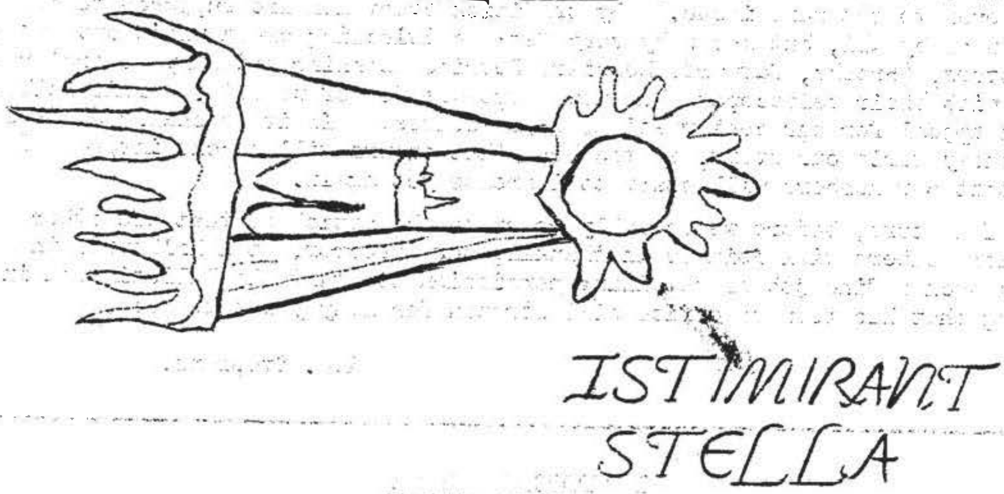
THE BRITISH ASTRONOMICAL ASSOCIATION

COMET SECTION



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FROM THE DIRECTOR:-

In introducing this first issue of the Comet Seotion Bulletin, I would like to extend good wishes to all members of the Section and to express my thanks for the great efforts made during the past years. At times, activity in the comet world is very low and it is hoped that this publication, which we anticipate issuing at quarterly intervals, will help to maintain interest during slack periods.

The aim of the Bulletin is threefold: To (1) provide comet news in greater detail than can be published on the BAA Circulars; (2) provide a medium for the publioation of members' observations and to report the progress of comet sweeping; (3) enable the interchange of ideas, hints, tips and observing methods between members.

Andy Stephens has kindly offered to act as Editor and material for publication, (except observations) should be sent directly to him. Observations and enquiries should, however, continue to be sent to the Director. Without Andy's offer, this publication could not have been envisaged and I am sure all members will join with me in expressing our grateful thanks to him.

I would also like to express our appreoiation to the BAA Council for giving the necessary permission and finance to make publication of the Bulletin possible.

S.W. Milbourn - Director.

EDITORIAL

The starting of a new venture always presents problems and this Bulletin has proved no exception. Response to the appeal for contributions published in the Circular was poor and so I would like to give a special thank you to Ernest Beet and Dr. Rodney Hillier who stepped in and saved the day, each producing a most interesting article. Perhaps, when this issue appears some of the more experienced Section members will consider submitting articles of similar length, but of course the Bulletin is open to all and I look forward to items from beginners also. As far as possible I hope to be able to include everything that is sent to me, any material in excess being held over to the next issue. By tradition comet men are supposed to be loners, spoken of by all, but known by very few; a dwindling breed who's once proud ancestors, (Brooks, Barnard, Messier, Perrine, Denning and many others) ranged free with their telescopes, but now there are few of us left. This Bulletin is an appeal for our conservation, by ourselves. In it we shall tell the astronomy world our story, in the hope that others will become interested and that our numbers will start to increase yet again.

I am sure, before we actually go on to the articles, that the other Section members will join me n thanking our Director, Stan Milbourn, in doing such a fine job of obtaining permission to start the Bulletin and in hoping that his term of office will stretch for many years to come.

A.P. Stephens.

INTRODUCING COMETS

Ernest Beet.

COMET: from the Latin cometes, which in turn was derived from the Greek kometes meaning 'long-haired' (with reference to stars, though I now suppose we could talk of 'a cometary young man').

'Then upon the feast of St. Michael, the fourth day before the nones of October, appeared an uncommon star, shining in the evening, and soon hasting to set. It was seen south-west, and the ray that stood off from it was thought very long, shining in the south-east. And it appeared this wise nearly all the week.' This is an early description of a comet given in the Anglo-Saxon Chronicle and dated 'A.D. 1097'. It would be about this time that the Bayeux Tapestry was completed. Its precise date is not known, but it is generally presumed to have been commissioned by Bishop Odo, whose cathedral at Bayeux was consecrated in 1077. Coincidentally 1097 was the date of the Bishop's death. The tapestry included one of the earliest pictures of a comet (now known to be Halley's), though it looks more like a many pronged fork than a long-haired star (see my rather poor cover drawing of the Bayeux Tapestry comet - Ed).

Seneca, a philosopher of the 1st century A.D., suggested that comets were bodies which 'journeyed far apart from the planets', but this true statement had no effect on the beliefs of the time. This was that comets were close to the Earth - how else could they move so rapidly? - and were apparitions in our own atmosphere, blemishes in the pure element of air and harbingers of evil. Thus Shakespeare (in about 1600) makes Caesar's wife warn her husband: 'When beggars die there are no comets seen; the heavens themselves blaze forth the death of princes'. Since comets were earthly portents and not heavenly bodies European philosophers did not take much trouble to record their exact positions, though they sometimes noted the date. The Chinese were more precise, they record d such details as the constellation (not the same as ours) and the leng h of tail; heir records go back to about 700 B.C. Information from both sources have enabled past appearances of periodic comets to be looked for, and it is thought that in the case of Halley's comet every return except one since 240 B.C. has been identified.

Tycho Brahe did measure the positions of comets among the stars, and in the case of that of 1577 had a special purpose in view. If the object were close to us, as everyone then thought, there would be a small displacement among the stars, due to parallax, when its altitude changed. He found no displacement and concluded that comets were beyond the Moon. Comets were now recognised as celestial objects worthy of astronomer's attention, and the way was prepared for Halley to show that the comets of 1531, 1607 and 1682 were probably one and the same, and he predicted a further reappearance in 1758. The astronomy of comets had begun.

So now it is time to leave the past and to look at the modern aspects - both professional and amateur.

- as most of you will already know Ernest Beet is the present Director of the BAA Historical Section.

THE DETECTION OF INFRA-RED RAYS FROM THE NUCLEUS OF COMET BENNETT

Dr. Rodney R. Hillier

The dramatic appearance of a comet in the sky is due to the development of two characteristic features. When the comet is still some distance away from the sun, the coma (an approximately spherical region) appears and, later, as the comet nears the sun an elongated tail develops. In the case of a periodic comet these features are produced many times, on each approach to the sun, and it has long been assumed that there must be a condensed component of the comet which partially vapourizes near the sun and supplies the material for the coma and the tail. But this condensed component, which is known as the nucleus, has proved very difficult to detect; theoretical arguments suggest that the mass of the nucleus is less than 10^{21} gms. (that is, less than 0.1% of the mass of an asteroid) and the detection of the reflected sunlight from such a small body is extremely difficult against the light of the coma.

James Myer working at the AMOS observatory in Hawaii has recently reported the first measurements of infra-red radiation from the nucleus of a comet (Astrophysical Journal 175, L49, (1972)). The measurements were made on Comet 1969i (Bennett) just after the comet has passed perihelion. Its distance from the sun was then 0.55a.u. and its distance from the earth was 0.69a.u.

The measurements were made at wavelengths between 8.0 microns and 12.9 microns, (1 micron = 10^4A^o). At these wavelengths the earth's atmosphere is comparatively transparent and measurements can be made from ground based observatories. Photographic emulsions are not sensitive to infra-red radiation and astronomers who work in this region of the spectrum must use electronic detectors. Myer used a germanium solid-state detector (essentially a form of transistor) at the Cassegrain focus of a 48in mirror. Such a detector merely delivers an electrical signal which is proportional to the intensity of radiation falling on to it: to produce an image it is necessary to use a scanning device in front of the deteotor. The electrical signals produced during the motion of the scanning device are recorded and analysed later. Myer placed a mask in front of his detector, which consisted of strips of alternately opaque and transparent, the width of each strip corresponding to an angle of 10 arc seconds in the image. He used an oscillating mirror to move the image to and fro across the mask and he looked for variations in the signal from the detector as the image moved. The image of the coma whioh was very much greater than 10 arc seconds in diameter, would produce no variation in signal as it was scanned across the mask since half of the image was always on the transparent strips and the other half on opaque strips; but a point-like image would produce variations in signal as it passed alternately over the opaque and the transparent strips.

Myer detected variations as he scanned the image of the comet across the mask and he concluded that he had detected radiation from the nucleus. The nucleus produces infra-red radiation in the following way. Radiation from the sun, which is contained mainly in the visible region of the spectrum, falls on to the nucleus and some is reflected, some absorbed. The nucleus is heated by the energy which it absorbs and it then re-emits this energy in the form of infra-red radiation. The intensity of the infra-red radiation depends on the size and the temperature of the nucleus. Unfortunately the temperature of the nucleus is poorly known - estimates range from 550^{o}K to 880^{o}K - and Myer could therefore only conclude that the nucleus was between 40km and 130km in diameter. The mass of the nucleus is still unknown since the infra-red radiation could be produced either by a loose swarm of small grains or by a single body of the same size.

- Dr. Hillier is currently at the Physics Department of Bristol University where much astronomical work is currently being done. This is concentrated in regions away from the optical window, with particular attention being paid to the X-ray region of the spectrum.

In the past the University has spawned many great scientists, not the least of whom is Sir Bernard Lovell of the Nuffield Radio Observatory at Jodrell Bank.

COMETS IN 1972 - being a review of comet activity in the last year by the Director of the Section.

1972a P/Tempel I . Recovered on 1972 Jan. 11.5 by Dr. E. Roemer and L.M. Vaughan using the Steward Observatory's 229cm reflector on Kitt Peak. Two 60 min. exposures revealed the comet as essentially stellar with little trace of coma, at magnitude 18 it was then too faint for amateur instruments.

P/Tempel I was discovered in 1867, re-observed in 1873 and 1879 and subsequently lost. A prediction was issued by Dr. B.G. Marsden and Dr. J. Schubart for 1967, following a rediscussion of some nineteenth century observations, and a possible recovery image was located on a plate exposed by Dr. E. Roemer on 1967 June 8. In the absence of any corroborating evidence, the recovery remained unproven.

Conditions in 1972 were a little more favourable and practically identical predictions were supplied by Dr. B.G. Marsden (BAAH 1972) and Dr. G. Schrutka (IAUC 2363). The recovery position indicated a correction of only ΔT = +0d.1 to the predictions, a truly magnificent result for a comet so long unobserved. The position and magnitude also proved that the 1967 image was indeed that of the comet.

During the first half of 1972, the comet brightened and a number of observations were made by members of the Section:

Date	Mag.	Coma '	TAIL Lgth '	TAIL p.a. °	Description	Instr.	Obs.	Type
Apr. 20.1	12.0	0.5	2 Fan	205 160-270	Highly cond. Tail narrow straight with fan.	15cm f/4.5	GHR	Ph 75 mins.
May 7.9	12.5	-	-	-	Coma slightly elongated	7.8cm f/4.5	HBR	Ph 30 mins.
May 10.9	12.0	-	-	-	As Apr. but less detail	15cm f/4.5	RLW IMP	Ph 30 mins.
May 10.9	12.5	-	-	-	Coma elong. in p.a. 250°	7.8cm f/4.5	HBR	Ph 50 mins.
May 12.9	12.5	-	-	-	As May 10.9	7.8cm f/4.5	HBR	Ph 60 mins.
May 15.5	12(appr)	-	-	-	Cent. cond. no tail	30cm x 132	VM	V
May 31.97	12.0	-	-	-	-	15cm f/4.5	RLW IMP	Ph
June 4.3	12.1	-	-	-	Slight condensation	31.7cm x 86	AJ	V
June 5.3	12.1	-	-	-	Slight condensation	31.7cm x 86	AJ	V
June 6.0	12.0	-	-	-	-	15cm f/4.5	RHS	Ph
June 6.4	12.0	-	-	-	Diffuse coma. Slight condensation. Brighter centre suspected.	31.7cm x 86	AJ	V
June 7.4	12.1	-	-	-	Diffuse coma. Slight condensation.	31.7cm x 86	AJ	V
June 14.4	12.1	-	-	-	Diffuse coma. Slight condensation.	31.7cm x 86	AJ	V
July 2.3	12.8	-	-	-	Coma diffuse.	31.7cm	AJ	V
July 8.3	12.7	-	-	-	Faint diffuse coma	31.7cm	AJ	V

Observers: A. Jones - Nelson N.Z.
H.B. Ridley - Godalming
V. Matchett - Indooroopilly
I.M. Purcell, G. Rutter, R.L. Waterfield, R.H. South - Woolston

1972b. P/Grigg-Skjellerup Recovered by J.B. and U.T. Gibson on 1972 Jan. 13.3 at the Yale-Columbia Southern Station, El Leoncito. Simultaneous 72 minute exposures with the 51cm double astrograph showed weak, diffuse images of magnitude 17.5.

Predictions were supplied by G. Sitarski (IAUC 2361) and by G. Lea and S.W. Milbourn (BAAH 1971-2). The recovery position indicated a correction of ΔT = +0d.01 to the former prediction and ΔT = +0d.02 to that of Lea and Milbourn.

The comet remained a faint object and no observations were obtained by members of the Section.

Recent perturbations have caused the comet's orbit to approach that of the Earth's; the distance at the ascending node being less than 0.004 A.U. At this apparition, the comet reached the node some 50 days before the Earth and a notice regarding the possibility of a meteor shower was published in the BAA Circular 538. Extensive watches were negative and it seems that either the comet is not a progenitor of meteoric fragments or that any such fragments have not yet had time in the present orbit to separate sufficiently from the parent body. Conditions at the next return will be more favourable and it may be possible to resolve the question on that occasion.

1972c. P/Tempel 2 Recovered by Dr. E. Roemer and J.Q. Latta on 1972 Feb. 10.5 using the Steward Observatory's 229cm reflector on Kitt Peak. The image was stellar, of magnitude 19.5 and the position was very close to that of the prediction by Dr. B.G. Marsden (IAUC 2370 : BAAH 1972). This is the fifteenth observed return since its discovery in 1873.

Dr. R.L. Waterfield made attempts to photograph the comet when it was well placed during May and June, but no definite image was recorded on the plates, an indication that the integrated magnitude was below 16 at the time.

1972d P/Giacobini-Zinner Recovered by Dr. E. Roemer and R.A. McCallister on 1972 March 11.5 using the Steward Observatory's 229cm reflector on Kitt Peak. The cometary images were strong and well condensed, mag 18.8, with a trace of tail to the west. The recovery position indicated a correction of ΔT = -0d.06 to the prediction by D.K. Yeomans (BAAH 1972). Originally discovered by Giacobini in 1900 and re-discovered by Zinner in 1913, the comet was making its ninth observed return.

The comet showed little structure throughout its apparition which started in June for members of the Section. The last observation was by A.F. Jones on October 17.7.

A short tail was photographed by Dr. Waterfield, a feature glimpsed visually by R.W. Panther on July 10. A maximum brightness of about mag. 10 occurred in mid-July, and this was maintained until early August when a sudden drop left the comet below 11 for the rest of the apparition.

The following observations were reported:

Date 1972	Mag.	Coma '	TAIL lgth. '	TAIL p.a. °	Description	Instr.	Obs.	Type
June 19.0	10.5	4	9	70	Highly cond. central coma 30" dia. within outer coma. Tail faint, broad diffuse.	15cm f/4.5	RLW	Ph
June 20.0	As June 19.0				Seen visually in 15cm refractor	15cm f/4.5	RLW RHS	Ph
July 10.0	10.0	1.5	22	260	Inner coma 40" dia. Tail straight, diffuse.	15cm f/4.5	DS	Ph
10.0	9.5	5	-	265	Coma mod. condensed. Slight ext. in p.a. 265.	20cm x 27	RWP	V
12.0	10.5	1	-	-	Diff. round coma, sharp cent. cond.	25cm x 48	PBD	V
12.0	10.0	4	-	-	Diffuse, weak cond. to sunward side.	20cm x 27	RWP	V
13.0	10.5	1	-	-	Circular coma, with diffuse cent. cond.	25cm x 48	PBD	V

Comets in 72 Cont.

Date 1972	Mag.	Coma '	TAIL Lgth. '	TAIL p.a. °	Description	Instr.	Obs.	Type
July 15.0	9.8	3	-	-	Outer coma very diff. Weak cond. to sunward.	20cm x 27	RWP	V
16.0	10.5	1	-	-	Diff. but stronger than on July 13. Looked more condensed with x 200.	25cm x 48 x 200	PBD	V
17.0	10.5	1	-	-	Diff. cent. cond. with x 200.	25cm x 48, x 200	PBD	V
18.0	10.5	1	-	-	As July 17	25cm x 48, x 200	PBD	V
Aug. 9.0	10 app.	2	-	-	No structure	10.5cm x 70	HBR	V
11.0	10 app.	2	-	-	No structure	10.5cm x 70	HBR	V
12.1	11.0	0.5	12	265	Much fainter than on July 12. Not seen vis. in 15cm refractor.	15cm f/4.5	GHR	Ph
Sept 10.7	11.4	-	-	-	Diffuse.	31.7cm x 86	AFJ	V
11.7	11.4	-	-	-	Diffuse coma. Moderate condensation.	31.7cm x 86	AFJ	V
12.7	11.4	-	-	-	As Sept. 11.7	31.7cm x 86	AFJ	V
17.7	11.6	-	-	-	Diff. coma. Slight condensation.	31.7cm x 86	AFJ	V
19.7	11.5	-	-	-	Diffuse coma. Fairly strong condensation.	31.7cm x 86	AFJ	V
20.7	11.5	-	-	-	Diffuse coma. Mod. condensation	31.7cm x 86	AFJ	V
29.7	12.0	-	-	-	Diffuse coma.	31.7cm x 86	AFJ	V
Oct. 4.7	11.9	-	-	-	Diff. coma, probably only cent. cond. seen.	31.7cm x 86	AFJ	V
14.7	11.9	-	-	-	Diffuse, fair cond.	31.7cm x 86	AFJ	V
17.7	12.1	-	-	-	Diffuse coma with mod. condensation	31.7cm x 86	AFJ	V

Observers: G.H. Rutter, R.H. South, R.L. Waterfield, D. Sykes - Woolston
P.B. Doherty - Stoke-on-Trent
A.F. Jones - Nelson, N.Z.
R.W. Panther - Northampton
H.B. Ridley - Godalming

Although the comet has been perturbed into an orbit which once again intersects that of the Earth's, the expected meteor shower predicted for 1972 October 8 did not occur.

1972e New Comet Gehrels Dr. T. Gehrels discovered a new comet on plates taken with the 122cm Schmidt (Palomar Mountain Observatory) on 1972 March 16.2 and 17.3. The object was diffuse with condensation, magnitude 16 and had a tail 10' long to ESE.

Elements by Dr. B.G. Marsden, based on observations to April 18 showed that the comet was well past perihelion which occurred on 1971 Jan 7.0 at a heliocentric distance of 3.3 A.U. Consequently, the comet was fading and the prediction placed the magnitude as faint as 20 by the end of July 1972.

<u>1972f New Comet Bradfield</u> Discovered by an Australian amateur, W.A. Bradfield, on March 12, using a 15cm refractor with a magnification of x26. The comet was a faint nebulous patch without detail about magnitude 10.

The comet proceeded north after discovery, where to northern observers it became lost in the long summer twilight, setting before the sky became dark enough to allow observing to take place

The following observations were made by Section members in the Southern Hemisphere:

Date (1972)	Mag.	Coma diam.	Tail	Remarks	Obs.
March 12.8	10 app.	-	Nil	Small fuzzy object, no tail	WAB
25.4	9.3	-	Nil	Strongly condensed.	MPC
25.8	9.5	-	Nil	Diffuse	MVJ
26.8	9.5	-	Nil	Diffuse	MVJ
27.8	9.5	-	Nil	Diffuse	MVJ
30.7	8.6	-	Nil	Diffuse coma. Fair condensation.	AFJ
31.7	8.7	-	Nil	Diffuse coma. Fair oondensation	AFJ
April 1.7	8.2	2'	Nil	Diffuse coma. Moderate condensation.	AFJ
2.7	8.2	-	Nil	Diffuse coma. Large prominent condensation.	AFJ
8.7	8.1	2'	Nil	Diffuse coma, strong condensation.	AFJ
9.3	8.0	3'	Nil	Diffuse coma. Fairly strong condensation. 12m nucleus susp.	AFJ
11.7	8.1	-	Nil	Diffuse coma. Large fairly strong cond.	AFJ
14.7	8.1	-	Nil	Diffuse coma strongly condensed to small centre.	AFJ
15.3	8.2	-	Nil	Diffuse coma. Fairly strong cond. 13m nucleus suspected with averted vision.	AFJ
16.3	8.3	3.5'	-	Diffuse round coma, fairly strongly cond.	AFJ
18.4	8.2	-	-	Small 13m nucleus	AFJ
22.4	8.2	-	-	Diffuse coma, fairly strong cond.	AFJ
30.3	8.1	-	Nil	Diffuse coma. Fair condensation.	AFJ
May 2.4	8.2	-	-	Diffuse coma. Moderate condensation. Small 12.5 nucleus susp.	AFJ
2.7	8.6	3'	Nil	Diffuse	JCB
3.7	8.6	3'	Nil	Diffuse	JCB
3.4	8.2	-	-	Diffuse coma. Moderate condensation. Faint 12.5m nucleus seen with averted vision.	AFJ
4.4	9.5	-	-	-	VM
5.7	9.2	-	-	Comet seems smaller and fainter.	JCB
6.4	9.5	-	-	-	VM
7.3	8.7	-	Short tail?	Diffuse coma elongated in p.a. 125° - short faint tail? Moderate condensation. Faint nucleus suspected.	AFJ
7.4	8.8	-	-	-	VM
9.7	9.0	-	-	-	JCB
10.4	9.2	2'	Nil	Diffuse coma, fair to mod. cond.	AFJ
10.7	9.2	-	-	-	JCB
11.7	9.5	-	-	Small faint object seen by averted vision.	JCB
16.4	11 appr.	-	Nil	Diffuse with central condensation.	VM

These observations show that the greatest brightness was reached in April, with a sharp decline in early May.

Key to observers and instruments in the Comet Bradfield report:-

JCB	J.C. Bennett	12cm refractor x21
WAB	W.A. Bradfield	15cm refractor x26
AFJ	A.F. Jones	32cm reflector x86 and 10 x 80mm binoculars
MVJ	M.V. Jones	20cm reflector x40
VM	V. Matchett	30cm reflector x40
MPC	M.P. Candy	12.5cm refractor?

- series to be continued on next Bulletin.

SECTION NEWS

NEIL MARKS - of Tutbury, Burton-on-Trent, who has been carrying out a programme of comet sweeping with a 10cm reflector, sent his final report, (March 1972 - 8 hours) before removing to Bracknell, Berks. He hopes to continue his programme from his new location as soon as circumstances permit.

KEN THOMASON and ANDREW STEPHENS - of Bristol are nearing completion on their telescope projects. Ken is grinding both the mirrors for the two telescopes, which will be an f/4, $11\frac{3}{4}$ inch and an f/5, $12\frac{1}{2}$ inch. Both mirrors are at the figuring stage, and the main bodies of the two instruments are well advanced, with the mirror-cells and spiders ready to be fitted on completion of the optics. Andrew is going to have an altazimuth mount for his telescope to facilitate comet sweeping, but Ken, who is also interested in stellar and cometary photography is going to equatorially mount his and drive it by a complicated series of electronic gadgets which are being made by another local amateur.

PETER J. MADEJ - of Huddersfield reports a faint nebulosity at R.A. 22h 12m: $+70^{\circ}$ (1950.0). The object has shown little or no movement over a period of time and cannot be a comet but as nothing is charted in this position, observers are asked to pay close attention to the area with the view of confirming Peter's observation.

CURRENT COMETS

1972j NEW COMET KOJIMA Magnitude 13 when discovered on 1972 Oct 31, this comet brightened during the rest of the year to reach 10.5 by Dec. 31 (AJ, Nelson, N.Z.). During January, the brightness remained fairly constant, 10.6 being recorded visually by Albert Jones and photographically by Dr. R.L. Waterfield. All observers have described the comet as diffuse with a strong central condensation. Albert Jones noted a trace of tail in p.a. 90° on Dec. 26 and recorded the tail 3' long in p.a. 105° on Jan. 2. Dr. Waterfield's plate on Jan 21 showed a highly condensed coma 20" arc in diameter and a fan-shaped tail containing two main streamers, 2' long in p.a. 120° and 1'.5 long in p.a. 80°.

The comet is now fading but should remain within the grasp of instruments with 25cm - 30cm aperture until the end of March. The following improved elements and ephemeris are by Dr. B.G. Marsden, based on 106 observations Oct. 31 to Dec. 20:

T 1973 Feb. 12.3276 ET ω $334^{\circ}.3270$
                                  Ω 42 .4934   1950.0
q 2.146691 A.U.   i 141 .8488

1973 ET	R.A. (1950.0) h	m	Dec. °	'	Δ	r	Mag.
Feb. 17	02	30.08	+00	46.0	2.309	2.147	11.1
22	02	26.10	02	15.6			
27	02	22.99	03	39.5	2.521	2.154	11.3

1973 ET.	R.A. (1950.0)		Dec.		Δ	r	Mag.
	h	m	o	'			
Mar. 4	02	20.60	04	58.5			
9	02	18.82	06	13.2	2.718	2.166	11.5
14	02	17.55	07	24.2			
19	02	16.70	08	32.0	2.894	2.185	11.7
24	02	16.21	09	37.2			
29	02	16.00	+10	40.0	3.045	2.210	11.9

Magnitudes have been adjusted to agree with Dr. Waterfield's observations.

Members managing to observe the comet are asked to make a careful plot of the field containing the comparison stars in order that the Director can deduce reliable magnitudes.

1973a NEW COMET HECK-SAUSE   Details of the discovery on Jan. 11.0 of 1973a by Andre Heck and Gerard Sause were given on BAA Circular 546. Magnitude estimates varied between 11 and 12 soon after discovery and as preliminary elements showed the comet to be three months past perihelion, fading in brightness was expected.

A plate exposed on 1973 Feb. 10.0 by Dr. Waterfield (assisted by N. Wood) shows a highly condensed coma 30" arc in diameter and a short tail 1' long in p.a. 200°. Magnitude 11.9.

The latest elements available are by Dr. B.G. Marsden, and are based on observations Jan. 4 to 31:

T	1972 Oct. 5.253 ET	ω	346°.149	
		Ω	175 .171	1950.0
q	2.50983 AU	i	138 .626	

The following ephemeris will enable members with suitable equipment to follow the comet during the next few weeks:

1973 ET.	R.A. (1950.0)		Dec.		Δ	r	Mag.
	h	m	o	'			
Feb. 17	11	16.56	+35	04.9	1.990	2.896	12.1
22	11	01.13	37	49.4			
27	10	44.95	40	15.3	2.060	2.949	12.3
Mar. 4	10	28.47	+42	19.5			
9	10	12.15	44	01.2	2.190	3.005	12.5
14	09	56.43	45	21.2			
19	09	41.71	46	21.5	2.367	3.063	12.7
24	09	28.25	47	04.7			
29	09	16.22	+47	33.9	2.578	3.123	13.0

LATE NEWS

Two faint periodic comets were recovered during 1973 January:

1973b P/TUTTLE-GIACOBINI-KRESAK   Recovered by Dr. E. Roemer and J.Q. Latta on 1973 Jan. 8.4. The prediction in the 1973 HANDBOOK requires a correction of Δ T = +0d.5. The comet could reach a total integrated magnitude of 13 in May and a short ephemeris (adjusted for Δ T) will be given in the next Bulletin.

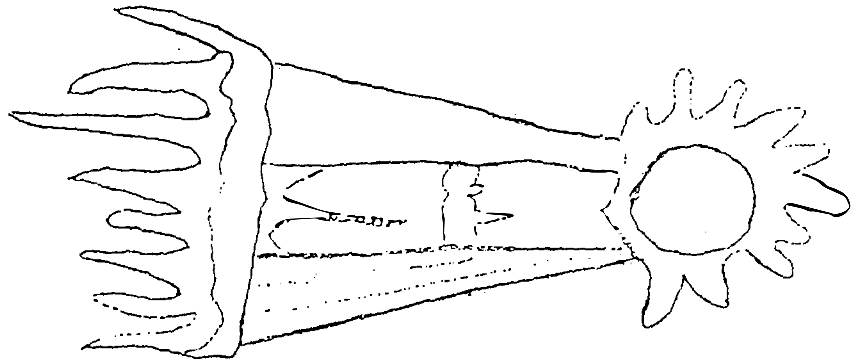
1973c P/WILD   Recovered by Dr. E. Roemer and J.Q. Latta on 1973 Jan. 8.3. The prediction in the 1973 HANDBOOK requires a correction of Δ T = +0d.75.

Full details of the recoveries will be given in the next BAA Circular.

S.W. MILBOURN
DIRECTOR.

THE BRITISH ASTRONOMICAL ASSOCIATION

COMET SECTION



ISTIMIRANT STELLA

BULLETIN No. 2. AUGUST 1973

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EDITORIAL

Already the Bulletin is beginning to do a worthwhile job. Within a couple of days of the appearance of No. 1 I had received a letter in the post from Mike Bean concerning Peter Madej's nebulous object. He correctly pointed out that the position given corresponded closely to that of a grouping of faintish stars. Following some more correspondence Mike has turned out a brief piece concerning comet-like nebulosities and I have pleasure in including it in this issue.

However, although Mike was on the ball I am still biting my nails wondering where my next supply of material is coming from. If anyone cares to put pen to paper, and send me the result, I will be delighted.

A.P. Stephens.

CONCERNING COMET-LIKE NEBULOSITIES - Michael Bean

It is the duty of every comet-hunter to be wary of certain traps, such as the misidentification of nebulae, clusters, faint galaxies and optical ghosts. The comet-hunter must discipline himself in the art of detection. The sky is full of such pitfalls and it is up to the observer to learn them. Few can hope to become as proficient as the late Reverend T.W. Webb, who knew the sky inside out, but by looking out for comet-like objects one stands in readiness for the real thing. With this in mind I have compiled the following short list of test objects. Each is characterised by its comet-like appearance.

NGC 7099 (M 30)	CAPRICORNI	21h 35.8m	-23° 32'	'Comet-like with x64'
NGC 2392 (H IV 45)	GEMINORUM	7h 24.4m	$+21^{\circ}$ 05'	'I thought it was either damp on the lens or a comet'
NGC 6205 (M 13)	HERCULIS	16h 39.9m	$+36^{\circ}$ 33'	'Messier was sure it contained no stars. Sir John Herschel describes 'hairy-looking curvilinear branches'.'

NGC 6210	HERCULIS	16h 41.6m	+23° 57'	'Small but sharply defined.. ..like a star out of focus.'
NGC 6568 (H VII 30)	SAGITTARII	18h 7.9m	-21° 37'	'Curious, large undefined cloud.'
NGC 6093 (M 80)	SCORPII	16h 14.1m	-22° 51'	'Like a comet.'

The possession of an instrument of size is, of course, a great advantage. One must only read Smyth's observations of M30 to see this:-

'What an immensity of space is indicated! Can such an arrangement be intended, as a bungling spouter of the hour insists, for a mere appendage to the speck of a world on which we dwell, to soften the darkness of it's petty midnight? This is impeaching the intelligence of Infinite Wisdom and Power, in adapting such grand means to so disproportionate an end. No imagination can fill up the picture, of which the visual organs afford the dim outline: and he who confidently probes the Eternal Designs cannot be many removes from lunacy.'

- if one never discovers a comet it is surely reward in itself to see the wonders of the heavens first-hand.

Mike Bean - Comet Section

<u>COMPLETING COMET REPORT FORMS</u> - A communication from the Section Director for all Section Members.

The following step-by-step notes are designed as an aid to the observer when reporting an observation on the standard report form.

1) Observation of Comet - Enter the name, year and assigned letter, i.e. Kohoutek, 1973f

2) Date (and decimal U.T.) - The time of the observation should be given in the form year, month, day and decimals of a day. For example, an observation made at 2330 U.T. on July 30th 1973 would read 1973 July 30.98. For normal visual observations the time to the nearest 15 minutes (0d.01) is sufficient, but any observer attempting a precise position should record to five places of decimals.

3) Approximate R.A. and Dec. - The position should be given to Epoch 1950.0 if possible - in any case, the epoch should be stated. Although the position is to be regarded as approximate it should be given as accurately as circumstances permit. A careful sketch of the area transferred to a large scale atlas will often allow positions to be measured to 0m.1 in R.A. and 2' in Dec.

4) Observing conditions - Sky transparency is the main consideration. A better guide than the words 'excellent' or 'fair' etc. is to give the magnitude of the faintest stars visible to the naked eye at the zenith and at the altitude of the comet. The age of the Moon, if present, should also be given.

5) Magnitude estimates (and comparison stars) - This is the most vexing problem of cometary observation. It is suggested, to provide some sort of conformity, that any tail present should be ignored and estimates concentrated on the coma. Although out-of-focus star discs look little like comets, some consistency can be obtained by racking out the draw tube whilst the impression of the carefully observed comet is retained in the mind. This is done until the diameter of the discs become the same as that of the comet <u>when it was in focus</u>. Two discs are chosen, one slightly brighter, one slightly fainter than the comet <u>when it was in focus</u>. The brightness of the comet is then estimated as a fraction between the two. The comparison stars are then identified allowing the magnitude of the comet to be deduced. Carrying out this observation two or three times allows the impression of the comet's brightness and size to be retained in the mind. A typical observation would be recorded thus:-

Star A (6) Comet (4) Star B   Star A = SAO No.   Or other
                               Star B = SAO No.   designation

This would mean that the observer had divided the difference in brightness between star A and star B into ten units and had estimated that the comet was 6 units fainter than star A and 4 units brighter than B. If the observer does not have access to a suitable catalogue, the Director will deduce the magnitude given the designations of the comparison stars or a careful plot of the field showing the comparison stars used. The magnitude of any nucleus present should be estimated separately.

6) Description

Coma - a) diameter - Recorded in minutes of arc and may be estimated from the known diameter of the field or by timing the passage of the coma across a vertical graticule or cross-wire. Then the diameter in minutes of arc = 0.25.cosδ.time in seconds.

b) degree of condensation - May be evenly diffuse, be brighter towards the centre or have a strong central condensation within a diffuse outer coma. Edges may be ill-defined or well marked. Central condensations may be weak or strong. Record any other features such as spikes or jets etc.

Nucleus - A true nucleus is always very sharply defined and excepting very large, bright comets, is practically stellar. Do not confuse a small central condensation with a nucleus - if in doubt record a strong central condensation.

Tails - If any tail is present, the observer should record any structural details and estimate its length and position angle. The length can be estimated by the known diameter of the field, providing it is short. The angular distances between stars can be used if it is long. The position angle (PA) is measured in degrees eastwards from the north.

7) Instrument (and x) - the aperture and magnification should always be quoted as there is some evidence that the deduced magnitude has some bearing upon these, particularly the magnification.

8) Observer - Do not forget to put your name here!

9) Field Sketch - To be placed on the reverse of the form. Plot the comet in relation to the field, identifying if possible at least one star. If the comet has structural detail, draw the sketch as accurately as possible.

'You would attain to the divine perfection,
And yet not turn your back upon the world.'

Michael Angelo

- a comment on professional astronomers?

COMETS IN 1972 (Continued from Bulletin No. 1)

1972g Comet P/Neujmin (3). The recovery of this short period comet (P 10.6 yrs) by Dr. E. Roemer and R.A. McCallister on 1972 April 17.5 was reported on BAA Circular 541. The comet was moderately well condensed, magnitude 19.2.

Comet P/Neujmin (3) was originally discovered in 1929, Aug. 2 as a diffuse object of magnitude 13.5. It faded rapidly and the last observation was on September 9 of that year. The comet was not seen in 1940 but subsequently recovered by Cunningham at Mt. Wilson on May 4, 1951 at magnitude 17. The comet was again missed in 1961 despite extensive searches - the present recovery is thus the third observed appearance.

The comet remained too faint to be observed by the Section.

1972h Comet Sandage. Discovered by Dr. A.R. Sandage, Hale Observatories, on 1972 June 9.2, using the 122cm Schmidt at Palomar. The comet was 2' in diameter and had a short tail 30' long to the south. Preliminary elements showed that the comet had a large perihelion distance (q = 4.3 AU) and was therefore intrinsically a large bright object. As subsequent observations accrued it became clear that a parabolic solution was not satisfactory and a hyperbolic orbit was necessary to represent the motion of the comet. The latest elements by Dr. B.G. Marsden (IAUC 2472) satisfy 93 observations, June 9 to October 4 with a mean residual of 1".38:

T	1972 Nov. 15.1298 E.T.	Epoch	1972 Nov. 19.0 E.T.
ω	56°.7154		
Ω	224.7838 1950.0	e	1.006673
i	79.3697	q	4.275325 AU

No visual observations have been reported but a number of photographic observations have been obtained by Dr. Waterfield and associates at Woolston Observatory:

Date 1972 U.T.	Mag.	Coma '	Tail Lgth '	Tail p.a. °	Description	Observers
Jun. 13.982	13.0	0.5	-	-	Very diffuse with negligible cond.	RLW; IMP; RHS
14.975	13.0		as above			
Jul. 9.971	13.0	0.3	1.5	200	Highly cond. coma with very faint and shallow outer coma. Tail straight.	RLW; IMP
Jul. 15.958	13.0	0.25	-	-	Stellar inner coma 10" diameter.	AG
Aug. 10.919	13.0	0.5	1	180	Highly condensed coma.	GHR; RLW
16.902	13.0		as Aug. 10.919			
1973						
Feb. 25.085	13.6	0.3	-	270	Very highly condensed coma. Suggestion of faint tail.	NW; RLW

Observers: Dr. R.L. Waterfield: I.M. Purcell, G.H. Rutter; A. Griffiths; N. Wood; R.H. South.

Precise positions measured from these plates (plus two exposed on Sept. 6.9 and Oct. 28.8 where hazy sky rendered magnitude estimates doubtful) have been published on BAA Circulars 543, 544 and 547.

The integrated magnitude of the comet is still around 14 and the ephemeris (see 'CURRENT COMETS'), from the above elements may encourage those observers with suitable equipment.

1972i Comet P/Reinmuth (1). Recovered by Dr. E. Roemer (assisted by M.R. Gonzales) on 1972 Sept. 12.4 using the Steward Observatory's 229cm reflector on Kitt Peak (BAA Circular 544). The comet was a well condensed 20th magnitude object close to G. Sitarski's prediction in the Handbook 1972

Reinmuth (1) was originally discovered as a 12.5 magnitude object on 1928 Feb.22, on plates exposed to track minor planets. Pre-discovery images were subsequently found on plates exposed on 1928 Jan.26 and Jan.29. On 1928 Feb. 26, W.H. Steavenson observed the comet visually with a 15cm refractor. Since that time, the comet has been observed at every return except 1942 but has never been recorded brighter than magnitude 16.

