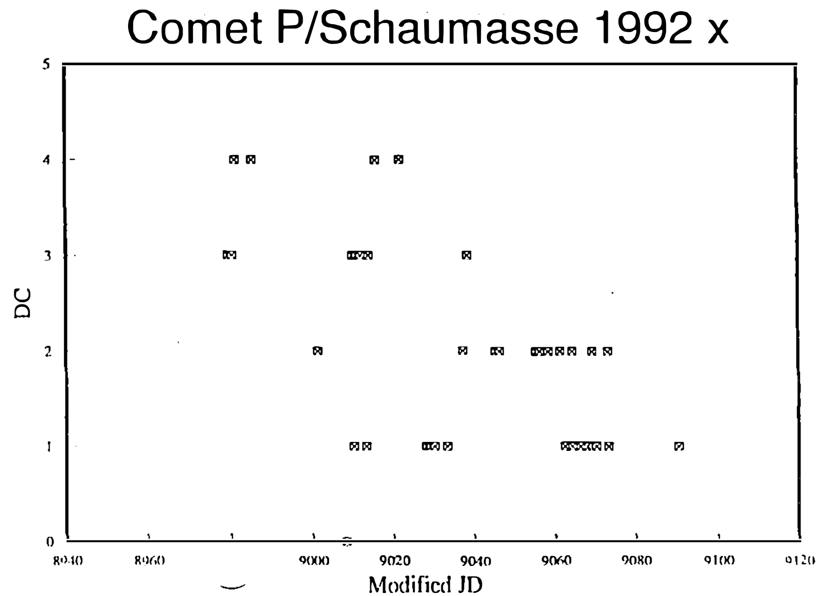
$$m = H1 + 5 * \log (Delta) + K1 * \log (r)$$

where m is the observed magnitude, Delta the distance of the comet from the Earth and r the distance of the comet from the Sun. The reduced magnitude is the observed magnitude corrected for the distance of the comet from the Earth and the modified JD is the number of days since an arbitrary date in 1968. An average comet has H1 = 7.1 and K1 = 10.0 (ie it brightens according to an inverse fourth law). If K1 is greater than 10 it brightens more rapidly as it approaches the sun, a value of 5 would imply simple reflection of sunlight and values smaller than this imply effective fading.

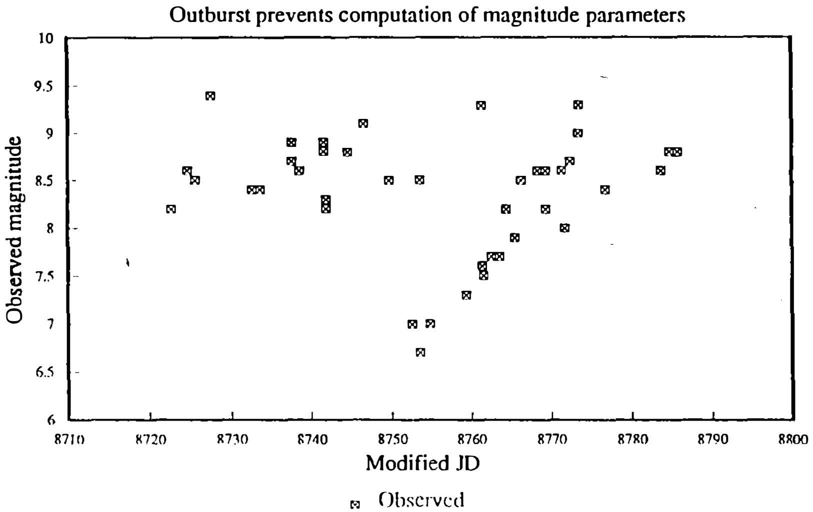

P/Schaumasse 1992 x
H1 = 8.8 K1 = 19.4
Reduced magnitude
Modified JD
Observed
Best fit


