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Bolides
Geminids
Meteors in SF
Solar longitudes

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Front cover photo

A bright Geminid and another fainter one close to the horizon. Taken by Javor Kac on 2004 December 14 from $03^h19^m24^s$ to $03^h25^m07^s$ UT with an $f/2$, 58 mm lens on Fuji 800 film. Location: from Kisovec (Kamnik Alps), Slovenia; longitude 14°39′52″ E, latitude 46°16′39″ N, altitude 1280 m a.s.l..

Writing for WGN This Journal welcomes papers submitted for publication. All papers are reviewed for scientific content, and edited for English and style. Instructions for authors can be found in WGN **31:4**, 124–128, and at `http://www.imo.net/articles/writingforwgn.pdf` .

Cover design Rainer Arlt

Editorial

Chris Trayner

In the last WGN I mistakenly announced that Marc Gyssens had taken over from Ina Rendtel as IMO Treasurer. This change will take place, but at the end of the year 2005, not immediately following IMC as I had thought. I appologise to Ina and Marc for any embarassment this may have caused, and to readers for any confusion.

The details of IMO's bank account, to which readers pay their fees, will also change. Details will be announced in due course, probably in the next WGN.

IMO bibcode WGN-336-editorial NASA-ADS bibcode 2005JIMO...33..145T

Jenniskens / October Camelopardalids — Correction

The paper (Jenniskens et al., 2005) in the last WGN contained errors. In the Abstract, (1) on line 6, 'apparent speed' should read 'geocentric speed'; (2) the last line should state '$i = 79^\circ\!.3$'. Table 1 contained several errors and is here presented, corrected, in its entirety.

Table 1 – Orbital elements from video observations (J2000.0, Epoch = 2005 October 5).

	Average of all	Meteor $17^{\rm h}08^{\rm m}40^{\rm s}$ UT	Tight cluster
RA	$164^\circ\!.1 \pm 2^\circ\!.0$	$\sim 161^\circ\!.5$	$166^\circ\!.0$
Dec.	$+78^\circ\!.9 \pm 0^\circ\!.5$	$\sim +78^\circ\!.5$	$+79^\circ\!.1$
V_g	$46^\circ\!.9 \pm 2^\circ\!.6$	~ 47.3	46.6 ± 0.5
a (AU)	∞ (Range $15 - \infty$)	∞	368
q (AU)	0.993 ± 0.001	0.992	0.993
ω	$170^\circ\!.5 \pm 1^\circ$	$170^\circ\!.1$	$170^\circ\!.6$
Ω	$192^\circ\!.59 \pm 0^\circ\!.04$	$192^\circ\!.484$	$192^\circ\!.57$
i	$79^\circ\!.3 \pm 0^\circ\!.5$	$80^\circ\!.1$	$78^\circ\!.6$

References

Jenniskens P., Moilarnen J., Lyytinen E., Yrjölä I., and Brower J. (2005). "The 2005 October 5 outburst of October Camelopardalids". *WGN*, **33:5**, 125–128.

IMO bibcode WGN-336-jenniskens-camelcor
NASA-ADS bibcode 2005JIMO...33..145J

Solar Longitudes for 2006

Rainer Arlt

A conversion table of dates to solar longitudes using (Steyaert, 1991) is given as every year. The longitudes are given on the next page; they are only valid for 2006. The conversion formulae for any time of the day are repeated here for your convenience.

If you want to calculate the solar longitude $\lambda_\odot$ of a specific time of the day, you may use a linear interpolation between two dates. Suppose you have a certain *Date* and the *Time* in hours (UT), you get the solar longitude by

$$\lambda_\odot = \lambda_{\odot,\rm Date} + (\lambda_{\odot,\rm NextDay} - \lambda_{\odot,\rm Date}) \times \frac{\rm Time}{24^{\rm\ h}}.$$

Alternatively, if you want to convert a certain solar longitude $\lambda_\odot$ into a time of the day, look up the *Date* with the next-smaller solar longitude in the table and calculate

$$\mathrm{Time} = \frac{(\lambda_\odot - \lambda_{\odot,\rm Date})}{(\lambda_{\odot,\rm NextDay} - \lambda_{\odot,\rm Date})} \times 24^{\rm\ h}.$$

The solar longitudes of 1988–2020 are given in two-hour increments and with three decimals at `http://www.imo.net/data/solar`.

References

Steyaert C. (1991). "Calculating the solar longitude 2000.0". *WGN*, **19:2**, 31–34.

IMO bibcode WGN-336-arlt-solarlong
NASA-ADS bibcode 2005JIMO...33..145A

Solar longitudes 2006. Dates refer to 00^{h} UT.

Jan	1	280.34	Mar	1	340.18	May	1	40.41	Jul	1	98.96	Sep	1	158.35	Nov	1	218.33
Jan	2	281.36	Mar	2	341.18	May	2	41.38	Jul	2	99.92	Sep	2	159.31	Nov	2	219.33
Jan	3	282.38	Mar	3	342.18	May	3	42.35	Jul	3	100.87	Sep	3	160.28	Nov	3	220.33
Jan	4	283.40	Mar	4	343.19	May	4	43.32	Jul	4	101.82	Sep	4	161.25	Nov	4	221.33
Jan	5	284.42	Mar	5	344.19	May	5	44.29	Jul	5	102.78	Sep	5	162.22	Nov	5	222.34
Jan	6	285.44	Mar	6	345.19	May	6	45.26	Jul	6	103.73	Sep	6	163.19	Nov	6	223.34
Jan	7	286.46	Mar	7	346.19	May	7	46.23	Jul	7	104.68	Sep	7	164.16	Nov	7	224.34
Jan	8	287.48	Mar	8	347.19	May	8	47.20	Jul	8	105.63	Sep	8	165.13	Nov	8	225.34
Jan	9	288.50	Mar	9	348.19	May	9	48.16	Jul	9	106.59	Sep	9	166.10	Nov	9	226.35
Jan	10	289.52	Mar	10	349.19	May	10	49.13	Jul	10	107.54	Sep	10	167.07	Nov	10	227.35
Jan	11	290.54	Mar	11	350.19	May	11	50.10	Jul	11	108.49	Sep	11	168.04	Nov	11	228.36
Jan	12	291.55	Mar	12	351.19	May	12	51.06	Jul	12	109.45	Sep	12	169.01	Nov	12	229.36
Jan	13	292.57	Mar	13	352.19	May	13	52.03	Jul	13	110.40	Sep	13	169.99	Nov	13	230.37
Jan	14	293.59	Mar	14	353.18	May	14	52.99	Jul	14	111.35	Sep	14	170.96	Nov	14	231.37
Jan	15	294.61	Mar	15	354.18	May	15	53.96	Jul	15	112.31	Sep	15	171.93	Nov	15	232.38
Jan	16	295.63	Mar	16	355.18	May	16	54.92	Jul	16	113.26	Sep	16	172.91	Nov	16	233.39
Jan	17	296.64	Mar	17	356.17	May	17	55.88	Jul	17	114.21	Sep	17	173.88	Nov	17	234.40
Jan	18	297.66	Mar	18	357.17	May	18	56.85	Jul	18	115.17	Sep	18	174.86	Nov	18	235.40
Jan	19	298.68	Mar	19	358.16	May	19	57.81	Jul	19	116.12	Sep	19	175.83	Nov	19	236.41
Jan	20	299.70	Mar	20	359.16	May	20	58.77	Jul	20	117.08	Sep	20	176.81	Nov	20	237.42
Jan	21	300.72	Mar	21	0.15	May	21	59.74	Jul	21	118.03	Sep	21	177.79	Nov	21	238.43
Jan	22	301.73	Mar	22	1.14	May	22	60.70	Jul	22	118.99	Sep	22	178.77	Nov	22	239.44
Jan	23	302.75	Mar	23	2.13	May	23	61.66	Jul	23	119.94	Sep	23	179.74	Nov	23	240.45
Jan	24	303.77	Mar	24	3.13	May	24	62.62	Jul	24	120.90	Sep	24	180.72	Nov	24	241.46
Jan	25	304.78	Mar	25	4.12	May	25	63.58	Jul	25	121.85	Sep	25	181.70	Nov	25	242.48
Jan	26	305.80	Mar	26	5.11	May	26	64.54	Jul	26	122.81	Sep	26	182.68	Nov	26	243.49
Jan	27	306.82	Mar	27	6.10	May	27	65.50	Jul	27	123.76	Sep	27	183.66	Nov	27	244.50
Jan	28	307.83	Mar	28	7.09	May	28	66.46	Jul	28	124.72	Sep	28	184.65	Nov	28	245.51
Jan	29	308.85	Mar	29	8.08	May	29	67.42	Jul	29	125.68	Sep	29	185.63	Nov	29	246.52
Jan	30	309.87	Mar	30	9.07	May	30	68.38	Jul	30	126.63	Sep	30	186.61	Nov	30	247.54
Jan	31	310.88	Mar	31	10.06	May	31	69.34	Jul	31	127.59						
Feb	1	311.90	Apr	1	11.04	Jun	1	70.30	Aug	1	128.54	Oct	1	187.59	Dec	1	248.55
Feb	2	312.91	Apr	2	12.03	Jun	2	71.26	Aug	2	129.50	Oct	2	188.57	Dec	2	249.56
Feb	3	313.93	Apr	3	13.02	Jun	3	72.22	Aug	3	130.46	Oct	3	189.56	Dec	3	250.58
Feb	4	314.94	Apr	4	14.00	Jun	4	73.18	Aug	4	131.41	Oct	4	190.54	Dec	4	251.59
Feb	5	315.96	Apr	5	14.99	Jun	5	74.13	Aug	5	132.37	Oct	5	191.53	Dec	5	252.60
Feb	6	316.97	Apr	6	15.97	Jun	6	75.09	Aug	6	133.33	Oct	6	192.51	Dec	6	253.62
Feb	7	317.98	Apr	7	16.96	Jun	7	76.05	Aug	7	134.29	Oct	7	193.50	Dec	7	254.63
Feb	8	319.00	Apr	8	17.94	Jun	8	77.00	Aug	8	135.24	Oct	8	194.48	Dec	8	255.65
Feb	9	320.01	Apr	9	18.92	Jun	9	77.96	Aug	9	136.20	Oct	9	195.47	Dec	9	256.66
Feb	10	321.02	Apr	10	19.91	Jun	10	78.92	Aug	10	137.16	Oct	10	196.46	Dec	10	257.68
Feb	11	322.03	Apr	11	20.89	Jun	11	79.87	Aug	11	138.12	Oct	11	197.45	Dec	11	258.69
Feb	12	323.04	Apr	12	21.87	Jun	12	80.83	Aug	12	139.08	Oct	12	198.43	Dec	12	259.71
Feb	13	324.05	Apr	13	22.85	Jun	13	81.78	Aug	13	140.04	Oct	13	199.42	Dec	13	260.73
Feb	14	325.07	Apr	14	23.83	Jun	14	82.74	Aug	14	141.00	Oct	14	200.41	Dec	14	261.74
Feb	15	326.08	Apr	15	24.81	Jun	15	83.69	Aug	15	141.96	Oct	15	201.40	Dec	15	262.76
Feb	16	327.08	Apr	16	25.79	Jun	16	84.65	Aug	16	142.92	Oct	16	202.40	Dec	16	263.78
Feb	17	328.09	Apr	17	26.76	Jun	17	85.60	Aug	17	143.88	Oct	17	203.39	Dec	17	264.80
Feb	18	329.10	Apr	18	27.74	Jun	18	86.56	Aug	18	144.84	Oct	18	204.38	Dec	18	265.82
Feb	19	330.11	Apr	19	28.72	Jun	19	87.51	Aug	19	145.80	Oct	19	205.37	Dec	19	266.83
Feb	20	331.12	Apr	20	29.70	Jun	20	88.47	Aug	20	146.77	Oct	20	206.37	Dec	20	267.85
Feb	21	332.13	Apr	21	30.67	Jun	21	89.42	Aug	21	147.73	Oct	21	207.36	Dec	21	268.87
Feb	22	333.14	Apr	22	31.65	Jun	22	90.38	Aug	22	148.69	Oct	22	208.36	Dec	22	269.89
Feb	23	334.14	Apr	23	32.62	Jun	23	91.33	Aug	23	149.66	Oct	23	209.35	Dec	23	270.91
Feb	24	335.15	Apr	24	33.60	Jun	24	92.28	Aug	24	150.62	Oct	24	210.35	Dec	24	271.93
Feb	25	336.16	Apr	25	34.57	Jun	25	93.24	Aug	25	151.58	Oct	25	211.34	Dec	25	272.95
Feb	26	337.16	Apr	26	35.55	Jun	26	94.19	Aug	26	152.55	Oct	26	212.34	Dec	26	273.96
Feb	27	338.17	Apr	27	36.52	Jun	27	95.15	Aug	27	153.51	Oct	27	213.34	Dec	27	274.98
Feb	28	339.17	Apr	28	37.49	Jun	28	96.10	Aug	28	154.48	Oct	28	214.34	Dec	28	276.00
			Apr	29	38.47	Jun	29	97.05	Aug	29	155.45	Oct	29	215.33	Dec	29	277.02
			Apr	30	39.44	Jun	30	98.01	Aug	30	156.41	Oct	30	216.33	Dec	30	278.04
									Aug	31	157.38	Oct	31	217.33	Dec	31	279.06