1972j Comet Kojima. Discovered on 1972 Oct. 31.8 as a 14th magnitude diffuse object close to the position of Comet P/Giacobini-Zinner, 1972d. Preliminary elements showed that the comet would brighten as it moved towards perihelion in 1973 February and the following observations were made by members of the Section:

Date 72/73	Mag.	Coma '	Tail Lgth '	Tail p.a. °	Description	Obs.	Type
Nov. 18.65	11.4	-	-	-	Small round diffuse coma, slightly cond.	AJ	V
30.54	11.5	-	-	-	Diffuse	VM	V
Dec. 1.58	11.5	-	-	-	Diffuse	VM	V
1.61	11.0	-	-	-	Diffuse, fair cond.	AJ	V
3.60	11.0	-	-	-	Diffuse coma, strong condensation.	AJ	V

Date 72/73	Mag	Coma '	Tail Lgth '	Tail p.a. °	Description	Obs.	Type
6.45	10.6	-	-	-	As Dec. 3.60	AJ	V
9.45	10.9	-	-	-	As Dec. 3.60	AJ	V
11.43	10.6	-	-	-	Diffuse, mod. cond. Small nucleus mag.12.3	AJ	V
12.53	11 apprx.	-	-	-	Diffuse	VM	V
15.60	10.5	-	-	-	Diffuse coma, fairly strong cond. Nuc. susp.	AJ	V
22.42	10.8	-	-	-	Diffuse coma, strongly cond. Small Nuc. mag. 12.5	AJ	V
24.53	10+	-	-	-	Diffuse with central condensation.	GT	V
25.45	10.5	-	-	90	Diffuse. Coma elongated (short tail?). Strong cond. Vis. in 78mm finder	AJ	V
26.43	10.4	-	-	90	Diffuse coma strongly cond. Small nuc. Trace of wispy tail.	AJ	V
28.23	10.6	-	3	80	Condensed coma.	KS	V
28.45	(11.1)	-	-	-	Diffuse with strong cond. Poor obs. - hazy sky	AJ	V
29.45	10.5	-	-	-	Diffuse, mod. condensation	AJ	V
30.44	11 appx.	-	-	-	Diffuse	VM	V
30.46	10.5	-	-	-	Diffuse coma fairly well cond. Nucleus mag. 12.5	AJ	V
30.89	10.5	0.13	-	-	Coma very diffuse. No nucleus or tail	ALM	V
31.48	10.4	-	-	80	Diffuse coma elongated (Wisp of tail?) Strong cond. displaced in 260 °	AJ	V
Jan. 1.47	10.6	-	-	-	Diffuse coma. Moderate condensation.	AJ	V
2.59	10.6	2	3	105	Diffuse coma, fairly well cond. Nuc. mag 12.5	AJ	V
3.45	10.5	-	-	-	Diffuse coma. Small strong cond.	AJ	V
21.80	10.6	0.3	2 1.5	120 80	Highly cond. coma. Fan tail with two streamers.	RLW	Ph 10 min.
21.84	10.6	As Jan. 21.80				NW	Ph
Feb. 21.84	11.5	-	-	-	Ill-defined coma slightly brighter to centre. Mag. == M.97	CM	V
Mar. 1.81	9.75 appx.	2	-	-	Poor seeing - approx. mag. only. Possible nucleus	KS	V

Observers:			
A. Jones	31.7cm	x86	78mm finder
A.G. Le Mocur	22cm	x90	
V. Matchett	30cm	x40	
C. Moore	23cm	x36	
K. Simmons	20cm		
K.M. Sturdy	15cm	x48	
G. Thompson	20cm	x96	
R.L. Waterfield	15cm	f 4.5	
N. Wood	15cm	f 4.5	

These observations show that the comet had little structure throughout the period of visibility although a short tail was apparent from time to time. Maximum magnitude was reached around the beginning of 1973.

1972k Comet P/Gehrels. On 1972 Oct. 11.4, Dr. T. Gehrels, Lunar and Planetary Laboratory, discovered a 19th magnitude comet on plates taken with the 122cm Schmidt telescope at Palomar. It was diffuse with slight condensation but without tail. Observations between then and Nov. 13 showed the comet to be of the short period variety and the following elements have been calculated by Dr. B.G. Marsden:

T	1973 Jan. 23.704 E.T.			
ω	28°.621		e	0.50484
Ω	14.639	1950.0	a_0	5.93927
i	9.670		n	0.068093
q	2.94086 AU		P	14.47 yrs.

The comet remained a 19th magnitude object and should now be fading.

1972l Comet Araya. This new comet was discovered by G. Araya, Cerro Tololo Interamerican Observatory on 1972 December 9.2 using the Curtis-Schmidt telescope. Plates showed a diffuse object with a bright central condensation, magnitude 13, with a suggestion of a tail. Orbital elements (BAA Circular 546) showed the comet to have a very large perihelion distance (q = 4.86 AU). Although the comet should have been between 12 and 13th magnitude and well placed for southern observers during the early part of 1973, no observations have been received from members of the Section.

CURRENT COMETS

Comet P/Tuttle-Giacobini-Kresak, 1973b.

Comet Tuttle-Giacobini-Kresak has undergone two major outbursts in the past two months. The maximum magnitude attained appears to be 4, on May 27.9 and 5 on July 8.0, representing an increase of ten magnitudes. These are probably the greatest outbursts on record for any comet and every effort should be made to follow the position of the comet for the rest of the apparition in the hope that a third outburst might occur. The following is a summary of the observations received:-

Date	Mag	Observer	Remarks
May 20.9	14	Seiler (Munich)	Slight protrusion to the west.
27.9	4	" "	Only slightly fainter than epsilon Leonis. Tail some 6' to 12' in p.a. 110° conspic.
31.9	6	" "	
Jun. 3.1	10.2	Bortle (New York)	Coma 3'. Tail 6' in p.a. 120°.
Jul. 6.9	5-6	Antal (Klet)	
8.0	5	Waterfield (Woolston)	
10.0	9½-10	" "	Central cond. mag. 11.2 Coma v. elongated 8' by 4' -

possible tail in p.a. 100°. Two jets from nucleus 1'.5 long in p.a. 110° and 1' in p.a. 240°. Coma very diffuse with no definite edge except for arc p.a. 20° to p.a. 270° which is brighter than the rest of the coma and remarkably sharply defined.

Although there are no comets currently visible brighter than 12th magnitude, four objects (two of them southern comets) are brighter than mag. 15 and the following ephemerides will assist observers with suitable equipment:

Date ET	R.A. (1950.0) h m	Dec. ° '	Δ	r	Total mag.
1972h Sandage					
Aug. 6	18 36.7	+71 29.2	4.722	4.799	13.7
16	18 30.6	70 52.1			
26	18 27.8	70 00.4	4.761	4.874	13.8

Date UT		R.A. (1950.0)	Dec	Δ	r	Mag.
1972 Sandage (continued)						
Sept.	5	18 28.39	68 57.5			
	15	18 32.27	67 46.3	4.802	4.954	13.9
	25	18 39.02	66 29.5			
Oct.	5	18 48.29	65 09.2	4.854	5.037	14.0
	15	18 59.65	63 47.4			
	25	19 12.72	+62 25.7	4.930	5.123	14.1

BGM - IAUC 2472

Date UT		R.A. (1950.0)	Dec	Δ	r	Mag.
1972 l Araya						
Aug.	6	02 53.20	-51 24.5	4.830	5.178	12.6
	16	02 44.08	53 27.4			
	26	02 31.59	55 27.8	4.746	5.233	12.6
Sept.	5	02 15.41	57 17.7			
	15	01 55.65	58 48.1	4.749	5.291	12.6
	25	01 32.99	59 50.8			
Oct.	5	01 08.73	60 19.9	4.854	5.354	12.7
	15	00 44.65	60 13.4			
	25	00 22.46	-59 33.9	5.058	5.419	12.9

BGM - IAUC 2538

Date UT		R.A. (1950.0)	Dec	Δ	r	Mag.
1973e Kohoutek						
Aug.	6	04 17.98	+65 40.9	1.735	1.630	12.8
	16	03 29.15	67 47.8			
	26	02 13.88	68 33.5	1.468	1.792	12.9
Sept.	5	00 42.44	65 56.4			
	15	23 25.86	58 48.7	1.292	1.974	13.0
	25	22 37.04	48 23.1			
Oct.	5	22 09.28	37 01.0	1.365	2.169	13.5
	15	21 54.47	26 41.3			
	25	21 47.74	+18 16.8	1.712	2.371	14.4

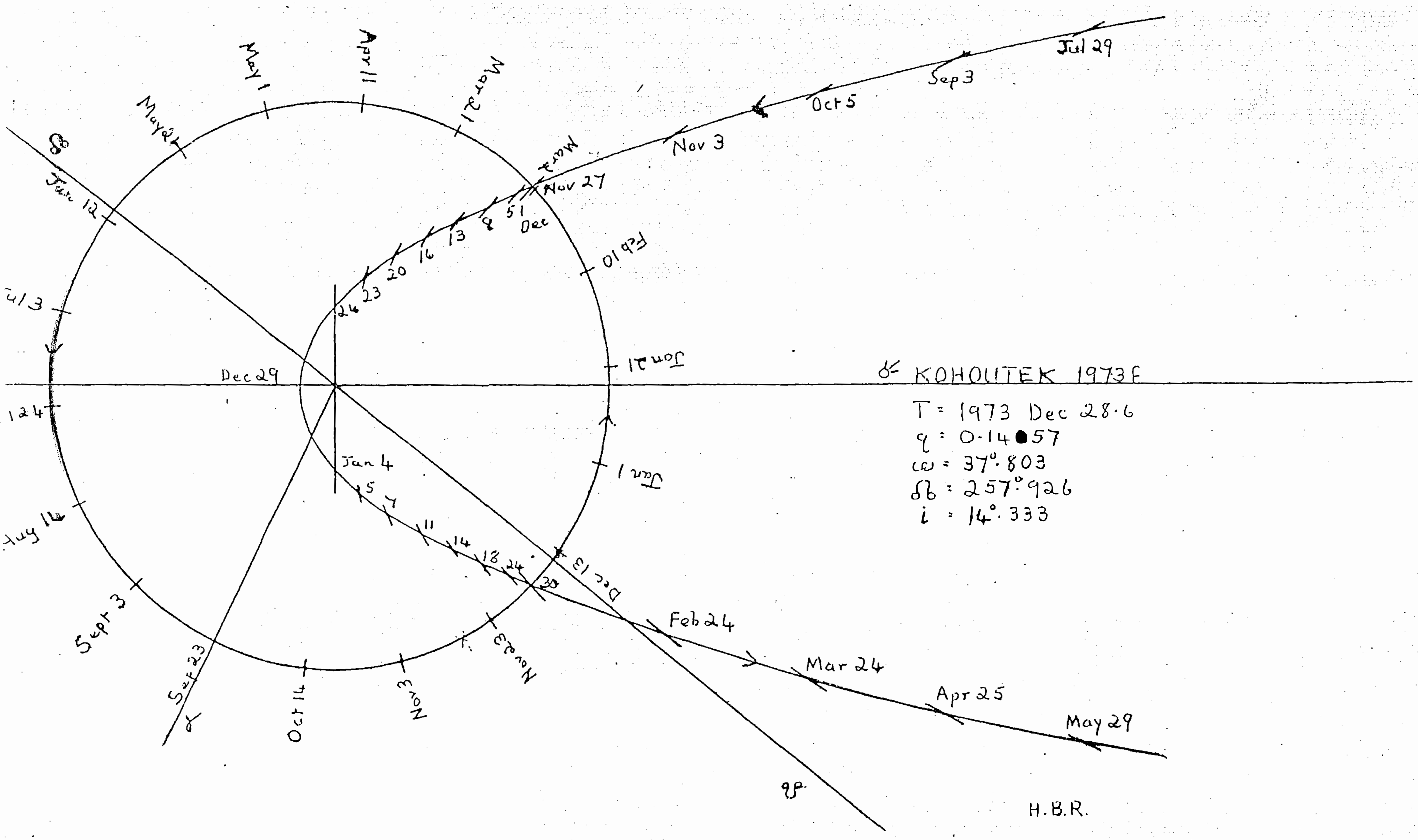
BGM - IAUC 2540

Date UT		R.A. (1950.0)	Dec	Δ	r	Mag.
1973i P/Clark						
Aug.	6	21 04.22	-39 20.2	0.727	1.709	13.6
	16	20 59.42	39 00.3			
	26	20 56.76	38 04.6	0.856	1.791	14.2
Sept.	5	20 57.03	36 41.7			
	15	21 00.40	-35 00.5	1.049	1.885	14.9

BGM - IAUC 2550

COMET KOHOUTEK 1973f

Comet Kohoutek, which promises to be a bright naked-eye object at the end of the year, moved into twilight in May and is at present on the far side of the Sun as seen from Earth. It will become a morning object during October and a detailed ephemeris for October and November appears on Circular 548. An ephemeris for December onwards will be issued as soon as post-conjunction observations confirm (or otherwise!) the accuracy of the improved orbit. In the meantime, the approximate ephemeris on Circular 547 should be sufficiently near the truth for observers to plan their programmes. To aid the observer, H.B. Ridley has drawn the attached orbit diagram and light curves.



KOHOUTEK 1973F
T = 1973 Dec 28·6
q = 0·14●57
ω = 37°·803
☊ = 257°·926
i = 14°·333
Jul 29
Sep 3
Oct 5
Nov 3
Nov 27
Mar 1
Dec
15
8
13
16
20
23
24
Feb 10
Jan 21
Jan 1
Dec 29
Jan 4
5
7
11
14
18
24
30
Dec 13
Feb 24
Mar 24
Apr 25
May 29
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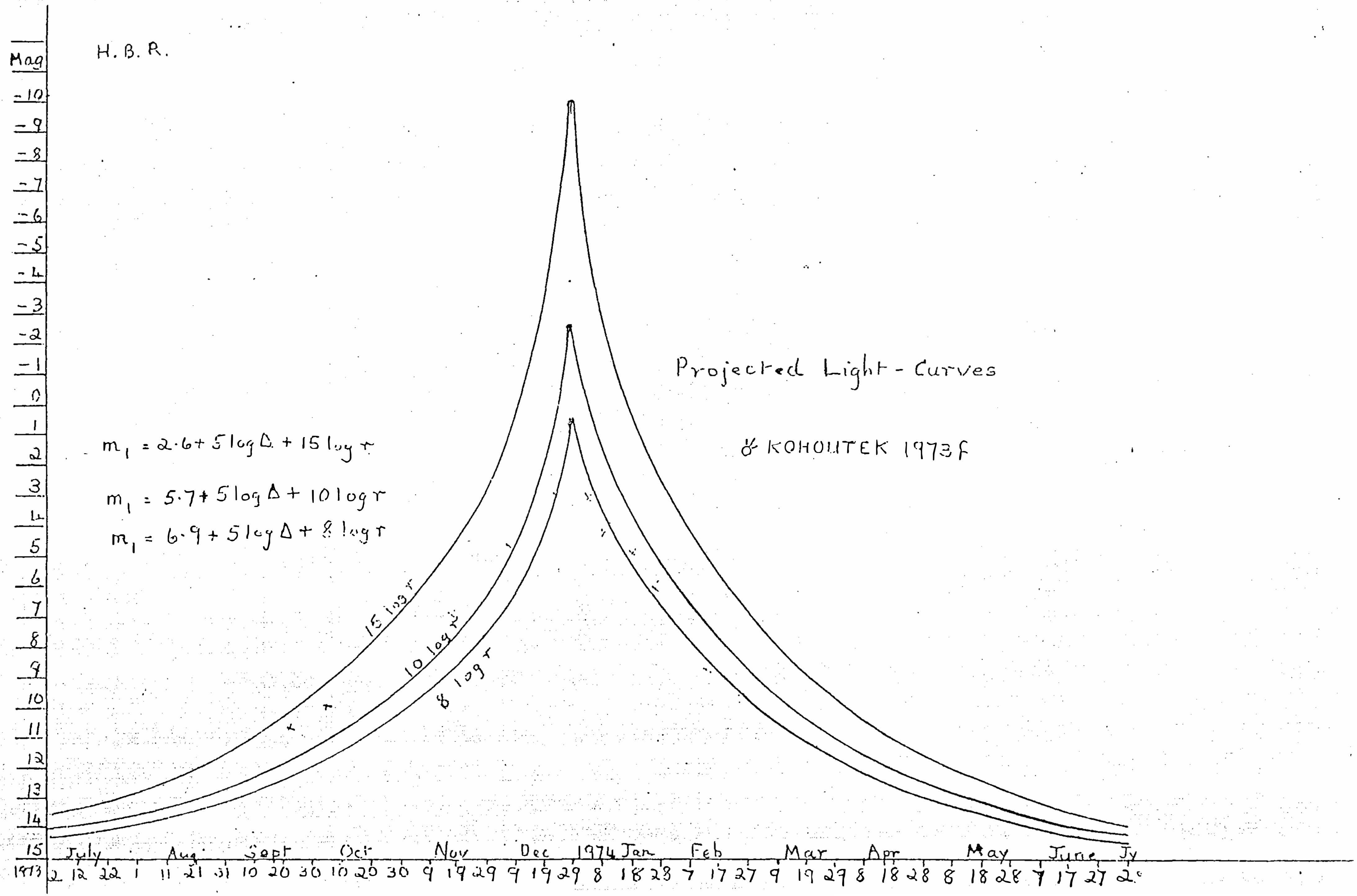
Nov 3
Nov 23
H.B.R.



H. B. R.
Mag
Projected Light - Curves
☌ KOHOUTEK 1973f
$m_1 = 2.6 + 5 \log \Delta + 15 \log r$
$m_1 = 5.7 + 5 \log \Delta + 10 \log r$
$m_1 = 6.9 + 5 \log \Delta + 8 \log r$
15 log r
10 log r
8 log r
1973
1974
July
Aug
Sept
Oct
Nov
Dec
Jan
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Mar
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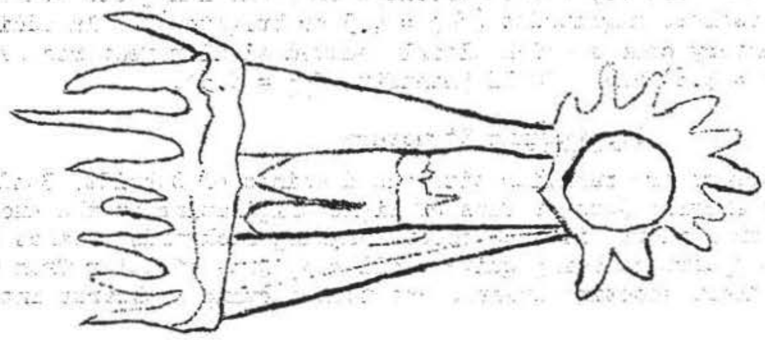
May
June

THE BRITISH ASTRONOMICAL ASSOCIATION

COMET SECTION



ISTIMIRANT
STELLA

BULLETIN No. 3 JANUARY 1974

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EDITORIAL

With all thoughts of hang-overs well behind us we can be looking to the skies of the New Year to bring us some of our most exciting observing for years. As this issue arrives comet Kohoutek should be providing a brave display, and we have much in this issue relevant to it. John Bortle has some thoughts on observing fountaining structures within the coma, Steve Anderson looks forward to using his new instrument to take shots as it recedes into the depths of space once more and Stan Milbourn brings current observations of it.

My last view of it was of a faint smudge in the early morning sky, using my 8x50mm elbow-telescope - and then it seemed to hold some vague promise of something spectacular - I hope that promise will be fulfilled. I hope also that the promise of this brave New Year is realised for us all, not only in the skies, but in all to which we apply ourselves.

Lastly, I would like to say a sincere word to all those who have helped me during the past year, and without whose help the Bulletin would surely have fallen by the wayside - Many Thanks.

Andrew Stephens.

CONCERNING THE OBSERVATIONS OF ENVELOPE AND FOUNTAINING STRUCTURES IN COMETS

During the nineteenth century, when comet observations were of a visual nature, the primary concerns of observers were positional work and the recording of internal details, particularly in the region immediately surrounding the nucleus. Although the former type of work is still actively pursued, visual studies of coma structure has all but disappeared since the advent of photography. Unfortunately, photography is not particularly well suited for recording such detail because of the wide variations in brightness involved and the fact that comet-photographs are usually very much under exposed (for positional work) or overexposed (for study of tail structures) to record the coma properly.

That it is likely that all comets show fountaining structure to some extent is evident from the fact that it was observed in many bright comets in the

Fountaining and Envelope Structures cont:

nineteenth century and also in the faint comet P/Pons-Winnecke when it passed very near the Earth in 1927. Nevertheless, structural features are far more evident visually in intrinsically bright comets. Of the seven nineteenth century comets that most clearly showed envelope or fountaining structures, five had unusually high absolute magnitudes (H_{10} = 4.5 or brighter). In addition, the two twentieth century comets which clearly showed simil r features were 1910 II (Halley, H_{10} = 4.6) and 1970 II (Bennett, H_{10} = 3.5).

Fountaining Structure

Most comet observers are familiar with the drawings of Schmidt, Bond and other contemporaries showing jets or fans of light originating on the nucleus and rising sunward for a short distance before bending backwards towards the tail. The overall appearance being quite similar to jets of water from an ornamental fountain first shooting upwards and then curving backwards into the surrounding pool.

Some idea of the apparent size of these jets can be derived from observations made by the author. For instance, in 1970 II, the largest jet rose less than 1.5' of arc sunward before turning back towards the tail. This would be in the same order of size as observations of similar features in the nineteenth century comets although their size probably varies from comet to comet.

Envelope Structure

True envelope structure would seem to be either rarer than the jet structure or possibly less evident in medium size instruments. It does appear to be more easily photographed than the jet structure and was quite evident in 1962 III and 1970 II (also visually in the latter).

Generally their appearance is that of a luminous arc sunward of the nucleus and rarely extending more than 180° or, as is most often the case, a rather sharply bounded bright layer superimposed upon the coma and following its general outline in shape (parabolic in the case of a large comet). Often several are visible at one time and each succeeding layer will be larger and fainter than the next interior layer, (in the nineteenth century these features were called 'hoods').

In at least one instance the size of the envelope was seen to increase from hour to hour, indicating rapid expansion, but little information is available as to whether this may be common for all features of this type.

Once, in the case of comet 1874 III, the nucleus did not occupy the axis of the envelopes and were observed to cross one another in front of the nucleus!

Some mention should be made of a feature which may be related to the envelope structure. Quite often the area behind the nucleus is less luminous than the rest of the surrounding coma or beginning of the tail indicating that a lesser amount of luminous material occupies this region. Very rarely, within this region it is possible to detect a very narrow dark lane, certainly no more than a minute of arc wide and up to several degrees long, the so called 'shadow of the nucleus'. The author saw this feature in comet 1970 II with a 55cm instrument, but it was quite beyond a 25cm instrument at the same time.

Method of Observation

Since both fountaining and envelope structures seem to be only a small percentage brighter than the general background of the coma, it is always advisable to use the largest instrument that the observer can gain access to. Probably apertures of 30cm to 60cm will prove the most successful for this type of work, although smaller instruments will suffice in the case of a large comet passing near to the Earth. In 1970 II, some structure was detectable in a 9cm instrument but this was an exceptional case, with foreknowledge that such details were present.

Since, as was mentioned earlier, the individual jets of fountaining structure subtend little more than a single minute of arc, magnifications in the order of 100x to 200x are called for. Naturally, the observer must take care not to over magnify for the aperture involved and thus reduce the comet's surface brightness below the threshold at which internal detail can be detected.

An interesting and possibly important fact in observing fountaining structure was noted by the author during his observations of 1970 II. During the period when this comet's internal structure was most pronounced the total magnitude was between +0.5 and +1.0 and its surface brightness was very great. During the course of each observing session it was noted that the fountaining structure became more apparent during very early twilight when the great brilliance, and thus contrast, compared with t e sky background was reduced.

On the other hand, observations of envelope structure seem best done in a totally dark sky and at a lower magnification. Since the surface brightness may differ only slightly from one envelope to the next, eyepieces resulting in an exit pupil of 5mm to 6mm would be recommended.

Observations made using various standard colour filters would certainly be of value in determining whether the jets are only visible in a certain part of the spectrum or are continuum features (as was the case in 1970 II).

Careful drawings of structure and particularly structural changes from hour to hour, where possible, would be highly desirable. Although personal style in drawings causes some distortion, comparison with other observers' work should allow a fairly accurate composite to be formed.

Observers possessing a filar micrometer could determine the size of individual jets and their PA of origin on the nucleus. Measurements of envelopes at the sunward point and at possibly 90° each side of it relative to the nucleus would have an extremely high value. Determinations every 30 minutes are recommended so as to monitor any expansion.

Conclusion

The final paragraph of 'Visual Observation of Comets' by Dr. S. Rahe and Donn (Sky & Telescope, Vol. 41, No. 4, p.214) serves to indicate the professionals' opinion on our contribution to this sort of work is important:-........'such observations can be carried out most effectively by serious amateurs...... supplementing the few comparable observatory photographs.......and providing a much needed continuous record'.

John E. Bortle
Stormville, New York, USA.

EDITOR'S NOTE:- I too observed jet structures in 1970 II, using a 10cm reflector of inferior quality. I had no knowledge of their existence at the time I observed them and I can only conclude that the structure in 1970 II was something out of the ordinary.

APS.

MAGNITUDE ANOMOLIES IN DIFFUSE OBJECTS

During some recent correspondence with Mr. Milbourn, I suggested that a standard list of comet-like objects be published in an attempt to investigate the apparent magnitude variation which occurs when instruments of different size, and carrying various magnifications are brought to bear on the same object. This occurs notably with comets and nebulae, but here we are concerned with using the latter to discover more about the former. To quote from Mr. Milbourn's letter:-

'If we can encourage members to make as many unbiased estimates (of a standard list of comet-like nebulae - ED) as possible using a variety of instruments and magnifications we may go some way to solving the problem.'

The following list of objects was compiled by myself using a pair of 7x50mm binoculars. The magnitudes quoted are to act as a guide only.

Const	Object	Mag.	Comments
AND	M31	Mag 6	Great Andromeda Spiral
AQR	M2	- 5	Globular. Foll. 24 AQR
AUR	M36	- 6	Open Cluster
-	M37	- 7	Open Cluster
-	M38	- 7	Open Cluster
CNC	M67	- 7.5	Open Cluster
CAS	M52	- 8	Open Cluster
-	NGC7789	- 8	Open Cluster
-	M103	- 7	Open Cluster
CYG	M29	- 7	Open Cluster
LYR	M56	- 8	Globular
MON	M50	- 7	Open Cluster
PER	M34	- 6	Open Cluster
-	NGC1528	- 8	Open Cluster

Mag. anomolies in diff. objects cont:

Const	Object	Mag.	Comments
SAG	M20	- 8	Trifid nebula
-	M71	- 8	Globular
TRI	M33	?	Great Triangulum Galaxy
UMa	M81	- 7.5	Galaxy
-	M82	- 8	Galaxy

— all observations should be sent to the Director and each should be accompanied by the usual instrument details, as well as a statement of the limiting magnitude of the sky at the time the observation was made. This will facilitate correlation of the results.

Peter Clayton.

EDITOR'S NOTE:- I would welcome additions to this list from members, as well as comments about the objects included. It should be borne in mind that in the case of the open clusters, estimates must be made by instruments not capable of resolving the cluster into individual stars. Because of this I would welcome comments on the usefulness of open clusters in such a list.

As soon as I received Pete's article I discussed the project with Ken Thomason, MA., FRAS. He reminded me that there are a multitude of factors which produce magnitude discrepancies between estimates by observers using even the same instrument, with the same eyepiece, from the same location on the same evening. These include age, health, social habits, i.e. smoking , drinking, individual eye defects, etc. Therefore estimates made by a single observer using a variety of instruments are of particular value.

APS

SECTION NEWS

Steve Anderson's Maksutov Project

Steve Communicates:- 'For many years I have been interested in accurate positional work for comets, but until recently the necessary equipment has eluded me. The ideal hardware would be a fairly fast lens, about F4 or F5, with a focal length of at least 24" - this would give a reasonable image scale, and a flat, wide field.

Following a discussion with Jim Muirden, during which we both agreed on the lack of amateur, comet-photographic stations, he announced he had a number of preformed Maksutov shells, and would be interested in making an F4 system.

I immediately purchased a 12" pyrex disc, and began to hog out the ¼" deep curve by hand. This method is not recommended, as one requires body-builders' muscles! Once the curve is fine ground Jim will take over, polish it, and then figure it. He has already polished the shell. Since the system is basically the same as the Schmidt camera, a field flattener is required because the focal plane is curved.

The final instrument will have a clear aperture of 8", a focal length of 32", and a physical length of about 4 feet.

The mount consists of a 4" aluminium fork bolted on to a car clutch-plate, which rests on a couple of bearings. A 10"brass gear wheel will drive the instrument in RA, aided by a variable frequency oscillator.

One hesitates to predict when the camera should be operational, but I hope it will be early this year.'

Bortle on Binos

Extracts from a personal communication from John Bortle, discussing the availability of big binoculars in the States read as follows: 'I have a great interest in large binoculars and have become rather well versed in the subject as a result. .....pairs of an aperture of about 100mm seem almost non-existent.....there appear to be approximately two hundred pairs of the 20x120mm or 15x120mm type.....perhaps a dozen of the 150mm to 175mm varieties in the States.. ..in almost all the cases these are captured Japanese equipment. Wachter (?) of Germany do 100mm glasses and these sell here at 450 dollars.....new Japanese Nikkon I've heard, sell in Japan for 250 dollars for the 15x80, and 1600 dollars for 20x120mm.'

On the subject of Kohoutek he had seen it seven times up to November 12th - can anybody beat that?

Astronomical Societies Convention '74

Members associated with local astronomical groups are reminded that tickets for the Astro. Soc. Convention are now available from Eddie Moore (no relation!) 7 Elvendon Road, Palmers Green, London, N13 4SJ, price 50p per ticket. This year's conference will be highlighted by a talk on comets by Mr. G.E.D. Alcock - which I am sure we all can't afford to miss.

COMETS IN 1974

With Kohoutek's comet still in our thoughts it is well to remember that there are some periodic comets to be seen in 1974. It should be borne in mind that the majority are very faint and we must wait until Halley's comet is back in 1986 before we can expect another bright one.

In the following summary, perihelion distances are given in Astronomical Units, where 1AU is equal to 92,957,130 miles, or 149,600,000km.

COMET BROOKS 2 - Discovered in 1889 it is making it's 11th appearance. Perihelion is expected on Jan 4, at a distance of 1.84AU. It's maximum magnitude is not expected to exceed 17.5. It has a period of 6.8 years.

COMET SCHWASSMAN - WACHMANN 3 - Discovered in 1930 this comet is making it's first observed return. Perihelion is expected on March 17th at a distance of 0.94 AU, with a maximum magnitude of 18. It has a 5.4 year period.

COMET DUE TOIT 1 - Discovered in 1944 this comet is making it's first observed return. Perihelion is expected on April 4th at a distance of 1.29AU with a maximum magnitude not exceeding 16.5. It has a period of 14.9 years.

COMET ENCKE - Makes it's 50th anniversary return this year. It was discovered in 1786. Perihelion is on April 28th at a distance of 0.33AU. Although some authorities say that this comet can no longer be seen with the naked eye, one set of figures gives it a maximum magnitude of 4.1 at the beginning of May. This comet then should be easily seen with small apertures. It has a period of 3.3 years - the smallest of any known periodic.

COMET REINMUTH 2 - Discovered in 1947, makes it's fifth appearance. Perihelion is expected on May 7th at a distance of 1.94AU with an expected maximum magnitude of 16.5. It's period is 6.7 years.

COMET BORRELLY - Discovered in 1904 it makes it's 9th appearance. Perihelion is expected on May 12th at a distance of 1.32AU and it's maximum magnitude is not expected to exceed 17. It has a period of 6.7 years.

COMET FORBES - Discovered in 1929, it makes its 5th appearance. Perihelion is expected on May 20th at a distance of 1.53AU with a maximum brightness of 14 mag. It has a 6.4 year period.

COMET FINLAY - Discovered in 1886 it is making its 9th appearance. Perihelion, expected on July 3rd, will be at 1.09AU with a maximum magnitude not exceeding 14.5. It has a period of 6.9 years.

COMET WIRTANEN - Discovered in 1947 it is making its 5th appearance. Perihelion is expected on August 22nd at a distance of 1.6AU. It has a 6.6 year period.

COMET SCHWASSMANN-WACHMANN 2 - Discovered in 1929 it is making its 8th appearance. Perihelion is expected on September 12th at a distance of 2.14AU with a maximum magnitude of 17. It has a period of 6.5 years.

COMET SWIFT 2 - This comet is making its first observed appearance since its discovery in 1895. Perihelion is expected on November 5th at a distance of 1.33AU with a maximum magnitude of 18.5. It has a period of 7.1 years.

COMET HONDA-MRKOS-PAJDUSAKOVA - Discovered in 1948 it is making its 5th appearance. Perihelion is expected on December 28th at a distance of 0.58AU, and it is expected to reach magnitude 13.5 by the end of the year. It has a period of 5.2 years.

Apart from these comets which reach perihelion in 1974, other comets will be visible throughout the year. These are those which came to perihelion in 1973 and now recede to the depths of space, or those which are moving towards a perihelion in 1975. In both cases these comets will be beyond the range of amateur owned instruments.

There is one more comet which will be observed in 1974. This is COMET SCHWASSMAN-WACHMANN 1, whose orbit lies entirely between Jupiter and Saturn, and which can be seen every year. It has a 16 year period and usually has a magnitude of around 18. However, this comet is subject to surprising increases

Comets in '74 continued:

in brightness; for example it reached magnitude 10.7 in October 1959, 12.5 in January 1960 and 14 in January 1965. These outbursts, which we suspect are linked to current solar activity are obviously worth looking for in any of the above comets, and any amateur equipped with photographic apparatus could do much by making exposures in the positions of these faint periodics. They would be of immense value, whether their results were negative or positive. In 1973, amateurs monitoring COMET TUTTLE-GIACOBINI-KRESAK in this manner were treated to flare-ups on two separate occasions. Each time the increase amounted to 10 whole magnitudes!

Alan R.J. Paine

EDITOR'S NOTE: I must apologise for the editorial lacerating which the above item has received. I apologise to Mr. Paine, but in this issue I had the welcome problem of having more than enough material. Keep up this exceptional work!

APS.

COMET KOHOUTEK 1973f - PRELIMINARY REPORT

Comet Kohoutek, 1973f was recovered by T. Seki on September 23.8 after its sojourn on the far side of the Sun. The comet was a diffuse object of magnitude 10.5. It steadily brightened as it moved towards perihelion but it soon became obvious that Kohoutek's comet was not to be the spectacular daylight object dreamed about by the press. So many observations have been received that it is impossible to enumerate them individually in a preliminary report of this nature but the following resume will give members an idea of the behaviour of the comet with regard to magnitude and tail development to date (1974 January 12):

Date	Mag.	Tail	No. of Obs.	Date	Mag.	Tail	No. of Obs.
Oct. 1	10.0		1	Nov. 23	7.2	30'	2
6	9.9		1	24	7.4	30'	2
10	8.8		1	26	6.1	45'	9
21	8.5	Trace	1	27	5.9	45'	11
24	8.8	Trace	2	28	5.6		1
25	8.4	$1\frac{1}{2}'$	4	29	5.6		2
26	7.5	40'	3	30	5.6	1°	3
27	8.3		4	Dec. 1	5.1	1°	3
30	8.1		2	2	5.3	30°	5
Nov. 2	7.1		1	3	5.5	55'	1
5	7.0		1	4	5.0	1°	2
6	7.8		5	5	4.8	1°	2
7	8.0	7'	1	6	4.4	2°	1
8	7.7	14'	3	7	4.6	$1\frac{1}{2}^\circ$	2
9	6.4		1	8	5.1	$1\frac{1}{2}^\circ$	3
11	7.8	10'	1	9	4.8	30'	2
12	8.0		1	13	4.4	30'	1
14	7.4		2	15	4.3		1
15	7.2		2	22	2.5		1
17	6.8	10'	5	Jan. 4	2.5	45'	1
18	7.2	10'	3	5	3.7		1
19	7.2	8'	2	6	3.3	$1\frac{1}{2}^\circ$	2
20	7.2	15'	6	7	4.0	$1\frac{1}{2}^\circ$	1
21	8.0		1	8	3.1	3°	2
22	7.1	30'	3	10	3.2	13°	1

The magnitude and tail estimates are the means of the observations.

The magnitude estimates on January 5 and 7 refer to the central condensation only and the tail length on January 10 was observed from a high altitude flight. The light curve indicates a steady rise until November 15, a stand-still from that date to the 24th followed by a steeper rise towards perihelion. Observations since perihelion are too fragmentary to draw a reliable curve but the comet appears to be fading fairly rapidly. Observers are urged to follow the comet for as long as possible as it recedes from the Sun. Members contributing to the above data were:

F. Ackfield; G.E.D. Alcock; Dr. V. Barocas; J.C. Bennett; J.E. Bortle; D.M. Brierley; R.E. Cole; F. de Jong; P.B. Doherty; D. Frydman; M.J. Gainsford; M.V. Gavin; M.D. Hamilton; M. Hather; T. Haymes; M.J. Hendrie; I.D. Howarth; A. Jones; M.V. Jones; A.G. Le Moeur; S. Lyttle; S.C. McMillan; P. Madej; Dr. V. Matchett; S.W. Milbourn; P.A. Moore; T. Moseley; H.C. Nightingale; M.F. Pace; R.W. Panther; W.E. Pennell; I.M. Purcell; H.B. Ridley; D.A. Rothery; G.H. Rutter; D.A.R. Simmons; G.A. Thompson; Dr. R.L. Waterfield; J.D.Whelan; T.D.S. Whelan; N. Wood; P.J. Young.

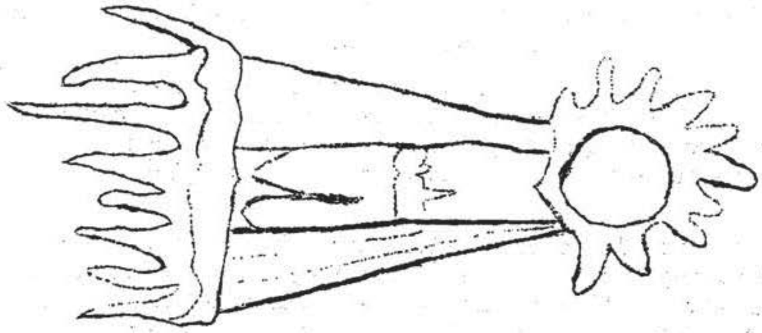
From the Director: In the summary of comets due in 1974, the comets P/Schwassmann-Wachmann 3, P/du Toit and P/Swift 2 are quoted as making their first OBSERVED return since discovery. I would like to point out that none of these comets has yet been recovered and it would perhaps be better to say that predictions are available for the 1974 return of these comets.

In the note on P/Encke, although the predicted magnitude is 4.1 at the beginning of May, the comet will be only 15° from the Sun at the time and location will be difficult in the twilight.