Comet P/Schaumasse 1992 x
Coma diameter
Modified JD
Coma diameter

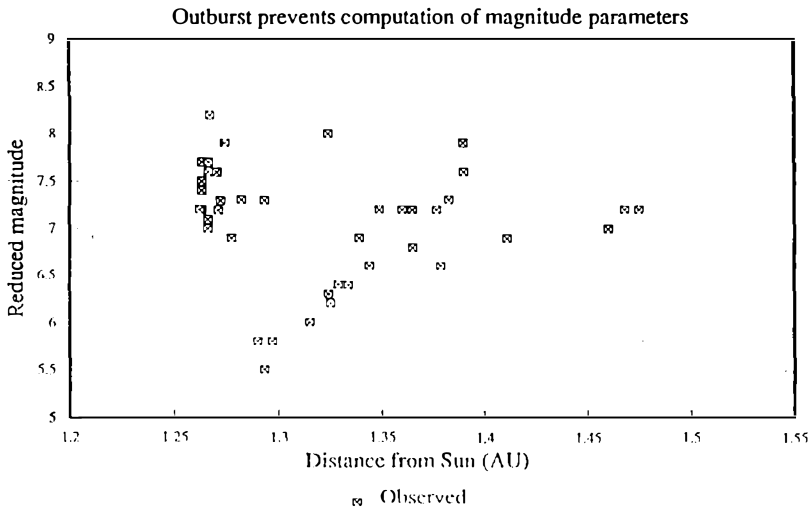

P/Schaumasse 1992 x
H1 = 8.8 K1 = 19.4
Reduced magnitude
Distance from Sun (AU)
Observed
Best fit