Letter — Electric and acoustic effects of bolides

George John Drobnock [1]

The skies over the North American Continent during the months of October and November 2005 offered the casual and dedicated observer a spectacular series of Taurid fireballs (Beech et al, 2004). The Amateur Meteor Society (AMS) keeps an online list of monthly observations with October having one of those rare moments when a large number of observers send in reports about the event. An observation that is cataloged as a fireball has usually two to four observers for any given day and hour of a fireball observation. However, on October 31, 2005 a large part of the population in the mid-Atlantic region of the United States, including Pennsylvania, New York, Virginia, Maryland (including Washington DC), and West Virginia, saw multiple fireballs from 18^h30^m EST to 21^h15^m EST. Robert Lunsford, editor of the AMS 'Meteor Trails', reported over 100 reports were submitted. The reason for the large number of sightings on the 31st of October was the observation of Halloween. A large number of families were watching Halloween Parades and walking with children in costume under clear mid-Atlantic skies.

This letter is an inquiry about a possible cause and effect that may have occurred on the entry of a large meteor or fireball into the atmosphere, south of my location. On 31 October 2005 two meteor events on the East Coast were witnessed by many and reported to either the IMO or AMS. I had the opportunity to view the 18^h30^m EST event. I missed the 21^h15^m EST brighter and larger fireball event. The general reports given to the AMS indicated that at 21^h15^m a meteor having an average magnitude of -13 entered the atmosphere. By current literature definition it may have been of sufficient size to create an electromagnetic pulse (creating either an electrophonic or VLF RF signature) or infra-sonic wave.

Some reports indicate a sonic boom was heard. My location is central Pennsylvania. I was indoors at 21^h15^m visiting friends. The room has an upright player piano (not playing). On the top was a music box. At the time the meteor passed, (21^h15^m local time) it was viewed by the neighbours. Being inside, we did not see the event, however a music box on top of the piano began to play for a few seconds. When the music box 'played' I checked my watch (21^h15^m), thinking it was a clock's chime. The playing was reminiscent of shaking an unwound mechanical watch or music box to see if movement was over wound or not. A small shaking of a mechanical clock movement is a common method used to see if the mechanism is free to oscillate.

Does anyone think that the passing of the fireball could create a significant VLF signature or infra sonic wave that could have caused the strings of the piano to vibrate? Could a series of strings tuned to various frequencies, enclosed in a heavy wooden box of a significant mass (estimated between 110 to 140 kg), have been put into vibration by the passing of meteor of significant mass? Could the vibrating strings cause the clockwork of the music box to oscillate (play)?

One thought that I have given to this event is an experimental and early method of tuning very high and ultra high frequency transmitters (ARRL, 1955). That is the use of Lecher wires, invented by Ernst Lecher, of Germany. Lecher was able to demonstrate visually the vibration of a standing wave(s) of high frequency electromagnetic waves or Hertz waves. I believe it is still used in some universities to show the standing wave length of VHF transmissions. For example a 140 MHz signal, or two-metre standing wave, would require two parallel wires of two metres in length, a shorting bar, and a small light placed at the proper wavelength of the frequency in question. The light glows at the corresponding frequency of the transmitter.

If the passing meteor (for example the meteor of 31 Oct 2005), with a visual magnitude of -13, did create electrical disturbance in the VLF electromagnetic spectrum, creating a harmonic or subharmonic to cause short piano strings to vibrate, or possibly a vibration caused by a sonic vibration, this may have caused the event I described above. However, in science one observation does not prove a thing. I would be interested to know if any early literature exists describing a similar event.

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Ongoing meteor work

Fireworks all night long — the 2004 Geminid maximum from Austria

Thomas Weiland [1]

For those above the high-altitude fog, excellent conditions in Austria during the 2004 Geminid maximum allowed the collection of a relatively large amount of data, even for a single observer. A reasonable number of 609 Geminids were recorded on December 13/14 during 6.91 hours of effective observing time and ZHR values indicate an activity plateau of the order of 150. An impression of the maximum and pre-maximum night together with a summary of the results is given.

Received 2005 November 13

1 Introduction

The Geminids are one of the most impressive meteor showers currently visible. In 2004 their maximum was expected to occur on December 13/14, $22^{h}20^{m}$ UT $\pm 2^{h}20^{m}$ (McBeath, 2003), which coincided perfectly with the new moon on December 12. As in many other parts of Europe, December is notorious for its bad weather in Austria. But in 2004 things seemed to be reverse — a high pressure cell lasting for more than a week covered nearly the whole of central Europe, bringing sunny weather to the mountains, whereas lower areas suffered from overcast skies. To escape the high-altitude fog a mountain plateau some 50 km southwest of Vienna (Ebenwaldhöhe; 15°42′ E, 47°59′ N) was chosen as a suitable observing site (field obstruction 5%). With an average altitude of 1000 m it usually lies above the inversion layer.

2 The pre-maximum night (December 12/13)

On pre-maximum night (December 12/13), observations started at $19^{h}00^{m}$ UT. By that time the Geminid radiant had an elevation of $h_R = 25°$ and conditions were nearly ideal: no clouds or wind at all. Limiting magnitudes stayed first at +6.2 and improved a little bit to +6.3 as the flood light of a far away skiing ground was switched off at $21^{h}00^{m}$ UT (without underlying fog, light pollution would have been much more dramatic, even at that distance).

During the first hour ($19^{h}00^{m}$ to $20^{h}00^{m}$ UT) 18 GEM were seen, followed by 32 GEM during the next ($20^{h}00^{m}$ to $21^{h}00^{m}$ UT) and 35 GEM between $21^{h}00^{m}$ and $22^{h}00^{m}$ UT. This corresponds to ZHR values of up to 72 ± 13, with population indices varying somewhat between $r = 2.04$ and 2.28 (see Table 1). The bulk of the Geminids was made up of meteors within the +1 to +4 magnitude range and bright ones flared up to magnitude −3. Colours seen were mostly bluish and yellow. About 11% of the Geminids — a bit more than usual — left trains.

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NASA-ADS bibcode 2005JIMO...33..148W

3 The peak night (December 13/14)

Maximum night still enjoyed cloudless skies (LM +6.0 before $21^{h}00^{m}$ UT and +6.2 after; see above). But a steady wind made observing conditions less comfortable. Nevertheless average Geminid rates were much higher than the previous night. Observations started again at $19^{h}00^{m}$ UT and during the first hour ($19^{h}00^{m}$ to $20^{h}00^{m}$ UT) 50 GEM were logged, followed by 54 GEM during the next ($20^{h}00^{m}$ to $21^{h}00^{m}$ UT). These correspond to ZHR values of 159 ± 22 and 141 ± 19 respectively. As the radiant climbed higher into the sky, visible rates jumped up quickly to 91 GEM between $21^{h}00^{m}$ and $22^{h}00^{m}$ UT (ZHR 172 ± 18). At that time every 30 to 45 seconds a Geminid travelled across the sky with occasional bursts of up to 3 appearing simultaneously. Other minor shower members (χ-Orionids and Monocerotids plus σ-Hydrids and Coma Berenicids later) added to the scene, together with a handful of sporadics.