S.W. Milbourn

THE BRITISH ASTRONOMICAL ASSOCIATION

COMET SECTION



ISTIMIRANT STELLA

BULLETIN No. 4 JUNE 1974

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EDITORIAL

Inflation, unfortunately, appears wherever we go these days; it hangs like a black cloud above us all. Usually it means that smiles take second place to frowns, and so it will surprise you to learn that inflation has hit this Bulletin - and I am smiling even wider! I will now resolve this paradox. The Bulletin cannot now be produced within our yearly budget, and this is due entirely to its popularity. So many copies are now being distributed each issue that we cannot afford to print it, and send them out. To rectify this situation Stan and I feel sure that all those of you who have read and enjoyed previous issues, and who wish to continue to receive copies, will send four s.a.e's to Stan to eliminate postage from future issues. This, rather than just offsetting the postal costs, will allow us to increase the size of the Bulletin considerably. The s.a.e's should be sent to the Director at the above address as soon as is convenient.

A NEW THEORY ON THE ORIGIN OF COMETS

Dr. Rodney R. Hillier.

Hubert Reeves, an astrophysicist working at Gif-sur-Yvette near Paris, has made an interesting contribution(1) to the theory of the origin of comets. In essence, Reeves suggests that comets are formed in the outer regions of the solar system from material which has escaped from the sun in the form of solar wind.

The existence of the solar wind was first proposed in 1957 by Biermann to explain the behaviour of comet tails. Up to that time the tendency of the tails to point away from the sun was attributed to radiation pressure - that is, the force of sunlight on the particles composing the tails. Biermann suggested that a stream of gas moving out from the sun through the solar system could also produce the observed orientation of tails, which was the main flaw in the pressure theory. If the solar wind was presumed to be not uniform then the nightly variation of some comet tails could also be explained.

The solar wind was actually detected in 1959, by instruments on the space probe Lunik III. Later experiments, conducted during the Apollo lunar landing series, measured the chemical composition of the solar wind. As expected this proved very similar to that of the outer layers of the sun.

Reeves pointed out that the amount of material leaving the sun in that solar wind is approximately a million tons a second. Most of this is in the form of Hydrogen and helium, but approximately ten thousand tons consists of carbon, nitrogen and oxygen. These are the elements which, combined with hydrogen, are thought to make up the bulk of comets. The rate at which material returns to the vicinity of the sun in the form of comets is not really known, because the mass of a comet has never been measured, but most astronomers agree on a figure of about ten thousand tons a second, which is a figure averaged over many years. Thus the solar wind is capable of supplying the material for the comets.

The details of the processes by which the solar wind condenses to form a comet is not known, but this problem is also shared in the old and favoured model developed by Oort and Whipple. In this theory comets were formed out of the solar nebula, (the cloud of gas from which the planets were formed.)

Reeves argues that it should be possible to distinguish between the two theories by measuring the amount of deuterium present in the comets. Deuterium is chemically very similar to hydrogen - it is sometimes called 'heavy hydrogen'. For example it will combine with oxygen to form so called 'heavy water', or with carbon to form 'heavy methane'. The difference between hydrogen and deuterium lies in the arrangement of the particles in the atomic nuclei. Normal hydrogen has a single proton in the nucleus, whereas deuterium has a proton plus a neutron.

At temperatures above one thousand degrees Kelvin, which are high by terrestrial standards - but low compared with those of star interiors - the deuterium nucleus breaks up and the deuterium is converted to hydrogen. It is therefore not surprising that deuterium has neither been found at the solar surface, nor detected in the solar wind. However, deuterium is present on the earth and has recently been detected in the atmosphere of Jupiter. It has also been found in the interstellar gas which concludes that it was present in the solar nebula. Oort's theory therefore predicts the appearance of deuterium in comets, whereas Reeves' theory predicts that they should contain no deuterium.

We can look forward with considerable interest to any work which might tell us whether or not Reeves' interesting suggestion is correct.

(1) Reeves, H., Nature 248, 398, (1974)

REPORT OF THE TRANSOLAR TRAVEL LTD. FLIGHTS ON JAN 10/11 1974 TO OBSERVE COMET KOHOUTEK

P.B. Doherty
S.W. Milbourn

Flights were organised by Transolar Travel Ltd. in order to observe comet Kohoutek 1973f from high altitude, thus avoiding the hinderance due to clouds and haze. After consultation between Transolar's Manager, Mr. David Magee and the BAA Comet Section it was decided that the best viewing period would be from Jan 9th to Jan 13th. As a result, aircraft were flown from Gatwick on Jan 10th and from Manchester on Jan 11th. Great interest was shown in the venture, and it was necessary to fly two aircraft from Gatwick to accommodate the bookings.

In each case, pre-flight briefings were given by the authors, and these observers were available for advice on the flight (PD at Manchester and SM at Gatwick). Mr. Patrick Moore accompanied the second Gatwick flight in a similar capacity. Take-offs were scheduled for 1730 U.T. and occurred on time, the aircraft quickly ascending to operational heights between 31,000 - 35,000. The first leg of the flights were on a NW bearing to allow observers on the port side to make observations. The second leg, on a SW bearing allowed observers on the starboard side to commence work.

The experiences of both the Gatwick and Manchester flights were similar, all take-offs took place under a canopy of cloud, the aircraft breaking through this main mass at about 20,000 ft. Some haze and cirrus cloud remained above this altitude, but by the time the operational height had been reached, all obscuration had been left below. At this point the cabin lights were extinguished and the extraordinary beauty of the dying twilight was revealed. Venus and Jupiter were complimentary to the vividly coloured sky and observers on the port side were soon busy attempting to locate the comet. At first it was a difficult object, but as darkness fell the port side observers had their first really good looks at comet Kohoutek 1973b. Course was altered slightly to bring the comet to a more advantageous position, and soon all were engrossed in tracing out the slender tail which could be followed for some 7 or 8 degrees with the unaided eye from the magnitude 4 coma. With binoculars, up to 13 degrees of tail were recorded.

After half the flight time had elapsed the aircraft turned for the second leg of the observations to begin. Although its altitude was lower now, and both Venus and Jupiter were being entwined with horizon haze, nobody had difficulty in locating the comet. All agreed that the venture was well worth while, affording views which, because of the prevailing weather conditions, would have been impossible from the ground.

During the descent passengers were entranced with the view of the countryside, with its splendid patchwork of brilliantly lit cities - this in spite of the energy restrictions then enforced.

Flight touched-down between 1915 and 1930 U.T. to end a memorable occasion. Although much photography was attempted, the combined aircraft movements and the lack of suitable drives rendered this task too difficult. No successful photographs were known to have been taken.

Both Mr. Doherty and Mr. Milbourn on behalf of the Comet Section would like to record their thanks to Mr. Magee for his enterprise and enthusiasm which made the flights possible.

COMETS IN 1974

Following the article in the previous Bulletin the following comments have been grateful received from John Bortle:-

P/Honda - Mrkos - Pajdusakova - Brightens very rapidly at its approach to perehelion, this is not indicated in the BAA Handbook. In 1969 it was visible in 10x50mm binoculars, and this should be the case in 1974-5. Checking several sources, I have reduced the formula

$m = 13.68 + 21.92 \log r + 5 \log \Delta$ to be close to the truth.

(Copies of an ephemeris based on this formulae by John, and showing the comet's position, mag., altitude and the comet-sun separation angle for 40°N, for the dates November 30 - January 9 are available from my address - ED.)

P/Forbes - The formula

$m = 11.0 + 10 \log r + 5 \log \Delta$ fits reasonably well, and gives the following magnitudes for this current comet. July 15th -12.9, July 30th -13.0, Aug. 15th -13.1, Aug. 30th -13.3.

P/Finlay - The formula above seems to fit equally for P/Finlay, this is based on the strength of previous returns. The following magnitudes are deduced: July 15th -12.2, July 30th -12.4, Aug. 15th -12.8, Aug. 30th -13.2.

The latter two comets will require large telescopes to be seen.

COMET KOHOUTEK 1973f - continuation of the preliminary report in Bulletin No. 3

Date	Mag.	No. of Obs.	Tail °	No. of Obs
Jan 4	3.1	3	2.9	3
5	4.0	2	2.0	2
6	3.6	16	1.2	12
7	3.7	13	1.6	10
8	3.7	16	3.1	12
9	3.9	16	2.3	14
10	4.4	11	4.3	10
11	4.3	19	4.8	13
12	4.5	6	4.8	5
13	4.4	18	5.1	14
14	4.9	6	1.4	4
15	5.0	8	3.1	4
16	5.5	3	6.3	3
17	4.8	5	5.8	3

Date	Mag	No. of Obs.	Tail °	No. of Obs.
Feb. 1	7.4	2	0.1	1
2	7.8	6	-	-
3	7.8	6	0.25	1
4	7.7	6	-	-
5	6.8	1	-	-
6	7.5	2	0.5	1
7	8.9	7	0.5	1
8	9.0	1	-	-
9	8.0	9	0.4	3
10	8.3	2	0.5	2
11	9.3	2	-	-
12	9.0	4	1.5	1
13	9.0	1	-	-
16	8.4	4	1.25	1

Comet Kohoutek 1973f (Continued)

18	4.9	5	2.6	4	18	7.8	1	1.0	1
19	5.2	33	3.2	24	19	8.9	2	0.75	1
20	5.4	12	2.8	6	22	9.5	10	-	-
21	5.4	7	3.0	4	23	8.6	3	0.75*	1
22	5.8	7	3.0	4	24	8.9	2	0.5	1
23	5.9	15	0.9	5	Mar. 3	9.8	1	-	-
24	6.0	23	1.6	15	11	9.0	1	-	-
25	6.1	15	2.0	7	13	9.0	1	-	-
26	6.3	6	2.1	5	14	9.2	1	-	-
27	6.6	2	-	-	15	9.1	1	-	-
28	6.0	1	-	-	21	9.8	1	-	-
29	6.9	6	2.0	1	22	10.0	1	-	-
30	6.5	3	1.5	1					
31	7.3	3	0.5	1					

* anti-tail

Observers contributing to the above report were:

G.E.D. Alcock; M. Aloisio; P.M. Andrew; J. McBain; C. Batton; D.E. Beesley; Sir John Blagdon; J.E. Bortle; T. Brelstaff; D.M. Brierley; J.T. Bryan, Jnr; S.F. Burch; J.A. Burger; H.T. Burgers; S.D. Castle; M.L. Clark; P. Clayton; R.E. Cole; A.C. Curtis; P.B. Doherty; L. Ferguson; D.H. Frydman; M.J. Gainsford; M.V. Gavin; M.D. Hamilton; W. Hannaford; M. Hather; T. Haymes; S.R. Heathcote; C. Henshaw; I.D. Howarth; A.F. Jones; M.V. Jones; F. de Jong; D.R. Keeby; A. Kemp; A.G. Le Moeur; J. Lewis; G. Lindsay Jones; P. Lyon; P. Macdonald; P. Madej; V. Matchett; S.W. Milbourn; G. Montgomery; T. Molseley; T. Murtagh; J.W. Napper; H.C. Nightingale; M.F. Pace; R.W. Panther; A. Payne; R.D. Pickard; Dr. T.W. Rackham; C. Raeburn; J. Roberts; J.H. Rogers; D.A. Rothery; J.D. Shanklin; D. Shevelan; Dr. D.A.R. Simmons; K. Simmons; D.J. Stanier; P. Stevenson; K.M. Sturdy; S. Szczyrbak; G.E. Taylor; M.D. Taylor; G.D. Thompson; A. Thomas; P.J. Wheeler; D. Whitehouse; R.H. Whittons; T.H. Why; A.A. Verschraegen; P.J. Young.

It is intended to issue a special Bulletin later this year giving details of each individual observation.

COMET BRADFIELD 1974b

Bill Bradfield's second comet, 1974b has been widely observed since discovery in February and achieved a magnitude of 4 shortly after perihelion. Features of the comet have been the intense central condensation and a broad fan-shaped tail. A report will be issued in the next Section Bulletin - in the meantime, the comet is still visible although it had faded to magnitude 10 by the end of May. The following elements and ephemeris will enable observers with sufficient aperture to continue their observations:

T 1974 Mar. 18.3564 E.T.

ω 333°.1301   q 0.503194 AU
Ω 143.0372   1950.0
i 61.2899   e 0.999733

(Dr. B.G. Marsden - IAUC 2667)

Date 1974 ET 0h	R.A. (1950.0) h m	Dec. ° '	Δ	r	Mag.
Jun. 2	14 25.5	+78 36.1	1.490	1.613	10.9
12	14 35.4	72 58.1			
22	14 44.34	67 38.2	1.778	1.923	12.1
Jul. 2	14 53.54	62 34.5			
12	15 03.14	57 47.0	2.082	2.217	13.0
22	15 13.18	53 16.0			
Aug. 1	15 23.66	+49 02.5	2.411	2.498	13.9

MAGNITUDE ANOMALIES IN DIFFUSE OBJECTS

Following the advent of this project (Bulletin No. 3), the underlisted estimates have been received.

Object		R.A. (1950.0) h m	Dec. ° '	Mag.	Aper.	x	Observer	NELM
NGC 221	(M32)	00 40.0	+40 36	9.0	50mm	10	RB	6.0
				7.5	114	45	PJM	-
224	(M31)	00 40.0	+41 00	5.3	50	30	PJM	-
				4.5	30	8	JL	5
598	(M33)	01 31.1	+30 24	8.0	30	8	JL	-
				9.0	100	31	JL	-
1039	(M34)	02 38.8	+42 34	5.5	30	8	JL	-
1912	(M38)	05 25.3	+35 48	7.8	50	10	RB	5.8
				7.0	30	8	JL	5
1952	(M1)	05 31.5	+21 59	9.0	114	73	PJM	-
1960	(M36)	05 32.0	+34 07	5.8	50	10	RB	5.9
				6.0	30	8	JL	5
1976	(M42)	05 32.9	-05 25	4.5	50	10	RB	6.0
2099	(M37)	05 49.0	+32 33	7.0	50	10	RB	5.8
				6.5	30	8	JL	5
2168	(M35)	06 05.7	+24 20	8.8?	50	10	RB	5.4
				4.3	30	8	PJM	-
2287	(M41)	06 44.9	-20 42	5.5	50	10	RB	6.0
2323	(M50)	07 00.5	-08 16	7.5	30	8	JL	5
2392	-	07 26.2	+21 01	7.5	150	48	JL	5
2392	-			8.0	100	31	JL	5
2440	-	07 39.9	-18 05	9.7	114	45	PMJ	-
2682	(M67)	08 48.3	+12 00	7.0	30	8	JL	5
3031	(M81)	09 51.5	+69 18	7.0	30	8	JL	4.5
				7.5	150	48	JL	4.5
3034	(M82)	09 51.9	+69 56	8.0	30	8	JL	4.5
				8.5	150	48	JL	4.5
3242	-	10 22.3	-18 23	7.5	150	48	JL	5.6
3587	(M97)	11 12.0	+55 18	11.0	150	48	JL	5.0
3623	(M65)	11 16.3	+13 23	8.3	50	30	PJM	-
3627	(M66)	11 17.6	+13 17	7.6	50	30	PJM	-
4594	(M104)	12 37.3	-11 21	8.0	114	45	PJM	-
4736	(M94)	12 48.6	+41 23	7.0	150	48	JL	5.6
5024	(M53)	13 10.5	+18 26	7.5	150	48	-	5.6
5055	(M63)	13 13.5	+42 17	8.0	150	48	-	5.6
5194	(M51)	13 27.8	+47 27	10.5	150	48	-	5
5272	(M3)	13 39.9	+28 38	6.0	30	8	-	5.6
				6.0	100	31	-	5.6
				6.0	150	48	-	5.6
				6.5	150	96	-	5.6
6205	(M13)	16 39.9	+36 33	4.3	50	55	PJM	-
6341	(M92)	17 15.6	+43 12	5.7	50	30	PJM	-
6779	(M57)	18 51.7	+32 58	8.0	114	45	PJM	-
7092	(M39)	21 30.4	+48 13	6.0	50	15	PJM	-
7654	(M52)	23 22.0	+61 20	7.1	25	5	RB	5.4

OBSERVERS:- R. Billington; J. Lewis; P.J. Madej.

ABBR:- Aper - aperture. x - magnification. NELM - Naked-eye limiting magnitude.

ANNULAR ECLIPSE AND KOHOUTEK

A very interesting item concerning the annular eclipse of December 24th in Columbia has been communicated by Karl Simmonds, one of our American members. In his letter he describes the trip made by Patricia Rogers, Norman McLeod, Chuck Vaughn, Kathryn Mc-Junkin-Brown, Richard Sweetsir and himself.

The expedition went first to Bogota, where an interesting visit was made to the Planetarium, which was showing a Kohoutek programme. From there it was a trip to the mountains east of Bogota. The eclipse was observed from here for nine minutes and forty-eight seconds, during which time Kohoutek kept well hidden. It escaped the naked eye, 7 x 50mm glasses and a 4¼ inch RFT with circles.

Annular Eclipse and Kohoutek (Continued)

After the eclipse some of the members continued on to the Amazon river to a latitude 5° South. It seemed a hopeful location from which to find the elusive Kohoutek, but for the expedition it was not to be. On the day of perehelion it was not visible in the daylight sky, and on the 29th Richard Sweetsir saw nothing brighter than second magnitude down to the western horizon.

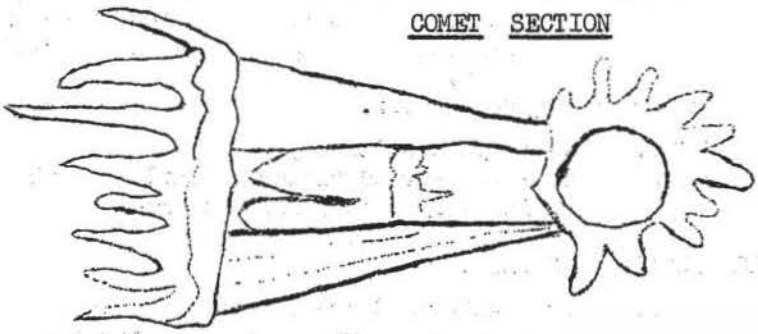
Our friends are to be congratulated on this fine effort, which I understand gave all the party their first glimpse of the Magellanic Clouds - it was not all in vain!

BULLETIN - on Bulletins

Those of you who unfortunately missed the previous issues can still get copies of Issues 2 and 3 by sending an s.a.e. to the Editor. Copies of number 1 are not available, but should there be a demand I could get copies done.

THE BRITISH ASTRONOMICAL ASSOCIATION

COMET SECTION



ISTIMIRANT STELLA

BULLETIN No. 5

JANUARY 1975

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EDITORIAL

With the way that things are in the world at the moment it is very difficult to wish anyone all the best during 1975, and actually believe that it could mean anything! However, astronomically speaking this year presents, as much as any other, the chance of new discoveries and the consolidation of existing theories in the light of fresh evidence - or indeed the proof of the erroneous nature of some of our current beliefs. With this in mind I wish you well for the New Year, may it bring new and exciting things for us all.

MAGNITUDE ESTIMATES OF DIFFUSE OBJECTS

Some interesting correspondence, particularly from G.J. Hodgkinson, has arrived on the subject of magnitude estimates in diffuse objects. This theme has of course been running in the previous issues of I.S., but obviously people have much to say on the subject.

Mr. Hodgkinson notes that there is a chapter in the book 'The Nature of Comets' by N.B. Richter (Methuen & Co. 1963) on the subject of changes in the brightness of comets, which refers to this problem of magnitude estimation. There are two useful references quoted:-

Investigations of the brightness of comets, part 1 by N.T. Bobrovnikoff, Contributions of the Perkins Obs. no. 15, 1941.

Investigations of the brightness of comets, part II by N.T. Bobrovnikoff, Contributions of the Perkins Obs. no. 16, 1942.

This research has led Mr. Hodgkinson to draw up the following table which gives us a clear insight into the variety of factors which come into play when we are dealing with estimates of such tenous objects. The ratio in which these factors act is at variance with each observer, but the clear definition of some general rules might be to our advantage.

The table follows:-

FACTORS INVOLVED IN MAGNITUDE ESTIMATES OF DIFFUSE OBJECTS

A. THOSE IN COMMON WITH VARIABLE STAR WORK (q.v.)

Comparison Stars: nearness-- affecting speed and accuracy,
brightness--the brighter the comet the further one will probably have to look for comparison stars. If fainter than mag. 9 they may be difficult to find.
number, altitude, colour.

Physiological: differences in eye sensitivity
whether direct or averted vision is employed, the latter being very susceptible to error.

B. THOSE ARISING FROM INSTRUMENTS USED.

Aperture: the observed magnitude decreases with increase in aperture. Bobrovnikoff: a correction to observed magnitude of a comet (to correct to a standard aperture) increases numerically with the difference in the size of the instrument by 0.17mag per inch of aperture (and can amount to 3mag or so). Sharp breaks in the magnitude curve arise from change of instrument.

Limiting Magnitude: for comets is about 2mag higher than for stars and this may give rise to error near the threshold of the instrument.

Magnification: Increase of magnification dilutes the extended image more than point images. Hence lowest possible magnification used.
angular size of comet--q.v.

C. THOSE ARISING FROM METEOROLOGICAL & OTHER CONDITIONS

Background luminosity: a bright background will dim a comet more than a star (also reduce apparent size) by an amount that may depend on physical properties of the comet--whether condensed or diffuse, size etc. Bobrovnikoff and previous investigators found strong correlation of the Moon and departures from computed curves (or fluctuations) in some comets.

Atmospheric Extinction: corrections are based on observations of stars--no guarantee that the same formulae are applicable to comets. Bobrovnikoff found nothing on this problem but the observations of nebulae by Wirtz (1923) revealed an appreciable difference between the extinction of light shown by stars and the nebulae. Bobrovnikoff quotes cases where observers who allowed for extinction obtained much greater brightness than the ones who made no allowance.

Local Condition: Industrial smoke, haze etc.
Altitude-- at higher altitude comets appear much brighter.

D. THOSE ARISING FROM PHYSICAL STATE OF COMET

Angular size: depends on instrument used; heavy relation with derived magnitude.

Shape:
Brightness
Condensation
Phase Angle

Variations may cause obscure errors.

COMETS IN 1973

Of those comets from previous years still visible in 1973 observations of Comet Kojima, 1972j were reported in Bulletin No. 2 (August 1973). Other comets for which observations were received were:

Date	U.T.	Mag.	Coma diam. '	Tail Lgth. '	Tail p.a. °	Description	Observers
P/Kearns-Kwee 1971c							
1972							
Dec	2.96	14.5	0.3	1	270	Coma heavily cond.	RWL:NW
1973							
Jan	9.01	13.9	-	-	-	-	GHR:RLW
Sandage 1972h							
1973							
Apr	7.03	13.7	0.25	-	-	Strongly cond.	MJH:RLW
Jun	30.01	13.5	0.5	-	-	Inner coma moderate cond. Faint shallow outer coma	RHS
Jul	1.00	13.5	As Jun. 30				NW
Sept	20.4	13.2	1	Nil		Rather dense circ. coma. No cond.	JEB
Sept	26.95	14.0	0.25(cent) 0.67(outer)	Nil		Cond. inner coma Outer coma faint	RLW:RHS

Observers: Dr. R.L. Waterfield, M.J. Hendrie, G.H. Rutter, R.H. South, N. Wood (Woolston, 15cm lens f/4.5 Photo)
J.E. Bortle (Stormville, New York; 32cm f/5.6 spec.x88; x146)

During 1973 fifteen comets received designations, eight of them being new comets. Also observed were the comets P/Encke (which did not receive a designation as it was observed at aphelion in 1972) and P/Schwassmann-Wachmann (1) which experienced an outburst in July.

Heck-Sause 1973a was discovered on 1973 Jan. 11.1 by Andre Heck and Gerard Sause with the 60cm f/3.5 Provence-Liege Schmidt telescope. The comet was diffuse with central condensation, magnitude 12, and had a short tail. Although past perihelion the comet maintained its magnitude well and a few observations were obtained by the Section:

Date	U.T.	Mag.	Coma diam. '	Tail Lgth '	Tail p.a. °	Description	Inst.	Observers
1973								
Feb	10.01	11.9	0.5	2	200	Highly cond. coma. Broad fan tail.	15cm f/4.5	RLW:NW
Feb	21.91	12.4	0.3	5	150 to 210	Highly cond. coma. Broad fan tail.	15cm f/4.5	RLW:IMP
Feb.	24.96	12.1	1	-	-	Well cond. coma	25cm x40	SWM
Feb	26.86	12	1½x0.7	-	-	Mod. Cond. coma elong in p.a. 170	15cm x48 x72 x192	KS

A photograph by W.E. Pennell on January 27 shows a broad fan-shaped tail, 5' long in p.a. 205°.

Observers: Dr. R.L. Waterfield, I.M. Purcell, N. Wood (Photo),
S.W. Milbourn, K. Sturdy (Vis.)

Dr. B.G. Marsden calculated a parabolic orbit based on 133 observations Jan 4 to Apr 5 (a pre-discovery image was found on a sky-patrol plate by M. Koishikawa, Sendai Municipal Astronomical Observatory):

T	1972 Oct 5.4152 ET	ω	346°.2172	
		Ω	175.1760	1950.0
q	2.510799 AU	i	138.6334	

P/Tuttle-Giacobini-Kresak 1973b was recovered by Dr. E. Roemer and J.Q. Latta on 1973 Jan 8.37 using the Steward Observatory's 229cm reflector on Kitt Peak. The images were weak and of mag. 21 approx. The apparition was notable for the major outbursts which occurred in late May and early July. Observations of these outbursts were given in Bulletin No. 2 (August 1973). To illustrate the behaviour of the comet during this return, the following magnitude estimates have been culled from the IAU Circulars and from observations received by the Section:

Date 1973		Mag.	Observer	Type
May	20.9	14	F. Seiler	Ph
May	23.1	Not seen fainter than 12	J.E. Bortle	Vis
	27.9	4	F. Seiler	Ph
	31.9	6	F. Seiler	Ph
Jun	3.1	10.2	J.E. Bortle	Vis
	13.9	12.6	M. Antal	Ph
	23.9	13.2	M. Antal	Ph
	26.9	13.5	M. Antal	Ph
Jul	6.9	4.8	M. Antal	Ph
	6.9	5.6	M. Antal	Vis
	7.9	6.1	M. Antal	Ph
	7.9	6.7	M. Antal	Vis
	8.0	4.5	R.L. Waterfield	Ph
	9.9	9.3	M. Antal	Vis
	9.9	8.5	M. Antal	Ph

Date 1973		Mag.	Observer	Type
July	10.0	9.5	R.L. Waterfield	Ph
	10.3	8.9	A. Jones	Vis
	10.9	9.4	M. Antal	Vis
	10.9	8.8	M. Antal	Ph
	11.3	8.9	A. Jones	Vis
	18.4	10.5	D. Seargent	Vis
	19.3	10.6	A. Jones	Vis
	20.4	10.5	D. Seargent	Vis
	21.4	10.5	D. Seargent	Vis
	24.1	11.1	J.E. Bortle	Vis
	25.1	11.3	J.E. Bortle	Vis
	30.1	11.5	J.E. Bortle	Vis
	31.1	15	D. Latham	Ph

Although one of the smallest members of the short-period comets, these outbursts represented an increase in intrinsic brightness of 10,000 times, by far the greatest ever recorded for any comet.

P/Wild 1973c Originally discovered by P. Wild, Berne in 1962, this comet was recovered by Dr. E. Roemer and J.Q. Latta on 1973 Jan 8.3 using the Steward Observatory's 229cm reflector on Kitt Peak. The comet was recorded as a small spot, only slightly cometary in appearance. As this was the first return after discovery, the prediction by B.G. Marsden was uncertain to about one week with regard to T but the recovery position indicated a correction by T of only +0d.75. The comet remained very faint and no observations were obtained by the Section.

P/Swift-Gehrels 1973d On 1973 Feb. 8.3 and Feb. 9.3, Dr. T. Gehrels found a 19th magnitude comet on plates exposed with the 122cm Schmidt telescope at Palomar. Parabolic motion did not fit the observations and it was first assumed that the comet was a new short-period object. As observations accrued, it became clear that the comet was identical with P/Swift 1889 VI which had passed through nine revolutions before being re-detected. The following elements by Dr. B.G. Marsden show that the comet was more than 5 months past perihelion when located:

T	1973 Aug 31.089	Epoch	1973 Feb 7.0
ω	$84^{\circ}.400$	e	0.69222
Ω	314.035 1950.0	a	4.39869
i	9.251	n°	0.106836
q	1.35385 AU	P	9.23 yrs

Conditions at the next return in 1981 approximate to those in 1889 when the comet was seen at 11th magnitude.

Kohoutek 1973e Not to be confused with 1973f, this comet was discovered by Dr. L. Kohoutek, Hamburg Observatory, Bergedorf, on 1973 Feb. 28.0. The comet was diffuse with condensation, mag. 14. Using 27 observations, Feb 28 to Sept 22, Dr. B.G. Marsden calculated the following elements. The mean residual was 1".55 and perturbations by all planets were included:

T	1973 Jun. 7.1817 E.T.	ω	74°.8585	
e	0.998739	Ω	164.1184	1950.0
q	1.382022 AU	i	121.6045	

The comet was bright enough for photographic observations to be obtained at Woolston Observatory:

1973	Mag.	Coma diam '	Tail		Observer
Mar. 5.90	14.0	3	Nil	Highly cond. inner coma within faint and diffuse outer coma.	RLW
8.95	14.0	-	-	-	RLW:IMP
22.85	14	-	-	Inner coma 15" diam.	RLW:NW
Apr 6.90	14.0	2.5	Nil	Cond. inner coma 20" diam. Outer coma very faint and diffuse.	MJH:RLW

Instrument: 15cm f/4.5 Observers: Dr. R.L. Waterfield, G.H. Rutter, I.M. Purcell, M.J. Hendrie, N. Wood

Kohoutek 1973f Discovered by Dr. L. Kohoutek on plates exposed at the Hamburg Observatory, Bergedorf on 1973 Mar. 7.87 and Mar. 9.86, the comet was a centrally condensed object of magnitude 16. Preliminary elements showed that the comet would have a small perihelion distance at the end of the year and would likely become a bright naked-eye object. It is unfortunate that a magnitude formula derived to approximate the behaviour of the comet as photographed with large reflectors during the early faint stages was extrapolated forward to yield an incredible -10 at perihelion and even more unfortunate that the press and general public seized upon this as an absolute fact, thus causing the furore that we all remember. Magnitude predictions based on more usual formulae gave a maximum of arou -3 and it appears from Skylab observations that -2 was in fact achieved for a few hours around perihelion. Even so, the comet faded much more rapidly than its pre-perihelion behaviour would have suggested and the magnitude was down to +3 or below by the time it was observable in the evening sky of January 1974. Notwithstanding this, almost 600 observations were received by the Section, more than the brighter Bennett in 1970 - a result of the brighter stages being visible in the evening sky. In order to report these observations within the space available it is necessary to condense the descriptive text and the following abbreviations have been employed:

a.v	averted vision	m.	moderate
b.	broad	n.	narrow
br.	bright	nuc	nucleus
c	coma	ph	photo
con	condensed	sl	slight
cond	condensation	sm	small
ctl	central	st	straight
d	diffuse	str	strong
def	defined	sus	suspected
f	faint	t	tail
el	elongated	v	very
l	large	w	weak

<u>1973f</u>

Date	U.T.	Mag.	Coma diam.	Tail lgth	p.a.	Description	Aper.	x	Obs.
1973			'	o	o		mm		
Sept	30.4	10.2	2	Nil		v. diffuse. No ctl cond.	200	80	KS
Oct	1.4	10.0	1½-2	Nil		sm. d. c. No ctl cond or nuc	200	56	JEB
	6.4	9.9	1	Nil		Circular c. Sl. con.	200	56	JEB
	10.8	8.8	0.4	Nil		-	50	16	FdJ
	16.2	10+	1	Nil		w. cond. No nuc.	150	60	PMA
	21.2	8.5	5	Tr	285	w. cond. sus. nuc	100	25	GEDA
	21.2	10	1	Nil		sl. ctl. cond. sus. nuc	300	80	PJY
	24.2	9.0	2-3	Nil		d. no cond.	300	96	IDH
	24.4	8.6	2.5	Tr	280	sus. sm. cond.	80	15	JEB
	25.2	8.3	4	-		d. mod. cond.	160	50	AGL
	25.2	7.8	1.5	0.02	285	Inner c 35" diam.	150	Ph	RGL:NW
	25.4	8.5	2.2	0.07	280	El.mod.con.c. No ctl.cond.	80	15	JEB
						13th mag. nuc.	320	88	JEB
	25.7	9.0	-	-		d.c. sl. cond.	317	86	AJ
	25.8	8.0	1	Nil		-	127	16	MC
	26.2	8.5	4	Nil		d. sl. cond.	160	50	AGL
	26.8	7.5	0.3	-		-	50	16	FdJ
	27.2	7.7	1.5	0.05	285	Inner c. 35" diam.	150	Ph	GHR:RLW
	27.2	8	6	-		-	200	30	GET
	27.4	8.3	2.8	0.12	280	No def. ctl. cond.	80	15	JEB
	27.6	9.5	-	-	-	mod. ctl. cond.	250	-	TW:JW
	27.7	9.0	-	-		d.c. mod. cond.	317	86	AL
	29.8	7.9	1.5	Tr	-	-	127	16	MC
	30.2	8.8	2	-		d.	120	20	DMB
	30.2	7.4	8	-	-	nuc. with a.v.	50	7	SL
Nov	2.8	7.1	1	-		-	50	16	FdJ
	4.4	8.4	5	Nil		sl. con.	100	14	KS
	5.8	7.0	0.9	-		-	50	16	FdJ.
	6.2	7.5	1.5	0.25	285	Inner c. 35" diam.	150	Ph	RLW:IMP
	6.2	7.2	3.5	-		v. con. f. nuc. sus.	254	48	PBD
	6.2	8.3	-	-		-	50	7	PC
	6.2	8.4	4	0.12	270	mod. con. ctl. cond. 0'.5diam	300	96	IDH
	6.2	8.2	6	0.1	290	sm. str. ctl. cond.	100	25	GEDA
	6.4	7.6	4	0.25	295	El.c. cond.offset to sunward	80	15	JEB
	7.2	-	-	0.12	270	No. nuc.	105	-	RC
	7.7	8	-	-		-	105	40	GT
	8.4	7.6	3.6	0.2	280	El. c. with v.d. edges	50	10	JEB
	8.7	8.6	-	Tr	290	d.c. str. cond.	317	86	AJ
	8.8	6.8	1+	-		-	50	7	FdJ
	9.3	6.4	10	0.5	-	ctl. cond.	50	10	MH
	9.8	6.9	2	0.1	-	-	127	16	MC
	11.2	7.3	-	-		str. ctl. cond.	30	8	TB
	11.2	7.8	2	0.17	285	El. c. str. ctl. cond.	300	80	PJY
	12.2	8	6	-		c. evenly d.	160	50	AGL
	13.2	8.3	-	-		-	50	7	PC
	14.2	7.8	8	-		mod. con. to sunward side	80	11	RWP
	14.3	6.9	10	-		-	50	7	SL
	15.2	7.8	6	-		mod. con. offset	80	11	RWP
	15.8	6.7	3	0.12	-	-	65	20	MC
	15.8	6.5	1+	-		-	50	16	FdJ
	16.2	7.4	-	-		-	50	7	PC
	17.1	7.0	-	-		c. el. in p.a. 280°	120	21	JCB
	17.1	5.5	-	-		v.d. with f. cond.	63	50	JMcB
	17.2	8.1	2	-		str.ctl.cond. el. in p.a.280°	300	80	SFB
	17.2	8.0	2.5	0.15		f. nuc. mag. 10. v.f.t.	300	200	JHR
	17.2	7.2	8	-		-	70	12	AAV
	17.2	7.8	2.5	0.17	285	str.ctl.cond. sus.nuc.	300	80	PJY
	17.2	6.7	0.9	0.03	280	No cond. or nuc.	60	30	MVG
	17.2	7	-	Tr		d. some ctl. cond.	127	72	PAM
	17.8	5.6	-	-		-	50	16	FdJ
	18.1	6	0.25	-		d. no t. or nuc. seen	50	7	HTB
	18.2	7.5	8	0.17	270	nuc. sus.	160	50	AGL
	18.4	6.8	1.3	0.17	287	Intense nuc. 5" diam.	50	10	JEB
	18.7	7.5	-	-		-	50	7	SMcM
	19.6	7.7	-	0.13	235	d.c. str.con. nuc.sus	78	-	AJ
	19.7	6.8	-	-		-	105	40	GDT