Comet P/Schaumasse 1992 x
DC
Modified JD

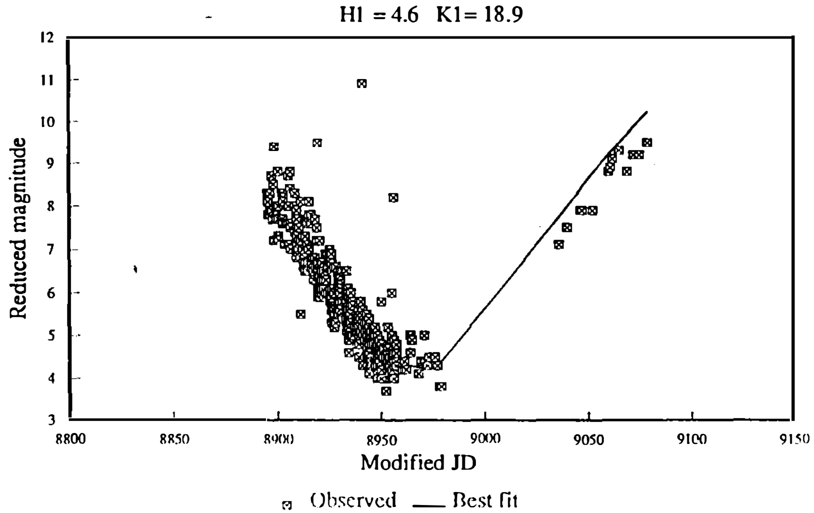
Tanaka-Machholz 1992 d



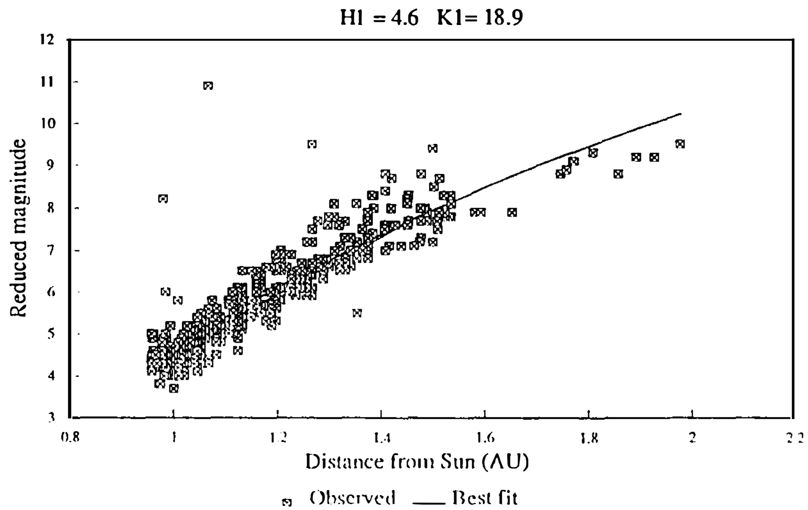
Tanaka-Machholz 1992 d



P/Swift-Tuttle 1992 t

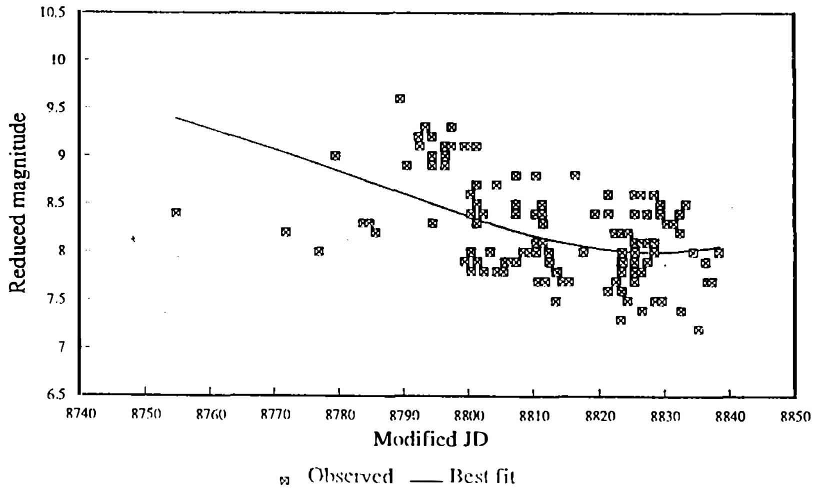


P/Swift-Tuttle 1992 t



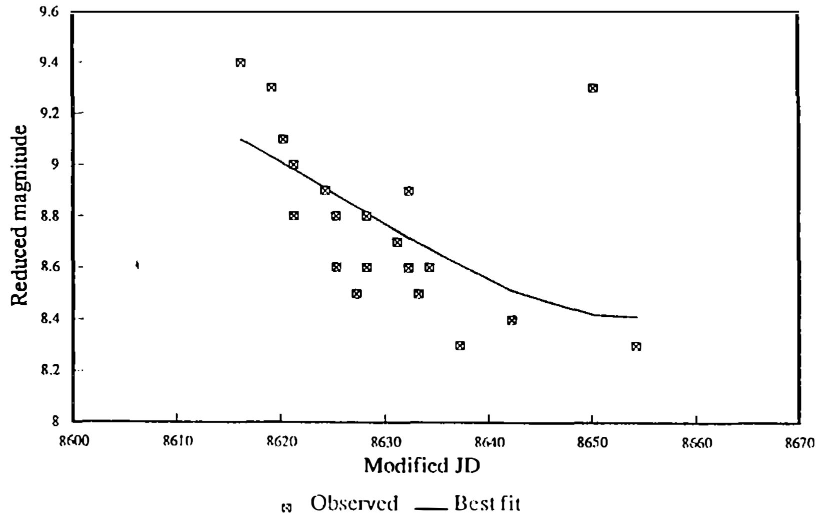
Shoemaker-Levy 1991 a1