After being less active between $22^{h}00^{m}$ and $23^{h}00^{m}$ UT (79 GEM, ZHR 135 ± 15) the Geminids were rising towards a second, even broader peak (ZHR 171 ± 20 between $23^{h}00^{m}$ and $00^{h}00^{m}$ UT, 72 GEM and 172 ± 17 between $00^{h}00^{m}$ and $01^{h}00^{m}$ UT, 108 GEM). Finally they began to lose strength and ZHR values fell to 132 ± 14 ($01^{h}00^{m}$ to $02^{h}00^{m}$ UT, 87 GEM) and then to 105 ± 13 ($02^{h}00^{m}$ to $03^{h}00^{m}$ UT, 68 GEM). In turn they tended to become brighter which is borne out by population indices and corrected mean magnitudes as well (see Table 1). Population indices were hovering around $r = 1.99$ to 2.25 throughout the night but went down to $r = 1.89$ during the last observing hour. These correspond to corrected mean magnitudes of +2.40 to +2.87 and +2.17 respectively. As the night before, the bulk of the Geminids was marked by meteors within the +1 to +4 magnitude range, with bright ones blazing up to magnitude −4. Colours seen were bluish, yellow and orange. Compared to December 12/13, fewer Geminids left trains (about 6%).

4 Discussion

Every meteor observer should keep in mind that conclusions drawn from single observations must be treated with caution. Nevertheless some aspects may be discussed.

4.1 Magnitude distribution

In general, the magnitude distribution of the 2004 Geminids fits a standard function. It is not clear whether the dips of observed meteor numbers seen both on December 12/13 and 13/14 in the +1 and +3 magnitude range are observational errors or not. However, since the author is a long-term observer this feature may be regarded as real.

Population indices were derived using the magnitude difference between the meteors and the limiting stellar magnitudes. The yielded values (see above and Table 1) are in line with those found earlier for the maximum and, to some extent, pre-maximum night (Rendtel & Arlt, 1997; Rendtel, 2000). The lower value of $r = 1.89$ after December 13/14, $02^{\rm h}00^{\rm m}$ UT may give a hint on mass segregation effects observed during previous returns (Rendtel, 2000, 2004).

Accordingly the slightly lower population indices during the maximum night are echoed in an overall corrected mean magnitude of +2.57, compared to +2.69 on December 12/13.

4.2 ZHR profile

ZHR calculation followed the procedure given in the 'Handbook for Visual Meteor Observers' (Rendtel et. al., 1995). The zenith exponent was assumed to be $\gamma = 1.0$. No perception coefficient was applied. ZHR values on December 12/13 lie within the order of previous returns (Rendtel & Arlt, 1997; Rendtel, 2000). On December 13/14 high activity is seen lasting for at least 6 hours from $19^{\rm h}00^{\rm m}$ UT until $01^{\rm h}00^{\rm m}$ UT with ZHR values in excess of 130 and up to 170. The ups and downs seen in Table 1 may be regarded as statistical fluctuations and it is better to assume an activity plateau with an average ZHR around 150. This fits quite well with IMO data, whereas a slightly later peak time than given in the 'Shower circular' (Arlt, 2004) is suggested.

4.3 General appearance

Geminids in the sky resemble 'falling stars'. Since they are made up of particles with higher bulk density than other meteor streams (Rendtel, 2004), only a few Geminids leave trains, usually less than 10%. This could be observed in 2004 as well. The typical Geminid had magnitude +2 to +3, though brighter shower members up to magnitude −4 were quite common. Predominant colours were bluish, yellow and orange.

5 Conclusion

Excellent observing conditions in Austria during the 2004 maximum allowed the collection of a reasonable number of Geminids. Population indices and ZHR values were comparable to those found during previous returns, whereas the activity profile suggests a plateau-like maximum lasting for several hours.

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Table 1 – Magnitude distribution of 694 Geminids logged by the author on 2004 December 12/13 and 13/14, together with mean meteor magnitudes ($\overline{m}_{6.5}$), population indices (r) and ZHR-values.

2004 December 12/13

Limiting magnitudes: 19^h00^m–21^h00^m +6.2, 21^h00^m–22^h00^m +6.3

Time (UT)	$T_{\rm eff}$	-4	-3	-2	-1	0	+1	+2	+3	+4	+5	+6	Σ	$\overline{m}_{6.5}$	r	ZHR
19^h00^m–20^h00^m	0.97^h	0	0	0	4	1	2	2	1	4	4	0	18	2.58	2.07	49 ± 12
20^h00^m–21^h00^m	0.94^h	0	1	1	1	4	1	6	3	10	5	0	32	2.92	2.28	72 ± 13
21^h00^m–22^h00^m	0.94^h	0	0	1	3	4	1	8	7	7	4	0	35	2.51	2.04	59 ± 10
Σ		0	1	2	8	9	4	16	11	21	13	0	85			

2004 December 13/14

Limiting magnitudes: 19^h00^m–21^h00^m +6.0, 21^h00^m–22^h00^m +6.2

Time (UT)	$T_{\rm eff}$	-4	-3	-2	-1	0	+1	+2	+3	+4	+5	+6	Σ	$\overline{m}_{6.5}$	r	ZHR
19^h00^m–20^h00^m	0.93^h	0	0	0	3	13	8	6	4	12	4	0	50	2.44	2.00	159 ± 22
20^h00^m–21^h00^m	0.94^h	0	0	1	2	9	6	10	6	12	8	0	54	2.87	2.25	141 ± 19
21^h00^m–22^h00^m	0.89^h	0	0	3	10	11	10	15	7	22	13	0	91	2.48	2.02	172 ± 18
22^h00^m–23^h00^m	0.90^h	0	1	3	4	12	3	11	16	15	14	0	79	2.70	2.14	135 ± 15
23^h00^m–00^h00^m	0.58^h	0	0	0	6	10	10	18	7	15	6	0	72	2.40	1.99	171 ± 20
00^h00^m–01^h00^m	0.87^h	1	0	1	3	11	11	22	23	24	12	0	108	2.81	2.21	172 ± 17
01^h00^m–02^h00^m	0.89^h	0	0	1	10	9	11	15	12	19	10	0	87	2.49	2.03	132 ± 14
02^h00^m–03^h00^m	0.91^h	0	1	2	5	12	8	13	8	14	5	0	68	2.17	1.89	105 ± 13
Σ		1	2	11	43	87	67	110	83	133	72	0	609			

SPA Meteor Section Results: July–September 2003

Alastair McBeath[1]

Information derived from reports, comments and data provided to the *SPA Meteor Section* from 2003 July to September is given, with some discussion. The Southern δ-Aquarids and α-Capricornids received excellent coverage in July and August, with maxima found around July 27–29 and July 31.5 ± 1.5 d, with ZHRs of ~ 12–18 and $\sim 5 \pm 1$ respectively. Moonlight hindered observations near the Perseids' best, but coverage across the shower was splendid, and a maximum at August 13, 01^h UT $\pm 0\overset{h}{.}5$, $\lambda_\odot$ (eq. 2000.0) = $139\overset{\circ}{.}85 \pm 0\overset{\circ}{.}02$, was found, with a mean ZHR of 119 ± 12. This was around an hour later than several theoretical computations had suggested in advance. Some other possible Perseid maxima on August 13 were hinted at, but the poor conditions meant these could not be confirmed, and the radio observations were unable to find a clear single peak for the shower, although echo counts were highest from roughly 20^h UT on August 12 to the same time on August 13. A very weak α-Aurigid return was found, with little sign of its predicted September 1 maximum. Three significant events attracted much attention later in September: a meteorite strike in New Orleans, USA, on September 23; images of a supposedly disintegrating meteorite over south Wales on September 24, which transpired to have been of Concorde's sunlit acceleration contrail off the south Welsh coast; and a substantial fall of meteorites over Orissa in eastern India on September 27. Little trace of any significant peak due to the Sextantids could be found in the late September radio results.

Received 2004 August 21

1 Introduction

Despite the full Moon coinciding with their maximum (McBeath, 2003, p. 8), the Perseids received most attention during the quarter and, for the first time in many years, results were obtained by visual Section contributors throughout the entire shower. This also meant excellent coverage was possible for the three stronger Aquarid-Capricornid showers, the Southern δ-Aquarids, α-Capricornids and Northern δ-Aquarids, over the late July maxima of the first two in particular, which coincided with new Moon. Radio observers struggled on against the northern summer's very unhelpful interference, notably Sporadic-E (Es), with results that even by the late September Sextantid epoch, were still far less complete than might have been hoped for. Indeed, September became more notable for three fireball/meteorite events, albeit one of them was not actually a fireball at all.

Table 1 has the observing tallies for the quarter. David Entwistle also contributed an image of a single Perseid in $0\overset{h}{.}02$ photography during August.

Radio results were received from:

Dirk Artoos (Belgium); Belorussian Radio Observers Ivan Bruykhanov, Alexey Gain, Alexey Golovanov, Roman Grabovsky, Zahar Lapitski, Leonid Molchanov, Leonid Serebrennikov and Kiril Ushakov (data from observer Ivan Sergey); Gilberto Klar Renner (Brazil); Bob White (England);

and the following Radio Meteor Observation Bulletin observers (RMOB; website: `www.rmob.org`; via editor Chris Steyaert, in RMOBs 120–122 inclusive, 2003 July to September respectively):

Enric Fraile Algeciras (Spain), Mike Boschat (Nova Scotia, Canada), Walter Boschin (Italy; with Diego Ganzini, Alessandro and Giuseppe Candolini), Jeff Brower (Colorado, USA), Maurice de Meyere (Belgium), Thierry Duhagon (France), Minoru Ehara (Japan), Kenji Fujito (Japan), Valter Gennaro (Italy), Ghent University (Belgium), Patrice Guérin (France), Steve Hansen (Massachussetts, USA), Toshihide Miyake (Japan), Naoki Moriwaki (Japan), Stan Nelson (New Mexico, USA), Sadao Okamoto (Japan), Mike Otte (Illinois, USA), Tian-Jing Ouyang (China), Shigeo Sambe (Japan), Robert Savard (Quebec, Canada), Marcel Schneider (Luxembourg), SKiYMET radar (Norway), Hirofumi Sugimoto (Japan), Dave Swan (England), Istvan Tepliczky (Hungary), Yung Cheich (Garfield) Tsao (Taiwan, China), Ilkka Yrjölä (Finland).

Standard analyses were carried out using the raw radio data, as normal in these reports, following the modified procedure outlined in (McBeath, 2004).