1973f

Date 1973	U.T.	Mag.	Coma diam '	Tail Lgth °	Tail p.a. °	Description	Aper mm	x	Obs.
Nov	20.2	8.4	2.5	0.17	290	str.ctl.cond. No. nuc.	300	200	SFB
	20.2	8.3	-	0.13	285	c.el. towards t.	300	80	AMS
	20.2	-	2	0.27	-	-	300	200	RWF
	20.2	8.0	2.5	0.17	285	str.ctl.cond. c.el. 285°	300	80	PJY
	20.2	6.2	6	0.1	-	c. teardrop shaped	254	48	PBD
	20.2	7.5	8	0.17	275	mod.con. no nuc.	160	50	AGL
	20.2	8.0	-	-		d.	250	60	BM
	20.2	7.2	-	-		-	50	7	PC
	20.2	7.6	2	-		str.ctl.cond.	30	8	TB
	20.2	7.5	7	-		-	80	11	DMB
	20.3	7.7	4	-		-	153	46	TH
	20.4	6.7	2	0.25	290	well cond. Ed es d.	50	10	JEB
	21.2	8	8	0.17	275	mod. cond. No nuc.	160	50	AGL
	21.8	6.2	3	0.17	-		65	20	MC
	22.2	7.2	8	0.2	275	mod.cond. nuc.sus.	160	50	AGL
	22.6	7.6	-	0.5	290	d.c. str. cond.	78	-	AJ
	22.6	6.8	-	Tr	-	Well defined	250	-	TW:JW
	23.1	6.3	-	0.5	280	-	120	21	JCB
	23.7	8.1	-	-		-	50	7	VM
	23.8	6.2	3.5	0.3	-	-	65	20	MC
	24.1	-	-	0.45	-	Well con. nuc.	75	28	JMcB
	24.2	6.4	-	0.03	320	str.ctl.cond. c.el	60	15	TB
	24.6	6.4	-	0.5	-	Fan-shaped t.	250	-	JW
	24.7	8.5	6	-		Nuc. mag. 12	200	40	MVJ
	24.8	6.1	3.5	0.25	-	-	65	20	MC
	25.4	7.7	-	-		-	80	10	DPG
	25.4	5.7	3.5	0.5	280	str.ctl.cond. El.c. Fan.t.	50	7	KS
	26.2	6.8	3.5	0.25	280	c.el.towards tail. str.con.	300	80	SFB
	26.2	6.8	2	0.3	280	c.el.towards tail.	80	10	AMS
	26.2	6.7	2	0.3	-	c.el.towards tail.	300	80	RFW
	26.2	-	1	0.05	280	-	50	7	JAB
	26.2	6.5	8	0.25	280	str.cond. t.fan with spikes	160	50	AGL
	26.2	6.7	5	0.17	285	mod.cond. c.el. in p.a.285°	50	7	IDH
	26.2	6.8	4	0.3	280	str.ctl.cond. c.el(P.a.280°)	80	10	PJY
	26.2	6.7	-	-		-	50	7	PC
	26.2	5.0	0.25	0.02	-	-	60	48	MH
	26.2	-	4	0.3	-	c.el.	105	-	DARS
	26.2	6.5	4	0.07	280	Fan.t. 5' wide. Ctl.cond. 1'	153	46	TH
	26.2	6.5	5	0.4	280	Pear-shaped c. Mod.cond.	80	11	RWP
	26.2	6.0	15	0.67	-	Nuc. Sus.cond. in t.	50	10	PBD
	26.2	6.3	-	?	-	Short t.	60	120	PS
	26.6	6.2	-	?	-	t. seems bifurcate	250	-	TW
	26.8	5.9	4	0.5	-	-	65	20	MC
	26.8	5.2	7	-		-	50	16	FdJ
	27.2	5.6	13	0.67	-	ctl.cond. c. teardrop-shaped	50	10	PBD
	27.2	7.0	3	0.3	280	c.el in 280° t.slight fan.	80	10	PJY
	27.2	5.6	5	0.67	280	c.el in 280° t.fan	80	10	SWM
	27.2	5.5	-	-		-	50	7	MJG
	27.2	4.3	-	0.3	-	t.br on north side	40	8	DS
	27.2	6.4	-	-		-	80	20	MDH
	27.2	6.3	5	0.3	280	c.el. mod.cond. st.t	80	11	RWP
	27.3	5.8	-	-		-	77	84	TH
	27.3	8.2	-	sus	280	f.ctl.cond.	320	50	CRA
	27.3	6.0	-	?	-	Short t.	60	120	PS
	27.3	5.8	-	-		c.el	50	10	MFP
	27.3	7	-	-		f. (London conditions	68	10	DF
	27.3	6.0	8	-		No cond.	50	7	DAR
	27.6	6.9	-	Tr	270	d.c. str.cond.	80	11	AJ
	28.2	6.7	1.1	0.03	-	-	80	10	DPG
	28.2	5.5	-	sus	-	-	80	10	JHR
	28.3	5.6	-	-	-	-	50	10	MFP
	28.8	5.7	4.5	0.6	-	-	127	16	MC
	29.3	6.3	-	-		-	50	7	SL
	29.3	5.0	2	-		c.con.	50	10	RB
	29.8	5.7	4.5	0.75	—	-	65	20	MC
	29.8	5.0	6	0.4	280	str.cond.	50	16	FdJ

1973f

Date 1973	U.T.	Mag.	Coma diam. '	Tail Lgth °	Tail p.a. °	Description	Aper mm	x	Obs.
Nov	30.2	5.9	6	-		Diffuse	50	7	DAR
	30.3	3.8	-	0.9	-	v.dense. No nuc.	75	36	PJM
	30.3	5.9	-	-		-	50	7	PC
	30.4	6.0	3.6	0.8	280	-	50	10	JEB
	30.4	-	2.6	1.0	280	str.con.c. Nuc.cond. 6"	320	88	JEB
	30.8	5.5	5	1.0	-	-	65	20	MC
	30.8	4.9	6	0.9	-	Seen with naked-eye	50	16	FdJ
Dec	1.3	6.4	-	-		-	50	7	PC
	1.3	7	-	0.25	-	-	250	?	FA
	1.3	5.6	-	?		Short tail	60	120	PS
	1.3	5.0	-	0.3	275	-	280	Ph	WEP
	1.3	5.2	15x9	-		Teardrop-shaped. Sus.t.	254	48	PBD
	1.3	7.1	-	0.17	-	con.c.	300	80	RDB
	1.4	5.5	4	0.7	270	c.el. in p.a. 270 t.st.	50	7	KS
	1.8	4.9	6	1.0	-	-	50	16	FdJ
	2.2	6.3	4	0.25	-	c.el.in p.a. 280. str.con.	80	10	PJY
	2.2	4.5	4	0.5	280	c.pear-shaped, str.cond.	60	13	MJH
	2.3	6.3	6x5	0.17	290	c.pear-shaped, mod.cond.	80	11	RWP
	2.3	-	5	-	-	No features-poor conditions	320	60	DAR
	2.3	6.4	1.5	0.1	270	ctl.con. diam 0'.5	80	10	DPG
	2.3	6.0	-	0.3	280	c.v.el. Str.ctl.cond.	320	80	SFB
	2.4	5.3	3.6	0.62	285	str.cond. Nuc.cond 5"	50	10	JEB
	2.8	5.2	5	1.0	-	-	65	20	MC
	2.8	4.8	5	1.0	-	-	50	16	FdJ
	3.4	5.4	-	0.9	280	-	50	7	KS
	3.4	5.5	3.2	0.9	280	c.edges d. t.st. ctl.cond.	50	10	JEB
	4.6	5.5	-	1.0	-	-	250	?	TW:JW
	4.8	4.9	5	2.0	-	-	130	16	MC
	4.8	4.6	2.5	1.5	-	-	50	16	FdJ
	5.1	5.2	-	1.0+	-	br.ctl.cond.	120	21	JCB
	5.8	4.5	-	0.5	-	Hazy sky	50	16	FdJ
	6.8	4.7	4.5	1.5	-	-	65	20	MC
	6.8	4.4	1.5	2.25	-	Nuc.visible in 115mm x45	50	16	FdJ
	7.1	4.9	-	1.5	279	t.narrower	120	21	JCB
	7.8	4.3	-	-		-	50	16	FdJ
	8.1	4.9	-	-		t.seems fainter than Dec 7	120	21	JCB
	8.1	5	-	-		Just vis. to naked-eye	50	7	JMcB
	8.6	6.0	-	0.18	285	d.c. str.cond.	80	11	AJ
	8.7	4.6	-	1.0	290	sm.head compared to t.	30	8	GDT
	8.8	4.2	1.25	2.5	-	-	50	16	FdJ
	9.2	4.8	-	0.5	-	-	50	7	HCN
	9.3	-	3	-	-	sm.str.ctl.cond. Sus.nuc.	300	80	PJY
	9.3	-	1	0.1	-	Br.nuc.	300	80	JHR
	9.8	4.5	4.5	1.0+	-	-	65	20	MC
	12.8	4.5	4	1.0+	-	-	65	20	MC
	13.5	4.4	1.2	0.4	270	Intense ctl.cond. sus.nuc.	50	10	JEB
	13.8	4.4	4	1.0	-	-	65	20	MC
	15.8	4.3	-	-	-	-	120	21	JCB
	15.8	4.0	4	0.5	-	-	65	20	MC
	19.8	3.5	3	-	-	-	65	20	MC
	20.8	3.3	3	-	-	-	65	20	MC
	22.1	2.5	-	-	-	Comet resembled 1965 VIII	120	21	JCB
	22.8	2.8	3	-	-	-	65	20	MC

This list completes the pre-perihelion observations received. Post-perihelion observations will be given in the next Bulletin. The aperture and magnification quoted is that used for the magnitude estimates. The description is culled from observations with all instruments. Lists of observers names were given in Bulletins 3 and 4.

1973f

Dr. B.G. Marsden, using 597 observations 1973 Jan 28 to 1974 March 16, calculated orbital elements taking into account perturbations by all nine planets and yielding a mean residual of 1".45. The "original" and "future" values of 1/a are +0.000020 and +0.000533 AU^{-1} respectively:

Epoch	1973 Dec. 24.0 E.T.	
T	1973 Dec. 28.43067 ± 0.00002 (m.e.) E.T.	
ω	37°.82380 ± 0°.00011	
Ω	257.76560 ± 0.00012	1950.0
i	14.30505 ± 0.00003	
q	0.1424249 ± 0.0000002 AU	
e	1.0000078 ± 0.0000005	
1/a	-0.0000548 ± 0.0000032 AU^{-1}	

COMET BENNETT 1974h

Although Comet Bennett, 1974h was expected to be a relatively easy object during the latter part of December 1974 and in January 1975, it has not been positively identified since November 25. Magnitude 9 at discovery, it brightened a little during the next day or two but a rapid decline set in and the comet became large and very diffuse with low surface luminosity. Attempts were made at many observatories to photograph the comet during the latter part of November and since but no trace of the object has been recorded.

It is obvious that the comet was undergoing an outburst at the time of discovery and but for this would have remained undetected. Whether the comet has disintegrated or become so diffuse to be below the limiting magnitude of the instruments used is a matter for conjecture.

COMET NOTES FROM OTHER JOURNALS G.J. HODGKINSON

A new theory has been proposed to explain cometary outbursts. Previous theories have invoked an explosive release of gases or chemical reactions, now H. Patashnick, G. Rupprecht and D. Schuerman (Nature 250,313-314 July 26, 1974) suggest that small pockets of a dense form of ice transform into ordinary ice as the comet approaches the sun, expanding and releasing energy as it does so, triggering the surrounding material into an outburst of activity. The difficulty of detecting Methane, CH_4, in comets may be avoided by identifying its decomposition products resulting from the action of solar Ly-α radiation on the molecule. (J.H. Black, ibid, 248,319 22 March 1974).

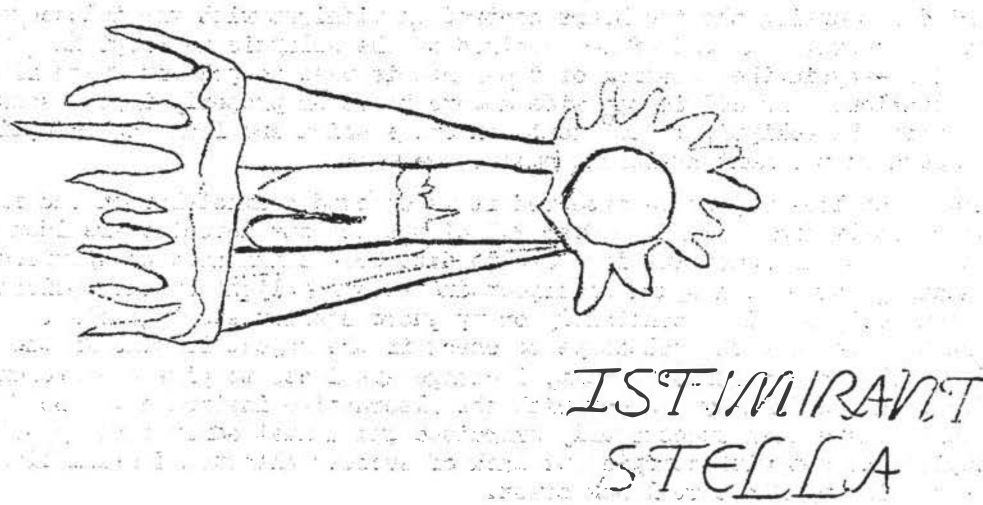
The majority of articles that have appeared this year refer to Kohouteck 1973f, its behaviour has been the subject of many papers (e.g. D.A. Mendis, W.H. IP; ibid, 249,536-537 7 June 1974). A sunward spike had been observed on December 29, 1973 and waving motions in the gaseous part of the tail occurred on January 16, 1974. (New Scientist, 7 February 1974, p.319). Optical emissions due to C_2, C_3, CN, NH_2, CO and Na and radio emissions due to HCN, CH and OH were recorded. B.L. Ulich and B.K. Conklin (Nature 248,121-122, 8 March 1974) detected radio emissions due to Methyl Cyanide, CH_3 CN, from the central regions late in 1973. This complex molecule had previously been detected in the interstellar clouds in the direction of the galactic centre, a fact that adds more weight to the interstellar origin of comets. Infrared observations were reported by M. Zeilik (Nature 248,120 8 March 1974). Rocket-borne Ultra-violet observations were reported by C.B. Opal et al (Science 185,702-704 23 August 1974 and P.D. Feldman et al (ibid p.704-707). Observations of the 8th and 5th January, respectively, revealed the presence of an extensive Hydrogen halo-- some 10^7 km from the comet. Similar haloes were discovered around Comet Tago-Sato-Kosaka in 1970 and later that year around Comet Bennett.

G.R. Hopkinson et al reported the presence of a dark streak running away from the head for 2.5° on exposures made on January 9 to 12, which they ascribe to the shadow of the head of the comet falling on to the tail (Nature 249,233-4 17 May 1974; also noted in New Scientist 23 May 1974, p.456). A diameter of 25,000 miles for the opaque zone is implied and mass estimates falls within the range expected for dusty comets. However, G.H. Rieke and T.A. Lee find from extensive photoelectric and infrared photometry that the nucleus is only 10.15km in diameter and that the comet contains relatively little dust.

Finally, review articles have appeared in 'Scientific American': The Nature of Cometa by F.L. Whipple, 230(2), 48-57, February 1974; and in 'Naturewissenschaften': Physical Properties of the Comets, by J. Rahe, 61(2) 45-50, 1974.

THE BRITISH ASTRONOMICAL ASSOCIATION

COMET SECTION



BULLETIN No. 6 JUNE, 1975

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EDITORIAL

When I.S. was first produced, it was hoped that it would provide a lively forum for what thew orld considered to be a silent and lonely breed. As Editor, I am in a position to report that so far the myth of the silent, sentinel, comet-sweeper has held rock-hard.

Stan and myself are finding it a struggle to raise enough material for quarterly issue, other than run of the mill observational reports. In an attempt to curb this, Stan has written a piece on how he comet hunts, called "My Way". We hope that others will come forward with "their way" in future issues, if not we may see U/S, instead of I.S.

COMET SWEEPING - MY WAY by S.W. Milbourn

Observers in general have their own pet methods when comet-sweeping and it may be of interest to put on record "my way" in the hope that members of the Section might communicate "their way" for future Bulletins.

Firstly equipment. My sweeping is carried out with a 20x120mm refractor and a 25.4cm reflector, both of short focus. Field sizes are $2^{\circ}.4$ in the case of the refractor and $1^{\circ}.5$ for the reflector. Ancillary equipment consists of Norton's Star Atlas for use at the telescope together with Atlas Coeli and the SAO star atlas for further reference.

As I am situated about half way between two towns and within 2 miles of Gatwick Airport, I have to contend with a fair level of reflected light in the sky so only really transparent moonfree nights are utilised and sweeping is not carried out below 30° altitude.

As soon as twilight has faded, the 20x120mm refractor (which is alt-azimuth mounted) is used to sweep very slowly between azimuths 240° and 300° and at an altitude of around 40°. I work slowly back and forth at a constant altitude allowing the rotation of the Earth to bring fresh fields into view. A similar operation is carried out on the occasions I sweep before dawn using azimuths 60° to 120°.

The 25.4cm reflector which is equatorially mounted is used in a different way in an effort to de ect faint periodic comets near opposition. Sweeping is carried out during he two hours centred on midnight with the telescope pointed due south. A band of 40° centred on the ecliptic is swept in declination - again the rotation of the Earth is used to present fresh fields for observation. As 40° is too wide an arc to cover properly in one session, I cover from the ecliptic to 20° north on one session and from the ecliptic to 20° south on the next available night.

When a nebulous object is detected it is checked against Norton and if necessary, Coeli and the SAO. Over 99% of the objects detected are identified in this way and the remaining few have to date been eliminated as spurious. It is amazing how real a spurious object due to stray light in the optical system can look, and I am constantly on my guard against such 'ghosts'. My first step is to move the telescope to check if the object remains in the same place relative to the stars. Next, I change eyepieces to give a different magnification and finally I check with the alternative instrument. So far, all 'ghosts' have been successfully exorcised and I must admit that my method of sweeping has met wi h conspicuous lack of success although I still live in hope of meeting my first real new comet.

Although it may be a blowto vital statistics, I am afraid that I cannot say how many hours I have spent comet-sweeping. I just work until I am tired with no note of the time consumed.

HALLEYS COMET

"Sky and Telescope", June 1975 pp 363-364 carries an article by R.G. Roosen and B.G. Marsden on the observing prospects for Halley's Comet at its next return. Using predictions by J.L. Brady and E. Carpenter, they suggest that the comet will probably be recovered towards the end of 1984 when still beyond the orbit of Jupiter. However, it is expected that it will be August 1985 before the comet becomes bright enough to be observed visually when it will be in the morning sky, probably about mag.14. The comet should brighten to 12th mag. by mid-September, 10th mag. by mid-October and will probably be 7th to 8th mag. by mid-November when it will be near opposition in Taurus, and at this time may show the beginnings of a tail. The distance of the comet from Earth increases towards the end of the year and it is unlikely to exceed 6th mag. during December, although by the end of the year, the tail should become more conspicuous. By mid-January 1986, the comet will be an evening object in Aquarius at mag.5 and may show a tail 5 degrees or more in length.

Comet Halley will disappear into the twilight around Jan.24th and is unlikely to be brighter than mag.4. After perihelion, it will re-appear in the morning sky but by the time it reaches an elongation of 20° from the Sun it will be well south of the Sun and not well placed for northern observers. The comet will continue to move south during March and April and will probably reach 3rd mag. with a tail possibly exceeding 20° and should be fairly striking for observers in the Southern Hemisphere. Halley's comet passes opposition during mid-April and then moves rapidly north to become visible to Northern Hemisphere observers by the end of April. By this time it is expected to be around 4th to 5th magnitude with perhaps a 5° tail. The comet will fade in May to about 7th mag. and by July is expected to be down to 11th mag, finally becoming lost in the evening twilight.

The authors point out that Halley is unlikely to be brighter than Comet Kohoutek, 1973f and if anyone was disappointed with the display of that comet then they must be prepared for a similar disappointment with Comet Halley.

COMETS IN 1973

Kohoutek 1973f (cont.)

Date 1974	U.T.	Mag.	Coma diam '	Tail Lgth °	Tail p.a. °	Description	Aper. mm	x	Obs.
Jan.	4.7	3.3	-	0.75	75	Con.coma. t.sltly fan-shaped	60	16	TM
	4.9	2.9	2	5	65	Intense cond.ctl. t.long st.	50	10	JEB
	5.0	4.0	-	3	-	-	50	7	KS
	5.8	3.7	-	1	80	-	60	16	TM

<u>1973f</u>

Date 1974	U.T.	Mag.	Coma diam '	Tail Lgth °	Tail p.a. °	Description	Aper. mm	x	Obs.
Jan.	6.0	4.4	-	3	-	-	50	10	KS
	6.7	3.3	2	1	72	Con.coma with sharp nuc.	50	10	PBD
	6.7	3.8	-	2	-	Prominent almost stellar nuc.	40	8	SFB
	6.7	-	10	0.5	-	-	100	68	AAV
	6.7	3	4	-	-	Con. to sunwards	50	10	MVG
	6.7	3.7	-	1	-	-	50	7	JDS
	6.7	4.0	-	-	-	-	80	20	MDH
	6.7	3.4	5	1.5	70	Str.cond. t.st.n.	50	12	RWP
	6.7	3.7	2.5	2	40	v.str.ctl.cond. Nuc.sus.	63	9	PJY
	6.7	4.0	1	-	-	No marked cond.	50	7	DAR
	6.7	2.5	-	-	-	-	30	8	PS
	6.7	3.0	-	0.5	-	-	68	10	DHF
	6.7	4.4	-	1.5	-	-	40	8	MDT
	6.7	3.[illegible]	-	1	10	-	50	7	PC
	6.7	5.4	-	0.8	50	Almost stellar ctl.cond.	30	8	TB
	6.7	4.0	-	0.5	50	-	50	7	TWR
	6.7	3.6	20	2.8	-	-	50	10	MH
	6.7	-	5	-	-	Str.ctl.cond.	50	10	GMH
	6.7	2.7	-	-	-	Distinctive "v" shaped tail	50	7	TM
	7.7	3.3	2.5	0.75	72	v.con.ctl.cond. Sharp nuc.	50	10	PBD
	7.7	4.2	-	1.8	-	br.ctl.cond.	40	8	SFB
	7.7	3.7	-	1	-	-	70	12	AAV
	7.7	5.0	-	2	-	Mag.ctl.cond. Photo	180	F5.5	TWR
	7.7	4.5	-	-	-	str.ctl.cond.	216	70	AK
	7.7	4	-	1.5	60	t.has two streamers	50	10	REC
	7.7	4	-	3	-	ctl.cond, almost stellar	50	10	JWN
	7.7	3.5	-	-	-	vis. to unaided eye	Naked-eye		PMA
	7.7	4.0	-	-	-	-	80	20	MDH
	7.7	3	4.5	-	-	Oval coma, str.con.sunwards	50	10	MVG
	7.7	3.7	-	1.5	-	Well condensed	25	8	TH
	7.7	3.5	-	2	-	-	50	7	TM
	7.7	4.0	-	1	-	br.coma. No nuc	75	40	DEB
	7.9	-	1	2	-	Intense ctl.cond. t.st.f.	50	10	JEB
	8.7	3.7	4	1.5	-	str.cond.	80	20	THY
	8.7	3.5	15	8	-	No nuc. seen	77	36	PM
	8.7	3.1	5	3	60	v.str.ctl.cond. t.b.st.	80	11	SWM
	8.7	4.0	-	3	-	t.st. suggestion of fan-shape	50	10	JWN
	8.7	3.5	-	-	-	br.coma. t.f.	50	6	GET
	8.7	3.5	0.8	-	-	-	-	-	MA
	8.7	4.5	0.7	1.3	60	ctl.cond. t.f.st. spine sus.	50	7	IDH
	8.7	3.0	-	-	-		40	8	SDC
	8.7	3.5	7	0.75	-	Oval coma. sus.spine in t.	60	28	MVG
	8.7	5.0	-	0.5	-	-	75	40	DEB
	8.7	4.0	-	3	-	-	50	10	ACC
	8.7	4.0	-	1.5	-	-	115	70	HBR
	8.7	3.5	7	3.5	-	-	76	50	LF
	8.7	4.5	-	-	-	Vague signs of tail	80	20	MNH
	8.7	4.5	-	3.5	-	-	50	7	TM
	9.0	3.5	1.5	5	60	Intense con. Boundaries d.	50	10	JEB
	9.0	3.9	-	2	-	-	50	7	KS
	9.5	3.6	3	2	-	-	65	20	MC
	9.7	4.0	-	1.5	-	str.con.coma	30	8	THY
	9.7	4.2	-	1+	80	str.ctl.cond. No nuc.	40	8	SFB
	9.7	3.8	4.5	2.5	-	br.ctl.cond. f.outer coma.	254	48	PBD
	9.7	3.9	3	4	55	v.str.ctl.cond, diffuse outer	63	9	PJY
	9.7	4	7	3.5	-	-	naked-eye		LF
	9.7	-	12	4	-	t.wider than c.	50	10	JWN
	9.7	4.2	0.7	0.5	60	c.con. No nuc	50	7	IDH
	9.7	4.0	-	1+	10	-	50	7	PC
	9.7	3.8	-	2	60	Stellar nuc.	30	8	TB
	9.7	4.6	5	4	-	str.con.c. Slender fan t.	50	7	RWP
	9.7	5.0	25	2.5	-	Nuc. c.evenly con.	150	48	JL
	9.7	4.5	-	-	-	No tail visible	40	8	MDT
	9.7	4.1	-	3	80	-	40	12	CH
	9.7	2.5	-	2	-	Mag. guess only	40	8	DS
	9.8	4.5	-	3.5	-	-	50	7	TM

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Date 1974	U.T.	Mag.	Coma diam. '	Tail Lgth °	Tail p.a. °	Description	Aper. mm	x	Obs.
Jan.	10.0	4.0	-	2	-	-	50	7	KS
	10.7	4.7	-	5	-	Visible to naked-eye	50	7	JDS
	10.7	4.7	-	0.4	88	Str.ctl.cond. t.fan-shaped	216	70	AK
	10.7	-	-	5	-	Almost stellar coma	80	10	TWR
	10.7	4.8	-	2.6	55	Evenly d. t.br. on E edge	50	7	SRH
	10.7	4.8	6	2	55	t.br. on following edge	50	7	DAR
	10.7	4.7	1.5	5	60	-	40	12	CH
	10.7	4.2	3	5	60	Str.ctl.cond. t.ctl.spine	63	9	PJY
	10.7	5.2	-	8	-	t. 1° wide. Vis to n.e.	102	-	GM
	10.7	3.2	-	3	-	Sm. almost stellar c.	40	9	DS
	10.7	4.8	-	4+	-	Fairly con. No obvious nuc.	50	7	MJG
	10.8	3.2	3	13	65	V.str.ctl.cond. t.v.st.narrow (from aircraft at 31000ft.)	80	11	SWM
	11.0	3.6	6	-	-	C.sl.el. Br.ctl.cond.	50	7	KS
	11.5	3.8	3	2	-	-	65	20	MC
	11.6	4.3	-	-	-	t.difficult. No nuc.	80	20	THY
	11.7	4.5	-	-	-	-	50	7	JDS
	11.7	4.7	2.7	4	-	Str.cond.c. t.st.	80	10	JHR
	11.7	5.2	-	0.5	50	Nuc.	30	8	TB
	11.7	3	5.5	3.5	-	Br.nuc. Fan-shaped t.	50	10	MVG
	11.7	5.0	0.7	3	65	Well cond. Nuc.sus. t.st.	50	7	IDH
	11.7	4.2	4	5	65	D.c. No nuc. t.st.	50	16	PMA
	11.7	4.3	-	2	-	Just vis. to n.e.	115	70	HBR
	11.7	4.0	-	1.5	-	-	80	20	MDH
	11.7	4.5	-	-	-	-	40	8	SDC
	11.7	4.8	-	5	30	Just vis. to n.e.	50	7	AWT
	11.7	5	9	-	-	-	50	10	JWN
	11.7	5.0	-	-	-	-	60	50	PS
	11.7	5.1	-	-	-	-	50	7	MJG
	11.7	4.5	25	4.0	70	Well con.c. Nuc.	150	58	JL
	11.8	-	-	4	-	Trace of shorter curved t.	50	7	JAB
	11.8	3.5	-	9	-	Sm.c with ctl.cond. Nuc.	30	8	PJM
	11.8	4.5	5	7	-	No. nuc. t. from photo	100	68	AAV
	11.8	4.0	-	8	-	t.seemed double near c. (from aircraft at 35000ft.)	50	10	PBD
	11.8	3.8	-	5	-	From aircraft at 35000ft.	50	10	CB
	12.4	4.2	6	-	-	Ctl.cond.	50	16	FdJ
	12.7	5.1	-	3	65	Br.con.c. slightly el. to t.	40	8	SFB
	12.7	5.0	-	5	-	Tail striated	50	7	DEB
	12.7	4	-	4.5	-	-	50	-	DARS
	12.8	5.0	-	5.5	-	-	50	7	TM
	13.0	4.0	3	6	60	Circ.c.str.ctl.cond. t.sus.curved	50	10	JEB
	13.4	3.5	-	0.5	-	-	30	8	GDT
	13.4	4.2	4	0.2	-	Nuc. glimpsed.	50	16	FdJ
	13.7	4.0	5	4	-	c.str.con. t.fanning	30	8	THY
	13.7	5.9	-	-	-	Weak ctl.cond.	50	10	TH
	13.7	4.5	5	0.8	65	Well con.c.	153	46	TH
	13.7	4.5	3.5	5	-	Well con. ctl.cond.v.br.	50	10	PBD
	13.7	5.0	-	3.5	-	-	70	12	AAV
	13.7	4.6	2.5	2	-	F.nuc.mag.10. St.t.	50	7	HCN
	13.7	4.9	-	-	-	-	40	8	MDT
	13.7	3.3	-	6.5	-	-	200	-	AP
	13.7	5.0	-	3	25	-	50	10	PC
	13.7	5.5	-	-	-	-	60	50	PS
	13.7	4.5	27	4	-	Nuc.vis.	150	48	JL
	13.8	5.0	-	20	79	Br.ctl.cond. Just vis. to n.e.	216	70	AK
	13.8	5	-	5	-	Impression of rays in t.	50	10	JWN
	13.8	4.0	-	-	-	-	naked-eye		DRK
	13.8	4.6	-	6	-	Vis. to n.e. Br.spine in t.	50	7	JDS
	14.0	4.1	5.2	9.5	62	V.str.ctl.cond. T.spine	50	10	JEB
	14.4	5	-	-	-	-	50	7	GDT
	14.4	4.3	5	0.2	-	c.weakly con. No nuc.	50	16	FdJ
	14.5	4.2	3	2.5	-	-	65	20	MC
	14.8	5.5	-	-	-	-	60	50	PS
	14.8	5.5	-	1	-	Photo	200	Schmidt	DARS

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Date 1974	U.T.	Mag.	Coma diam. '	Lgth °	p.a. °	Description	Aper. mm	x	Obs
Jan.	15.0	5.4	3.5	2	-	-	50	7	KS
	15.4	4.4	4	-	-	Ctl.cond. No. nuc.	50	16	FdJ
	15.7	5.3	-	-	-	-	80	10	JHR
	15.7	5.0	5	3	-	v.con. t.fanning	50	10	PBD
	15.7	5.1	-	3.5	-	Easily seen with n.e.	70	-	HCN
	15.7	5.3	-	3	64	Nuc. seen	30	8	TB
	15.8	4.5	-	2	50	Str.cond.c.	115	70	HBR
	15.8	5.0	-	-	-	-	30	8	PS
	16.0	5.4	5	-	-	Ctl.cond. Wide fan-tail	50	7	KS
	15.8	4.8	5	3	-	Br.ctl.cond. c.seems oval	50	7	KMS
	16.7	4.5	-	4.8	-	t.v.d.	50	7	JMcB
	16.8	6	-	8	-	t. 1° wide	102	-	GM
	16.8	6	-	6	-	-	50	7	TM
	17.0	5.3	-	0.5	-	-	50	7	KS
	17.0	5	-	5	-	Vis. to n.e. t.curved	50	7	JTB
	17.4	4.6	-	?	50	No nuc. longish t. sus.	50	16	FdJ
	18.0	4.8	7.1	7.5	60	Intense cond. t.long.n.	50	10	JEB
	18.4	4.5	-	-	-	-	n.e.	-	GDT
	18.8	5.2	6	0.3	70	Well con.c.	153	46	TH
	18.8	5.1	0.6	2.5	-	Ctl.cond.	50	10	WH
	18.8	6.5	5	2.5	-	Coma diffuse	50	10	JWN
	18.8	-	-	5	-	Glimpsed only	50	7	JAB
	19.0	5.2	-	-	-	-	50	7	KS
	19.1	5	-	3	60	t.curved to north	50	7	JTB
	19.5	4.6	3	2	-	-	65	20	MC
	19.7	5.0	-	2	-	Str.cond.	80	20	THY
	19.7	5.3	5	0.3	70	Well con.c.	25	8	TH
	19.7	5.6	4	4	80	Br.ctl.cond. c.el. t.st.	40	8	SFB
	19.7	5.0	7.5	4.5	-	V.br.ctl.cond. t.two rays	50	10	PBD
	19.7	5.3	-	4.5	-	Seen n.e.	70	-	HCN
	19.7	5.6	5	6	65	V.str.ctl.cond. t.br.ray	63	9	PJY
	19.7	5.7	-	-	-	f.d.	200	-	AP
	19.7	4.5	-	-	-	T.glimpsed. Mag. guess	68	10	DF
	19.7	4	-	-	-	f.d.	50	7	PM
	19.8	5.8	4.5	3.5	62	Ray in t. at p.a. 82°	80	10	JHR
	19.8	5.5	-	2	-	Br.ctl.cnd. No nuc.	50	7	RDP
	19.8	5.5	4.5	5.5	70	C.well def. ctl.cond. Nuc.sus.	50	12	PMA
	19.8	5.0	-	-	-	-	30	8	PS
	19.8	5.2	-	1	55	Str.ctl.cond. Edges ill-d.	50	7	DAR
	19.8	5.0	-	-	-	-	30	8	PJW
	19.8	5.7	5	1	-	Mod.con. No.nuc.	50	7	MJG
	19.8	4.8	-	-	-	-	80	20	MDH
	19.8	5.4	-	2	30	-	50	7	PC
	19.8	3.8	-	-	-	-	60	11	CR
	19.8	5.5	8	3.3	58	C.not so con. t.st.n.	120	20	SWM
	19.8	5.2	-	3.5	-	-	80	20	SS
	19.8	6.5	-	-	-	-	50	20	DJS
	19.8	5.4	-	2.5	-	-	50	16	GLJ
	19.8	5.2	-	1	53	Ill.d.c.	50	7	SRH
	19.8	5.0	-	2	60	Br. nuc.	30	8	TB
	19.8	5.2	-	5	-	Just vis. to n.e.	50	7	JDS
	19.8	5.8	10	2	-	-	50	10	GMH
	19.8	5.0	-	-	-	Str.ctl.cond. Ill-d.edges	320	60	DW
	19.8	-	-	5.5	-	C.v.con. t.st.	50	7	JAB
	19.8	5.5	-	5	-	-	50	10	MFP
	19.8	5.6	4.5	2	55	Ctl.cond. Nuc. sus. mag.12	150	72	KMS
	20.0	5.3	5	7	60	Intense ctl.cond. t.long.n.	50	10	JEB
	20.1	5	-	6	-	C.teardrop shaped.	50	7	JTB
	20.4	5.9	-	-	-	D.c.with str.ctl.cond.	80	11	AJ
	20.4	4.8	-	-	-	-	30	8	GDT
	20.4	5.7	10	3.5	-	-	50	7	MVJ
	20.4	5.6	-	-	-	-	50	7	VM
	20.5	5.0	5	-	-	c.v.d. but internally con.	60	16	FdJ
	20.7	5.5	6.7	2.7	-	Br.ctl.cond. Two rays t.	50	10	PBD
	20.7	5.9	-	2	50	Str.ctl.cond.	30	8	TB
	20.8	5.8	-	-	-	(photo)	71	F2.5	TWR
	20.8	5.6	-	-	-	-	40	8	MDT
	20.8	5.6	4.5	0.3	55	Ctl.cond. sus.nuc.	50	7	KMS
	20.8	5.1	0.5	2	-	Ctl.cond.	50	10	WH

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Date 1974	U.T.	Mag.	Coma diam.	Tail Lgth °	Tail p.a. °	Description	Aper. mm	x	Obs.
Jan.	21.1	5	-	4	-	Just vix. to n.e.	50	7	JTB
	21.4	6.1	5	3.5	45	-	50	7	MVJ
	21.4	5.5	-	-	-	-	30	8	GDT
	21.5	5.2	5	-	-	Diffuse c. with f.ctl.cond.	50	16	FdJ
	21.7	5.6	-	3	-	Visible to n.e.	70	-	HCN
	21.8	5.6	4.5	0.3	55	Ctl.cond. sus.nuc.	50	7	KMS
	21.8	5.1	0.5	1.5	-	Ctl.cond.	50	10	WH
	22.0	5.5	7	4	70	Large ctl.cond.	50	7	KS
	22.4	6.4	-	Nil	-	Diffuse c. with str.cond.	80	11	AJ
	22.5	5.4	-	-	-	-	50	16	FdJ
	22.8	6	-	1.5	25	Diffuse c.	50	7	HTB
	22.8	6	3	Nil	-	Str.ctl.cond. nuc.sus	160	50	AleM
	23.0	5.7	7.5	4.2	60	Mod.cond. Nuc. T.st.	50	10	JEB
	23.0	5.8	-	2	60	-	50	7	KS
	23.8	6.0	-	-	-	Circular c. with ctl.cond.	40	8	MDT
	23.8	6.2	-	1.3	66	Str.ctl.cond.	30	8	TB
	23.8	6.1	4.5	0.8	-	Well con.c. No nuc. T.f.	50	7	MJG
	23.8	5.8	-	-	-	Ill def. but with ctl.cond.	50	7	SRH
	23.8	5.8	-	-	-	Str.ctl.cond. No nuc.	50	16	JR
	23.8	5.3	2.5	Nil	-	-	50	10	PL
	23.8	7	13	Tr	-	El.c. 10'x13'	76	50	LF
	23.8	5.5	-	-	-	-	30	8	PS
	23.8	6.8	-	1.3	58	-	50	16	GLJ
	23.8	6.1	4	-	-	-	50	7	DAR
	23.8	5.8	-	0.5	-	T.v.d.	80	11	DMB
	23.8	5.6	9	0.5	65	Circular mod.con.c.	80	11	RWP
	23.8	5.8	-	Nil	-	-	50	7	AWT
	23.8	6.3	10	1	65	-	50	10	GMH
	23.8	6.3	-	2.5	55	Str.con.c. T.legth from ph.	115	70	HBR
	23.8	5.0	-	-	-	-	80	20	MDH
	23.8	5.5	-	Tr	-	Diffuse. vague t.	68	10	DF
	24.0	5.9	-	-	-	-	50	7	KS
	24.4	6.0	-	Tr	-	D.c. with str.con. t.sus.	80	11	AJ
	24.5	5.7	-	-	-	Very diffuse	50	16	FdJ
	24.7	5.8	3.5	0.05	80	Poorly con.c.	153	46	TH
	24.7	5.9	-	0.5	-	Mod.cond.	30	8	THW
	24.7	6.0	10	1.7	-	Mod. cond. Two br.ray in t.	50	110	PBD
	24.7	5.9	-	-	-	-	40	8	JHR
	24.7	5.5	-	-	-	-	80	20	MDH
	24.7	5.5	-	Tr	-	Short d.t.sus.	68	10	DF
	24.8	6.0	3.5	1.5	-	Possible br.spine in t.	50	16	PMA
	24.8	5.8	-	2	-	-	40	12	SS
	24.8	6.1	7	0.5	70	D.c. Nuc.mag.10.7	70	7	IDH
	24.8	6.4	10	1	-	-	50	10	GMH
	24.8	5.8	5	1.5-	58	Sm.ctl.cond. within outer c.	80	11	SWM
	24.8	6.1	-	-	-	-	30	8	PRS
	24.8	6	2	0.5	30	Str.ctl.cond.	160	50	AleM
	24.8	6.0	-	Tr	-	-	50	7	RDP
	24.8	6.2	-	2.5	-	-	50	7	JDS
	24.8	6.0	4	2.5-	70	V.sm.ctl.cond. Two tails (80°)	40	8	SFB
	24.8	-	4	1.5	-	-	50	10	JWP
	24.8	6.1	4	Tr	40	-	50	7	DAR
	24.8	6.2	-	0.5	-	-	50	10	JB
	24.8	6.2	-	0.3	50	-	50	7	AWT
	24.8	6.3	-	2	60	"Spring onion" appearance. t.ph.	115	70	HBR
	25.0	5.6	-	2	-	-	50	7	KS
	25.7	6.2	-	1	35	-	30	8	TB
	25.8	6.2	-	Nil	-	Sl.ctl.cond. Ill-def.edges	50	7	SRH
	25.8	6.0	2.5	Nil	-	-	50	10	PL
	25.8	6.0	8	-	-	T.two components. Ctl.cond.	50	10	PBD
	25.8	6.5	-	-	-	-	30	8	PRS
	25.8	5.9	-	Nil	-	C.el.in p.a.30°. Ctl.cond.sus.	50	16	DH
	25.8	5.8	-	-	-	-	40	12	SS
	25.8	6.1	2.8	Nil	-	No.str.ctl.cond. Ill-def.edge	50	7	DAR
	25.8	5.9	-	1	10	-	50	7	PC
	25.8	6.5	-	Nil	-	Large br.ctl.cond.	-	-	RHW
	25.8	6.4	2.3	0.9	64	Multiple tails	80	10	JHR