H1 = 8.4 K1 = 5.3



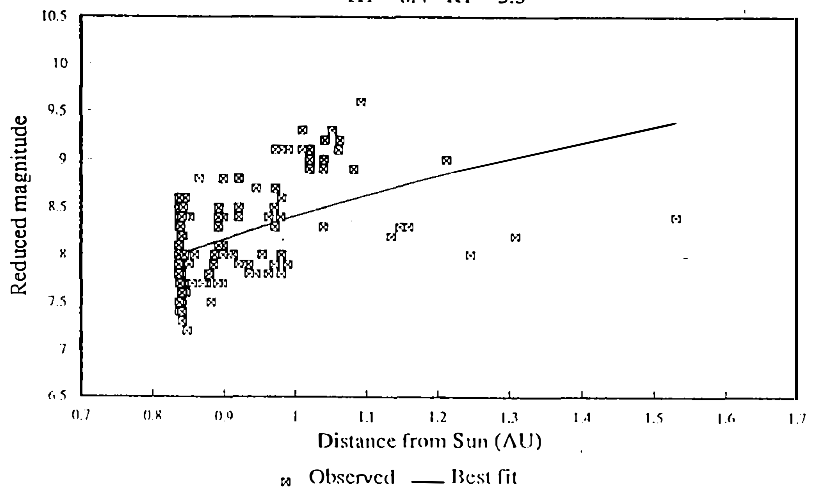
Zanotta-Brewington 1991 g1

H1 = 9.1 K1 = 3.6



Shoemaker-Levy 1991 a1

H1 = 8.4 K1 = 5.3



Zanotta-Brewington 1991 g1

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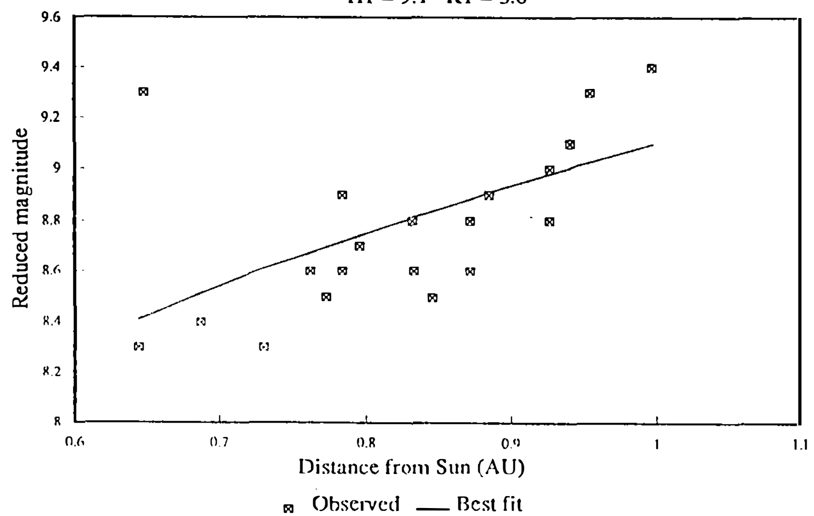
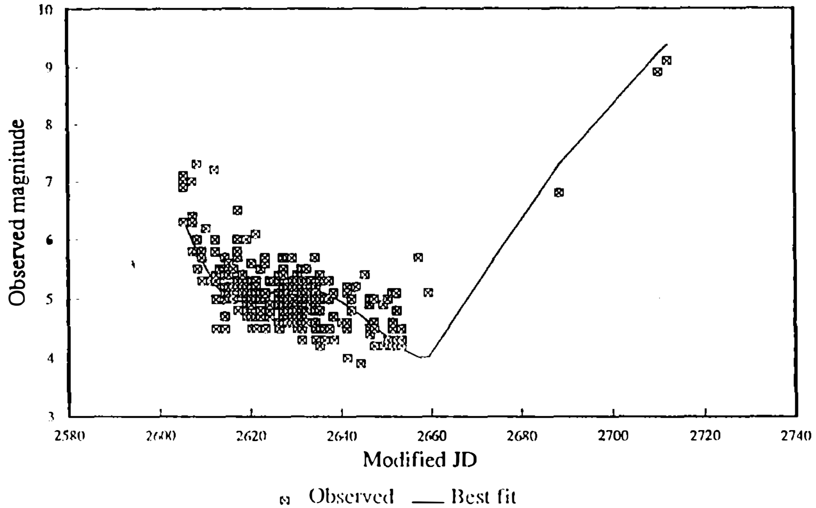