Visual data contributors comprised:

American Meteor Society observers (website: `www.amsmeteors.org`; summary tables in their journal Meteor Trails 21, December 2003, provided thanks to editor and observer Bob Lunsford in California, USA): Jure Atanackov (Slovenia), Sidney Ferreira (California, USA), Mark Fox (Michigan, USA), George Gliba (West Virginia, USA), Amir Hassanzadeh (Iran), Robert Hays (Illinois, USA), Davood Hemati (Iran), Edwin Jones (Arizona, USA), Javor Kac (Slovenia), Soheil Khoshbinfar (Iran), Gene Kispert (Minnesota, USA), Thomas Lazuka (Indiana, USA), Mike Linnolt (Hawaii, USA), Pierre Martin (Ontario & Quebec, Canada), Paul Martsching (Iowa, USA), Bert Matous (Kansas, USA), Norman McLeod (Florida, USA), Dale Niedfeldt (Minnesota, USA), Mazyar Seyyednezhad (Iran), Wesley Stone (Oregon, USA), Richard Taibi (Florida, USA), William Watson (New York, USA), Kim Youmans (Georgia, USA)

Arbeitskreis Meteore observers (website: `www.meteoros.de`; data from their journal Meteoros 6:10, 6:11 (both 2003) and 7:2 (2004), submitted by Ina Rendtel, in Germany where not remarked): Rainer Arlt, Pierre Bader, Lukas Bolz, Frank En-

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IMO bibcode WGN-336-mcbeath-spams2003c
NASA-ADS bibcode 2005JIMO...33..151M

Table 1 – Visual and radio hours' totals, plus visual meteor numbers recorded (with a partial breakdown of types), per month.

Month	Visual	SDA	NDA	CAP	PER	KCG	AUR	DAU	SPI	Meteors	Radio
July	$168^{\mathrm{h}}.9$	206	71	129	191	—	—	—	—	1631	4523^{h}
August	$427^{\mathrm{h}}.5$	174	175	104	2945	176	61	—	—	5808	6357^{h}
September	$87^{\mathrm{h}}.1$	—	—	—	—	—	13	71	57	703	6639^{h}

zlein, Darja Golikowa, Mathias Growe, Daniel Grün, Sirko Molau, Selina Müller, Sven Näther (Croatia & Germany), Jürgen Rendtel, Heinrich Wiechell (Greece), Roland Winkler, Oliver Wusk; Michael Brooke (England), Terry Churms (England), Csilla Csonti (Hungary), David Entwistle (England), Mike Feist (England), Zoltan Hevesi (Hungary), Albert Heyes (England), Edward Mallett (England), Tony Markham (England), Alastair McBeath (England), SARM-Romania members (all in Romania): Valentin Grigore, Dan Mitrut, Adriana Nicolae, Diana Ogescu, Cristina Tinta-Vass, Raul Truta, Emil Neata; Jonathan Shanklin (England).

2 July

As commented in the Introduction, new Moon in late July meant conditions were very good for covering the Aquarid-Capricornid showers, with maxima due from the Southern δ-Aquarids on July 28 and the α-Capricornids on July 30 (McBeath, 2003, pp. 9–10). Visual coverage of these two showers was excellent for once, despite the low activity of the α-Capricornids. Table 2 gives magnitude distributions for both, as well as the July-August sporadics, the Perseids and Northern δ-Aquarids. Few train details were recorded for showers other than the Perseids, none at all for the Southern and Northern δ-Aquarids. Train percentages for the α-Capricornids, Perseids and July-August sporadics respectively, were 12%, 29%, and 6%.

The relatively small numbers of meteors available for the magnitude distributions, aside from the Perseids and sporadics, make these details less reliable than would be desirable, but the moderately-to-very low activity from the other three sources means this is about as accurate as practical. It is interesting that the α-Capricornids still stand out as significantly brighter than the two δ-Aquarid sources and the sporadics, despite this problem.

Figures 1 and 2 give computed mean nightly ZHR values for the Southern δ-Aquarids and α-Capricornids. This nightly averaging of ZHRs has largely been done for clarity, and to reduce the error bars because of the generally low observed meteor counts. Each datapoint was based on results obtained between approximately 21^{h}–11^{h} UT, though usually during a rather shorter interval than this on any given date.

The general profile shown by the Southern δ-Aquarids here was similar to that from 1988–1995 given by Rendtel et al. (1995, p. 179), and those from 1993–2002 and 1997–2002 in Dubietis & Arlt (2004), including a minor peak around July 21 ($\lambda_\odot = 118° \pm 1°$), here

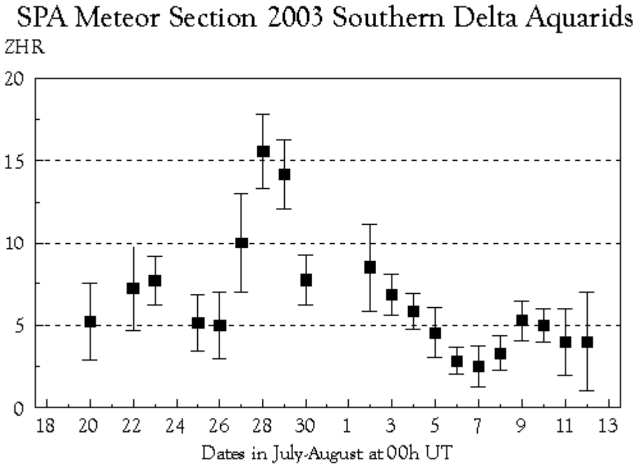

Figure 1 – Nightly mean ZHRs for the Southern δ-Aquarids during 2003 July and August, computed using an assumed r-value of 3.2.

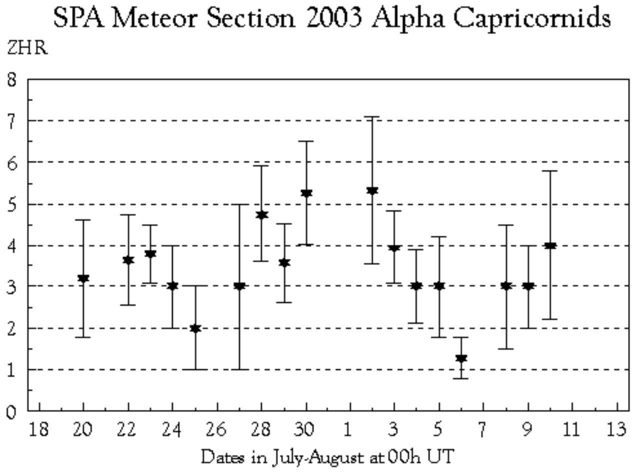

Figure 2 – Nightly mean ZHRs for the α-Capricornids during 2003 July and August, computed using an assumed r-value of 2.5.

on July 21–23, and the sharp, roughly two to four day long maximum ($\lambda_\odot = 124°$–$126°$, (Rendtel et al. *loc. cit.*), equivalent to 2003 July 27–29, and in these results, or $\lambda_\odot = 124°$–$128°$, July 27–31 (Dubietis & Arlt, 2004)). The circa August 9 minor peak ($\lambda_\odot = 136°$) suggested here was not found in the IMO results from 1988–1995, where only a steady decline in activity was recorded, but there were indications of something similar in the more recent findings around this time. This peak may be significant in regard to the Northern δ-Aquarids, however, as discussed below for August. The SPAMS peak ZHRs were lower than the longer-interval IMO ones of $\sim$ 17–25, at $\sim$ 12–18, but were more comparable with the range in (Dubietis & Arlt, 2004),

Table 2 – Global magnitude distributions for the 2003 Southern δ-Aquarids, α-Capricornids, Northern δ-Aquarids, Perseids and July-August sporadics seen under better sky conditions (cloud cover $< 20\%$, LM $= +5.5$ or better, excepting the Perseids, where the LM criterion was relaxed to $+4.25$ or better between August 9 to 17, owing to full Moon coinciding with their maximum in 2003), including mean LMs and corrected mean magnitudes.

Shower	≤ -3	-2	-1	0	$+1$	$+2$	$+3$	$+4$	$\geq +5$	Tot	LM	$\overline{m}_{6.5}$
SDA	0	0	0.5	6	13	29	45.5	33.5	11.5	139	+6.54	+2.84
CAP	1	3	3	5.5	15	22.5	23	10	9	92	+6.39	+2.37
NDA	0	0	0.5	3	8.5	12.5	29.5	18.5	9.5	82	+6.57	+2.93
PER	12	14.5	53.5	103.5	180.5	181	198	144	65	952	+6.02	+2.50
SPO	1.5	2.5	8	25	69	98	135.5	122.5	90	552	+6.31	+3.15

$\sim$ 11–17. SPAMS' rates away from the maximum were marginally higher than in any of the IMO data.

A comparison with the Forward Scatter Meteor Year (FSMY) findings (McBeath, 2001) showed weak, ill-defined peaks around $\lambda_\odot = 116°$ (2003 July 19) and $120°^{+3°}_{-1°}$ (July 23, with error bounds of 22–26), although the former was only found in 1996 and 1999. A more obvious maximum was usually present around $\lambda_\odot = 124°$–$126°$ (2003 July 27–29), as part of an enhanced spell typically between $\lambda_\odot = 122°$–$128°$ (July 25–31), but sometimes persisting for up to two days before and three days after this period, blending into other weak maxima without this interval. The previous radio peaks around July 23 and 27–29 seem nicely in line with the visual findings this year.

Unfortunately, a mere six radio datasets (four of those from Japan) were intact enough to show anything useful from the end-July time, and these provided only a weak consensus as to when the more active peaks might have been. July 28–29 probably gave the best overall response, which is at least reassuring with what the visual results indicated.

Analysing the weaker α-Capricornids was less easy. There seemed to be a peak implied by the SPAMS data around July 31.5 ± 1.5 d, with mean ZHRs of $\sim 5 \pm 1$, albeit the break in available results between July 29–30 and August 1–2 added to the uncertainty here. This interval suggested a possible maximum between $\lambda_\odot = 126°$ and $130°$, which would fit with the FSMY $\lambda_\odot = 122°$–$128°$ and $\lambda_\odot \sim 129°$ peaks at least. Breaks in many of the radio datasets this year meant coverage over this time was too patchy to confirm the FSMY or visual results.