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Date 1974	U.T.	Mag.	Coma diam. '	Tail Lgth °	Tail p.a. °	Description	Aper. mm	x	Obs.
Jan.	25.8	5.9	-	3	-	Just vis. to n.e.	50	7	JDS
	25.8	6.7	15	1.5	63	-	50	10	GMH
	25.8	6.1	-	1.5	70	Con.c.	40	8	SFB
	25.8	5.1	5	0.8	-	Well con. No nuc.	50	7	MJG
	25.8	6.7	-	-	-	-	80	20	MDH
	25.8	6.6	6	Tr	-	Ctl.con 40" diam. T.difficult	115	70	HBR
	26.0	5.9	4.5	6	58	Str.ctl.cond. T.n.long.st.	50	10	JEB
	26.0	5.8	6	3.5	70	Br.ctl.cond.1'diam	50	7	KS
	26.1	5.7	-	3	50	-	50	7	JTB
	26.8	6.3	11	1.3	-	Str.ctl.cond. t.two br.rays	50	10	PBD
	26.8	7.0	-	-	-	Faint diffuse	200	-	AP
	26.8	5.8	-	2	-	-	50	10	MFP
	26.8	7.6	3	0.5	40	Good ctl.cond.	50	16	AleM
	27.0	6.2	-	-	-	-	50	7	KS
	27.8	7.0	-	Nil	-	Slight stl.cond.	50	7	JMcB
	28.5	6.0	-	-	-	V.d. Hint of ctl.cond.	50	16	FdJ
	29.8	7.7	-	-	-	-	80	20	MDH
	29.8	7.1	-	?	-	Ctl.cond. Diffuse t.	50	10	TH
	29.8	6.5	2.4	?	-	N.ray in t. at p.a. 70°	80	10	JHR
	29.8	7.1	2	2	-	-	80	10	JDS
	29.8	6.9	-	-	-	Hint of tail	40	8	SFB
	29.8	7.0	-	-	-	No nuc. or t. seen	50	7	RDP
	30.0	6.3	7.2	-	-	Mod.con.c. Nuc.sus. no t.seen	50	10	JEB
	30.4	6.5	-	-	-	Diffuse c.	80	11	AJ
	30.5	6.3	3	-	-	V.d. with no ctl.cond.	50	16	FdJ
	31.0	6.5	6.4	1.5	55	Mod.cond. Edges poorly def.	50	10	JEB
	31.8	6.5	6.5	-	-	Mod.ctl.cond.	50	10	PBD
	31.8	8	-	0.5	-	-	80	10	JDS
Feb.	1.7	7.5	2	Nil	-	Sm.br.ctl.cond. 30" diam	70	-	HCN
	1.8	6.8	-	-	-	-	40	12	SS
	1.8	8	2.5	Nil	-	Weak cond.	160	50	ALeM
	2.8	6.7	-	0.25	50	-	50	10	GMH
	2.8	8.0	-	Nil	-	Possible ctl.cond.	250	65	RDP
	2.8	7.3	-	1	-	Nuc. seen	77	84	TH
	2.8	7.6	2	0.1	-	T.narrow	80	10	JHR
	2.8	9.2	3	-	-	-	320	80	JDS
	2.8	7.4	1.2	-	-	Sm.ctl.cond. ill-def.edges	77	44	SRH
	2.8	8	2.5	Nil	-	Diffuse	160	50	ALeM
	2.9	6.9	2	Nil	-	Poorly con.	153	46	TH
	3.0	6.8	-	-	-	-	50	7	KS
	3.8	8.2	-	-	-	-	30	8	TB
	3.8	7.1	5	0.2	60	Diffuse c. F.stubby t.	50	7	IDH
	3.8	8.4	-	-	-	-	50	7	PC
	3.8	8.0	1.5	-	-	-	250	65	RDP
	3.8	8.3	5.5	Nil	-	Ctl.cond.	150	48	KMS
	3.8	-	6	-	-	Diffuse	115	70	HBR
	4.5	6.7	-	-	-	-	50	16	FdJ
	4.8	8.5	2.3	Nil	-	Poorly con.	210	35	MJG
	4.8	8.5	-	-	-	-	80	20	MDH
	4.8	7.6	2.5	Nil	-	Very diffuse	300	80	SFB
	4.8	8.6	6	-	-	-	115	70	HBR
	4.8	6.6	12	-	-	Mon.con. Oval c. 12'x10'	80	11	RWP
	4.8	8.0	1.5	-	-	-	250	65	RDP
	5.0	6.8	-	-	-	-	50	7	KS
	6.0	7.2	4.5	0.5	55	Mod.cond. Edges undefined	50	10	JEB
	6.8	7.7	5	Nil	-	Circular c. Nuc.sus.	50	7	IDH
	7.4	7.3	6.4	0.5	-	Mod.con.c. Edges v.d. f.nuc.	50	10	JEB
	7.7	8.7	-	-	-	-	80	20	MDH
	7.8	8.4	-	-	-	-	50	7	PC
	7.8	8.3	4	Nil	-	Fairly br.ctl.cond.	150	24	KMS
	7.8	10.3	1.6	Nil	-	Poorly con. F.nuc.	300	80	JHR
	7.8	10	4	-	-	-	320	80	JDS
	7.8	9.5	-	-	-	-	300	80	SFB
	8.8	9	1	-	-	-	76	50	LF
	9.0	8.0	5	Nil	-	-	100	14	KS
	9.7	8.5	-	-	-	Diffuse	50	7	HCN
	9.8	8.7	-	-	-	-	80	20	MDH

1973f

Date 1974	U.T.	Mag.	Coma diam. '	Tail Lgth °	Tail p.a. °	Description	Aper mm	x	Obs.
Feb.	9.8	8.4	15	Nil	-	-	50	10	GMH
	9.8	8.1	4	0.25	60	F.anti-tail p.a. 210° (ph)	115	70	HBR
	9.8	7.5	5	Nil	-	Some ctl.cond. No nuc.	250	65	RDP
	9.8	7.2	6	Nil	-	Br.ctl.area within outer c.	50	10	PBD
	9.8	7.6	3.5	1	-	Mod.con.c. Nuc.a.v.	40	8	SFB
	9.8	7.5	3	0.5	-	-	50	7	JDS
	9.8	8.5	4	Nil	-	Mod.cond. No nuc.	210	35	MJG
	9.8	11	2	Nil	-	-	160	50	ALeM
	9.9	8.3	2	-	-	D.c. Sus.mottling with a.v.	153	46	TH
	10.8	8.9	4.5	0.3	-	Ctl.cond.	150	24	KMS
	10.8	7.7	-	0.7	-	-	50	7	JDS
	11.4	10	-	Nil	-	Slight ctl.cond.	300	40	VLM
	11.9	8.6	4.5	Tr	65	D.c. with f.ctl.cond.	150	48	KMS
	12.0	7.4	11	1.5	55	T.b.fan-shaped. Jet 30' p.a.90	50	10	JEB
	12.0	8.8	-	-	-	-	100	14	KS
	12.4	11	-	Nil	-	Slight ctl.cond.	300	40	VLM
	12.8	8.6	4	Nil	-	W.ctl.cond. Sus.nuc.mag 12	150	24	KMS
	13.0	9.0	-	-	-	-	100	14	KS
	16.0	7.6	10.8	1.25	55	Mod.cond. Sus.nuc.mag.12	50	10	JEB
	16.8	7.5	-	-	-		40	12	SS
	16.8	8.5	10	Tr.	30	Sus.jet p.a. 50°. Ctl.cond.c.	250	65	RDP
	16.9	10	3.5	-	-	V.d.c. Sus.nuc	300	80	SFB
	18.0	7.8	7.2	1	65	Sm.ctl.cond.with nuc. T.f.st.	50	10	JEB
	19.0	7.9	9.0	0.8	70	Ctl.cond. Nuc.mag.12.5 Sus.anti-tail p.a. 270°	50	10	JEB
	19.4	9.8	-	Nil	-	D.c. with mod.cond.	317	86	AJ
	21.9	10.0	-	-	-	Very diffuse	115	70	HBR
	22.8	9.5	2	Nil	-	Very diffuse	210	35	MJG
	22.8	9.5	4	?	-	Diffuse. T.and anti-tail.ph.	115	70	HBR
	22.8	10.5	2	-	-	C.v.d. with mod.ctl.cond.	300	80	SFB
	22.8	10	2	-	-	-	320	80	JDS
	22.8	9.3	-	-	-	C.v.d.el.in p.a.185°.Nuc.sus	150	60	PMA
	22.8	8.7	7	-	-	V.d.oval c. W.ctl.cond.	80	11	RWP
	22.8	8.9	-	-	-	V.dc.with distinct ctl.cond.	150	24	KMS
	22.8	11	2.4	Nil	-	-	300	80	JHR
	22.8	9.3	-	-	-	-	80	20	MDH
	22.8	8.6	3.5	-	-	Diffuse coma	153	46	TH
	22.8	9.5	7.5	-	-	Very diffuse	250	65	RDP
	23.8	9.0	5	-	-	-	320	80	JDS
	23.8	8.4	5	-	-	V.d.c. with sl.ctl.cond.	150	24	KMS
	24.0	8.4	8	0.75	283	See note below	50	10	JEB
	24.8	9.5	-	-	-	-	80	20	MDH
	25.0	8.4	11	0.4	40	Anti-tail 30' in p.a. 40°	50	10	JEB
Mar.	2.8	-	-	-	-	Not seen - mag.fainter than 9½	50	10	GMH
	9.0	11.1	3	-	-	-	200	-	KS
	11.0	9.0	8	-	-	Sus.ray p.a. 280°. V.d.c.	120	20	JEB
	13.0	9.0	7.3	Nil	-	C.d. and of v.low surf.br'ness	120	20	JEB
	14.0	9.2	6	Nil	-	C.without def.boundaries	120	20	JEB
	15.0	9.1	10	Nil	-	V.f.c. No ctl.cond. or nuc.	120	20	JEB
	21.0	9.8	7	Nil	-	Extremely f.d.object	120	20	JEB
	22.0	10.0	6	Nil	-	Extremely f.d.object	120	20	JEB

Note: John Bortle's observation of Feb. 24.0 contains so much interesting detail that it is worth giving it in full. He notes "In the 32cm refl. the coma is onion shaped with the extension pointing in the direction of the Sun! The coma is more or less circular in 10x50mm and 20x120mm bin., boundaries totally undefined. Coma slightly condensed, rather dense in 32cm. but without a central condensation or nucleus. Coma diam. in both 10x50mm and 20x120mm approx 8'; in 32cm. 6'.3. An extraordinary anti-tail is present, much brighter than the material in the direction where the normal tail was last observed. In the 20x120mm, after a long period of dark adaptation, the anti-tail can be traced for 45' in p.a. 283°. Where it joins the coma, it is about as wide as the coma, but widens slightly as it advances. In all the region joining and north of p.a.'s 50° and 280° with the centre of the coma there is a diffuse nebulous light extending out perhaps 20' from the centre of the coma, but of a much lower surface brightness than the anti-tail. Occasionally in the 20x120mm, the former location of the normal tail seems somewhat brighter than the rest of the glow and the 32cm. even suggests the presence of a vague spine pointing towards p.a. 40°. In the direction of the anti-tail, the 32cm shows a fairly narrow, somewhat diffuse jet which blends with the brighter part of the coma where they meet and is not wider than 2' arc. This jet is surrounded by a narrow diffuse glow".

This list completes the tabulation of the observations of Comet Kohoutek, 1973f, began in Bulletin No. 5. The abbreviations in the description were listed in that Bulletin and lists of observers names were given in Bulletins 3 and 4.

Comet P/Reinmuth (2) 1973g. Recovered by Dr. E. Roemer on 1973 Apr. 26.3 with the 229cm reflector of the Steward Observatory at Kitt Peak. The comet was essentially stellar in appearance, mag. 20.0. A further observation was obtained on May 25 when the comet was recorded as a small weak spot of magnitude 20.5. No further observations were reported during the year.

Comet Huchra 1973h. Discovered by J.P. Huchra on 1973 Apr. 25.3 on a plate taken with the 122cm Schmidt telescope at Palomar. The comet was a diffuse, 13th magnitude object in Bootes and had central condensation but no tail. Comet Huchra was bright enough to be photographed by Dr. R.L. Waterfield and N. Wood at Woolston and was recorded as a 14.5 - 15th magnitude object having an inner coma 15" diameter within a very faint outer coma 1'.5 diameter. The following precise position was measured from the plate:

1973	U.T.	R.A. (1950.0) h m s	Dec. ° ' "
June	2.00300	13 53 12.99	+18 11 09.9

Elements were calculated by Dr. B.G. Marsden from 34 observations, Apr 25 to June 24:

T	1973 Mar. 11.5857 E.T.			
e	0.972800	ω	123°.4850	
q	2.384384 AU	Ω	57.1492	1950.0
P	821 yrs	i	48.3239	

By the end of June, the comet had faded to 19th magnitude.

Comet P/Clark 1973i. This new periodic comet was discovered by M. Clark, Mount John University Observatory, Lake Tekapo, New Zealand, on 1973 June 9.7 using a 10cm f/6 camera. The comet was diffuse, with condensation and had a short tail 1' long in p.a. 260°. Magnitude 13. The comet was observed until 1973 November 21. As observations accrued it became clear that the comet was of short period and the following elements were calculated by Dr. B.G. Marsden (Comet Catalogue 1975):

T	1973 May 24.8785 E.T.			
ω	209°.1276		e	0.500354
Ω	59.1303	1950.0	a	3.122933 AU
i	9.5008		n°	0.1785912
q	1.560361 AU		p	5.519 yrs

Comet P/Brooks 1973j. Recovered by Dr. E. Roemer and J. Latta on 1973 July 1.4 on plates taken with the 229 cm reflector of the Steward Observatory at Kitt Peak. The comet was a sharply condensed 20th magnitude object with a trace of tail extending 3" to the south-east and was very close to the prediction in the Handbook 1973, ΔT being only -0d.02. The comet brightened to magnitude 18.7 by September and observations continued until November 25.

Comet Sandage 1973k. Discovered by Dr. A.R. Sandege on 1973 July 4.2 on plates taken with the 122cm Schmidt telescope at Palomar whilst photographing a quaser field in Serpens Caput. The comet was a diffuse object with condensation, magnitude 15 and had a short tail 1'.5 long towards the south-east. The comet remained around 15 - 16th magnitude until conjunction - when reobserved after conjunction it had faded to mag. 17.

Comet Sandage 1973k (cont.)

The following elements have been calculated by Dr. B.G. Marsden, based on 25 observations 1973 July 4 to 1975 Feb. 15:

T	1973 Nov. 8.1651	E.T.	Epoch	1973 Nov. 14.0	E.T.
ω	72°.5541		e	1.000036	
Ω	278.5454	1950.0			
i	137.4017		q	4.812054 AU	

Perturbations by all nine planets were taken into account.

Comet P/Schwassmann-Wachmann (2) 1973l. Recovered by M. Antal on 1973 Aug. 28.1 using a Schmidt camera at the 29 metre focus of a 2 metre reflector. An independent recovery was made by C. Shao and G. Schwartz on the following night using a 1.5 metre reflector at the Agassiz station of Harvard College Observatory. The comet was diffuse with condensation, magnitude 19 and very close to the prediction in the Handbook 1973. A brightening to mag. 17.5 was observed from September 26 to November 24 - the last observation of 1973.

Comet P/Borrely 1973m. Recovered by Z.M. Pereyra on 1973 Aug. 23.1 using the 154 cm reflector at Bosque Alegre. The magnitude was 19.5 but nothing was reported about its description. The recovery position was close to the prediction in the Handbook 1973. No other observations were reported before the end of the year.

Comet P/Encke. This comet was photographed by Dr. E. Reomer on 1973 September 21.2 using the Steward Observatory's 229cm reflector on Kitt Peak. The image was practically stellar in appearance and of mag. 20.5. As reported on BAA Circular 551, P/Encke was observed at aphelion in 1972 and no letter designation has been affixed for the current return.

Comet P/Gehrels (2) 1973n. Discovered by Dr. T. Gehrels on 1973 Sept. 29.4 on a plate taken with the 122cm Schmidt telescope at Palomar. Of magnitude 15 - 16, the comet was diffuse with a fan-tail 2' long in p.a. 230° to 260°. Dr. Waterfield and associates at Woolston Observatory obtained observations and precise positions were reported on BAA Circular 551. On November 16, he described the comet as having a fairly well condensed inner coma 15" in diameter with a fainter outer coma 30" in diameter, mag. 15.5. A later plate on December 17 showed an inner coma 10" in diameter with a very faint small outer coma, mag. 16.2

Elliptical elements have been calculated by Dr. B.G. Marsden using 32 observations between 1973 Sept 29 and 1974 Feb 25, perturbations by all nine planets having been taken into account:

T	1973 Dec. 1.6457 E.T.		Epoch	1973 Nov. 14.0 E.T.
ω	183°.3460		e	0.409859
Ω	215.6130	1950.0	a_o	3.979481 AU
i	6.6706		n^o	0.1241551
q	2.348455 AU		P	7.94 yrs.

Comet Gibson 1973o. Discovered by J. Gibson, Observatorio Austral Yale-Columbia, El Leoncito on 1973 November 24.2 using the 51cm double astrograph. The comet was of magnitude 15.5 and at first it was not certain if it was a comet or a minor planet. However, later observations revealed faint streamers of a tail 15" long in p.a. 355° and 15°. On December 31st, a plate showed a tail 1' long in p.a. 25°.

Dr. B.G. Marsden has calculated the following parabolic elements from 8 observations 1973 Nov. 30 to 1974 Jan. 25. Perturbations have not been applied:

T	1973 Aug. 10.1241 E.T.	ω	221°.3256	
		Ω	243.9083	1950.0
q	3.843731 AU	i	108.0712	

NUMERICAL DESIGNATION OF COMETS

1972	I	P/Holmes	1971b
	II	P/Grigg-Skjellerup	1972b
	III	Bradfield	1972f
	IV	P/Neujmin 3	1972g
	V	P/Tempel 1	1972a
	VI	P/Giacobini-Zinner	1972d
	VII	P/Swift-Gehrels	1973d
	VIII	Heck-Sause	1973a
	IX	Sandage	1972h
	X	P/Tempel 2	1972c
	XI	P/Kearns-Kwee	1971c
	XII	Araya	1972l
1973	I	P/Gehrels 1	1972k
	II	Kojima	1972j
	III	Huchra	1973h
	IV	P/Reinmuth 1	1972i
	V	P/Clark	1973i
	VI	P/Tuttle-Giacobini-Kresak	1973b
	VII	Kohoutek	1973e
	VIII	P/Wild	1973c
	IX	Gibson	1973o
	X	Sandage	1973k
	XI	P/Gehrels 2	1973n
	XII	Kohoutek	1973f

COMET KOHOUTEK: A LITERATURE GUIDE. by G.J. HODGKINSON

Many of the important observations of Comet Kohoutek (1973f) were reported in ICARUS volume 23, no 4, December 1974, in an issue especially dedicated to that comet. References in this edition are referred to by page number, additional references are given in several instances where work has been reported elsewhere.

Kohoutek (p491) described the circumstances of the discovery of the comet. The chief investigations appear to have been the search for molecules and the analysis of dust in the tail. Several new techniques were used for some of the observations. Preliminary results have been compiled by Carruthers and published elsewhere (Astronaut. Aeronaut., 12(10), 42-5, 1974). The crew of Skylab IV observed the comet at perihelion and made drawings (Gibson, P493, also Sky & Telescope 48, 208, 1974) and were the first to observe the "anti-tail" a sunward-spike like that of Arend-Roland 1956. Discussions of this anti-tail were given by Sekanina (p502) and by Gary and O'Dell (p519) who considered that its shape and orientation could be satisfactorily explained by ejection of large particles near perihelion. As the comet receded from the sun the anti-tail became less intense.

Two features were observed to propagate down the tail at a velocity of about 250km/sec (Hyder et al,p601), and other photographs were reported (Crump & Cruikshank, p611).

Various people found and measured the emissions of molecules familiar to comets e.g. C_2, H_2CO, CN etc. (e.g. Fehrenbach & Andrillat, C.R. Acad.Sci., Ser.B,278(13), 607,1974). However, searches for the possible parent molecules H_2O, NH_3, CH_3OH and N_2O in the frequency range 22.2 to 25.2GHz were unfruitful (Mango et al,p590). Traub & Carleton searched unsuccessfully for H_2O and Methane, CH4 (p585), an upper limit for the production of methane was also given by Roche et al (Icarus 24, 120, 1975). Blamont & Festou observed OH in the comet by resonance scattering in the infrared (C.R.Acad.Sci., Ser.b,278 (11), 479,1974) and HCN was detected by its radioemission (Hueber et al, p580), Ulrich & Conklin reported radioemission due to CH_3CN (Nature 248, 121,1974). The last two molecules are of special interest in two respects — they may be the first parent molecules detected in comets, and secondly, these molecules are generally regarded as representative of an interstellar medium. The 9cm emission due to the methylidene radical, CH, was detected up to several days after perihelion (Black et al, Astrophys, J., 191, L45,1974).

Hydroxyl radical, OH, was observed in the ultraviolet to lie in a nearly spherical coma, about 3' diameter, around the comet (Harvey, Publ. Astron. Soc. Pacific 86,552, 1974). Other observations of this radical include those of Turner (Astrophys. J., 189, L137, 1974) and F. Biraud et al (Astron.Astrophys., 34,163, 1974) who detected OH in absorption at 18cm wavelength from December 1973 through to February 1974, after they reappeared in emission around mid-January.

Hydrogen emission at Lyman-α showed an enormous halo about 4° diam. around the comet and condensed toward the head of the comet (e.g. Carruthers et al, p526). Various infra-red observations, made over a range of heliocentric distances, are reported (Noguchi et al, p545; Zeilik & Wright, p577 Barbieri et al, p568; and Ney, p551 and Astrophys. J. Lett., 189, L141, 1974); and various other ground-based spectroscopic results reported (Lanzerotti, p618)

An attempt to observe radar echoes from the comet was made at 3.8cm wavelength on 12 January, 1974 using the Haystack Observatory radar in Massachusetts. No positive results were obtained, but by making reasoned assumptions it was concluded that the nucleus of comet Kohoutek 1973f must be less than 250km in diameter and that the density of any millimetre-sized particles must be less than one per cubic metre for a coma of diameter 10,000km (Chaisson et al, Icarus 24, 188, 1975).

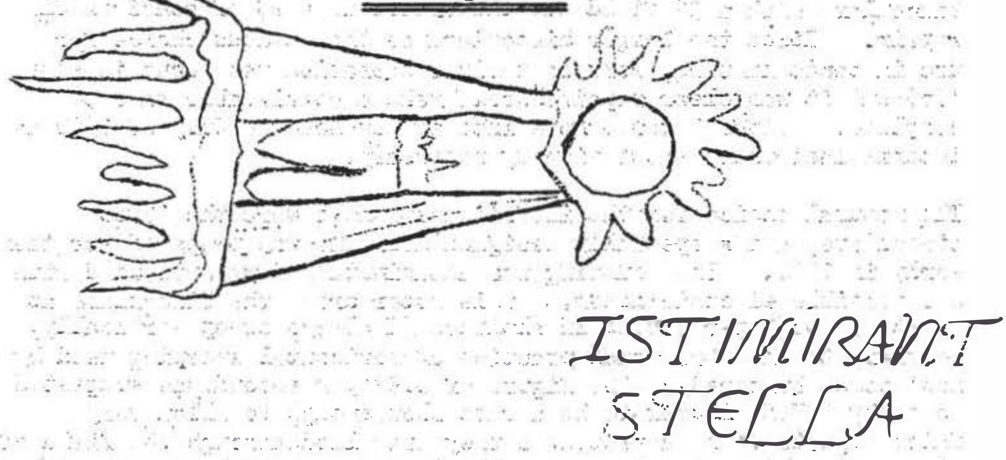
Finally, visual estimates of the total coma brightness between November 24, 1973 and February 6, 1974 were used to produce a light-curve for the comet by Angione et al (Icarus 24, 111, 1975).

CATALOGUE OF COMETARY ORBITS - 2ND EDITION

A new edition of the Smithsonian Astrophysical Observatory's Catalogue of Cometary Orbits by Dr. B.G. Marsden has been published. Copies can be obtained from the Assistant Secretary, British Astronomical Association, Burlington House, Piccadilly, London, W1V ONL, price £1.50 post free.

THE BRITISH ASTRONOMICAL ASSOCIATION

COMET SECTION



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EDITORIAL

Many thanks to those who have contributed material for this issue. I hope this will encourage others to put pen to paper, and that we shall receive many more articles in time for our next issue.

MY METHOD OF COMET HUNTING From J.E. Bortle

The desire to be the first discoverer of a new comet has probably touched each of us at one time or another. The idea caught my fancy in the early 1960's when Ikeya and Seki were gaining fame with their many discoveries. Unfortunately, at the time I lived in an urban area whose skies were not suitable for competitive comet hunting. The idea stuck with me though and when I began looking for a new house some years later, one of the prime considerations was that its property provided a good horizon. As things turned out, I had a house built in the spring of 1970 in a quite rural area atop a hill which commanded an unparalleled view of the horizon in every direction. At this site I have no obstruction higher than $3\frac{1}{2}^{\circ}$.

During the year prior to my relocation I spent a considerable amount of time corresponding with such successful comet hunters as L.C. Peltier, G.E.D. Alcock, and J.E. Mellish, obtaining suggestions and opinions on the best methods of comet hunting, instrumentation, etc.

My final decision was to construct an installation similar to that built by L.C. Peltier many years before. I had visited with Peltier and had actually used his comet seeker, finding it ideal. Since the observer is virtually sealed in the rotating building, at least partial heating of the structure is practical in winter. Since temperatures could reach as low as -35°C at my home, keeping warm while comet hunting was a very necessary consideration. Also important factors in favour of the Peltier arrangement were that the observer always remains comfortably seated and that eyepiece travel was at a minimum.

In the late 1960's I had acquired two pairs of very large binoculars, both of the Japanese military type. The first were a fine pair of

15x80's with a 4^{o} field of view. The other pair were 20x120 binoculars with a 3^{o} field but these were in need of considerable repair. Since the larger binocular was the obvious choice for use in comet hunting, work on their restoration was begun in late 1969 but it was clear repairs would take a consierable time to complete. Since I would move into my new home in July of 1970 an interim instrument was obviously necessary.

The natural choice for the interim instrument were the 15x80 binoculars, and a specially designed mounting was prepared for them early in 1970. The mounting was altazimuth and was provided with a reversible electric motor. This motor drove the binoculars at a rate of 0.5^{o} per second in altitude (I always sweep vertically, contrary to t e more usual practice of horizontal sweeping used by most comet hunters). The figure of 0.5^{o} per second was suggested to me by G.E.D. Alcock to be a rate slow enough to allow very faint objects to be detected as they travelled through the field of view. An object passing centrally through the field was in view for 8 seconds and nebulae as faint as 10th magnitude were routinely detected. Sweeping with this instrument began 1970 August 1st and the 15x80 binoculars remained in regular service for exactly one year, during which time a total of 62.5 search-hours were accumulated. A picture of this instrument appeared on page 234 of the 1973 October issue of Sky & Telescope.

Construction of the Peltier-type comet-seeker was begun in the spring of 1971 and was completed by August 1st. The building was adapted from a commercially available steel yard shed and measured 1.5 by 1.7 metres and stood 1.7 metres high. An opening in the roof and on the wall opposite the entrance was cut allowing the instrument a view of the sky from the horizon to zenith. The former opening is covered by a completely removable hatch while the wall opening had a swing-away door. A wooden floor was constructed for the building incorporating 4 small rubber wheels, each about 30cm in diameter, located at the middle of each of the building's four walls. These wheels serve to raise the structure slightly off the platform on which it rides. Out of the centre of the platform rises a piece of steel shaft. A large bearing is attached to the centre of the structure's flooring and with the shaft passing through it provides a pivoting point and causing the structure to rotate about its centre. Within the structure and directly in front of the seated observer is a small automotive-type steering wheel which, through a shaft, pulley and belt, when turned imparts horizontal motion to the entire structure in either direction. Vertical motion for the now completely rebuilt 20x120 binoculars was provided in a rather novel way. The binoculars were attached to the leading edge of a large U-shaped iron bar 1.7 metres across. The sides of the U are attached at their midpoints to pivot shafts on the wall to the left and right of the seated observer. The ends of the U carry counter-weights which slightly overbalance the binoculars. To the front of the binoculars is attached a cord which runs down to a small crank directly in front of the observer and just above the steering wheel. Turning this crank raises or lowers the binoculars. It takes about four complete revolutions of the crank to take the binoculars altitude 15^{o} to 60^{o} so turning the crank by hand can easily be done slow enough to provide a rate between 0.5^{o} and 0.7^{o} per second.

Since the eyepieces of the 20x120 binoculars protrude at 45^{o} from the body of the binocular, the observer is always either looking downward or little more than straight ahead as he sweeps from altitude 15^{o} to 60^{o}. Heat is provided by a two speed electric heater which has been found to be very helpful in winter. Electric eyepiece and dewcap warmers are also provided. This comet-seeker observatory is pictured on page 269 of the 1971 November Sky & Telescope.

Following Peltier's example, I try to cover as much of the sky as possible each month, not just concentrate on the regions near the sun. Beginning on the night the full moon is first absent for a short time after twilight ends, I sweep an area 90^{o} wide from altitude 15^{o} to 60^{o} centred over the sun. On each following night sweeps cover the remaining quadrants, north to east, east to south, etc. Morning sweeps begin when the moon is six days from new and attention is usully concentrated in the quadrants north to east and east to south. Each session requires about 75 to 90 minutes but occasionally sessions of as much as 15 Ominutes are done. Sweeps proceed generally in a clock-wise direction and field overlap is about one-third. Because of the diurnal motion of the heavens, it is necessary to return to the starting point to cover the newly risen section of sky before completing morning sweeping.

Occasionally, in recent months, I have also employed a 32cm f/5.6 reflector working at 55x with a field of 1.2° to do some sweeping in the regions close to the sun in hopes of detecting very faint comets. These sweeps are done horizontally and cover an azimuth of 45° and to altitude of 40°. While this instrument is very effective at detecting faint objects, lack of eyepiece and optics heaters occasionally results in fogging of one or more of the surfaces, particularly in cold, damp weather. Thus, it is mostly limited to summer work.

As of 1975 November 25th a total of 436.3 search hours had been accumulated. On three occasions in the past 64 months the writer has come very close to finding a new comet. In the case of comet 1970m, the writer's sweeping carried him about 5° above it on the night of its discovery by the Japanese. Comet 1975h was missed by about the same amount (again passing above it) and for comet 1975k the writer's morning sweeping programme started at 7° south of the comet's position two mornings before its discovery by the Japanese (it was located in the only area of sky that had not been swept that month!) Since there have been only five northern hemisphere visual discoveries during the period 1970 August to 1975 November, the three near misses suggest that the writer is at least competitive, even if not lucky.

From Christopher St. John Kear (15)

Most of my observations are carried out with 20x50 Carl Veitch binoculars and a 60mm refractor (altazimuth mounted). First of all, before I even go out to observe, I look at a rota of various sections of the sky which I have drawn up. From this I select the observing zone for the night. Then, I leave the house and take my equipment into a nearby field. I do this because I live pretty near a colliery which has lamps on high standards on my western horizon, which is most important for 'comet-seekers'. I then make preliminary observations of the area to be searched with the binoculars, using the telescope on low power for 'investigating' any interesting objects. I make a note of these, and finish my observations when my 'lazy' telescope eye (i.e. the one which is not used for looking down the eyepiece) is completely exhausted, and, perhaps, aching. The objects which have been noted are then checked against a list of clusters and nebulae indoors. So far, everything which has been noted has been either globular cluster or a nebula. The instruments are then put away until another clear night arrives.

I never observe below about thirty degrees above the horizon, and my rota is always set out for the region 45° either side of west. West is always the best place for comet seekers with small apertures to search, as comets near perihelion with the sun are the brightest.

MY WAY — From K.M. Sturdy

How does one write about comet hunting, let alone do it?

It is an activity that does not lend itself well to popularisation in scientific literature, yet it is, in many ways one of the most fascinating forms of observation.

Paradoxically, the comet hunter spends more time looking at stars and nebulae than at comets, and often I have to break off sweeping if a particularly splendid cluster of stars or double swims into the field. I never use binoculars, I find them uncomfortable. My 150mm reflector is always used with a Frank eyepiece with 1° field, or a Kellner of 45', on bright nights (moon) sweeping is sometimes done with a X60 Ramsden 40' field.

Most of my work is done in the western sky, particular attention is paid to the low S.W. in autumn because that is where the ecliptic is; however, the north circumpolar regions are fairly well covered. All this relates to hunting for new comets, in searching for known comets a different method is used.

Using the SAO atlas in conjunction with Nortons I locate the comets exact position in the sky, if the comet is not there sweeping is done around the area, perhaps 25 or 30 square degrees being covered. To me the beauty of the SAO atlas is that it allows one to set an altazimuth telescope with the accuracy of an equatorial with circles.

Since 1967 my telescope has been mounted on a home-made altazimuth which was admittedly a bit shaky in a wind, but on the whole quite good for low power work. Soon it will be an equatorial with circles but I think I shall still use the SAO for setting on a comet because I have had a lot of practice at it. Of course you can use this technique for finding asteroids and faint nebulae as well.

I have been a fairly regular sweeper for about 9 years without success but I don't find that at all necessary to keep up enthusiasm. It was George F. Chambers and his splendid "Story of the Comets" (the best comet book ever written) that started me off and I am eternally grateful.

GREAT COMET WEST 1975n

S.W. Milbourn

Discovered by Richard M. West on 1975 Sept. 24.0 with the 100cm Schmidt at La Silla, the comet appeared as a 16th magnitude object with a coma diameter of 2" - 3" and a tail 10" long. Subsequent trails were found on plates exposed on August 10 and August 13.

Preliminery elements showed that the comet would probably become a fairly bright naked-eye object by March 1976 but none could have foreseen the brilliant spectacle which ensued. The comet brightened steadily through the last months of 1975, reaching mag. 13 by early November, 12 by early December and by the end of the year, 9th magnitude was attained.

By the end of January 1976, Comet West was of 6th magnitude and running nearly two magnitudes brighter than predicted. However, by mid-February observers were reporting magnitudes around 3.5 (fainter than predicted) and doubts were raised whether we were to witness another Kohoutek. Doubts were quickly allayed when, just before perihelion, Comet West gathered itself and with a stupendous outburst became visible in broad daylight on the day of perihelion, Feb. 25 (J. Bortle, 10x50mm binoculars). John saw it with the naked-eye 10 minutes before sunset on the same day and the magnitude at this time must have been -3 at least. Comet West had become Great Comet West.

At the beginning of March, the comet moved into the morning sky and during the first few days of the month observers witnessed a magnificient sight as the comet began to move away from the Sun. On March 1st, the magnitude was still - 2 and the broad tail curved gently to the east. The tail exhibited a number of streamers and the general visual impression was of a sheaf of golden hair. As March progressed the comet began to fade but the tail increased in length from around 4° at the beginning of the month to 25° to 30° by the 9th. Good conditions were necessary for this length of tail to be seen and few observers had such conditions. Although 'tail' has been used above to describe the appendage, it was in fact a bundle of tails, some gas and some dust. The lengths given were those of the brightest dust component.

As early as March 5th, reports were being received of a splitting of the nucleus and by March 11th observers were recording no less than four separate nuclei. Z. Sekanina (Centre for Astrophysics) suggest that the reported positions of the nuclei indicate the following sequence of splitting: nucleus B separated from nucleus A on Feb. 22; nucleus D probably from B on Feb. 25 or less probably from A on Feb 17 and nucleus C from A on March 5. (IAUC 2930).

Although Great Comet West is now but a shadow of its former glory, those lucky enough to have had clear skies during the first few days of March have been treated to a magnificient spectacle memory of which will last a lifetime.

COMET BRADFIELD 1976d

Bill Bradfield (Adelaide) discovered yet another comet on 1976 March 3.8. The comet was diffuse without condensation, magnitude 9. Dr. B.G. Marsden has calculated parabolic elements from six observations March 4 to March 10, residuals being within 2" arc:

T 1976 Feb. 25.060 ET	ω 221.°760		
	Ω 69.506	1950.0	
q 0.67829 AU	i 147.772		

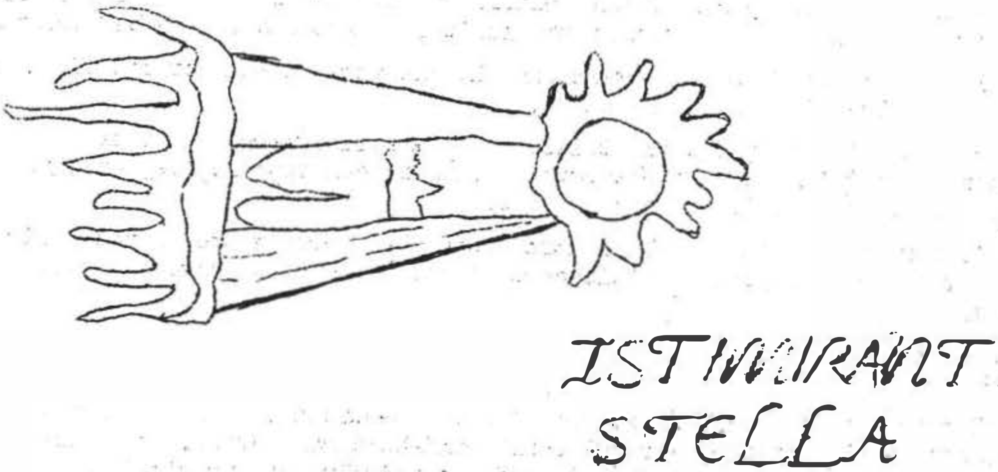
Although the comet is fading and not well placed for observers in northern latitudes (remaining south of the Sun), the following ephemeris may aid observers with large instruments:

1976 ET	R.A. (1950.0)		Dec		Δ	r	Mag
	h	m	°	'			
Apr 2	04	36.81	-07	12.6	1.031	1.004	11.6
7	04	49.47	-02	57.2			
12	04	59.08	+00	13.9	1.376	1.147	12.8
17	05	06.85	02	42.0			
22	05	13.45	04	40.1	1.710	1.293	13.8
27	05	19.29	+06	16.4			

Mag. = 11.5 + 5 log + 10 log r

THE BRITISH ASTRONOMICAL ASSOCIATION

COMET SECTION



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EDITORIAL

Several members have written in praise of the Bulletin, and this is always nice to receive. Remember though, it is the quality of your submissions which insure that the Bulletin always has the success ingredient - so keep them coming.

NEW APPOINTMENT

As many of you will have seen in the February Journal M.J. Hendrie has been appointed Deputy Director of the Section. The Bulletin welcomes this move and reminds the Section that Michael can be reached at the following address: 'Overbury', 33 Lexden Road, West Bergholt, Colchester, Essex.