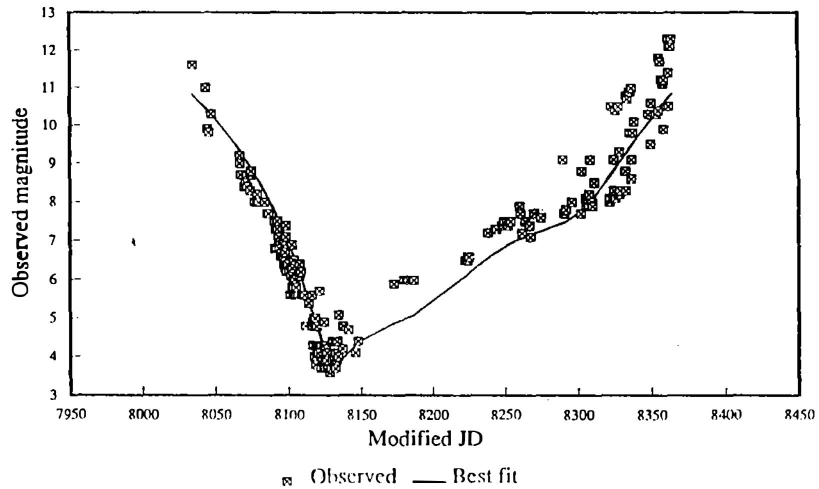
Kobayashi-Berger-Milon 1975 h

H1 = 7.4 K1 = 10.0



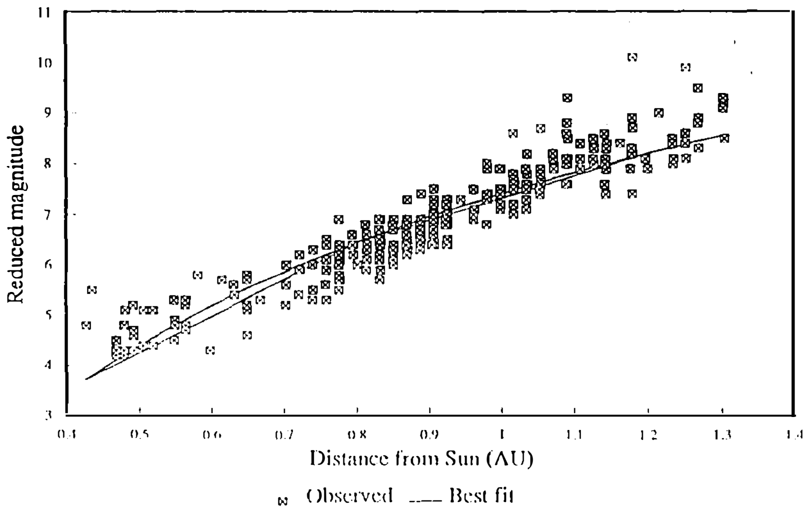
Levy 1990 c

H1 = 4.3 K1 = 10.0



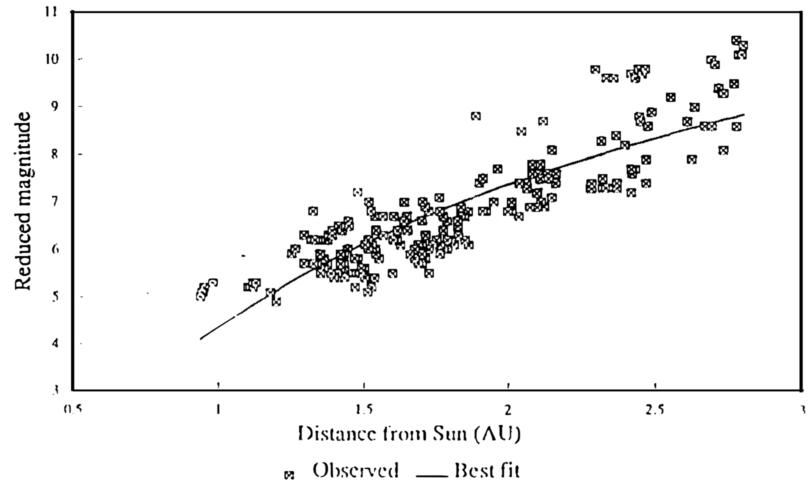
Kobayashi-Berger-Milon 1975 h

H1 = 7.4 K1 = 10.0



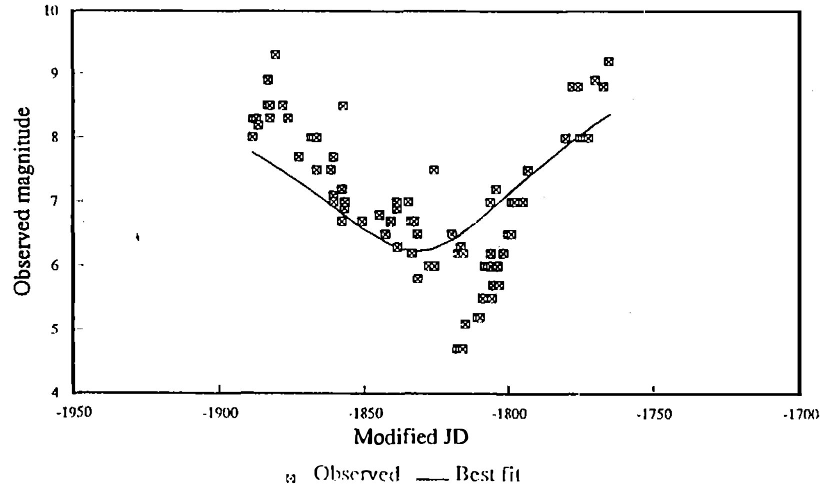
Levy 1990 c

H1 = 4.3 K1 = 10.0



Alcock 1963 b

H1 = 6.1   K1 = 2.9



Alcock 1963 b

H1 = 6.1   K1 = 2.9