Examining the IMO graph for the shower from 1988–1995 in (Rendtel et al., 1995, p. 183) and 1997–2002 in (Dubietis & Arlt, 2004) showed a general similarity of pattern to that found here, but with typically slightly lower ZHRs. A fairly broad maximum lasting for several days was certainly suggested by the IMO data, from roughly $\lambda_\odot = 125°$–$131°$(2003 July 28 to August 3), with the fractionally highest activity on $\lambda_\odot = 127°$–$129°$(2003 July 30 to August 1), essentially what was found in the SPAMS data this year. The fine-scale variations are somewhat conjectural, because of the very low ZHRs, but there seemed to be no counterpart to the apparent rise late in the SPAMS 2003 graph, from August 8–10, in the IMO results. This may have sim-

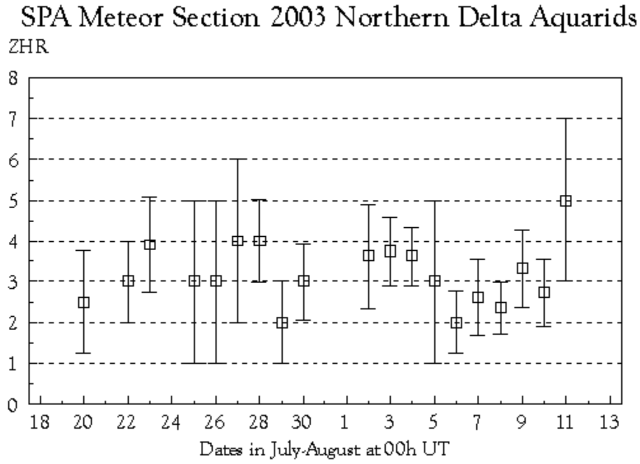

Figure 3 – Nightly mean ZHRs for the Northern δ-Aquarids during 2003 July and August, computed using an assumed r-value of 3.4.

ply resulted from poorer observing conditions as the Moon waxed, but some further discussion of this period is given under the Northern δ-Aquarids below.

3 August

Although some 75 Southern ι-Aquarids were recorded in July and August, activity was never high enough to permit meaningful ZHR computations to be carried out for more than an isolated night or two, and the maximum estimated around August 4 could not be confirmed from these. The same problem applied later in August for their Northern twin shower, even near its proposed maximum, circa August 21–24, of which source 67 meteors were seen.

The Northern δ-Aquarids received more attention, as Figure 3 demonstrates. The first part of their activity, through into early August, resembled the *IMO* findings from 1988–1995 in (Rendtel et al., 1995, p. 178). After then, the patterns shown by this year's SPAMS analysis differed significantly, since while there should have been a rising trend from August 6 or so to the maximum expected around August 9 (McBeath, 2003, p. 8), the reverse was found, with only a possible rise to a peak around August 10–11. This latter data point is most uncertain, witness the substantial error bar, and the fact the bright Moon was making conditions extremely difficult for observers by then.

Radio observers struggled to provide useful coverage even near the main Perseid peak this time, and the data in the days up to August 11 was often too broken to assist with this problem. Past FSMY results have indicated typically minor peaks around $\lambda_\odot = 135°$ and 137° (the latter as part of the lead-up to the Perseid maximum, and sometimes seen to blend in with the earlier peak), which might suggest some variability in the timing of the Northern δ-Aquarid maximum. However, the unexpected rise in Southern δ-Aquarid rates around August 9, the rise beginning from August 6–7, together with the marginal increase in α-Capricornid ZHRs near this time, might imply problems in determining shower association as a more probable cause. In this respect, it is interesting that Dubietis & Arlt (2004) also reported problems with shower association in connection with this source. The three 'peaks' they found for the Northern δ-Aquarids coincided with the Southern δ-Aquarid, and predicted Southern and Northern ι-Aquarid, maxima (around $\lambda_\odot \sim 126{.}^\circ 5$, 132° and 150° respectively). A weak rise in Northern δ-Aquarid rates was apparent in their results too near $\lambda_\odot \sim 139°$, near the Perseid peak. This all seems to imply this shower is a lot weaker than previously supposed, and perhaps does not exhibit a visually-definable maximum at all. Such a finding would fit with the video results on the Aquarid-Capricornid streams reported by Shigeno & Shigeno (2004), where only the Southern δ-Aquarid and α-Capricornid radiants could be easily defined, although the 2002 August 3–7 data did imply a loose concentration of radiants in the vicinity of the Northern δ-Aquarid one too.

While the maximum of the Perseids was almost exactly at full Moon, coverage throughout the shower was some of the most complete the Section has ever amassed, as Figure 4 illustrates. Perseid activity was visible at at least a low, but persistent, rate from July 18–19 to August 25–26, albeit barely detectable after August 22–23 for the most part. Some of the minor enhancements, notably that in the first week of August, have been suggested by earlier results, and may relate to the FSMY $\lambda_\odot = 131°$–$133°$ or 135° weak radio maxima. The first interval was not detected before 1999 however, while the second timing was not clearly confirmed from 1997–2000 data. It is difficult to be sure how realistic the mild enhancement between July 21–25 was, since not all datasets agreed on it. The virtual halving of ZHRs during the most active phase of the Southern δ-Aquarids is suggestive that perhaps some 'Perseids' may have been mis-identified by observers centring their attention to cover the Aquarid-Capricornid showers, either inflating the counts in the third week of July, or deflating them in the third to fourth week. A magnitude distribution for the Perseids in July–August is given in Table 2.

The popularity of the Perseid maximum among meteor enthusiasts is undoubted, and has been so for many years, as the number of observers who watched and reported data from this highly moonlit return testify. Part of this may have been because of Esko Lyytinen's prediction of possibly enhanced activity around $\lambda_\odot = 139{.}^\circ 82$ (2003 August 13, 00^h10^m UT) (Lyytinen, 2003), a prediction confirmed and supplemented by Huan Meng (Meng, 2003), who suggested possible peaks on August 13 around 00^h03^m and 00^h39^m UT ($\lambda_\odot = 139{.}^\circ 806$ and $139{.}^\circ 83$ respectively), the latter perhaps very weak.

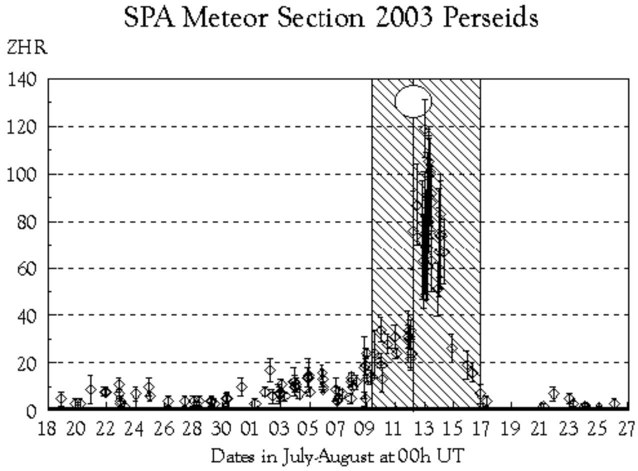

Figure 4 – Mean ZHRs for the Perseids during 2003 July and August, computed using an assumed r-value of 2.6. The exact time of full Moon is shown by the line with the white disc attached near its top, while the shaded area between August 9 and 17 indicates the period that most observers whose data were used here were unable to enjoy twilight-free skies with no moonlight. During this interval only, the LM criterion for ZHR calculation was relaxed from the normal minimum of +5.5 to +4.25, although very few observations were used where the LM was this poor.

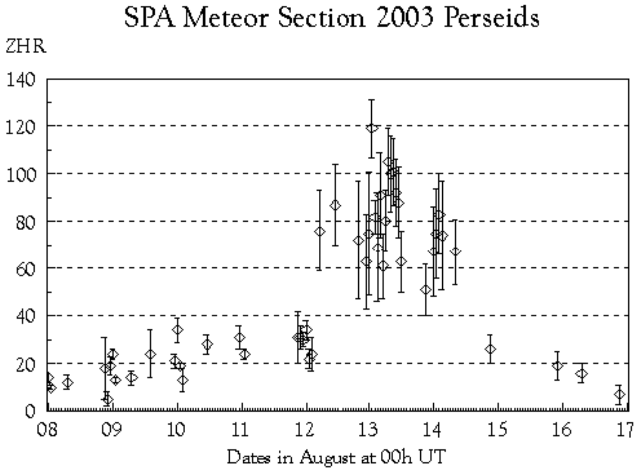

Figure 5 – Mean ZHRs for the Perseids near their maximum, extracted from Figure 4, which Figure's caption contains the variable computational parameters.

As Figure 5 demonstrates, there was a maximum around this time, with possibly another following some time later, although the moonlit nature of the observations makes them rather less reliable than normal, especially regarding the actual ZHR values, which may have been somewhat inflated by the increased correction factors necessary to allow for the bright sky. To keep the errors more manageable under these difficult circumstances, one-hour binning intervals were used, centred on the hour. Shorter intervals were initially tried, but failed to provide usable results.