Michael's duties will be the receipt, acknowledgment and collation of observations and the enrolment of new members. We wish him the best of luck.

MY WAY - the series continues:-

John Lewis

Comet hunting has been a regular part of my programme since the appearance of comet Bennett 1970 II, blazing its way across the skies. I can still recall getting up in the small hours of March 31st and braving the cold, early-morning air, armed only with a 95mm reflector, a pair of 8x30mm binoculars and writing implements. Less than an hour later, just before four o'clock I had my first view of the comet shining in the pre-dawn sky. Fortunately it was one of the brightest comets this century and served admirably as an introduction to this kind of work.

Since then I have devised the following procedure.

I use an f5.6 216mm reflector using a x30 Kellner, and a x48 Orthoscopic (respective fields 1°8' and 50'). As the telescope is mounted equatorially the sweeping is done in RA and raised or lowered in declination after each sweep. I find the glow from street lights particularly bothersome at below about 35 degrees in some directions and another problem is the buildings which obscure parts of the Western and Eastern sky. Therefore all my main searches are concentrated at the zenith, at areas selected beforehand.

I find atlases Coeli, Nortons and the SAO very useful for identification as well as the location of known comets.

Recently I have moved the telescope to a roll-off-roof type of observatory, and this has made observing much more comfortable, especially if one stays at the eyepiece for some time.

So far my efforts have been unrewarded, but perhaps one of these nights I will be the first to point my telescope at one of these elusive objects. Who knows!

<u>Graham Keitch</u>

I have a variety of instruments for comet-hunting. These include a 3" refractor working at x26, several small hand-held refractors, an 8" and a 6" reflector, (both working at f4 and used exclusively for sweeping) and finally a lightweight pair of Japanese 15x80mm binoculars. The two reflectors are both equatorially mounted and this assists sweeping. Atlases and reference works include Nortons, Coeli and the RNGC, (I am also hoping to get an SAO).

The method of search and the instrument employed depends on the circumstances and primarily, conditions. For instance, the binoculars easily mist-up and cannot be used on very cold, damp nights. As the British weather is notoriously bad for astronomy it is necessary for the writer to keep an almost perpetual watch on the sky conditions.

Apart from the brief period of strong moonlight the alarm is set to go off every morning before dawn on the off chance of a clear sky.

Twilight searches are done in the hope of detecting a new comet at perehelion. As such a comet is likely to be large and faint a low magnification is used in the hope of condensing the image to clear visibility. The binoculars are useful for this work. In a dark sky nebulous objects of mag 10 are easily seen. Other advantages of the binoculars include ease of handling and large field in view (3.5°).

Turning to other parts of the sky the emphasis is placed on light grasp as any comet here is likely to be both faint and small. Binoculars are less suited to this work. Wherever possible then the 8" is preferred for its greater aperture and resolution, the latter being very useful when groupings of stars are encountered, say at the edge of the Milky Way. Plossl eyepieces are used providing sweeping magnifications of x27 and x45 with a maximum field of 2°. The higher power provides excellent definition and contrast over a dark field of 1.3°. The oculars were obtained from an ex-government source, the supplies of which are rapidly diminishing and are unlikely to be replenished. The erfle eyepiece is not favoured by the writer who finds fields in excess of 55' unsuitable. Apart from the reduced light transmission which is not insignificant, and the increased light scatter if the elements are not bloomed, too great an apparent field necessitates considerable eye-movement resulting in fatigue and consequent loss of discerning ability. The smaller field of the Plossl provides greater eye-relief and it is possible to absorb most of the field without undue eye movement. Having probably come from small focal-ratio systems they are well corrected for the usual faults.

Sweeping itself is made in strips of azimuth with a 2/3 field overlap. The instruments are not in continual motion being manually operated allowing each field in turn to be examined. The reference points for each session are recorded in a log book together with a note of the sky condition, instrumentation and time - from which the duration of the session can be derived. A note is also made of objects detected as a more accurate measure of performance and conditions.

It appears today that the most highly rated instruments for comet seeking are the giant 4" or 5" binoculars. The greatest asset of such equipment is the binocular vision, which is undoubtedly superior to monocular vision. The difficulty of observing with a singular ocular as with any conventional telescope is the lazy eye which either detects spurious light or impairs the vision of the observing eye when it is forced to squint. A dummy eyepiece or a dark patch worn over the eye, as used by the writer, can improve the

G. Keitch's Way cont:

performance of the monocular system dramatically. The writer's initial attempts at sweeping through the 6" and 8" were erratic until this facility had been attained.

Although having never looked through binoculars larger in size than the 15 x 80mm, the writer feels that the 8" f/4 is probably equal to, if not better than the favoured binoculars. Further, the writer would not be happy searching the areas of sky well away from the sun with magnifications as low as 20x or 25x, which are the normal operating powers of such instruments. Surely comets would escape detection at such low powers? The writer therefore pays more attention to the darker areas of sky where the 8" is probably more effective. The success of the binocular users in this field might possibly be attributed to the large number of binoculars used at Skalnate Pleso in the 1950s and 1960s.

The village from which the writer observes is about to be swallowed up by urban expansion and increasingly the conditions are becoming more difficult. If the 8" f/4 can be relocated in more favourable settings, objects of magnitude 12 and 13 should be easily swept up - making this particular instrument a very powerful tool. As it is, objects of magnitude 12 are in easy reach of the 6" and the 8". but as the situation worsens a decline in performance is inevitable. It is worth noting that several of today's most successful comet-hunters make lengthy journeys to observing sites free from artificial light pollution.

'An analysis of comet discoveries' - as printed in the Journal of the BAA Vol. 72, 1962 - by M.J. Hendrie reveals that comparatively few comets are discovered visually of magnitude 11 to 14. This suggests a range of magnitudes at the threshold, or beyond the limit of most amateur comet-seekers. The writer is optimistic, therefore, that perhaps one day those extra inches of aperture mightbring success.

CHANGE OF ADDRESS

Attention should be drawn to the address of the Editor which has been changed since the appearance of the last Bulletin. The Editor apologises for any inconvenience this may have caused to correspondence arriving at the old address and naturally resulting in delays to the reply.

Also in this connection, it is worth remembering that in the effort to keep down postage bills the normal submission of articles etc. for appearance in the Bulletin will not herald theappearance of an acknowledgment to the author unless there is some query on the submission. If you feel you would like a reply, or if your enquiry demands a reply, then please enclose a stamp to cover this. My thanks to all the members who have written in the past, and I trust these few remarks will be borne in mind for all those who will be most welcome in writing in the future.

COMETS IN 1974

1974a P/Forbes. This short period comet was recovered by Dr. E. Roemer and L.M. Vaughn on plates exposed with the Steward Observatory's 229cm reflector on Kitt Peak on 1974 Jan. 19.5. The images were of around mag. 20 and rather well condensed. This is the fifth observed apparition since discovery in 1929.

During 1974 June to August the comet was bright enough to be detected visually with large sized amateur telescopes, the magnitude reaching 12.6. On August 17, a photograph by Dr. R.L. Waterfield showed a broad diffuse fan tail 6' long. Despite a rigorous determination of the motion between 1942 and 1961, the recovery position indicated a correction of $\Delta T = -0.27$ day to the predicted elements - an indication of probable changes in the non-gravitational parameters since 1961.

1974b Bradfield W.A. Bradfield (Adelaide) discovered his second comet on the night of 1974 Feb. 12 when he detected a 9th magnitude diffuse object in Sculptor. Preliminary elements indicated that the comet would probably become bright enough to be visible to the naked-eye during March, a probability which duly became fact, the magnitude reaching $4 - 4\frac{1}{2}$ during the second half of the month. The comet was widely observed and one of the most striking features was the extreme condensation of the coma which rendered it almost stellar in appearance for a long time. The tail developed during March and the visual length was around 4 degrees by the end of the month. By that time the tail had become a very broad fan and numerous streamers were noted by some observers. April saw a consistent fading of the comet and the tail length diminished and by July the magnitude was below 12, no tail being visible.

The following orbit by Dr. B.G. Marsden is based on 159 observations Feb. 14 to Nov. 18, 1974 perturbations by all nine planets and non-gravitational effects being taken into account.

T 1974 Mar. 18.35634 E.T.		Epoch 1974 Apr. 14.0 E.T.
ω 333°.13024		q 0.5031906 AU
Ω 143.03795	1950.0	
i 61.28976		e 0.9996972

1974c Lovas. The second new comet of 1974 was discovered by M. Lovas (Budapest) on March 22.0 - a diffuse 14th magnitude object in Virgo. Comet Lovas was over 5 AU from the Sun when discovered and with perihelion at 3 AU in August 1975 there was some hope that the magnitude would reach about 9 by that time. However, as observations accrued it became apparent that the comet was experiencing an outburst at the time of discovery and the magnitude formula was eventually revised downwards by 5½ magnitudes. The most recent orbit by Dr. B.G. Marsden is based on 119 observations 1974 Mar 21 to 1976 Nov 21, perturbations by all nine planets being taken into account:

T 1975 Aug. 22.1813 E.T.		Epoch 1975 Aug. 16.0 E.T.
ω 261°.36407		q 3.011456 AU
Ω 11.6714	1950.0	
i 50.6422		e 0.999601

1974d P/Finlay. Recovered by T. Seki (Kochi) on 1974 June 24.8 very close to the prediction by Dr. D.K. Yeomans (see below). Seki was using a 22cm f/5.2 camera at the Kochi Observatory's Geisei station and on June 24 the comet was very diffuse. Later observations on July 18 and 19 showed some condensation and on the latter date a short tail was recorded. This is the ninth recorded appearance of P/Finlay since discovery in 1886.

Predicted Elements (perturbations by all nine planets plus non-gravitational effects):

T 1974 July 3.9489 E.T.		Epoch 1974 July 12.0 E.T.
ω 322°.1278		e 0.699181
Ω 41.7813	1950.0	a 3.642982 AU
i 3.6454		n° 0.1417485
q 1.095877 AU		P 6.953 yrs.

1974e Cesco The third new comet of 1974 was discovered on July 26.2 when Dr. C.U. Cesco and M.R. Cesco of the Observatorio Austral, El Leoncito located a diffuse 14th magnitude object in Sagattarius. The comet was already past perihelion and fading rapidly and observations were continued until October only.

The following elements by Dr. B.G. Marsden are based on 15 observations July 27 to Sept. 18:

T 1974 May 13.0963 E.T.		
ω 176°.8420		e 0.981819
Ω 165.0470	1950.0	q 1.373498
i 173.1652		P 657 yrs

1974f P/Honda-Mrkos-Pajdusakova. Recovered by Dr. E. Roemer and L.M. Vaughn on Nov. 10.1 using the Steward Observatory's 229cm reflector on Kitt Peak. The comet appeared as a small spot of magnitude 19 - 19½ and was making its fifth appearance since discovery in 1948. During December the comet became bright enough to be observed visually, the total magnitude reaching 9 by mid-month. By early

January 1975 magnitudes around 7.5 were reported but the comet was running quickly south and the comet was shortly unobservable from the British Isles.

The correction to the predicted elements was negligible:-

T	1974 Dec. 28.1355 E.T.	Epoch	1974 Dec. 19.0 E.T.
ω	184.5674	e	0.809079
Ω	232.9814 1950.0	a_o	3.031981 AU
i	13.1327	n	0.1366872
q	0.578869 AU	P	5.279 yrs.

1974g van den Bergh. The fourth of 1974's new comets was discovered by Dr. S. van den Burgh on November 12.2 using the 122cm Schmidt telescope at Palomar. The comet was a 17th mag. object in Triangulum, was diffuse without condensation but with a short tail 2' long.

Preliminary elements showed that the comet has a very large perilhelion distance, a result confirmed by later orbit determinations which showed q to be a record 6 A.U. Comet van den Burgh was past perihelion at the time of discovery and remained a very faint object

The following elements are by Dr. B.G. Marsden and based on 31 observations 1974 Nov. 12 to 1975 March 4, perturbations by all nine planets being taken into account:

T	1974 Aug. 8.1758 E.T.	Epoch	1974 Aug. 21.0 E.T.
ω	151°.8041	e	1.004022
Ω	225.4025 1950.0		
i	60.8578	q	6.019617

1974h Bennet. The fifth and last of the 1974 new comets was a discovery by J.C. Bennett of Pretoria, South Africa when on Nov. 13 he found a diffuse 9th magnitude object in Hydra. The comet had no condensation or tail and during the following week faded rapidly and became very diffuse. Comet Bennett was not positively identified after Nov. 25 although faint nebulous images some 5' x 15' in extent which were almost certainly those of the comet were found on plates taken with the Maksutov astrograph at Cerro El Roble by C. Torres and J. Parra on December 8, 9 and 10.

The following elements were calculated by Dr. B.G. Marsden from 10 observations Nov. 14 - 25:

T	1974 Dec. 1.521 E.T.	ω	324°.971
		Ω	50.655 1950.0
q	0.86462 AU	i	134.819

1974 P/Wirtanen Making its fifth appearance since discovery in 1948, P/Wirtanen was recovered by Dr. E. Roemer and L.M. Vaughn on December 20.5 using the Steward Observatory's 229cm reflector on Kitt Peak. The comet was extremely faint, mag. 21.5, but fairly well condensed. The recovery position indicates a small correction of $\Delta T = -0.07$ day to the predicted elements by Dr. B.G. Marsden which are based on observations at the four previous apparitions, perturbations by all nine planets and non-gravitational effects being taken into account:

T	1974 July 5.6655 E.T.	Epoch	1974 July 12. E.T.
ω	351°.8301	e	0.614209
Ω	83.5425 1950.0	a_o	3.255799 AU
i	12.2677	n	0.1677713
q	1.256059 A.U.	P	5.875 yrs.

P/Encke Although not receiving a letter designation, having been observed at aphelion in 1972, P/Encke returned to perihelion in 1974. A number of visual observations were obtained between mid-April and mid-June, the comet reaching a maximum magnitude of 7.5 in late April

P/du Toit I. In March 1975, Mr. C. Torres, Department of Astronomy, University of Chile reported that he had found faint images of du Toit I on plates taken with the Maksutov astrograph at Cerro El Roble in March and April 1974. The April plate showed a centrally condensed coma 1' in diameter and of magnitude 18-19. The two positions are consistent with the line of variation for the comet and indicate that T = 1974 Apr. 1.50 U.T. No letter designation was given to this comet.

P/Schwassmann-Wachmann I. This annual comet experienced one of its irregular outbursts during 1974 Sept 11 - 23 when the total magnitude reached 12 instead of its customary 18.

ROMAN NUMERAL DESIGNATIONS OF COMETS IN 1974

Comet	T	Name	Year/Letter
1974 I	Jan. 4.0	P/Brooks 2	1973j
II	Feb. 15.3	P/Schwassmann-Wachmann I	-
III	Mar. 18.4	Bradfield	1974b
IV	Apr. 1.5	P/du Toit I	-
V	Apr. 29.0	P/Encke	-
VI	May 8.2	P/Reinmuth 2	1973g
VII	May 12.7	P/Borrelly	1973m
VIII	May 13.1	Cesco	1974e
IX	May 19.9	P/Forbes	1974a
X	July 3.9	P/Finlay	1974d
XI	July 5.6	P/Wirtanen	1974i
XII	Aug. 8.2	van den Burgh	1974g
XIII	Sept. 12.3	P/Schwassmann-Wachmann 2	1973l
XIV	Nov. 4.3	P/Longmore	1975g
XV	Dec. 1.5	Bennett	1974h
XVI	Dec. 28.1	P/Honda-Mrkos-Pajdusakova	1974f

COMET BRADFIELD 1974b (= 1974 III)

Comet 1974b was discovered by W.A. Bradfield at Adelaide on 1974 Feb 12.49. The comet was of 7m described as diffuse with central condensation (BAAC 552)

Comet Section observations cover the period 1974 Feb. 14.4 to 1974 Aug 16.1 when the comet had faded to mag 12.8. Perihelion was on Mar. 18. The comet reached its maximum brightness about then at 4.0m or a little brighter. For much of the time the comet showed a tail and a nucleus, or stellar condensation. Maximum tail length recorded was 4°. At times the coma was very diffuse and ill-defined and estimates of brightness, coma size and taillength varied considerably depending on the instrument and darkness of the sky.

Comet Bradfield was near -40° South declination at discovery moving into the Northern hemisphere on March 20 when it was 0.506 AU from the Sun. The comet became circumpolar to observers in Northern Europe during the early days of April and passed less than 1° from the North Celestial Pole on May 15. When observed by J.E. Bortle on 1974 Aug. 16.1 it was at $+43^{\circ}$ declination on the borders of Hercules and Bootis.

The high northern declination and moderate brightness of 1974b allowed 36 observers to make 385 observations of this comet. Their observations are all included below. It has, of course, been necessary to reduce the amount of information given to a single line, whereas some observers used both sides of the form. Their comments have been selected to try to give the best overall picture of the comet's activity, so that features seen in small telescopes are sometimes excluded in reporting features seen in large telescopes, so that features only seen in the large telescopes can be recorded (e.g. in the case of a nucleus).

Following the Director's use of abbreviations in the report of Comet Kohoutek 1973f, these have been used here to save space and are given again below.

M.J. Hendrie
Deputy Director

LIST OF OBSERVERS - COMET BRADFIELD 1974b

INITs	NAME	PRINCIPAL LOCATIONS	PRINCIPAL INSTRUMENTS
GEDA	G.E.D. ALCOCK	PETERBOROUGH	105 x 25 B
CRA	C.R. ANDERSON	LICHFIELD	40 x 10 B
JEB	J.E. BORTLE	STORMVILLE, NEW YORK	Bin. & 320mm S
TB	T. BRELSTAFF	GUISBOROUGH	30 x 8 B
JB	J. BROWN	NOTTINGHAM	Bin. & 216mm S
JTB	J.T. BRYAN	BELLEVUE, NEBRASKA	250mm S
SFB	S.F. BURCH	LEEDS	40 x 8 B & 200mm R
PRC	P.R. CLAYTON	EDINBURGH	50 x 7 B
PBD	P.B. DOHERTY	STOKE-ON-TRENT	Bin. & 450mm S
RDE	R.D. EBHERST	EDINBURGH	80 x 11 B
DF	D. FRYDMAN	WILLESDEN, LONDON	68 x 10 M
MJG	M.J. GAINSFORD	NUNEATON	Bin. & 210mm S
RTG	R.T. GLYNN	BISHOPS CLEEVE	30 x 8 B
DPG	D.P. GRIFFIN	BRISTOL & CAMBRIDGE	Bin. 150mm S 205mm R
MJH	M.J. HENDRIE	COLCHESTER	Bin. 125mm R 100mm F4.5
IDH	I.D. HOWARTH	PORTSMOUTH	Bin. & 300mm S.
DH	D. HUFTON	PONTEFRACT	50 x 10 B
GMH	G.M. HURST	EARLS BARTON	Bin. & 260mm S
FAJ	F.A. de JONG	EDEN HILL, W. AUSTRALIA	Bin. & 200mm S
AFJ	A.F. JONES	NELSON, N.Z.	317mm S
AGM	A.G. Le MOEUR	JERSEY, C.I.	160mm S
VM	V. MATCHETT	INDOOROOPILLY, AUST	Bin. & 300mm S
SWM	S.W. MILBOURN	COPTHORNE, SUSSEX	Bin. 120mm R 250mm S
HCN	H.C. NIGHTINGALE	MALAWI	Bin. & 92mm Maksutov (S)
MFP	M.F. PACE	STOKE-ON-TRENT	Bin. & 450mm S
RWP	R.W. PANTHER	NORTHAMPTON	Bin. & 125mm S
AP	A. POTTS	KNUTSFORD, CHESHIRE	77mm R
JR	J. ROBERTS	PONTEFRACT	50 x 16 B
JHR	J.H. ROGERS	HULL & CAMBRIDGE	Bin. & 200mm R
ES	E. SCHIRMER	AUSTIN, TEXAS	320mm F/6
JDS	J.D. SHANKLIN	I. OF ARRAN & CAMBRIDGE	Bin. & 200mm R.
KMS	K.M. STURDY	YORK	Bin. & 150mm S.
GDT	G.D. THOMPSON	BRISBANE	105mm R.
ALV	A.L. VINCE }	MARKS TEY	162mm R
PHV	P.H. VINCE }	COLCHESTER	
RW	R. WILSON	MALTA	125mm R

Instrumental Code: B = Binoculars M = Monocular
S = Reflector R = Refractor
Photographic abbreviations, e.g. 100mm F4.5

ABBREVIATIONS

a.v.	averted vision	m	moderate
b	broad	n	narrow
br	bright	nuc	nucleus
circ	circular	ph	photograph
c	coma	sl	slight
con	condensed	sm	small
cond	condensation	st	straight
ctl	central	str	strong
d	diffuse	sus	suspected
def	defined	t	tail
f	faint	v	very
elong/d	elongated	w	weak
env	envelope		
l	large.		

COMET BRADFIELD 1974b (= 1974 III)

UT.		Mag	Coma Diam '	Tail Lgth °	Tail p.a. °	Description	Aper. mm	x	Obs
1974									
Feb.	14.4	9.0	-		-	Diffuse without cond.	105R	40	GDT
	15.5	9.0	2		-	Diffuse without tail	200S	-	FAJ
	18.5	7.5	2		-	V. str. con. no tail	50B	16	FAJ
	19.4	8.5	-		-	D. coma. Fairly str. cond.	78R	-	AFJ
	19.4	-	-	-	100	Short tail	317S	-	AFJ
	25.4	8.5	-	-	-	-	78R	-	AFJ
	25.4	9.6	-	0.1	110	D.cel twds tail. Str.con. Nuc.sus	317S	-	AFJ
Mar.	3.4	7.3	1.5	0.05	230	F. nucleus	105R	40	GDT
	3.5	7.1	3	-	-	V.str.cond. Trace of tail	50B	16	FAJ
	10.5	6.5	5	-	-	Tail visible	50B	16	FAJ
	11.5	6.4	5	0.1	109	Altitude 4°	50B	16	FAJ
	15.0	5.0	2	-	-	Almost stellar. Nuc. 5.8m	80B	15	JEB
	17.7	5.2	2-3	0.5	70	Ctl.cond. 40". Nuc.sus. Fan tail	50B	7	HCN
	19.0	4.2	3	0.5	100	C.v.cond.Star like centre T.st.v.n.	50B	10	JEB
	19.3	4.4	-	1.5	90	Sm.Str.cond.	78R	-	AFJ
	19.3	-	-	-	-	C.merged with b.fan tail. Parab.env.	317S	-	AFJ
	19.8	3.0	3	0.2	85	Str.cond. T.broad fan	115R	90	HBR
	20.4	-	-	0.25	90	2nd tail 4' long pa 110°	300S	66	VM
	20.4	5.2	-	-	-	Altitude 6°	50B	7	VM
	20.8	5.0	3	0.1	90	Str.cond. almost stellar	115R	90	HBR
	21.0	4.5	-	-	-	V.cond.coma with diffuse boundaries	50B	10	JEB
	21.0	-	-	1.5	95	Stellar nuc. 6.1 in centre	80B	15	JEB
	21.0	-	2	-	-	Str.narrow tail, sharper on N side	150R	30	JEB
	21.7	4.8	-	4	-	Broad tail	50B	7	HCN
	21.8	5.0	2	-	-	No tail. Str.cond	115R	90	HBR
	22.0	4.0	-	-	-	-	50B	10	JEB
	22.0	-	-	2	86	V.cond.nuc. 6.3. T.n. and st.	80B	15	JEB
	23.0	4.2	-	-	-	-	50B	10	JEB
	23.0	-	-	1.5	87	Nucleus 6.8	80B	15	JEB
	23.0	-	1.4	-	-	Nuc 8.2 Coma str.cond.	320S	88	JEB
	24.0	4.3	-	3	83	V.str.cond. Stellar nucleus	50B	10	JEB
	24.0	-	1.9	-	-	B.spine 1' long. Tail str. and narrow	320S	88	JEB
	24.1	4.5	6	1	80	Nuc.stellar. Coma teardrop. Spine	250S	80	JTB
	24.8	4.7	-	3	-	-	50B	7	HCN
	25.0	4.4	2	3	83	V.cond. coma Tail slender	50B	10	JEB
	25.0	4.0	-	-	-	-	naked eye		JEB
	25.0	-	2	-	-	Sus.hoods., tail fanshaped	320S	88	JEB
	26.0	4.6	-	-	-	-	50B	10	JEB
	26.0	-	-	4	82	Nuc.stellar 7.9. Tail str.narrow	80B	15	JEB
	26.0	-	1.7	-	-	Coma small but less cond.	320S	88	JEB
	26.0	-	-	-	-	Parabolic head with str.cond.	320S	F/6	ES
	28.0	4.6	-	-	-	Faint circ. glow around head	50B	10	JEB
	28.0	-	-	4	74	Nuc. 7.9 Coma parab.	80B	15	JEB
	28.0	-	1.9	-	-	Str.cond. coma. Nuc.stellar 9.5	320S	88	JEB
	28.1	6.5	-	1	70	Nuc.stellar. Central ray in tail	250S	80	JTB
	29.0	4.5	-	-	-	Vis naked eye	50B	10	JEB
	29.0	-	-	3	74	Tail long, narrow. N.edge sharper	80B	15	JEB
	29.0	-	1.8	-	-	Mod.cond. Nuc.stellar. B ray in coma	320S	88	JEB
	29.8	5.7	2	-	-	Strongly condensed. No tail. Vis poor	115R	70	HBR
	29.8	5.4	-	-	-	-	80B	11	RDE
	30.8	5.2	-	-	-	Prominent anti-tail	105B	25	GEDA
	30.8	5.0	-	-	-	Tail very broad fan	120R	20	SWB
	30.8	-	2	0.3	70	V.str. cond.coma. Ctl.cond. 30"	250S	40	SWB
	30.8	5.8	3.5	0.1	90	Str.cond.coma. Broad fan tail	115R	70	HBR
	31.8	4.9	-	-	-	-	35B	9	JHR
	31.8	4.7	-	1.5	60	V.cond.coma. Tail str.and narrow	40B	8	SFB
	31.8	-	2.3	-	-	Stellar nucleus	150S	45	SFB
	31.8	5.4	-	-	-	-	105B	25	GEDA
	31.8	5.7	-	-	-	V.cond.like slightly defocussed star	50B	7	IDH
	31.8	5.0	5	0.1	-	Bright and condensed coma	162R	50	AWV
	31.8	5.3	-	-	-	Cent. cond. 5.6	120R	20	SWB
	31.8	-	3	0.3	70	Nuc.stellar. Tail v.broad fan	250S	150	SWB
	31.8	5.0	-	0.1	-	Short tail, difficult	162R	180	PHV

UT		Mag.	Coma Diam '	Tail Lgth °	Tail p.a. °	Description	Aper mm	x	Obs.
1974									
Mar.	31.8	5.8	3	0.1	100	Str.cent.stellar cond. Tail broad	115R	70	HBR
	31.8	5.0	-	-	-	-	50B	7	PRC
	31.8	5.6	-	-	-	-	80B	11	RDE
	31.8	4.8	4	1.5	50	Tail curved	50B	10	GMH
	31.8	-	-	-	-	Ctl.cond.with nucleus 8.1	260S	40	GMH
	31.9	4.6	-	0.7	50	Coma ill defined. Tail only vis by a.v	40B	10	CRA
	31.9	5.0	-	-	-	-	30B	8	DPG
	31.9	-	2.5	0.1	60	-	150S	60	DPG
Apr.	1.0	-	-	-	55	Tail with bright rays	400R	F/6	ES
	1.9	5.3	-	-	-	-	50B	7	JDS
	2.8	5.1	-	-	-	-	30B	8	DPG
	2.8	-	4	0.3	60	-	150B	60	DPG
	2.8	5.7	-	-	-	-	105B	25	GEDA
	2.8	5.9	2-3	0.1	110	Str.stellar cent.cond	115R	70	HBR
	3.0	4.8	-	-	-	Coma circular. mod. cond.	50B	10	JEB
	3.0	-	3	2	56	Stellar nuc 8.5 Coma diffuse	80B	15	JEB
	3.0	-	2	-	-	Mod.cond. Tail not well defined	320S	55	JEB
	3.9	4.4	-	-	-	-	50B	7	JDS
	4.2	5.0	-	2	-	-	105B	25	GEDA
	4.8	5.8	3	0.1	60	V.str.ctl.cond.stellar.B.tail	115R	70	HBR
	4.8	4.6	-	-	-	Str.ctl.cond. no tail	50B	7	CRA
	4.9	4.5	4	0.5	-	Tail stubby, slightly curved	50B	10	GMH
	4.9	-	-	-	-	Ctl.cond.oval with nuc	260S	40	GMH
	4.9	4.8	-	2	-	Tail a.v.	80B	11	SWB
	4.9	5.0	-	-	-	-	30B	8	DPG
	4.9	-	4	0.6	40	-	150S	60	DPG
	4.9	5.0	-	-	-	-	50B	7	JDS
	5.8	4.8	-	-	-	-	30B	8	DPG
	5.8	-	4	0.6	30	-	150S	60	DPG
	5.8	5.2	-	-	-	-	105B	25	GEDA
	5.8	5.5	3	0.1	60	Ctl.cond. less stellar. Tail difficult	115R	70	HBR
	5.8	4.9	3	0.1	60	Faint spur sus.pa 320° 1-2' long	50B	10	IDH
	5.8	-	-	-	-	Dense centre coma, no nucleus	310S	99	IDH
	5.9	5.0	5	0.5	40	V.str.con inner coma. Tail faint	120R	20	SWB
	5.9	5.2	-	-	-	Diffuse, short tail	68M	10	DF
	5.9	5.4	-	-	-	-	30B	8	RTG
	5.9	4.7	8	-	-	-	50B	7	JDS
	6.8	6.0	5	1	-	V.con. ctl.cond. diam 1' B.spine	50B	10	PBD
	6.8	-	-	-	-	Nuc.stellar 8.5 - 9.0	254S	200	PBD
	6.8	5.6	2	0.1	60	Poor conditions. Full moon	115R	70	HBR
	6.8	4.9	5	0.3	40	Ctl.cond. oval area	50B	10	GMH
	6.8	-	-	-	-	Nuc.offset p.a. 220°	260S	80	GMH
	6.9	4.9	-	-	-	- Full moon	35B	9	JHR
	6.9	5.3	6	-	-	Possible tail	50B	7	JDS
	7.8	5.6	3.5	0.1	50	Str.ctl.cond. Broad diverging tail	115R	70	HBR
	7.8	5.7	-	-	-	-	50B	7	PRC
	7.8	5.5	-	1.5	30	Sus.naked eye. Tail curved sus.split	50B	10	GMH
	7.8	-	-	0.4	30	Nuc. 10.0	260S	80	GMH
	7.8	5.8	-	1.5	-	-	50B	10	MFP
	7.8	5.1	-	-	-	Poor sky. Hazy patch with cond.	50B	10	DH
	7.9	5.3	5	1	40	V.str.con. Faint outer coma. Fan tail	120R	20	SWB
	7.9	5.1	4.5	0.7	40	Mod.con. 40° wide fan tail	80B	11	RWP
	7.9	5.5	-	-	-	Ctl.cond. 5.9. Dble tail fanning	50B	10	PBD
	7.9	-	5	1.5	-	Steller nuc. 9.0. Str.ctl.cond.	254S	200	PBD
	7.9	5.2	8	0.3	-	Indication of tail	50B	7	JDS
	7.9	5.2	4	0.2	-	Ctl.con. Narrow tail	50B	7	IDH
	7.9	-	-	-	-	Possible nucleus	300S	96	IDH
	8.0	5.1	3	2.5	40	Vis.naked eye. Tail broad, sus multiple	50B	10	JEB
	8.0	-	3	-	-	Mod.cond. Sus.stellar nucleus	320S	88	JEB
	8.8	6.0	-	0.5	-	Head almost stellar. Hint of tail	40B	8	SFB
	8.8	-	-	0.3	65	No nuc.str.cond.	150S	45	SFB
	8.8	5.8	-	1.0	-	Inner coma 4'. V.con.centre	50B	10	PBD
	8.8	-	-	-	-	Coma elongated into fanning tail	254S	48	PBD
	8.8	6.3	-	0.4	-	-	50B	16	JR
	8.8	5.8	-	-	-	-	50B	7	PRC
	8.8	5.3	-	0.5	10	Sl.ctl.cond. Tail sus a.v.	50B	16	DH

UT		Mag.	Coma Diam '	Tail Lgth °	Tail p.a. °	Description	Aper	x	Obs
1974									
Apr.	8.8	6.2	3	0.1	50	Str.cond. Fainter than Apl 7.8	115R	70	HBR
	8.9	6.2	-	-	-	Marked fading since Apl 7.8 Tailv.f	120R	20	SWB
	8.9	6.5	4	0.3	5	Coma hazy. Stellar nucleus	75R	62	AP
	8.9	5.8	-	-	-	-	68M	10	DF
	8.9	5.8	-	0.5	50	Bright well con. coma	50B	7	MJG
	8.9	-	4	0.5	50	Ctl.cond. No nucleus	210S	200	MJG
	8.9	5.5	-	-	-	-	30B	8	DPG
	8.9	5.3	9	0.75	-	Just vis.naked eye. Tail broad	50B	7	JDS
	9.8	6.5	-	0.8	60	Str.central cond.	30B	8	TB
	9.8	6.4	-	-	-	-	40B	8	SFB
	9.8	-	-	-	70	Str.ctl.cond. Narrow st.tail	150S	100	SFB
	9.8	6.0	-	-	-	-	50B	10	PBD
	9.8	-	5	0.6	-	Str.con.coma. Tail 2 bright rays	254S	48	PBD
	9.8	6.3	3	-	-	Coma hazy. Nucleus. No tail	50B	10	AP
	9.9	6.5	3	0.1	50	Str.ctl.cond. Stellar con.Complex tail	115R	70	HBR
	9.9	6.0	-	-	-	Diffuse short tail	68M	10	DF
	9.9	5.7	-	-	-	-	50B	7	MJG
	9.9	-	2.5	0.5	20	Con. no nucleus. Tail fainter	210S	35	MJG
	9.9	6.0	-	0.8	-	-	50B	10	MFP
	9.9	5.7	5	1.0	-	Ctl.cond.str. not stellar. Fan tail	120R	20	SWM
	9.9	5.6	-	-	-	-	30B	8	DPG
	9.9	5.3	8	0.5	-	-	50B	7	JDS
	11.0	5.8	4.5	2.3	50	P.a 25° to 75° N.edge sharpest	50B	10	JEB
	11.0	-	-	-	-	Sus. 2 or 3 tails, str.curved to Sth	120B	20	JEB
	11.0	-	3	-	-	Nucleus Coma v. diffuse	320S	88	JEB
	11.9	6.9	2½	0.1	45	Ctl. cond. no longer stellar	115R	70	HBR
	12.9	7.0	3	0.3	-	Bright centre. Sus. fantail	160S	50	AGM
	13.9	6.5	-	-		Coma extends into tail	50B	10	PBD
	13.9	-	5	0.5	-	Fantail 2 components. No nucleus	254S	48	PBD
	13.9	6.7	-	1.5	50	Tail 40° from p.a. 30-70°	100	F/4.5	MJH
	13.9	6.3	-	-	-	-	80B	10	DPG
	14.1	6.5	6	0.3	-	Dblectl.cond. Nuc.Broad Fantail	254S	48	PBD
	14.8	6.3	-	0.5	-	Wide tail	50B	16	JR
	14.8	6.8	6.5	0.3	-	Ctl.cond.double tail	50B	10	PBD
	14.8	-	-	-	-	Spine in ctl.cond. stellar nuc. 10.5	254S	48	PBD
	14.8	7.9	20	10	-	Large head,con. Faint tail	50B	10	GMH
	14.8	6.8	-	-	-	-	50B	7	PRC
	14.9	7.1	3	0.4	30	Mod con. round coma	80B	11	RWP
	14.9	-	-	0.4	30	Faint 30° fantail. Ctl. spine	125S	25	RWP
	14.9	7.3	-	-	-	Large ctl. cond. No tail	30B	8	TB
	14.9	7.0	3	0.2	-	Tail str. fan Ctl.cond.	160S	50	AGM
	14.9	7.0	-	0.5	40	-	50B	10	MFP
	14.9	6.2	3	0.3	55	Coma con. tail fairly narrow	50B	7	IDH
	14.9	-	-	-	-	No nucleus	300S	96	IDH
	14.9	6.3	-	0.5	-	-	50B	7	MJG
	14.9	6.6	-	-	-	-	80B	10	JHR
	14.9	-	-	0.2	-	Nuc. 11.5 a.v. Fanshaped tail	200R	40	JHR
	14.9	7.1	-	-	-	-	80B	8	SFB
	14.9	-	-	0.2	-	Sn.cl.coma. Wide fantail. Sus nuc.	150S	45	SFB
	14.9	6.7	2	1.0	-	-	50B	7	JDS
	14.9	-	-	0.3	-	Fantail Mod con. coma	60R	17	JDS
	14.9	7.5	3	0.1	5	-	75R	62	AP
	15.9	7.5	-	1.0	40	Head strongly condensed	60B	13	MJH
	15.9	-	2	1.0	40	Tail fan shaped p.a. 20°-60°	100	F/4.5	MJH
	15.9	7.2	6	0.25	-	Coma m. con. Tail faint	50B	10	PBD
	15.9	-	-	-	-	Faint nucleus. Structure near head	254S	48	PBD
	15.9	7.2	1	0.25	-	-	50B	7	JDS
	15.9	-	-	0.2	-	-	60R	17	JDS
	16.8	7.5	5	0.3	-	Ctl. cond. Fantail	254S	48	PBD
	16.9	7.3	3	0.3	-	Nucleus displaced from centre	160S	50	AGM
	16.9	7.5	-	0.1	30	Ctl.cond. pear-shaped	450S	120	MFP
	17.3	6.9	2.6	2.3	40	Tail broad between p.a. 26°-65°	50B	10	JEB
	17.3	-	-	2.3	40	Coma parabolic. Tail faint	120B	20	JEB
	17.3	-	1.8	-	35	Stellar nuc. 11.5. Coma ill-defined	320S	88	JEB
	18.1	7.0	4.2	1.5	75	Tail pa. 36° - 83° fanshape	50B	10	JEB

UT.	Mag.	Coma Diam '	Tail Lgth °	Tail p.a. °	Description	Aper	x	Obs
1974								
Apr 18.1	-	2.6	1.5	75	Tail sharply curved to South	120B	20	JEB
18.1	-	2.5	-	-	Head elongated tear, sm str. cond	320S	88	JEB
18.2	7.0	-	0.5	40	Coma diffuse with small cond.	250S	120	JTB
18.9	7.6	2.5	0.3	-	M.cond. Fantail	160S	50	AGM
19.9	8.0	2	0.3	-	Bright cond. or nucleus	160S	50	AGM
19.9	7.7	2	0.1	35	Ctl. cond. Tail difficult	115R	70	HBR
19.9	7.5	-	-	-	Less condensed	50B	7	IDH
20.1	7.0	3.6	0.6	50	Coma parabolic, sharply con.	50B	10	JEB
20.1	-	2.6	1.2	50	Broad tail p.a. 20°-60°	120B	20	JEB
20.1	-	2.3	-	50	M.cond. Nuc. 11.5-12 Tail broad	320S	88	JEB
20.9	7.9	2	0.1	35	Ctl. cond. but more diffuse	115R	70	HBR
21.1	7.4	4.4	0.8	30	-	50B	10	JEB
21.1	-	-	0.8	30	Tail broad p.a. 25°-57°	120B	20	JEB
21.1	-	2.1	-	30	Small cond. Stellar nuc 11.5	320S	88	JEB
21.1	7.0	-	0.5	40	Cond. parabolic head. No nucleus	250S	120	JTB
21.9	7.8	6	0.3	65	Round coma, weakly con. Stellar nuc.	80B	11	RWP
21.9	8.5	2	0.1	35	Ctl.cond. Nuc. 9.5 sus	210S	200	MJG
21.9	7.9	-	-	-	-	80B	10	JHR
21.9	-	-	0.2	40	Sm.br.ctl.cond. Fantail p.a. 15°-65°	200R	40	JHR
21.9	7.8	4	0.7	-	-	80B	10	DPG
21.9	7.9	-	0.7	-	M . con. coma. Fantail	80B	10	JDS
21.9	7.5	-	0.5	-	-	40B	8	SFB
21.9	-	-	-	-	V.con. coma. Nuc. Fantail	200R	40	SFB
21.9	7.9	3	0.2	50	M.con. No nucleus	300S	96	IDH
21.9	7.7	-	1.0	30	-	50B	10	GMH
22.0	8.3	1.5	0.1	20	Ctl.cond. almost stellar. Tail faint	115R	70	HBR
22.9	8.4	1.5	0.1	20	Str. con. tail 2' ill-defined	115R	70	HBR
23.0	7.7	1.0	0.5	25	Large head. Tail easy	50B	10	GMH
23.9	8.6	2	0.1	-	Faint nucleus. Fantail	160S	50	AGM
23.9	8.5	-	-	-	Much fainter than Apl 15	60B	13	MJH
23.9	-	-	-	Head	less defined. Tail barely vis	50R	20	MJH
23.9	-	2	0.3	40	Str.con. tail width 20° Cond 1'5	100	F/4.5	MJH
23.9	7.9	-	-	-	-	80B	10	JHR
23.9	-	-	0.2	40	-	200R	40	JHR
23.9	8.1	-	-	-	-	80B	10	DPG
23.9	8.1	2	0.2	-	Well condensed	200R	40	JDS
23.9	8.8	3	0.2	25	-	50B	20	JB
23.9	-	-	-	-	Coma 4' x 3'	216S	56	JB
23.9	8.5	1.5	-	-	Ctl.con. No. nuc. Tail difficult	115R	70	HBR
24.9	8.4	1.5	0.1	20	Stellar cond. Spine in broad fan	115R	70	HBR
25.0	7.9	4	0.3	-	M.con. Fantail with spine 10'	254S	48	PBD
25.9	8.7	1.5	0.1	15	Ctl.con. Tail not easily seen	115R	70	HBR
25.9	8.0	-	-	-	V.short tail p.a. 20°	50B	10	MFP
25.9	8.0	3.4	-	-	M.con. 2'. Tail easy. fan shape	50B	10	PBD
25.9	-	-	-	-	Sus. 2 components in tail	254S	48	PBD
26.1	7.0	5.5	1.5	45	Coma large circular	50B	10	JEB
26.1	-	2.6	1.5	45	Sm.cond. Tail 20° fan	120B	20	JEB
26.1	-	1.5	-	-	Coma parabolic. F.stellar nuc.	320S	88	JEB
26.9	8.4	3	0.1	40	Nuc. star like. Tail strong, fan	260S	80	GMH
26.9	9.0	2	0.1	50	Sus.nuc x 35 clearly cond. x 200	210S	200	MJG
26.9	8.8	2	0.2	40	Tail v. faint	200R	40	JHR
26.9	8.2	1-2	0.2	-	Well cond. Tail slight fan	200R	40	JDS
26.9	8.6	1	0.1	20	Ctl. con. not stellar. Tail difficult	115R	70	HBR
26.9	8.2	4	0.2	-	Similar to M51	10B	50	PBD
26.9	-	-	-	-	V.con.centre. Fantail, even bright	254S	48	PBD
27.0	9.0	5	0.3	25	-	50B	20	JB
27.0	-	-	-	-	Coma 5' x 3'	216S	56	JB
27.3	7.5	4.8	1.3	40	Tail p.a. 32°-48° broad faint	50B	10	JEB
27.3	-	-	-	-	Tail's north edge better defined	120B	20	JEB
27.3	-	2.2	-	-	Coma parab. Sm.cond. F.nucleus	320S	88	JEB
28.3	7.6	4.4	0.7	50	Tail stubby, broad, faint pa 35°-65°	50B	10	JEB
28.3	-	-	-	-	Sm.cond. Coma v. diffuse	320S	88	JEB
28.9	9.5	2	0.02	30	Ctl. cond. No. nuc. V.faint tail	260S	80	GMH
29.9	9.0	1	-	-	Sl.con. No tail. Poor conds.	115R	70	HBR
29.9	8.7	2.5	-	-	No structure. Little cond.	254S	48	PBD

UT		Mag.	Coma Diam '	Tail Lgth °	Tail p.a. °	Description	Aper	x	Obs
1974									
Apr	30.3	8.0	3.2	0.6	40	Coma parabolic with sm. cond.	50B	10	JEB
	30.3	-	1.8	-	-	Nuc. 12.5. Tails edges p.a. 35°-75°	320S	88	JEB
	30.9	9.7	1	0.05	50	Nuc. 12.8. Tail fan p.a. 40°-60°	260S	80	GMH
	30.9	8.9	1	-	-	No tail Good sky. Bright moon	115R	70	HBR
	30.9	8.5	2.5	0.1	-	Slightly con. Tail easy	254S	48	PBD
	30.9	9.2	-	-	-	-	50B	7	PRC
	30.9	9.2	-	-	-	-	200R	40	SFB
	30.9	9.2	1.5	-	-	-	200R	40	JHR
	30.9	9.1	-	-	-	-	200R	40	DPG
	30.9	9.2	1	-	-	-	200R	40	JDS
	30.9	9.5	6	-	-	Mod.con. Extension in p.a. 25°	200S	27	RWP
May	1.9	9.2	1	0.05	5	Str.con. Tail sus. p.a. 0°-10°	115R	70	HBR
	1.9	9.3	2	0.1	0	Well condensed	200R	40	JDS
	1.9	8.8	3	0.2	45	Stellar ctl. con. 11. Circ. coma	300S	96	IDH
	2.3	7.9	3.4	0.6	38	Broadtail p.a. 34°-70°	50B	10	JEB
	2.3	-	2.0	-	-	Nuc. 12 . Coma circular	320S	88	JEB
	6.8	9.3	2	-	-	Nuc. 11 a.v. No tail. Full moon	300S	96	IDH
	6.9	9.3	1.5	-	-	Str. ctl. cond. No tail	115R	70	HBR
	7.0	9.7	1	-	-	Condensed, almost stellar	200R	120	JDS
	7.9	8.3	1.5	0.1	-	Haze round coma. Ctl. con.	220S	54	AGM
	7.9	9.2	5	-	-	Well con. Nuc. Coma elong. p.a. 0°	200R	40	JDS
	7.9	8.0	4	0.1	50	M. con. round coma. Faint tail	200S	27	RWP
	8.1	7.8	2.7	-	-	Coma v. diffuse. Ctl cond.	50B	10	JEB
	8.1	-	2.1	0.5	46	Narrow faint tail	120B	20	JEB
	8.1	-	-	-	-	Nuc. Cond. v. small	320S	110	JEB
	8.9	9.2	1	-	-	Stellar ctl. cond. Tail sus.	115R	70	HBR
	8.9	8.9	1-2	-	40	Coma d.ctl. cond. Faint tail sus	300S	96	IDH
	9.1	7.9	4.7	-	-	M.con. coma. Tail invisible	50B	10	JEB
	9.1	-	2.8	0.6	44	Coma circ. Nuc cond. 11 .	320S	88	JEB
	10.9	9.0	2.5	0.1	-	M.con. Fantail	50B	10	PBD
	10.9	9.0	-	-	-	Coma condensed	200R	40	SFB
	10.9	9.1	3	-	-	M.con. coma Sus. elong. p.a. 15°	200R	40	JDS
	10.9	8.8	5	0.3	35	Coma m.con. Nuc. a.v. Tail straight	300S	96	IDH
	10.9	9.2	-	-	-	No detail visible, too faint	125R	50	SWM
	10.9	9.2	-	-	-	-	125R	50	RW
	10.9	9.3	1.5	-	-	M.con.coma Cond. No tail	220S	54	AGM
	11.0	-	5	0.4	25	Clouds interferred	216S	56	JB
	11.9	9.3	1	-	-	Ctl.cond. No tail visible	115R	70	HBR
	12.0	-	-	0.2	25	Nebulous patch. Not vis 10 x 50B	216S	56	JB
	12.1	8.1	5.2	-	-	Tail sus	50B	10	JEB
	12.1	-	5.2	0.7	55	Coma parabolic, tail straight	80B	15	JEB
	12.1	-	-	-	-	Sl.diffuse nuc. 11.5 Tail difficult	320S	55	JEB
	12.9	9.4	1.5	0.1	-	V.bright ctl. cond. Short tail sus	220S	54	AGM
	12.9	9.3	1.0	-	-	Ctl.cond. Tail suspected	115R	70	HBR
	13.9	9.1	4	-	-	M.con. Nuc 12 a.v. Sus tail p.a. 90°	300S	96	IDH
	13.9	9.5	1.5	0.1	-	M.con. Sus wide fan tail	220S	54	AGM
	13.9	9.3	1	0.1	0	Ctl.con. Probable tail	115R	70	HBR
	13.9	9.3	3	0.1	145	Tail fan p.a. 125-165°	260S	80	GMH
	14.1	8.0	9	-	-	Coma v. large elong. p.a. tail	50B	10	JEB
	14.1	-	-	-	-	Coma seems fan with sm. con.)	80B	15	JEB
	14.1	-	5	0.7	85	offset towards apex)	120B	20	JEB
	14.1	-	2	-	-	Nuc 13. M.con.circ.coma	320S	88	JEB
	14.8	9.3	1.5	-	-	Ctl.con. Tail sus. 3' long	115R	70	HBR
	14.9	9.1	-	-	-	-	200R	40	SFB
	14.9	9.4	1	-	-	Coma con. elong 4' p.a. 15°	200R	40	JDS
	14.9	9.1	4	0.2	105	M.con.coma. No nuc. Tail sus	300S	96	IDH
	14.9	9.3	2	0.2	-	Fan shape tail	220S	54	AGM
	14.9	8.7	5	-	-	Weak cond. Short tail sus	80B	11	RWP
	15.1	8.2	4.5	-	-	V.diffuse coma, small cond.	50B	10	JEB
	15.1	-	5.0	0.3	123	Tail slightly curved to south	120B	20	JEB
	15.1	9.2	2.3	-	-	Nuc. 13.2. Coma circular	320S	55	JEB
	15.9	9.2	4	-	-	Mod. con.	200R	40	JDS
	15.9	9.5	1	-	-	Faint outer coma. No tail	100	F/4.5	MJH
	17.9	9.3	3.5	0.1	140	Less con No. nuc. Faint tail	300S	96	IDH
	17.9	9.8	1.5	0.1	-	Br. towards centre. Faint tail	220S	54	AGM

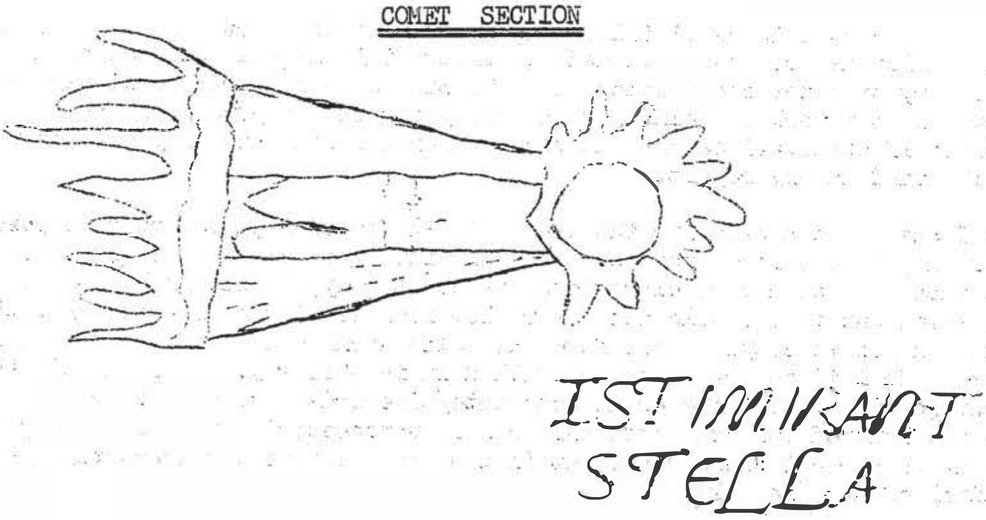
UT		Mag.	Coma Diam '	Tail Lgth °	Tail p.a. °	Description	Aper	x	Obs
1974									
May	17.9	9.1	1.5	-	-	Ctl.cond. Conds. v. good	115R	70	HBR
	18.0	9.1	4	0.1	130	Str. con. Tail fan p.a. 120°-140°	260S	80	GMH
	18.0	9.5	2	-	-	V.faint, sl.con.	200R	40	JDS
	18.9	9.5	1	-	-	Centrally condensed	115R	70	HBR
	18.9	9.1	6	-	-	Circ. coma. weakly con.	80B	11	RWP
	19.0	9.5	3	0.2	130	Ctl. cond. displaced to p.a. 310°	300S	96	IDH
	19.1	9.5	3-4	-	-	Sl.ctl.con. No tail	150S	48	KMS
	19.1	8.6	5.0	-	200	Coma fan v. diffuse	50B	10	JEB
	19.1	-	4.0	-	200	Tail v. faint curved to south	80B	15	JEB
	19.1	9.4	2.3	0.4	200	Coma circ. Nuc. 13.5	320S	88	JEB
	19.9	9.2	2	0.1	180	Stellar nuc. coma faint	200R	40	JDS
	19.9	9.4	1	-	-	Ctl. con. elong. pa 0°	115R	70	HBR
	19.9	9.5	4	-	-	Coma elong. p.a. 180° Nuc 12	150S	48	KMS
	19.9	8.8	2	0.1	155	Tail p.a. 140°-170°. Nuc	260S	80	GMH
	20.0	9.3	-	-	-	-	200R	40	JHR
	20.1	8.8	9	-	-	V. diffuse. Cond. 5'2 Sunward	50B	10	JEB
	20.1	-	-	0.7	217	Tail straight and diffuse	120B	20	JEB
	20.1	9.8	2.3	-	-	M.con. Nuc. 13.5	320S	88	JEB
	21.1	9.2	2	-	-	Coma v.f elong pa 170°	200R	40	JDS
	21.1	9.2	4.0	-	-	Coma rather diffuse. Tail sus	50B	10	JEB
	21.1	-	3.3	0.6	190	Coma fan-shaped. Tail straight	120B	20	JEB
	21.1	9.8	1.2	-	-	Cond. elong. pa 0°-180°	320S	88	JEB
	22.0	9.3	8	-	-	Circ. diffuse coma. Cond. weak	80B	11	RWP
	22.0	9.1	1.5	0.1	180	Coma mod. cond. Tail 30° wide	200R	40	JDS
	24.0	9.4	2	-	-	V.faint. Poorly con.	200R	40	JDS
	24.1	9.0	6.3	-	-	Coma circ. w. cond. Tail sus	50B	10	JEB
	24.1	9.4	2.8	0.3	195	Nuc. cond. elong. pa 0°-180°	320S	88	JEB
	24.9	10.3	2	-	-	Sl. cond. Sus. short tail	220S	54	AGM
	25.1	10.1	2	0.1	140	Parab. coma m. cond. Nuc 13.5	300S	96	IDH
	25.9	9.6	2	-	-	Faint Sus elong. pa 170°	200R	40	JDS
	26.1	10.4	4	-	-	More diffuse. Sus elong. pa 160°	300S	96	IDH
	26.9	9.5	2.5	-	-	Mod. con. faint stellar nucleus	200R	40	JHR
	26.9	9.8	3	-	-	V.faint. Poorly condensed	200R	40	JDS
	26.9	9.5	3	-	-	Diffuse with slight cond.	150S	48	KMS
	27.1	9.8	2	-	-	Nuc 13 Coma diffuse. No tail	320S	55	JEB
	29.9	10.0	1	-	-	V.difficult object. No detail	115R	70	HBR
	30.0	9.8	5	-	-	Diffuse, no tail weak cond.	300S	96	IDH
	30.0	-	2	-	-	V.faint, no definite form	200R	40	JDS
	30.0	9.8	9	-	-	Coma circ. V. slight cond.	125S	25	RWP
Jun	2.0	10.5	3	-	-	V.diffuse Ctl. cond. sus	150S	48	KMS
	5.0	0	2	-	-	V.faint fuzzy patch	200R	40	JDS
	5.0	10.4	4	-	-	Diffuse glow. Little cond.	300S	96	IDH
	9.9	11.5	1.5	-	-	Sus oval coma p.a. 100°-280°	260S	80	GMH
	10.0	11.5	1.5	-	-	V.diffuse. Seen by a.v.	254S	96	PBD
	12.0	11.0	3-4	-	-	Cond. 2'-3' displaced p.a. 350°	300S	96	IDH
	12.1	10.7	2.8	0.1	205	V.diffuse. Nuc. 13 Fantail	320S	88	JEB
	13.1	10.7	2.8	0.1	200	Coma circ. ill-defined. Sus. tail	320S	88	JEB
	13.9	12.0	1	-	-	V.faint object. Good sky	254S	96	PBD
	14.0	11.0	3	-	-	10m star in coma. No nuc. No tail	300S	96	IDH
	14.1	10.7	3	0.1	210	Coma v.d. Nuc 13.5 St. tail	320S	88	JEB
	19.1	10.8	2.4	-	220	V.st.con coma. Nuc 13.5 F.tail	320S	88	JEB
	21.1	11.9	2	-	-	Coma 2' x 3' elong 150°-330°	300S	96	IDH
Jul	9.1	12.4	1.2	-	-	V.diffuse and faint. No tail	320S	88	JEB
	11.1	12.0	1.1	-	-	V.ill-defined. No cond. or nuc	320S	88	JEB
	12.1	12.1	1.1	-	-	V.slight cent. cond.	320S	88	JEB
	13.1	12.4	1.1	-	-	V.faint circ. coma. No cond.	320S	88	JEB
	17.1	12.4	1.7	-	-	V.faint, diffuse. No cond.	320S	44	JEB
	20.2	12.4	1.6	-	-	Extremely faint	320S	88	JEB
	21.2	12.5	1.6	-	-	Coma totally undefined	320S	88	JEB
	22.1	12.5	1.0	-	-	Circ. without cond.	320S	88	JEB
Aug	16.1	12.8	1.3	-	-	V.diffuse, barely seen	320S	88	JEB

1974 - FULL MOON

FEBRUARY	6.9	JUNE	4.9
MARCH	8.5	JULY	4.5
APRIL	6.8	AUGUST	3.1
MAY	6.4	SEPTEMBER	1.8

THE BRI ISH ASTRONOMICAL ASSOCIA ION

COMET SECTION



BULLETIN NO. 9 MARCH 1978

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FROM THE DIRECTOR

Last Autumn S.W. Milbourn notified the Council of his wish to relinquish the Directorship of the Comet Section and on 1977 November 30 the Council appointed me to succeed him.

Stan Milbourn was appointed Director in 1968 on the retirement of M.P. Candy and during his term of office there were several specially interesting comets, including the bright comets Bennett 1970 II, West 1975n and Kohoutek 1973 XII. There were also several lesser comets like Kobayashi-Berger-Milon 1975 IX, and in all some 3500 observations of more than 40 comets were received by the Section during his term of office.

In addition to co-ordinating the observing work of the Section for the last 10 years, Stan has carried out valuable visual observations of comets, and searched for new comets (he also has a reputation for his accurate artificial satellite observations), edited the BAA Circulars, presided over the introduction of our Section Bulletin and of course continued his work on computing cometary orbits. It is mainly in order to devote more time to this computing work that Stan decided to stand down as Director. The advent of reasonably priced programmable scientific calculators has held open this field to amateurs when it seemed that only those with large institutional computing facilities behind them would be able to tackle the more pressing problems.

We are fortunate to retain his services as an Assistant to the Director (along with A.F. Jones and H.B. Ridley) and he will undertake all correspondence and answer all queries on orbit computing work within the Section, and will continue as Editor of the BAA Circulars (a separate BAA Council appointment). Stan will also handle any really precise positional observations although in the absence of any special arrangement with him, all observations should be sent to me initially. All other correspondence (excepting material for the Bulletin which should be sent to the Editor) and all observations of comets should be sent to me please.

Relieved of some of these duties handled personally by earlier Directors I hope to be able to devote some time to analysing and publishing reports of members observations. It is a great help if observations can be sent to me in batches during the apparition of the comet, or soon after the

Continued:

comet has ceased to be visible. Clearly it is not worthwhile to send each observation as soon as it is made (although this is helpful soon after discovery or after conjunction with the Sun) unless there are likely to be very few, but work on collating and analysing the observations may be delayed if observations are outstanding for too long and they may not then be included in any report.

May I also make a plea for the use of the standard report form when possible; these may be obtained from me. I appreciate that some overseas observers and those who do not regularly observe comets may not always be able to use the forms and this should not deter them from sending me reports by letter. Notes on how to complete the forms are also available from me and it helps a great deal if report forms are filled in in this way. For example the first job is to sort the forms into date/time order and when there are several hundred for one comet this can be unnecessarily time consuming when the dates are not clearly set out in the same sequence, year/month/day/decimal of day (in U.T).

I should like to return to the reporting of observations in a later Bulletin. The analysis of comet observations is complicated by the fact that one is not dealing with a single object like a planet where a fixed reference system can be easily established nor is one dealing with a number of objects of similar appearance like variable stars.

To store and publish comet observation information in a concise and unambiguous way probably means converting more of it to numerical form. Verbal descriptions of features convey a good general idea to other observers but may be difficult to record and analyse concisely. Accurate drawings and photographs may convey more information but always need careful indications of scale and orientation. However, I think we should attempt in the first place to add more numerical information to our descriptions as is sometimes done in describing the degree of condensation of the coma.

When it comes to publishing observations it is essential that this be done in a concise manner; publication costs are too high to allow scores of drawings or lengthy descriptions. It is also very difficult to combine observations not made to a common system. One must decide at what level the information should be held or published, bearing in mind that one does not know what data investigators will require in the future (a cometary probe for example could raise questions which would start a search for particular features in earlier comets).

Since 1948 our members have sent in well over 6000 observations of more than 120 comets and if only 20 items of information have to be recorded, this still amounts to 120,000 pieces of data. Though this is very small in commercial or industrial terms it is none-the-less a formidable amount of information to deal with by hand as a spare-time activity.

It would, of course, be possible to have our data stored, analysed and printed using a commercial data processing system, but even ignoring the expense we are not yet in position to know for certain what we want to do. Developments in desk-top computers using the cartridge system for storing programmes and data and bubble memory storage systems suggest that in the next few years a reduction in cost and increase in sophistication will take place comparable with that in pocket calculators over the past 3 or 4 years. This could mean that the price of a system to handle all our mathematical and data processing requirements would be no higher than that of a moderate sized amateur's telescope. The ability to interface these machines with printers and plotters already exists so that one could perhaps provide data as required in almost any form.

The long term aims of the Section must, I believe, be to increase the number and quality of observations still further. This can only be accomplished as and when the opportunities arise. The reporting and analysis of observations is a means to the end of making this data available to researchers in a concise and convenient form and should take up as little of the Section's time as possible. We should, I believe, be prepared to take advantage of new developments here as much as in our observational work.

Continued:

I hope to return to this again in a later Bulletin and also to consider whether the comet Report Forms could be redesigned to enable information to be extracted more easily. Eventually the form could be the input document for a mechanised data handling system.

These things need to be borne in mind over the next few years so that any developments we may introduce will be towards the eventual goal of a more streamlined system, but it is too early to introduce any changes now and we would be wise to wait and see how things develop.

Finally, turning again to observational work, there has recently been more discussion on the best way to make visual magnitude estimates. I hope we can discuss this in a future Bulletin. I am also very interested to see members trying to observe fainter comets and keeping a watch on some periodic comets for unexpected outbursts, in observations in moonlight and under other difficult conditions, and I hope that some members will introduce new methods, equipment and techniques into the Section's work.

I hope that there will continue to be many interesting comets to observe and that our members who are continuing the tradition of searching for new comets will be rewarded by a discovery before long.

Michael J. Hendrie.

Colchester, Essex.

EDITORIAL

I would like to wish Michael all the very best as the new Director on behalf of the Section.

I think you will agree that he has given us much to think about in his communication; the ideas presented make me sure that the Section is in for some pretty exciting times ahead.

The idea of mechanical data handling of comet information is not a new one, but as Mike says it could well prove to be very beneficial to our observation storage problems in the foreseeable future.

ERRATUM

The following errors have been pointed out by Graham Keitch in the typing of his 'My Way' article on page 2 of Bulletin 8.

Para 1: Both reflectors are on atlaz mounts as this assists sweeping.

Para 5: The erfle eyepiece is not favoured by Graham who finds apparent fields in excess of 55° unsuitable (not 55').

COMET BRADFIELD 1974 III

In Bulletin 8 H.B. Ridley was omitted from the list of observers, although his observations were included (he was in fact the first member to observe the comet from this Country.)

Please add the following to the list on page 7:

HBR	H.B. Ridley	Godalming	115R

COMETS IN 1975

1975a = 1975 I P/Boethin. Discovered by the Rev. Leo Boethin (Abra, The Philippines) on 1975 Jan 4 as a very diffuse 12th magnitude object without tail near the border of Aquarius and Pisces. Moonlight quickly interfered with observations and it was early February before the discovery was finally confirmed. Preliminary calculation indicated that a short period orbit was

Continued:

possible and the ellipticity was confirmed as the observed arc extended. The comet was at perihelion when discovered and although magnitudes around 11 - 11.5 were reported in early February (Feb 10; mag. 11.3; Bortle) it consequently faded rapidly (Mar 30; 15.5, coma 20" diam, R.H.S. South, Woolston) and by the date of the last observation (June 3, E. Roemer, M.A. Daniel, 229cm reflector, Kitt Peak) the comet was almost invisible on the plate.

The following elliptical elements have been calculated by R.J. Buckley on the basis of 39 observations, Feb. 8 - June 3 perturbations by Venus to Neptune being taken into account:

T	1975 Jan 5.6271	ET	Epoch 1974 Dec. 19.0	ET	
ω	11°.1219		e	0.779447	
Ω	26.9712	1950.0	a	4.958658	AU
i	5.9117		n°	0.0892602	
q	1.093647	AU	P	11.042 yrs	

1975b = 1975IV P/West-Kohoutek-Ikemura. Discovered by Dr. Lubos Kohoutek on 1975 Feb. 27.8 as a diffuse 12th magnitude object in Aries and independently by Ikemura on March 1.5. The comet was also identified on plates taken by N. Kojima (Ishiki) on Feb. 28.4 and by R.E. McCrosky (Agassiz) on March 1.0. Elliptical orbit calculations by B.G. Marsden showed that the comet was identical with one discovered by R.M. West (La Silla) on 1974 Oct. 15.1 although at that time no other observations were obtained to confirm the object. These calculations showed that perihelion occurred just prior to the discovery by Kohoutek and later observations showed a progressive fading, the magnitude being 15.3 by May 4 (R.H.S. South, Woolston).

Taking 37 observations 1974 Oct 15 to 1975 May 30, R.J. Buckley has calculated the following elements, perturbations by Venus to Neptune being applied:

T	1975 Feb. 25.7825	ET	Epoch 1975 March 9.0	ET	
ω	358°.0062		e	0.581857	
Ω	84.6568	1950.0	a	3.344193	AU
i	30.0802		n°	0.161636	
q	1.398351	AU	P	6.116 yrs	

1975c = 1975 III P/Kohoutek. The third short period comet to be discovered during the first two months of 1975 was found by Dr. L. Kohoutek (Bergedorf) on 1975 Feb. 9.8, a diffuse magnitude 14 object in Taurus. At first it was thought that this comet and the one located by Dr. Kohoutek on Feb 27.8 (see 1975b) was the same object having moved westwards during the interval. However, further observations showed that the Feb. 27 comet was moving Eastwards and it was apparent that two separate comets were involved. Dr. Kohoutek quickly relocated 1975c further Eastwards in Taurus and by March 6, Dr. B.G. Marsden was able to calculate preliminary elliptical elements which showed that like the first two short period comets, 1975c was past perihelion, consequently it faded, the last observations in 1975 being obtained on May 30. However, in 1976, on April 29, Dr. E. Roemer managed to secure a pair of plates using the 229cm reflector at Kitt Peak in conjunction with an image intensifier which showed the comet at mag. 21.5. Using these positions together with the 1975 observations, S.W. Milbourn has calculated the following elements, perturbations by Venus to Neptune being applied:

T	1975 Jan 18.1944	ET	Epoch 1975 Jan 28.0	ET	
ω	169°.7604		e	0.537094	
Ω	273.1890	1950.0	a	3.387379	AU
i	5.4179		n°	0.1580915	
q	1.568037	AU	P	6.234 yrs	

1975d = 1975 V Bradfield. Mr. W.A. Bradfield (Dernancourt, Adelaide) discovered his third comet when on 1975 March 12.4 he found a 9th magnitude diffuse object in Cetus. The comet maintained its magnitude for a few weeks as it approached perihelion and at times displayed an elongated coma giving

Continued:

the appearance of a short fantail. After perihelion a fading set in, the last observations in 1975 being made on June 18 as the comet moved into twilight. After conjunction it was re-observed as a 17th magnitude object in 1976 January.

R.J. Buckley using 74 observations over the total arc has calculated hyperbolic elements, the mean residual being 2".50:

T	1975 Apr. 4.5837 ET		Epoch 1975 Jan. 28.0 ET	
ω	264°.1309			
Ω	157.2130	1950.0	e	1.001667
i	55.2498		1/a	-0.00136985
q	1.216971 AU			

Perturbations by Venus to Neptune have been taken into account.

<u>1975e = 1975 VII P/Smirnova - Chernykh</u>. The fifth discovery of 1975 was also found to be moving in a short period orbit and was found by T.M. Smirnova and N.S. Chernykh (Crimean Astrophysical Observatory) on 1975 March 4.8 and March 16.8. The comet a diffuse 15th magnitude object with central condensation was moving North-Westwards on the borders of Leo and Cancer. On 1975 April 17 plates obtained with the Steward Observatory's 229cm reflector on Kitt Peak by E. Roemer, R.A. McCallister and S. Waaland showed a condensation at the apex of a fan shaped coma extending 0'.1 to the SE and on April 29 a plate exposed by R.H. South and R.L. Waterfield (Woolston) showed a 16th magnitude image with a slightly diffuse central coma 20" in diameter. The comet moved into twilight by mid-summer but was re-observed in 1976 January, the magnitude still being around 16.

Using 53 observations 1975 Mar. 4 to 1976 May 3 and including perturbations by Venus to Neptune, R.J. Buckley has provided the following elements, the mean residual being 1".24:

T	1975 Aug. 7.0379 ET		Epoch 1975 Jan 28.0 ET	
ω	90°.2940		e	0.145298
Ω	77.1148	1950.0	a	4.173557 AU
i	6.6417		n°	0.1155965
q	3.567150 AU		P	8.526 yrs.

The present orbit is due to a close approach to Jupiter in 1963 and owing to the small eccentricity the comet should be observable annually.

<u>1975f P/Wolf</u>. This short period comet was recovered by Dr. E. Roemer and L.M. Vaughn on 1975 May 17 using the Steward Observatory's 229cm reflector on Kitt Peak. The image was very faint, of mag. approx 22 and the position indicated a correction of ΔT = -0d.2 to the prediction in the Handbook 1975. The comet was observed until the end of the year but remained a very faint object.

<u>1975g P/Longmore</u>. Discovered by A.J. Longmore (Siding Spring Observatory) on a plate taken with the 122cm Schmidt telescope by P.R. Standen on 1975 June 10.6. The comet, in the constellation Pavo, was a diffuse 17th magnitude object with central condensation and had a faint tail 15" long. Owing to the faintness of the comet and approaching conjunction only 8 observations were obtained (June 10 - Oct 4) but they were enough to show that this was yet another short period comet. Using the 8 observations and taking into account perturbations by Venus to Neptune, R.J. Buckley has calculated the following elements, the mean residual being 0".22:

T	1974 Nov. 4.4215 ET		Epoch 1974 Nov. 9.0 ET	
ω	196°.2891		e	0.342409
Ω	15.0055	1950.0	a_o	3.653017 AU
i	24.4017		n°	0.141648
q	2.402191 AU		P	6.982 yrs.

Continued:

1975h = 1975 IX Kobayashi-Berger-Milon. Discovered by T. Kobayashi (Imadate, Fukui) on 1975 July 2.7 and independently by D. Berger (Union City, California) on July 5.3 and D. Milon (Mount Washburn, Wyoming) on July 7.4. The comet was a $7\frac{1}{2}$-8th magnitude object, diffuse with condensation and moving North-Westwards in Aquarius. By the middle of July the magnitude had reached 6 and the development of a tail began. As the comet moved almost overhead during August it was plainly visible to the naked-eye at around mag. 4.5 and the coma which had reached a diameter of almost half a degree in July, began to contract as the comet approached perihelion. The tail length grew, some 8 to 10 degrees being reported visually under good conditions by the end of the month and a plate exposed by G.H. Rutter (Woolston) on August 11 showed 11 degrees. During September the comet began to fade from magnitude 5 at the beginning of the month to 7 by the close and this fading continued with a shortening of the tail for the rest of the period of visibility.

Using 277 observations from July 6 to October 14, Dr. B.G. Marsden has provided the following elements, perturbations by all nine planets being applied, the mean residual being 1".49:

T	1975 Sept. 5.3347 ET	Epoch 1975 Sept. 25.0 ET	
e	1.000099	ω 116°.9755	
q	0.425561	Ω 295.6526	1950.0
		i 80.7781	

1975i = 1975 XII P/Churyumov-Gerasimenko. This short-period comet was making its first return to perihelion since discovery in 1969 and was recovered by Dr. E. Roemer on 1975 Aug. 8.3 on a single plate exposed with the Steward Observatory's 229cm reflector on Kitt Peak. The plate showed a well condensed image of approx. magnitude 19.5. Two predictions were available based on observations in 1969 and 1970, the uncertainty for ΔT being about ± 1 day. The recovery position indicated corrections within this tolerance being +0d.43 for the prediction by Dr. B.G. Marsden (IAUC 2783) and -0d.39 for that by N.A. Belyaev (Handbook 1976). At the present time elements linking both apparitions have yet to be published.

1975j Mori-Sato-Fujikawa. Discovered independently by H. Mori, Y. Sato and S. Fujikawa on 1975 Oct 5, the comet being a diffuse $10\frac{1}{2}$ magnitude object moving South-Eastwards in Hydra. The comet's Southerly motion accelerated and by mid-November it was too far South to be observed from the British Isles. The comet did not become a conspicuous object but attained a magnitude of 8 during November and December. Tail development was weak but on December 30, S. Barros (Cerro El Roble) recorded a faint narrow tail 2 degrees long.

Using 177 observations 1975 October 6 to 1976 Sept 20 and taking into account perturbations by all nine planets, Dr. B.G. Marsden has calculated the following elements:

T	1975 Dec. 25.8774 ET	Epoch 1975 Dec. 14.0 ET	
e	0.997450	ω 246°.2475	
q	1.603933	Ω 277.9800	1950.0
		i 91.6061	

To be continued.

COMET KOHLER 1977m

Comet 1977m was discovered on 1977 Sept 4.2 by amateur astronomer Merlin Kohler using a 20cm Schmidt-Cassegrain telescope, at Quincy California. The discovery was reported in IAU Circular 3103 by A.R. Klemola and confirmed by E.A. Harlan using the Lick Observatory's 52cm double astrograph. This 40 minute exposure confirmed the comet's motion to be towards the South-east

In Sky and Telescope for 1978 January John Bortle reports the independent discovery of this comet by variable star observer Michel Verdenet.

At the time of discovery comet Kohler was well placed for observation moving through Corona Borealis in the evening skies of the northern hemisphere.

Comet Section observations received by the Director up until mid-January cover the period 1977 September 11.8 until 1977 November 28.7; 24 observers made 180 observations. By late November the comet was low in the SSW sky

Continued:

after sunset and difficult to observe from the latitude of the British Isles.

Six observers saw comet Kohler on Sept 11 and reported coma diameters between 2' and 6' and magnitudes between 9.5^m and 10.5^m. The comet was diffuse without a tail but a 12^m nucleus was reported. By October the head was moderately condensed to most observers and between 8^m and 9^m magnitude. Differences in estimates of $1\frac{1}{2}$ magnitudes continued in early October but as the comet brightened and became more centrally condensed these variations were generally less than one magnitude.

Several observers reported seeing structure in the head often described as spikes. About mid-October a few observers reported suspecting a tail whilst other observers reported no tail. Both these observations and those reported elsewhere seem to show that any tail was weak and difficult to see and may well have varied in extent, form and brightness from night to night. IAU Circular 3118 reports that a spectrogra taken on 1977 Oct 5.1 using the 1cm reflector and image intensifier (Goddard Space Flight Center) showed several emission bands but only a weak continuum implying a low dust to gas ratio. Thus the tail was probably of type 1 (ionised gas tail) usually faint visually and quite possibly subject to rapid variations in strength and form.

By early November observers were recording a brightness between 6.5^m and 8.0^m, the comet being strongly condensed, someti es with a faint, short fan-shaped tail. The comet was described as like a fainter M 11 gobular cluster, near which it passed in early November.

The last observation showed it around 6.5^m at the end of November, circular, moderately condensed with a faint narrow tail 20' long in p.a. 40°/65°. Estimates of apparent size, magnitude and the presence of a tail depended throughout the period under review to a considerable degree on the type of instrument and observing conditions. As is usual with this type of comet and magnitude range, binoculars generally gave lower magnitudes (great comet brightness) and larger extension of the coma, than larger instruments.