Under these strictures and provisos, a clear max-

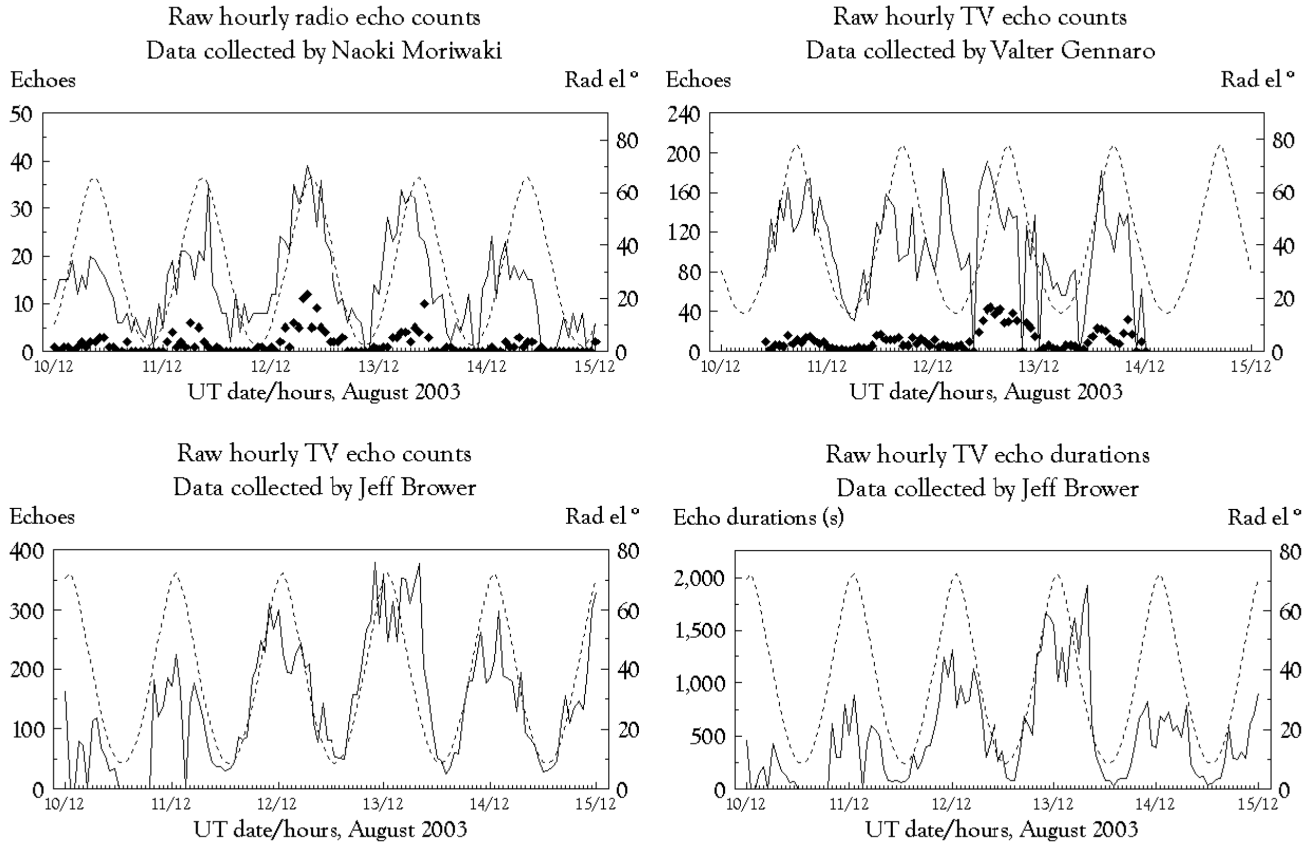

Figure 6 – Four graphs of raw hourly radio or TV meteor echo counts, showing activity over the Perseid maximum in August 2003. In each, the echo results are given by the irregular lines, or symbol-lines, keyed to the left-hand y-axes. Drops to zero in these in general indicate times when no reliable recording was possible, usually because of Es. The daily-symmetric curves show the Perseid radiant elevation, keyed to the right-hand y-axes. The four give an impression of how activity was perceived in different parts of the world: Top left: Japan (Naoki Moriwaki; the upper continuous trace shows the all-echo counts, the lower symbol-line gives longer duration, D > 20 s, echo counts). Top right: Europe (Valter Gennaro; upper continuous trace is the all-echo counts, lower symbol-line the longer duration ones, D > 10 s; this system was effectively operational only between 22^{h} UT on August 10 to 12^{h} UT on August 14). Bottom: North America (Jeff Brower; the bottom-left graph gives the all-echo counts, the bottom-right graph a count of total echo durations in second per hour, giving an indication of when more longer duration echoes were present).

imum was apparent in the 01^{h} UT bin for August 13 (i.e. the bin covers 01^{h} UT $\pm 0.^{h}5$, $\lambda_\odot = 139.^\circ85 \pm 0.^\circ02$), when the mean ZHR was 119 ± 12. Intervals to either side gave ZHRs of 75 ± 26 (00^{h} UT, $\lambda_\odot = 139.^\circ81$) and 82 ± 7 (02^{h} UT, $\lambda_\odot = 139.^\circ89$), which suggests the real peak, regardless of the ZHR numbers, may have fallen between 01^{h} and $01^{h}30^{m}$ UT then. Interestingly, Kamil Złoczewski and Kamil Szewc (2004), using a single radio meteor system, found a possible radio peak within the one-hour interval centred at $01^{h}24^{m}$ UT ($\lambda_\odot = 139.^\circ87$). This infers the enhanced maximum predictions were around an hour to an hour and a half earlier than the increased Perseid rates were recorded, but it seems a maximum earlier than expected from the usual nodal crossing time prediction did indeed happen.

The nodal crossing was due around $04^{h}40^{m}$ UT on August 13 (McBeath, 2003, p. 8), with two other possible peak times suggested (though neither has been recorded in recent years), around $02^{h}40^{m}$ and $14^{h}40^{m}$ UT on this date. ZHRs were variably strong for much of August 13 following the $\sim 01^{h}$ UT peak, at around 60–100 or so, thus it is difficult to be sure how significant some of the other stronger variations, none of which were as obvious, may have been. ZHRs peaked at $\sim 90 \pm 18$ in the 04^{h} UT bin, which may equate with the near-nodal peak, but rates were ~ 100 again in the 07–09^{h} UT bins as well, during the North American night. Given the trying observing conditions, it is perhaps best not to read too much into these peaks, aside from the strongest $\sim 01^{h}$ UT one.

Reception problems for many radio observers, even fairly near the expected Perseid maximum, meant coverage of the shower was not ideal. Several observers registered no clear maximum from the Perseids at all, beyond a general consensus that activity was enhanced on most dates between August 11–14. At best, a careful examination suggested activity was probably most elevated from roughly 20^{h} UT on August 12/13 to the same time on August 13/14, but without a single obvious maximum coincident between the various datasets beyond this. Some of the longer-duration echo counts provided a guide as to which date produced the better such activity, but no timing resolution less than this was possible. It was highly unfortunate that the strongest visual peak fell during the European night-time transmitter shutdown. Figure 6 provides a selection of some of the more useful radio datasets, to illustrate these points and problems.

The κ-Cygnid maximum around August 18 (McBeath, 2003, p. 8), was also severely moonlit, and while a steady, persistent drizzle of these meteors was reported during the month, numbers were typically too few to derive useful ZHRs from for most of the time. No sensible confirmation of their likely peak was possible from the very limited data collected near August 18, unfortunately.

4 September

From observers' comments, which came in along with their data, it was clear very quickly that the field opinion was of a poor α-Aurigid return in 2003. While some had been registered in the last week of August, much as usual, this early trickle of shower meteors failed to increase towards the expected maximum, around midday UT on September 1 (*op. cit.*, p. 11). With observed activity often at or below one meteor per hour by early September, this was a significant surprise. It seems now that while rare years may bring enhanced ZHRs from this source, other — hopefully at least — equally rare returns may produce substantially weaker activity than the normal ZHRs of ~ 7–8. The δ-Aurigid maximum was lost to full Moon around September 9.

Radio observing circumstances improved somewhat during the month, such that eleven datasets, just under half the total active observers during September, were available for inspection across the possible September 15–17 period, which has been reported as providing enhanced radio meteor rates in the past, most notably in 1989 (Artoos, 1990) and 1999 (McBeath, 2000). No significant activity peak was found this time, but 65% of the available results favoured a weakly-enhanced spell on either September 16 or 17, without a clear consensus as to when this might have taken place. A minor peak like this around $\lambda_\odot = 173^\circ$–$174^\circ$ was not unexpected from the FSMY results.

The waning Moon should have permitted something of the Piscid maximum, near September 20, to be seen but, rather like the α-Aurigids earlier, rates were disappointing from this shower all month. No evidence for even marginally higher numbers could be found near the equinox, with some observers recording no Piscid meteors at all then. Piscid ZHRs are never high, so this was not too great a surprise, but the shower has sometimes been rather better represented at previous returns.

After this, it was thought the next significant event would be the late September Sextantid radio peak, but between September 23 and 27, this was rather upstaged by three fireball/meteorite events, although only two were actually meteoric. All three provoked requests for information to the Section, as well as some observations, hence their inclusion here.

The first was a meteorite fall which crashed into and through a wood-built house in New Orleans, USA, shortly after $21^{\rm h}$ UT (4 p.m. local time) on September 23. The recovered meteorites were reported as belonging to an originally substantial-sized achondrite, which smashed through the roof, upper and ground level floors, with the main pieces ending up in the crawl-space below the lower floor. Fragments were found scattered in the rooms the object had passed through. It had broken up an antique desk and cut through a carpet on the way. Luckily the family living there were out at the time, but neighbours reported hearing a noise like a car crash, which they were unable to identify until the householder returned and found the damage.

The following evening, a schoolboy from Pencoed, south Wales imaged an unusual, initially fierily bright, linear cloud formation soon after local sunset, at around $18^{\rm h}13^{\rm m}$–$18^{\rm h}15^{\rm m}$ UT. Some time later, he e-mailed his pair of images to NASA, asking if they knew what the cloud feature might be. NASA published one as their 'picture of the day' for October 1, initially captioned as a disintegrating meteorite. Although NASA quickly amended this hugely speculative comment, controversy followed, which took a full month after the original images were taken to finally resolve, as the images were open to a number of possible interpretations. The early favourite solution, suggested by several people, was that it was probably an aircraft contrail catching the setting Sun. Additional images came to light during October, including a series from the same Welsh village by another photographer who had watched the contrail being formed, and with this fresh information, it was eventually confirmed that it had been the sunlit contrail produced by Concorde, as it accelerated to supersonic velocity after crossing the Welsh coast outbound for New York on its evening flight. Much of the discussion concerning this event can be found summarized in the Cambridge Conference Network e-mail notices between CCNet 81/2003 (for October 2) to CCNet 92/2003 (October 24). Among a series of comments on the BBC News website regarding the original images were some amusing ideas, a personal favourite of which was from someone signed only as 'Sophie, UK': *I think it's a terrible photo - if only he'd aimed more to the left he'd have gotten a unique picture of the dragon itself!* Highly apt, with one of the Welsh emblems being a red dragon, and the sunlit trail looking very like a jet of fire a dragon might have just breathed out.

While this event turned out to be entirely non-meteoric, the debate it engendered was interesting and useful for making fresh contacts and re-establishing old ones. Moreover, it also helped bring to light two sightings of a daylight fireball over the UK, probably on October 1, between $17^{\rm h}$ and $17^{\rm h}30^{\rm m}$ UT although, unfortunately, neither was detailed enough to allow significant information to be established for the event.

The final meteoritic event that generated considerable correspondence, including some observations, was a shower of meteorites over Orissa in eastern India. This event was preceded by a brilliant fireball seen from across Orissa and West Bengal, around $6^{\rm h}30^{\rm m}$ p.m. local time ($\sim 13^{\rm h}$ UT) on September 27. It produced a sonic boom which rattled doors, and was reported as breaking some windows. A number of chondritic meteorites weighing up to 5.7 kg were recovered in the days afterwards, some of which had struck houses, as well as producing minor craters in fields. This fall was especially significant as early reports suggested there had been at least twenty casualties caused by the meteorites, but this was later downgraded to three casualties which happened after the event; media sources listed burns and people collapsing from shock. Very sadly, a fourth person, an elderly man, appeared to have collapsed from shock on seeing the fireball, and died later in hospital. A persistent report that one person aside from these injuries had been struck and killed by one of the falling fragments remained unconfirmed. In addition, there were also reports of house fires being started by the meteorite strikes. All such were finally ruled out, as theory suggested they should have been, in that ordinary small meteorites are not believed capable of retaining sufficient heat to cause fires directly, after landing. However, an incoming meteorite might secondarily cause a fire after knocking over a burning lamp, or scattering ashes from a lit fire, for example. There was one instance in Orissa where a minor fire was caused when a kerosene stove fell over in one of the houses hit by a meteorite, but whether the meteorite was the agent that knocked the stove over, through to whether the two events were unconnected and merely close together in time, could not be firmly established.