(Observations have been received from A.F. Jones, M.L. Clark and J. Seward since this report was compiled; A.F. Jones reports the comet a faint diffuse patch $12^m.4$ on 1978 February 8.4)

M.J. Hendrie
(Director)

LIST OF OBSERVERS - COMET KOHLER 1977m

Initls.	Name	Principal Locations	Principal Instruments
GEDA	G.E.D. Alcock	Peterborough	105x25B
JAA	J.A. Anastasi	Malta	210mm refl.
JLB	J.L. Benton	Clinton, S. Carolina	110mm OG
AGB	A.G. Bowyer	Epsom Downs	155mm refl
LE	L. Entwisle	Elland, Yorks	50x10B
DF	D. Frydman	Willesden, London	50x70B, 70mm OG
MJG	M.J. Gainsford	Nuneaton	210mm refl.
MJH	M.J. Hendrie	Colchester	Bin., 125mm OG, 100mm f/4.5
JGH	J.G. Hosty	Huddersfield	80x10B
LGI	L.G. Inge	Shaftesbury	60x12B
MLJ	M.L. Joslin	Chel sford	214mm refl.
CK	C. Kear	Allerton Bywater, Yorks	152mm refl.
GSK	G.S. eitoh	Stoke Gifford, Bristol	80x15B, 203mm refl.
AGM	A.G. Le Moeur	Jersey, C.I.	160mm refl.
SWM	S.W. Milbourn	Copthorne, Sussex	120mm OG
HCN	H.C. Nightingale	Lusaka, Zambia	50x7B
RWP	R.W. Panther	Northampton	105x25B, 80x15B
AP	A. Potts	Knutsford, Cheshire	152mm refl.
CFR	C.F. Radley	Nacton, Ipswich	150mm OG
HBR	H.B. Ridley	Godalming	115mm OG, 80mm f/6.3

Continued:

Initls.	Name	Principal Locations	Principal Instruments
KRS	K.R. Sturdy	Helmsley, Yorks	213mm refl.
GET	G.E. Taylor	Cowbeech, Sussex	500mm refl.
HCT	H.C. Taylor	Chandlers Ford, Hants	160mm refl.
RT	R. Tremblay	Quebec	200mm refl.

Instrumental Code

B = Binoculars
OG = Refractor
refl = Reflector

Photographic Observations:

Aperture in mm, focal ratio, e.g. f/4.5
100mm x 4.5 = 450mm focal length

(These codes have been changed for correspond to those adopted for the JBAA)

COMET KOHLER 1977m

UT	Mag.	Coma diam '	Tail Lgth '	p.a. °	Description/Remarks	Aper mm		x	Obs
Sep									
10.8	-	-	-	-	Conditions excellent - not seen	210	r	35	MJG
11.8	-	2	-	-	Diffuse, no tail	500	r	-	GET
11.9	9.5	6	-	-	Round, Diffuse, v.sl.ctl.cond	105	B	25	RWP
11.9	10.5	-	-	-	Little cond. No tail	210	r	35	MJG
11.9	-	4	-	-	Nucleus 1145-1240	210	r	200	MJG
11.9	-	5	-	-	Diffuse, v sm cond.f.elong pa 70°	105	B	25	GEDA
11.9	9.7	4	-	-	Circ.v.sl.cond. No. nucleus	152	r	48	AP
12.9	<10	-	-	-	20 min exp. Comet not found	100		f/4.5	MJH
12.9	<10	-	-	-	Not seen	210	r	35	MJG
12.9	9.5	3	-	-	Slightly condensed	152	r	48	AP
12.9	9.7	6	-	-	Circ.sl.cond. No tail	203	r	45	GSK
13.8	10.5	5	-	-	Circ.coma sl.cond.	203	r	45	GSK
13.9	<10	-	-	-	Sky poor. images weak 40 min exp.	100		f/4.5	MJH
14.9	9.8	5	-	-	Circ. coma. mod.cond.	203	r	45	GSK
14.9	10.5	-	-	-	Diffuse and shapeless. No tail	210	r	80	MJG
14.9	9.5	6	-	-	Circ.diffuse coma, sl.cond.	80	B	15	RWP
15.8	9.5	-	-	-	Sky poor - just glimpsed	203	r	33	GSK
17.8	10.4	3	-	-	Coma evenly diffuse	160	r	50	AGM
17.8	9	8	-	-	Cent.cond. 10m, coma elong 5'x10'	250	OG	75	CFR
17.8	10	4	-	-	Diffuse coma, sl.ctl.cond	160	r	30	HCT
17.9	-	-	-	-	Diffuse with ctl. cond.	214	r	45	MLJ
18.8	10.0	-	-	-	V.sm diffuse disc. No tail	60	B	12	LGI
18.8	9.5	-	-	-	Noticeably brighter than on Sep 11.8	500	r	-	GET
18.8	10.0	4	-	-	Diffuse coma, sl.cond. No nucleus	160	r	48	HCT
28.8	8.5	5	-	-	Faintish disc, strongly con.	80	B	15	GSK
28.8	9	5	-	-	Diffuse but more ctl. con.	160	r	48	HCT
29.8	9.8	3	-	-	Evenly diffuse	160	r	50	AGM
30.8	9.5	-	-	-	Badly placed - very diffuse	210	r	51	JAA
Oct									
1.8	8	3	-	-	V.diffuse. sl.cond. br. on sun side?	213	r	50	KW
1.8	8	4	-	-	Hazy outline, mod.con.	60	B	13	MJH
1.8	8	3	-	-	Mod.con. No tail. Exp 19 mins	100		f/4.5	MJH
1.8	8.8	4	-	-	Coma irregular. sl.cond.	115	OG	70	HBR
1.8	8.6	3	-	-	Probably only ctl.cond. seen	120	OG	20	SWM
1.8	9.0	4	-	-	Circ. coma, slightly con.	80	B	15	RWP
2.7	9.5	-	-	-	Still v.diffuse and difficult	213	r	51	JAA
2.8	8.8	5	-	-	Globular coma, m.con.	80	B	15	RWP
2.8	7.6	4	8	45	2 streamers sus. broad tail	80	B	15	GSK

Continued:

UT	Mag.	Coma diam '	Tail Lgth '	Tail p.a. o	Description/remarks	Aper mm		x	Obs
Oct									
2.8	8.2	4	-	-	Sus.coma oval, no tail	50	B	10	LE
2.8	9.4	1	-	-	Like dimmer M13, coma 40" (sic)	152	r	41	CK
2.8	8.7	4	-	-	Coma irregular, slight cond.	115	OG	70	HBR
2.8	8.0	4	-	-	Circ.moderately cond.	60	B	13	MJH
2.8	-	6	-	-	Br.ctl.cond. offset to south	152	r	32	GSK
2.8	7.5	7	-	-	Circ.str.cond. Nuc. 11^m x100	160	r	48	HCT
4.0	7.8	-	-	-	Circ.coma, diffuse sl.cond.	110	OG	66	JLB
4.7	9	-	-	-	Diffuse, sl.ctl.cond.	213	r	51	JAA
4.8	-	-	-	-	Comet not found	213	r	50	KMS
4.8	8.9	4	-	-	Circ.coma. mod.cond.	80	B	15	RWP
4.8	7	3	-	-	Circ. moderately condensed	210	r	35	MJG
4.8	8.0	7	-	-	V.diffuse coma. Sl.cond.	80	B	10	JGH
4.8	9.6	1	-	-	Str.ctl. cond. Coma sl.cond.	152	r	41	CK
4.8	8.0	7	-	-	V.diffuse. No tail	152	r	63	JGH
4.9	8.0	4	-	-	No cond. sl.oval. No tail	50	B	10	LE
7.8	8.8	5	-	-	Sl.cond. No tail	115	OG	70	HBR
7.8	9.1	5	-	-	Sl.cond. No nucleus	213	r	50	KMS
7.8	8	3	-	-	Circ.mod.cond. No nuc x 200	210	r	35	MJG
7.8	8	4	-	-	Like Globular cluster	160	r	50	AGM
7.8	7.3	5	-	-	Mod.cond. elong Pa 50/230°	80	B	15	GSK
7.8	-	4	-	-	Br.ctl.cond. Spikes sus	203	r	33	GSK
7.8	8.3	5	-	-	Circ.coma, bright small ctl.cond	80	B	15	RWP
7.9	7.9	5	-	-	No tail, no distinct cond.	50	B	10	LE
8.8	8.1	5	-	-	Circ. coma mod. con.	80	B	15	RWP
8.9	7.1	5	-	-	Rather diffuse, br.ctl.cond.	80	B	15	GSK
9.7	9.0	1	-	-	Coma diam 45", no nucleus	213	r	51	JAA
9.8	7.2	6	-	-	Possible elong pa 40/220°	80	B	15	GSK
9.8	8	7	-	-	Elliptical, cond. no tail	155	r	60	AGB
9.8	8.2	4	-	-	Slightly cond. No tail	115	OG	70	HBR
10.8	8	3	-	-	Circ. coma, mod.con. No tail	100		f/4.5	MJH
10.8	8.5	3	-	-	Like globular cluster	160	r	50	AGM
10.8	-	3	-	-	Br.diffuse coma. Stellar cond.	80	B	15	GSK
10.8	7.3	3	-	-	Possible elong pa 27/207° x 61	152	r	24	GSK
10.8	7.8	7	-	-	V.diffuse coma, elong coma	152	r	63	JGH
10.8	7.8	7	-	-	V.diffuse. not quite circ.	80	B	10	JGH
10.8	7.4	4	-	-	Coma sl.cond. circ. no tail	60	B	13	MJH
10.8	-	3	-	-	Moderately cond.	125	OG	80	MJH
10.8	7.4	6	-	-	Centrally condensed	50	B	10	LE
10.8	9.0	1	-	-	Ctl.con. 30", coma 1' x 1!5	152	r	41	CK
10.8	8.3	4	-	-	Sl.cond. No tail	115	OG	70	HBR
10.8	9.1	5	-	-	Str.ctl.cond. no nuc. no tail	213	r	60	KMS
10.8	7.5	4	-	-	Poorly condensed. No nuc x 200	210	r	35	MJG
10.9	8.4	5	-	-	Well condensed	120	OG	20	SWM
10.9	8.0	5	-	-	Mod.ctl.cond. Circ. coma	80	B	15	RWP
11.8	8.5	1	-	-	Coma 40" wedge shaped. Sm.cond.	213	r	51	JAA
11.8	7.5	5	-	-	Circ. mod.con. No nuc x 200	210	r	35	MJG
11.8	8.3	5	-	-	Sl.more con. than before	115	OG	70	HBR
11.8	7.2	4	10	45	Coma 6' av. Tail suspected	80	B	15	GSK
11.8	7.9	4	-	-	Circ.coma Mod.ctl.cond.	80	B	11	RWP
12.8	8.5	3	-	-	Nebulous, sl.cond. No tail	210	r	35	MJG
12.8	7.2	5	4	45	Tail sus. Br.ctl.cond. glimpsed	80	B	15	GSK
12.8	-	3	-	-	Outer haze or coma diam. 6' cond.	203	r	45	GSK
12.8	8.4	2	3	-	Oval,mod.cond. hyperbolic tail	152	r	41	CK
12.8	7.9	4	-	-	Mod. broad ctl.cond.	80	B	11	RWP
12.8	8.4	5	-	-	Mod. condensed. No tail	115	OG	70	HBR
12.8	7.8	3	-	-	Faint outer glow, bright centre	160	r	50	AGM
13.8	7.7	3	-	-	Mod.cond. No tail. No nuc.	160	r	50	AGM
13.8	7.8	6	-	-	Slight ctl.cond. No tail	50	B	10	LE
13.8	8.4	5	-	-	Mod.cond. No tail	115	OG	70	HBR
14.8	7.9	4	-	-	Broad mod. ctl.cond.	80	B	11	RWR
14.8	8.0	-	-	-	Poor sky - very faint hazy patch	60	B	13	MJH
14.8	-	-	-	-	V.sm.ctl.cond. 1!8, nuc. stellar	317	r	150	GSK
14.8	7.5	4	-	-	Spikes noted, nuc sus	160	r	50	AGM
14.8	8	7	-	-	Eliptical coma, evenly con.	155	r	60	AGB
14.8	6.5	-	-	-	Fan shaped mod. condensed	80	B	15	GSK

Continued:

UT	Mag.	Coma diam '	Tail Lgth '	Tail p.a. °	Description/Remarks	Aper mm	x	Obs
Oct								
15.7	8.5	-	-	-	Poor cond. Coma fan-shaped	213 r	51	JAA
15.8	7.7	3	-	-	Mod. cond. No tail or nucleus	160 r	50	AGM
15.8	8.3	5	-	-	Mod.cond. No tail	115 OG	70	HBR
16.8	7.0	3	-	-	Spikes around coma suspected	152 r	24	GSK
16.8	8.2	5	-	-	Mod.cond. No tail	115 OG	70	HBR
16.8	7.5	-	-	-	Small diffused disc. Sky poor	60 B	12	LGI
19.8	6.6	-	-	-	Br.intense nebulosity	50 B	10	GSK
19.8	7.4	4	-	-	Several spikes suspected	152 r	32	GSK
19.8	7.4	4	-	-	Circ. coma. Broad ctl.cond.	80 B	11	RWP
23.7	7.5	-	3	-	Nuc. Coma forming fantail	213 r	51	JAA
24.1	-	-	-	-	Coma elongated NE. Ctl.cond.	200 r	36	RT
24.7	7.5	-	-	-	Moon. Stellar nuc. Fantail	213 r	51	JAA
25.8	8.5	3	-	-	Moon. No nuc x 200	210 r	35	MJG
25.8	7.2	5	-	-	Circ. coma. V.sm bright centre	80 B	15	RWP
25.8	6.6	6	-	65	Intense coma. Possible tail	50 B	10	GSK
25.8	6.6	5	-	-	Inner coma 3'. sm.str.ctl.cond. sus	152 r	32	GSK
27.7	7.3	-	-	-	Fan shaped tail visible	213 r	51	JAA
29.7	7.3	-	-	-	Sky v. poor	213 r	51	JAA
29.8	7.2	3	-	-	Sus a few faint spikes; no real tail	160 r	50	AGM
29.8	7.3	7	-	-	Comet elliptical. No tail seen	155 r	60	AGB
31.7	8.0	-	-	-	"Fuzzy blob"	50 B	7	HCN
31.7	7.3	6	-	-	Strongly cond. No tail seen	115 OG	70	HBR
31.7	-	-	-	-	Exp. 1 hr. No tail recorded	80	f/6.3	HBR
31.8	7.0	3	-	-	Well con. Spikes to NE	160 r	50	AGM
31.8	6.3	6	-	-	Mod con. V.bright nebular.	50 B	10	GSK
31.8	6.4	8	60	98	Stellar cond. Sus thin tail	203 r	45	GSK
31.8	7.5	3	-	-	Bright, condensed, no tail	210 r	200	MJG
31.8	6.6	5	-	-	Mod. Str. broad ctl.cond.	80 B	15	RWP
Nov								
1.7	7.3	-	10	-	Stellar nuc. Fantail	213 r	51	JAA
1.7	8.0	-	-	-	Possibly Fan-like	50 B	7	HCN
2.7	8.0	-	-	-		50 B	7	HCN
3.7	7.3	-	-	-	Nuc. brightening, starlike a.v.	213 r	51	JAA
3.8	6.9	6	-	-	Str.con to centre. No tail	115 OG	70	HBR
3.8	-	-	-	-	30 min exp. No tail recorded	80	f/6.3	HBR
3.8	6.5	6	-	-	Broad diffuse cond. Circ. coma	80 B	15	RWP
3.8	6.2	9	-	-	Sm round nebulosity with outer coma	50 B	10	GSK
3.8	6.4	4	-	-	Possible bright ctl. cond.	152 r	24	GSK
5.7	7.3	-	-	-	Fan shaped coma - no tail	213 r	51	JAA
6.7	8.0	-	-	-	Like small M11. No tail	50 B	7	HCN
6.8	7.0	3	-	-	No tail or nucleus	160 r	50	AGM
6.8	6.8	5	-	-	Lower surface brightness than	50 B	7	DF
6.8	7.2	5	-	-	M11 in same field	70 OG	68	DF
6.8	7.0	6	-	-	Condensed, no tail	115 OG	70	HBR
6.8	-	-	-	-	25 min ex. No tail recorded	80	f/4.5	HBR
6.8	7.1	5	-	-	M11 a little brighter and larger	50 B	10	GSK
6.8	6.7	3	-	-	Circ. coma. Mod. cond.	80 B	11	RWP
7.1	7.0	-	-	-	Strongly condensed centre	200 r	36	RT
7.7	7.3	-	-	-	Sky poor	213 r	51	JAA
7.7	7.5	-	-	-	Larger and fainter than M11	50 B	7	HCN
7.7	7.8	4	-	-	Str.ctl.cond. No tail	215 r	60	KMS
8.7	8.2	2	5	-	Short streaky tail. No nucleus	92 r	70	HCN
8.8	7.7	5	-	-	Str. cond. No tail	215 r	60	KMS
8.8	7.0	3	-	-	V.bright centre. No tail	160 r	50	AGM
9.8	7.0	3	-	-	Sus. faint wide tail	160 r	50	AGM
9.8	8.2	-	-	-	Difficult, low altitude	50 B	7	HCN
11.7	7.0	-	-	-	Fan-shaped tail still visible	213 r	51	JAA
12.7	6.0	6	-	-	V.diffuse, sus bright ctl.cond	50 B	15	GSK
12.7	7.0	5	-	-	Str. cond. No tail. Elong. E-W	115 OG	70	HBR
12.8	6.9	5	-	-	Large diffuse cond. bright sm. centre	80 B	11	RWP

Continued:

UT	Mag.	Coma diam. '	Tail Lgth. '	p.a. o	Description/Remarks	Aper	x	Cbs
Nov.								
12.8	6.6	8	-	-	Str. cond. No tail seen	60 B	13	MJH
12.8	8.2	-	-	-	Coma possibly larger than Nov 9	50 B	7	HCN
13.7	7.0	-	-	-	Starlike nuc. visible x 102	213 r	51	JAA
13.7	8.2	-	-	-		50 B	7	HCN
14.8	7.2	5	-	-	Strongly condensed. No tail	115 OG	70	HBR
15.8	6.3	-	-	-	Diffuse circ. coma. Moon	50 B	10	GSK
16.7	8.2	-	-	-	Moonlight	50 B	7	HCN
16.7	7.0	-	-	-	Near moon - difficult obsn.	213 r	51	JAA
16.8	7.0	4	-	-	Circ. coma. Mod. cond. Br. centre	80 B	15	RWP
17.7	7.8	-	-	-	Appears to have brightened	50 B	7	HCN
17.8	7.1	5	-	-	Circ. diffuse coma. Weak cond.	80 B	15	RWP
18.7	7.8	-	-	-	Moon and poor conds.	213 r	51	JAA
18.7	7.8	-	-	-		50 B	7	HCN
18.8	7.1	6			No change from Nov. 17.8	80 B	15	RWP
20.7	-	-	-	-	Moon overhead, obsn. doubtful	50 B	7	HCN
21.7	8.0	-	-	-	Seen easily	50 B	7	HCN
22.7	8.0	-	-	-		50 B	7	HCN
27.7	7.2	6	-	-	Circ. diffuse edge. Mod cond.	80 B	15	RWP
27.8	6.5	6	-	-	Alt. low, misty. Poss stellar cond.	80 B	15	GSK
28.7	6.6	7	60/80	85	Tail narrow, diffuse fan 20' pa 40/65°	80 B	15	GSK
Dec								
13.8	-	-	-	-	Not seen < 9^m	50 B	7	HCN
22.7	-	-	-	-	Not seen < 9^m	50 B	7	HCN

1977	FULL MOON
Sept	27.3
Oct.	27.0
Nov.	25.7
Dec.	25.5

Abbreviations

a.v.	averted vision	f	faint	str	strong
b	broad	elong	elongated	sus	suspected
br	bright	l	large	t	tail
circ	circular	m	moderate	v	very
c	coma	n	narrow	w	weak
con	condensed	nuc	nucleus		
cond	condensation	ph	photograph		
ctl	central	sl	slight		
d	diffuse	sm	small		
def	defined	st	straight		

A NEW PUBLICATION

The literature on comets is very scarce, and what books there are tend to be either very simple popular accounts, or very technical conference proceedings. The comet observer who wishes to gen up on technique can normally only find short sections in more general amateur observational texts.

This is highly unsatisfactory for the comet hunter, who needs much technique and experience to increase his chances to the maximum.

I hope it will be pleasant news to the Section to find that a text is now well advanced that will at last fill the gap in the literature.

Continued:

The book will examine the areas in which amateurs can make discoveries, in other words it will deal at length with all aspects of comet, nova and supernova discovery work.

There are several authors co-ordinating their activity under the general editorship of Andy Stephens - Editor of the Bulletin, and each is an expert in his field. The result is planned as a massive compendium of information that will be priceless to the observer, and sure to be a standard text.

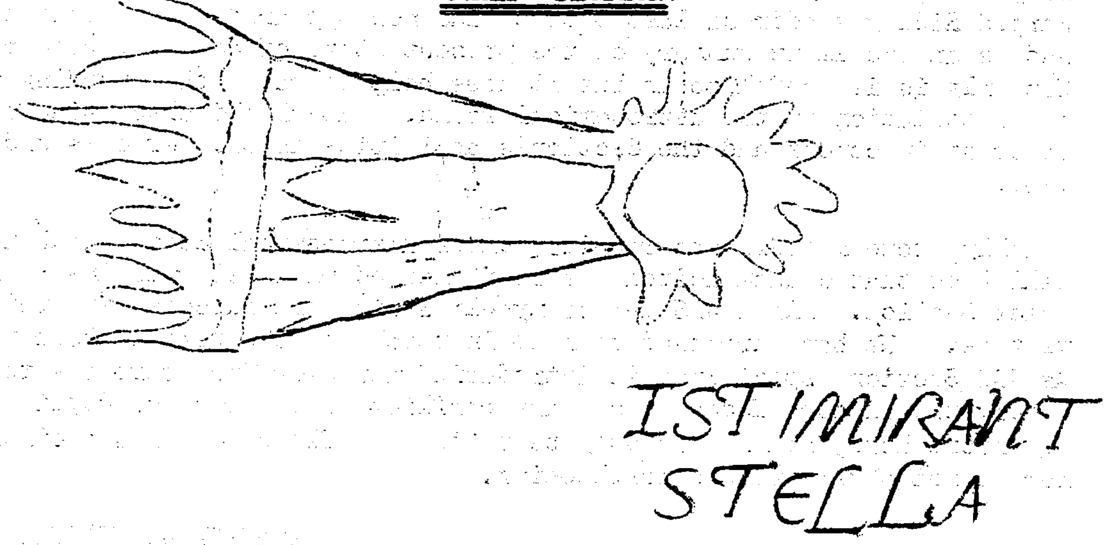
In this connection the Editor would be very pleased to hear from anyone who feels that they have something to say on any of the quoted subjects. Although the text is well advanced it is not too late to include valuable information. Also anyone who has good photos of comets or suitable equipment is invited to send them for possible book illustrations.

Finally, in connection with the supernova section of the book, there is a requirement for photos of bright, face-on galaxies that correspond closely to visual appearances in average amateur instruments. If the galaxy is close and bright the requirement for it to be a face-on galaxy is not critical.

If anyone can help in this undertaking they are requested to urgently contact Andy at the address quoted on the front of the Bulletin.

THE BRITISH ASTRONOMICAL ASSOCIATION

COMET SECTION



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FROM THE DIRECTOR

Since the last Bulletin Andy Stephens has expressed a wish to devote more time to his writing and local astronomical society activities and I should like to thank him on behalf of the Section for initiating the Bulletin with Stan Milbourn and editing the first nine issues over the past five years.

I believe the Bulletin performs a useful function for the Section and hope to keep it in being, aiming at around 12 pages twice yearly. However, the size, frequency and even the continued existence of the Bulletin does depend very much on the support of the Section. I would not like to see issues devoted entirely to contributions by Section Officers (although these are to be welcomed); still less do I want to see issues written entirely by the Director!

I am sure that other members have interesting and valuable experience to pass on, as some have already in earlier issues. With a view to stimulating interest and discussion I am raising in this issue a number of problems that interest me and that I think we ought to know more about. I hope that readers will respond with letters or articles for publication on these or other topics. For Bulletin 11 these should reach me by 1979 Jan 31 please. Also on the subject of the Bulletin, Stan Milbourn has agreed to continue for the time being to organise the typing, proof-reading, duplicating and despatch to members.

I am very pleased to welcome Paul Doherty as an Assistant to the Director (despite conflicting statements in recent Journals). He will strengthen our visual observing and recording work especially and he has contributed an article on this subject in this issue. Paul is of course well known for his beautiful drawings and paintings of the planets and brighter comets. Visual observation of fine detail in the heads of bright comets has been much neglected since photography became well established in comet work with the result that astronomers usually have to go back to nineteenth century records to study features near the nucleus, a situation that should slowly be improved by the use of very short exposures with large telescopes, but visual observations will continue to be important and I hope that we shall be able to make better use of future opportunities for observation with Paul's help.

A Presidential Address on Comets is not a Section activity but not surprisingly they are in practice given by officers of the Section. Harold Ridley's address last October has now appeared in the Journal and is an excellent summary of the present state of cometary research. Not only is it useful to us but it does help to raise the standing of the Association in the astronomical world. It should also stimulate interest in comets and the Section's activities as Dr. Merton's did in 1951.

Finally, some members who receive Junior Astronomical Society publications will know that Graham Keitch has been charged with establishing a JAS Comet Section. As a JAS member myself I wish him success with this venture. We have arranged to keep in touch and co-operate where possible. As JAS Sections specialise in introducing newcomers to astronomy to observational work I do not see any conflict of interest or duplication of effort here, and it can only be to the benefit of the BAA section if more comet observers are forthcoming.

MICHAEL J. HENDRIE

RECORDING VISUAL OBSERVATIONS OF COMETS - P.B. DOHERTY

It is generally thought that the best way to record comets is to photograph them. This method certainly brings out incredible detail in the tails, usually showing much that is impossible to observe visually. For this reason photography is indispensible. However, contrary to popular belief, recording the visual appearance of comets by drawing is in no way out-moded by photography. The few bright comets that we have had the good fortune to witness during the past decade, have served well to illustrate this fact.

While photography picks out faint detail in the tail it tends to loose any faint detail that may exist in the head and close to the nucleus simply because the image in this region is burned out through over exposure. Attempts to record fine detail in the head by using short exposure photography meet with the same sort of limited success found with planetary photography. Given the right conditions, visual observation with a given telescope will show detail that is impossible to photograph with any clarity, especially close to the nucleus. Since the nucleus is the very body giving rise to all other associated phenomena, any detail seen near to it is bound to give vital information about the comets make up, tail formation and even movements within the head.

Obviously the bright comets tend to have the most detailed structure though faint ones can often spring the odd surprise. The two finest comets in recent years were Bennett in 1970 and West in 1976. Each rewarded visual observation. Spiral jet structures were seen near the nucleus of Bennett but the greatest triumph for the visual observer was the early reporting of the disintegration of the nucleus of comet West. The early stages were seen much more clearly visually and photographs at this stage were very ill-defined. As a result of early records the future motions of the fragments with respect to each other were worked out with considerable accuracy, teaching us a great deal about movements within the comets head.

Apart from the observation of these spectacular phenomena, which are admittedly rare, there are many other useful things to be recorded with the majority of comets. These are as follows:-

1) Appearance of nucleus, (stellar or small disc). If a disc has it sharp or softened edges. If single or multiple, colour.

2) Central condensation, apparent diameter, round or elliptical, degree of condensation, p.a. of major axis if elliptical. Structure.

3) Coma, diameter, shape, detail within (hoods, haloes, jets, dark regions.

4) Tails, length, p.a., shape, anomalous tails, condensations.

Drawings of most if not all of these features could be attempted and are far better than written descriptions. One accurate drawing is worth a thousand words. Particular attention should be paid to the distances and positions of any structure relative to the nucleus and any observer who cannot draw should supply with any written description measured estimates of any feature relative to the nucleus.

Apart from all this it is obvious that estimates of the comet's visual magnitude should be made as often as possible. It may indeed be advantageous to make a number of estimates in one night since the detection of rapid variations is one area where visual work comes into its own. Small rapid fluctuations tend to be evened out by long exposure photography and though such fluctuations are infrequent they should always be borne in mind.

Estimates of the comet's position are of limited use but are necessary in establishing if one has the right object. You never know but you might well be looking at a previously unobserved comet that just happens to be in the same region as the known one. Photography really scores over visual observation when it comes to astrometrics, however, fairly accurate positions can be obtained. I find it handy to make up a series of triangles using the stars around the comet. You can always find two stars that make up a triangle with the comet and the shape of that triangle can be estimated quite accurately, if you can make up a number of such triangles so much the better.

As for the actual recording of detail by drawing, the method used by the writer is to draw the comet in negative form, the brighter parts of the comet appearing darkest on the sketch. Though this does not give the actual appearance it is an easy method and enables detail to be illustrated faithfully and with considerable accuracy. With bright and detailed comets it is often preferred to make more than one sketch showing the appearance of the comet when different magnifications are employed. Anyone who has the ability to draw may find it better to use fairly smooth paper (though not too smooth) and a medium grade pencil, say F. The observer with less artistic ability will find it easier to use more grainy paper and a softer pencil, say HB to B. Using these materials quite a pleasing effect can be obtained with the finger rubbing method. This smooths out the shading; however, it must be remembered that it is accuracy we require and not just a nice drawing.

Making drawings at the telescope leads to certain problems, particularly when the object is a faint and extended one. Illumination of the paper is the main difficulty. When drawing bright objects like the planets fairly considerable illumination can be used since one does not have to worry about loss of dark adaption. This is not so with comets. One may have built up dark adaption for a considerable time and this should not be wasted by using a bright light. At most a very dim red light should be used and even then the light itself shielded from the observer's eyes. I prefer to observe for as long as possible before using any light and become entirely familiar with the object in view so that it is practically possible to make a complete accurate sketch in one go, then finally check on the main details with a further prolonged view.

With very faint objects or detail it will often be found that averted vision is a great help. I would like to point out, however, that when using averted vision, the eye, though more sensitive to faint illumination away from the centre of vision tends not to be so acute. Any observation made entirely by averted vision must be a little suspect and this method should only really be used to establish the actual existence of a particular feature, the observer being then aware of the features existence, stands a better chance of detecting it by direct vision and will be able to record it accurately. If a feature is included on a sketch and was seen by averted vision only, then a note to this effect should accompany the sketch.

There is nothing more pleasing than a good photograph of a comet. This method of recording is highly desirable and should be attempted. But let us not forget the high value of visual work and the drawing of features seen. Even while taking a photograph it can be possible to observe it visually. In fact when taking photographs myself, I find it advantageous to keep the comet under observation to ensure correct guiding, so what better time to record visual features. On the other hand, the comet observer who is not set up for photography should in no way feel at a disadvantage, far from it. Visual work forms the major part of the Comet Section programme and complements very well the valuable photographic work. It is also less expensive!

PHOTOGRAPHIC COMET SEEKING

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 something 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

COMETS IN 1975 (Continued from Bulletin 9)

1975k = 1975 X Comet Suzuki-Saigusa-Mori. Discovered independently by 5 Japanese observers within 30 minutes on 1975 Oct 5, the first three being S. Suzuki (Aichi), Y Saigusa (Yamonashi) and H. Mori (Gifu). The comet was a diffuse 9th magnitude object moving SSE in Ursa Major. Preliminary elements indicated that the comet was close to perihelion (Oct 15) and would make a very close approach to the Earth at the end of the month (minimum distance 0.105 AU) when the magnitude could be expected to be around +5. On Oct 28.41 J.E. Bortle estimated the visual magnitude at 5.5 with a coma diameter of 12'. Using 20x120mm binoculars he observed a tail 1 degree long in p.a. 320° and remarked upon an elongated cloud just north of the tail (elongated in p.a. 150° - 330°), the outer coma being surrounded by a diffuse halo 30' in radius. The comet was moving very swiftly south at this time and by Nov 2 was not visible from mid-northern latitudes.

The following elements by Dr. B.G. Marsden (Q.J.R.A.S. Vol. 19 No. 1) are based on 82 observations 1975 Oct 6 - 1976 Jan 4, perturbations by all nine planets being applied:

T 1975 Oct. 15.3602 E.T.	Epoch 1975 Nov 4.0 E.T.
e 0.985653	ω 152°.0241
q 0.838047 AU	Ω 216.1091 1950.0
P 446 yrs	i 118.2381

1975 l = 1976 VIII P/Harrington-Abell. Making its fourth return to perihelion since discovery in 1955, this short-period comet was recovered by Dr. E. Roemer and M.A. Daniel with the Steward Observatory's 229cm reflector at Kitt Peak on 1975 Oct 6.4. The comet was extremely faint of around mag. 21, the indicated correction to the prediction in the Handbook 1975 being $\Delta\alpha$ +0m.21; $\Delta\delta$ +0'.6. Owing to a very close approach to Jupiter in April 1974 (0.037 AU) the correction cannot be interpreted as just one in T.

1975m = 1975 VI P/Arend. Also making its fourth return to perihelion since discovery, P/Arend was recovered by Dr. E. Roemer and M.A. Daniel using the Steward Observatory's 229cm reflector on Kitt Peak on 1975 Oct 6.5 just a short while after the recovery of P/Harrington-Abell. The comet was quite condensed at magnitude 20, the recovery position indicating a correction of only +0d.02 to the prediction in the Handbook 1975.

1975n = 1976 VI West. A report on the conditions concerning discovery and the visual aspects of this brilliant comet was published in Bulletin No. 7 (April 1976). The comet was under observation until 1976 Sept 25 and the following elements by Dr. B.G. Marsden are based on 41 pre-perihelion observations 1975 Aug. 10 - 1976 Feb 16 and 177 post-perihelion observations 1976 Mar. 4 - Sept 25 of nucleus A, perturbations by all nine planets being taken into account. There are small systematic trends in the residuals but attempts to utilise other of the nuclear components were less satisfactory:

T 1976 Feb. 25.2216 ET	Epoch 1976 Mar. 3.0 ET
e 0.999971	ω 358°.4190
	Ω 118.2313 1950.0
q 0.196626 AU	i 43.0700

1975o P/Gehrels (3). Discovered by Dr. Tom Gehrels on 1975 Oct. 27.1 using the 122cm Schmidt at Palomar. The comet was so strongly condensed that it appeared almost stellar on the plate but some coma was visible. Dr. B.G. Marsden quickly found the orbit to be of short-period, the elements indicating a close approach to Jupiter during the past revolution. Work by R.J. Buckley indicated a close approach to Jupiter of 0.04 AU in 1973 and possibly to 0.01 AU in 1970. Before the comet settled into its present orbit it appears that q was much larger being in excess of 5 AU thus rendering the comet invisible. The small eccentricity of the present orbit would offer hopes that the comet will be visible right round its orbit and in fact observations have continued into 1978.

The following elements by Dr. B.G. Marsden are from 14 observations 1975 Oct 27 - 1976 Feb. 26, perturbations by all nine planets being applied:

T 1977 Apr. 23.0257 E.T.	Epoch 1977 Apr 7.0 E.T.
ω 231°.4712	e 0.152339
Ω 242.5584 1950.0	a_o 4.038677 AU
i 1.1010	n^o 0.1214354
q 3.423429 AU	P 8.116 yrs

1975p = 1975 XI Bradfield. The fourth comet to be discovered by W.A. Bradfield (Dernancourt, nr. Adelaide) came on 1975 Nov 11.7 when he detected a 10th magnitude diffuse object in Antila. Preliminary elements showed a small perihelion distance of 0.219 A.U. on 1975 Dec 21 and it was thought that the magnitude could reach a value of +1.8 at that time. The comet did not brighten as rapidly as expected only reaching a magnitude of 7.0 by December 6. Although 4 Japanese observers reported seeing it at mag. 1 - 3 just after sunset at Christmas, the comet had faded to mag. 6.5 by the end of the year. By February it had faded to mag. 10.5 and by late April 13.0. A short tail was reported by many observers and a photograph taken by Dr. R.L. Waterfield on 1976 Jan 3.75 in fairly bright twilight showed a main tail 6' long with an antitail almost as bright 3' long.

The following elements are by Dr. B.G. Marsden (Q.J.R.A.S. Vol. 19 No. 1) and based on 56 observations 1975 Nov. 13 - 1976 Jan 26, perturbations by all nine planets being applied:

T	1975 Dec 21.1813 E.T.	Epoch	1975 Dec 14.0 E.T.
e	1.000004	ω	358°.0972
		Ω	270.6123 1950.0
q	0.218719 AU	i	70.6259

1975q = 1976 I Sato. Discovered by Y. Sato (Tochigi) on 1975 Dec 5.76 as a diffuse magnitude 9 object moving rapidly SSE in Coma Berenices. Comet Sato did not become a striking object, reaching a maximum visual magnitude of 7.5 by mid-December when the Earth-Comet distance was near minimum (0.28 AU on Dec 19). Later as the comet receded rapidly from the Earth it faded and by the time of perihelion (1976 Jan 3.9) the magnitude was down to 10. A short tail was noted by Seki and McCrosky on December 10 but in general no tail was reported.

Parabolic elements have been calculated by Dr. B.G. Marsden (Q.J.R.A.S. Vol 19, No. 1) based on 49 observations 1975 Dec 9 - 1976 Jan 7:

T	1976 Jan. 3.9353 E.T.	ω	215°.4852
		Ω	280.7896 1950.0
q	0.863949 AU	i	93.9434

S.W. MILBOURN

EQUIPMENT AND METHODS

Readers of the Bulletin may have specialist knowledge that would be valuable to others or they may be willing to investigate and report on a particular topic. Anything related to the observation of comets not readily available elsewhere would be of interest written either as an article or report, or as a letter to the Bulletin.

The following are subjects that I feel that I should know more about but the list is by no means complete. Perhaps readers can add to it.

Photometry - Visual Photometers have been little used in cometary work. Stan Milbourn mentioned the other day that some form of comparison image photometer with an artificial comet would seem to be useful. Has any one tried it or can they say why these have never been exploited.

Photoelectric Photometers appear to overcome the problem of the dissimilar appearance of comet and star which is the main obstacle to accurate visual or photographic magnitude estimates, yet they too seem to have been little used by amateurs or professional astronomers for comets.

Image Intensifiers - these are advertised in Sky and Telescope (e.g. see 1978 September page 235). Although very expensive ($1550 visual and $2440 photographic), is this something that could enable fainter comets to be seen without larger telescopes? Is it likely to become useful and reasonably priced in the future? There must be disadvantages apart from price; do we know what they are and how these particular devices work.

TV - what are the eventual prospects of remote comet seeking, from ones desk with catalogues and charts to hand. Professionals now use it for setting and finding with large telescopes. Whilst on the subject of remote control, what are the costs and problems of shaft encoders for remote (or just readily readable) circle readings. Computer control of small telescopes now seems to be practical, and no doubt will come in time, although it may not be necessary. However, for guiding on a moving comet for example, there would be advantages in feeding the apparent motions directly to the telescopes drive, to the guiding eyepiece or to the plateholder itself.

Cold Cameras - There has been some discussion of this in S and T and elsewhere, and of soaking also. Soaking plates and films seems rather difficult for amateurs, but many already use cold cameras. However, there are both problems and advantages with comets. On the one hand it is often not possible to prepare for observation well beforehand, and on the other, it is very desirable to keep comet photograph exposures short. Does anyone have any experience on the practical problems of operating such a camera?

Photographic Materials - does anyone know or would they undertake to find out, up-to-date sources of plates and films for astronomical purposes. Are there alternatives to obtaining these from Kodak in the USA? Do Agfa still make them, and if so are they cheaper, readily available and suitable? Is Polaroid film any good to us?

Any contributions for the Bulletin 11 should reach me by 1979 Jan 31 but notice that something is on the way would be helpful.

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