The Sextantids were expected to reach a maximum sometime between September 26–29 (McBeath, 2003, p. 8), although as the FSMY data indicated, this might not occur equally well in all years, despite occasional stronger returns. Ten radio datasets were available across this spell, and beyond, for comparison, but no clear maximum signature was found in these at all. There were weak signs of possible peaks around September 27 and 29/30, but these were not present in all the results, and the timings were not well confirmed. This may simply have been one of the shower's weaker returns, but definitely a period to monitor in future.

5 Acknowledgements

Grateful thanks go to all the observers and correspondents who have helped make this report possible, as always. In addition, I would particularly like to thank the following for their contributions to the debate on the September 24 fireball-that-wasn't images from south Wales, mostly through personal contacts: Marco Langbroek (for various comments, not least of which was establishing just when the first images were taken), Robert Matson (who first suggested the event may have been Concorde's contrail), Robert Nemiroff (for various points, including the later genuine fireball reports the story helped recover) and Benny Peiser, CCNet moderator (for general discussions, and keeping me up to date with some of the later developments, aside from his operating of the CCNet messages generally).

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SPA Meteor Section results: October–December 2003

Alastair McBeath[1]

Analysis and discussion of data sent to the SPA Meteor Section from 2003 October to December are presented. No Draconid outburst was found in early October, despite predictions, with minor radio maxima near this time probably due to the Sextantids instead. A weak radio Orionid peak seems to have been present between October 20 and 23, without a clear single maximum. Mean visual ZHRs were $\sim 13 \pm 2$ consistently during this time, but were slightly higher on October 19/20 at $\sim 16 \pm 2$. This latter date also produced a radio peak for Japanese observers. November 18/19 produced the strongest visual Leonid rates, when ZHRs were recorded as variable between $\sim$ 15–65, with an approximate mean for the night of 40 ± 2. Leonids were present from November 13 to 23, often with ZHRs $\simeq$ 15–20. A minority of the radio data indicated a possible Leonid peak on November 13/14 for Europe and North America, with a suggestion this may have been due to brighter meteors (more longer-duration echoes). The strongest Leonid radio response was found on November 19/20, but no more specific timing could be achieved. A weak radio peak on November 21/22 was probably due to a normal α-Monocerotid return. The visual Geminids gave good, if moonlit, mean ZHRs on December 13/14 (116 ± 6) and 14/15 (88 ± 5). Radio observations suggested a probable mean Geminid maximum time of $10^{\rm h}55^{\rm m} \pm 1^{\rm h}$ UT on December 14 ($\lambda_\odot$ (eq. 2000.0) = $261\overset{\circ}{.}969 \pm 0\overset{\circ}{.}042$). There were radio-visual signs that brighter Geminids were more prevalent after the expected maximum, early in the European night of December 14/15. A low Ursid maximum was detected, with radio-visual activity most obvious on December 22/23 (mean ZHRs = 7 ± 1).

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1 Introduction

Many showers, or potential showers, during the final quarter of 2003 were affected by the Moon to a greater or lesser degree, including the Draconid epoch in October, the Taurids in early to mid November, the Leonids at their first post-storms return, and the Geminids. The Orionids were to be fairly Moon-free by their maximum at least, while the normally-minor α-Monocerotids and Ursids both had maxima timed for new Moon. Unfortunately, the weather and radio interference (less by Sporadic-E at last, but more by some badly-timed auroral storms) made quite a few observers struggle to collect much useful data. Some interesting results were possible despite this.

The observing totals for the quarter are in Table 1. Radio observers comprised:

Dirk Artoos (Belgium); Belorussian Radio Observers Vladimir Piytich, Stanislav Pyatich and Ivan Sergey; David Entwistle (England - data also in Radio Meteor Observation Bulletins, RMOBs); Chris Heapy (England); Gilberto Klar Renner (Brazil); Bob White (England);

and the following RMOB reporters (website: `www.rmob.org`; data in RMOBs 123 to 125, 2003 October to December inclusive, kindly submitted by editor Chris Steyaert):

Masami Aihara (Japan), Enric Fraile Algeciras (Spain), Arima High School (Japan), Mike Boschat (Nova Scotia, Canada), Walter Boschin (Italy; with Diego Ganzini, Alessandro and Giuseppe Candolini), Jeff Brower (Colorado, USA), Maurice de Meyere (Belgium), Gaspard de Wilde (Belgium), Thierry Duhagon (France), Minoru Ehara (Japan), Kenji Fujito (Japan), Valter Gennaro (Italy), Ghent University (Belgium), Patrice Guérin (France), Masahiko Matsuda (Japan), Toshihide Miyake (Japan), Naoki Moriwaki (Japan), Kazuyuki Nagao (Japan), Stan Nelson (New Mexico, USA), Hiroshi Ogawa (Japan), Sadao Okamoto (Japan), Mike Otte (Illinois, USA), TianJing Ouyang (China), Shigeo Sambe (Japan), Robert Savard (Quebec, Canada), Marcel Schneider (Luxembourg), Hironobu Shida (Japan), SKiYMET radar (Norway), Hirofumi Sugimoto (Japan), Dave Swan (England), Istvan Tepliczky (Hungary), Diego Valeri (Italy), Michinaro Yamamoto (Japan), Ilkka Yrjölä (Finland).

Processing and checking of the raw radio data were carried out as normal, the procedure amended as described in (McBeath, 2004).

Video results were received from Steve Evans (England) in October and Enrico Stomeo (Italy) in December. Totals of 27 Orionids, 21 Northern Taurids, 4 Southern Taurids and 5 Ursids were recorded from the overall trail counts.

The visual observers included:

American Meteor Society observers (website: `www.amsmeteors.org`; data from tables in their journal Meteor Trails 22, March 2004, provided by editor and observer Bob Lunsford in California, USA): Joseph Assmus (California, USA), Jure Atanackov (Slovenia), Javad Azazi (Iran), Mike Boschat (Nova Scotia, Canada), Dustin Brown (Washington, USA), Peter Brunone (Texas, USA), Brian Cudnik (Texas, USA), Sidney Ferreira (California, USA), Vincent Giovannone (New York, USA), George Gliba (Maryland & West Virginia, USA), W T Goodart (Arizona, USA), Robin Gray (California & Nevada, USA), Davood Hemati (Iran), Paul Jones (Florida, USA), Javor Kac (Slovenia), Soheil Khoshbinfar (Iran), Gene Kispert (Minnesota, USA), Thomas Lazuka (Indiana, USA), Mike Linnolt (California & Hawaii, USA), Pierre Martin (Ontario & Quebec, Canada), Felix Martinez (Virginia, USA), Paul Martsching (Iowa, USA), Norman McLeod (Florida, USA), Thom Morgan (North Carolina, USA), Mazyar

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Table 1 – Visual, video and radio hours' totals, visual and video meteor numbers recorded (with a partial breakdown of visual types), per month.

Month	Visual									Video		Radio
	Hours	NTA	STA	ORI	LEO	GEM	URS	COM	Total	Hours	Total	Hours
October	$119\overset{h}{.}5$	34.5	48.5	312	—	—	—	—	1220	15^{h}	55	9355^{h}
November	$111\overset{h}{.}8$	94	42	1	536	—	—	—	1182	—	—	10533^{h}
December	158^{h}	—	—	—	—	993	81	22	1895	$0\overset{h}{.}8$	6	8928^{h}

Seyyednezhad (Iran), Wesley Stone (Oregon, USA), David Swann (Texas, USA), William Watson (New York & North Carolina, USA), Kim Youmans (Georgia, USA), Brad Young (Oklahoma, USA);

Arbeitskreis Meteore watchers (website: www.meteoros.de; data from their journal Meteoros 6:12 (2003), 7:1 and 7:2 (2004), provided by Ina Rendtel), all in Germany: Mathias Growe, Daniel Grün, Sven Näther, Jürgen Rendtel, Roland Winkler; John Bingham (England), Paul Brierley (England), Terry Churms (England), Mike Dale (Scotland), Mike Feist (England), Valentin Grigore (Romania), Chris Heapy (England); Hegyháti Observatory Foundation observers Tibor Horvath, Antal Poczek, Vince Tuboly (Hungary); Alastair McBeath (England), Sejal Patel (England), Jorge Segurola (Puerto Rico), Jonathan Shanklin (England), George Spalding (England), Richard Taibi (Maryland, USA; data also in Meteor Trails 22), Roy Watson (Scotland).

2 October

Full Moon on October 10 was never going to assist observers of any potential Draconid activity, originally suggested as most likely on October 8 or 9 from recent past returns (McBeath, 2003, p. 12), if anything happened at all. However, further interest was generated by a late prediction of a possible faint-meteor outburst on October 7, around 19^{h} UT (Lyytinen, 2003). An additional note by Jeremie Vaubaillon on IMO-News on October 3 indicated that Draconid ZHRs were liable to be ~ 1 at best, so would probably not be detectable. Coverage of the possible Draconid epoch was very patchy among the Section's visual watchers, so this information is hardly conclusive, but just six possible shower meteors were spotted in almost 11^{h} of observing between October 5–8, five of those meteors by one observer in 3.5^{h} on October 8, activity not confirmed by any others watchers. In the radio results, no Draconid activity could be found. As the Draconid radiant elevation has an approximate antiphase correlation with the diurnal sporadic activity for any given site in early October (i.e. the Draconid radiant is highest in the sky when sporadic rates are near their daily low point, during the local early evening hours), this can be taken as much more conclusive that no significant Draconid outburst occurred. An especially careful check was carried out in the data for several hours around the predicted outburst time but, again, with entirely negative results.

Several observers did record minor increases in activity around October 6–8, which was commented on by some radio workers, including in the IMO-News message posted by Hiroshi Ogawa on October 10. Following discussions, notably with Dirk Artoos (to whom many thanks), a fuller investigation of this aspect was carried out, and the activity increases around these dates were found to coincide with the daytime Sextantid radiant's best-visibility for those sites registering such count enhancements. This strongly suggests late activity from this source — possibly a submaximum — was the cause. The Forward Scatter Meteor Year (FSMY) analyses (McBeath, 2001) found two relevant peaks in this regard, at $\lambda_{\odot} = 190°–192°$ (2003 October 3–5) and $\lambda_{\odot} = 195°$ (October 8). Sometimes the first was seen to extend for a day before, and up to three days after, these limits (thus blending it into the second peak), while the second might persist into the next day. Up to three minor maxima were found during the $\lambda_{\odot} = 189°–195°$ period in some years, with one around $\lambda_{\odot} \sim 191°$ occasionally appearing moderately strongly. A substantial outburst was recorded around $\lambda_{\odot} = 195°$ only in 1998, when the Draconids produced their most recent excellent return. In previous of these results papers, it had been suggested the $\lambda_{\odot} = 195°$ peak especially might relate to weak annual Draconid rates. This latest analysis implies this theory can now be discounted, and shows longer monitoring of the Sextantid epoch from late September through to the potential Draconid epoch, may be useful for future years. Given that the Sextantids were thought to end on October 9, this may indicate an extended activity period from them is possible.

While lunar conditions were partly favourable for the Orionids later in October, the weather often was not, and no useful European visual observations were received from nights nearest the expected maximum, October 21/22 (McBeath, 2003, p.12). Steve Evans managed to secure some CCD video coverage then, using his 'Emily' system, with an $f/1.8$, 28mm lens, giving a field of view of 36°, and a video-stellar LM of +5.0. Unfortunately, as Figure 1 shows, by comparison with others of Steve's images pictured in these reports previously, the system's intensifier is degrading, making the images increasingly noisy. Although the automatic meteor detection software can still cope with this, the images are not quite so attractive for a casual viewer, and eventually the image quality will be such that useful data can no longer be collected with this intensifier. Hopefully, that is still some time off.

Steve's data revealed a few curiosities. His two better nights with the Orionid radiant well on-view were

Figure 1 – A composite video-still Orionid image from October 26 at $01^{\rm h}23^{\rm m}$ UT, compiled by Steve Evans. The bright star near the centre is Polaris, α Ursae Minoris, with β (left) and γ (right) UMi towards the centre-top of the image. Alternate frames have been stacked to construct this view, giving breaks in the trail to allow the meteor's apparent velocity to be measured.

October 19/20 ($2\overset{\rm h}{.}99$ between $23^{\rm h}15^{\rm m}$ and $02^{\rm h}14^{\rm m}$ UT) and 25/26 ($6\overset{\rm h}{.}04$ from $23^{\rm h}16^{\rm m}$ to $05^{\rm h}19^{\rm m}$ UT). His counts for the ORI, STA and NTA respectively on these nights were 3, 2, 6 and 19, 0, 14. The Northern Taurid counts seem unusually high, particularly on October 25/26. This may be due to the choice of field centre, as any centre north of the pair of Taurid radiants will tend to favour assigning meteors to the more northerly radiant during data reduction. This seems to suggest that, as with telescopic observing, regularly shifting the field centre for video work too, may bring benefits for radiant determinations. For the Taurids, shots east and west of the radiants might well provide a better definition of both sources, as well as to the north and south, when the radiants are high enough in the sky. It is interesting to note the relative similarity in Orionid and Taurid rates by the later date.

Visual Orionid ZHRs (computed assuming $r = 2.9$) were higher on October 19/20, at $\sim 16{\pm}2$, than between October 20/21 to 22/23 inclusive, when ZHRs consistently averaged $\sim 13 \pm 2$. This suggested a weak, and possibly slightly unusual, Orionid maximum in 2003.

In apparent confirmation, radio observers found the Orionid peak to be only marginally detectable. Interference was rather severe for Europe and at times in Japan as well, creating some very 'noisy' radio activity graphs. With visual auroral activity present on many nights in mid-month and later, this was clearly the root cause of many difficulties and, following so closely after another strong northern summer Sporadic-E season, it was most disappointing for the radio workers. No good consensus could be found for a specific peak time, or even a peak night, but counts seemed to be higher in the majority of datasets between October 20 to 23 inclusive. Four of the five Japanese datasets spanning across the peak epoch found their better responses on October 19/20, but no other data elsewhere confirmed that. When coupled with the visual results, this might suggest a possible stronger Orionid submaximum, as the radio event happened when the Orionid radiant was well above the horizon for Japan, but as the reports did not give a consistent timing, and with all the other interference throughout the Orionids' best, it is perhaps best not to read too much into this finding. Orionid rates should have been relatively low, assuming the $\sim$ 12-year ZHR cycle suggested for the Orionids and η-Aquarids to be correct (Dubietis, 2003), with the latest rates-trough around 2001–2002. This was certainly suggested by the available SPAMS data.

Auroral activity grew even worse during the last few days of October, with storms seen down to quite low latitudes (such as Florida in the USA) from October 29–31. These reduced the available radio datasets to a literal handful — five — to give some coverage during the sometimes-enhanced Taurid spell at this time. Although no Taurid 'swarm' return was anticipated, it is always useful to have calibration data from such an 'off' year. No consensus could be seen between the various systems as to when, or if, anything unexpected had taken place meteorically. Under the circumstances, 'inconclusive' is again probably a useful adjective. The few visual observations not distracted by the aurorae indicated only the usual low Taurid ZHRs normally anticipated, and although a few fireballs were reported, often by people out observing the aurorae, these casual rates were no different to the rest of the month. A recent paper (Beech et al, 2004) examining data back to 1962 has found model predictions of enhanced Taurid activity during that time to be largely accurate, giving hopes that future predictions — including that for late 2005 — may also be correct.

3 November

As the Taurid maxima were lost to November's full Moon, visual attention concentrated around the Leonid/α-Monocerotid epoch later in the month. Thanks to various predictions made shortly before the event (detailed in WGN **31:5**, summarized by Arlt (2003a), with additional discussion by Meng (2003)), that epoch was extended in the radio analysis here to cover from midday UT on November 12 to the same time on November 24. Maxima were predicted for different times between roughly midday UT on November 13 through to $03^{\rm h}$ UT on November 23, of varying durations, strengths, and meteor brightnesses.

Visually, circumstances were not easy, with last quarter Moon in Leo for November 17/18, brighter and fuller before this time, and the ZHR computations provided at best only a rough guide to what happened (all Leonid ZHRs used here were calculated using an assumed $r = 2.5$, taken from intervals only where the LM was +4.5 or better). Few results were available from November 13 or 14 meeting this minimum LM criterion, although the IMO preliminary results (Arlt, 2003b) suggested ZHRs may have been as high as $\sim$ 20–35 at times between about midday to midnight UT on November 13. ZHRs were though apparently rather variable within that timeframe. SPAMS data, such as it was, concurred with the IMO results after this through

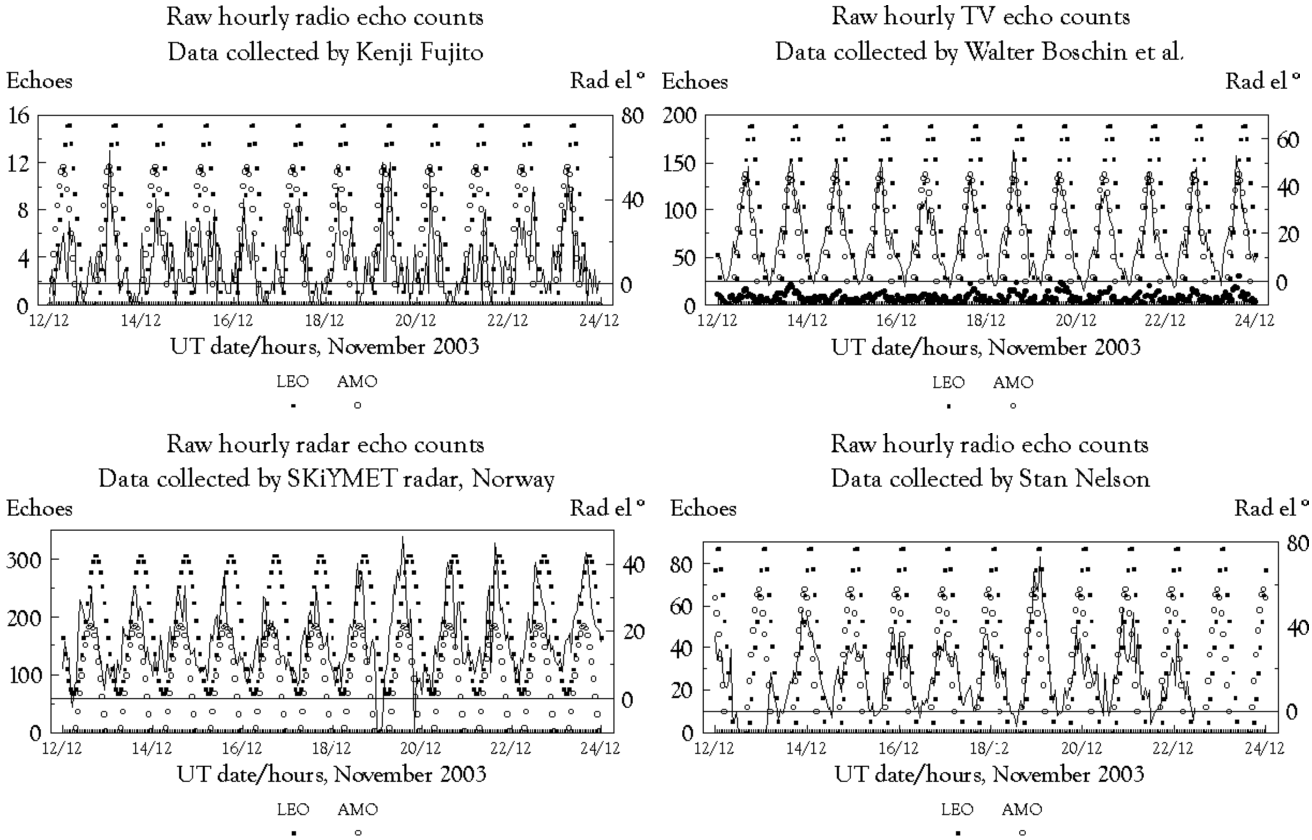

Figure 2 – Four sample raw radio, radar or TV echo count graphs, from the 2003 Leonid and α-Monocerotid epochs. The echo count lines are the irregular continuous or symbol-line ones, keyed to the left-hand y-axes. The daily-symmetrical symbol-curves, keyed to the right-hand y-axes, show the Leonid and α-Monocerotid radiant elevations for each site. The Taurid radiant elevations have been omitted for clarity. To a first approximation, these followed very similar diurnal curves to the Leonids, but were offset by around 6–7^h before the Leonid radiant reached a similar elevation. The graphs are intended to show how activity during this part of November was radio-perceived from different parts of the world: (a), *top left:* Japan (Kenji Fujito); (b), *top right:* Europe (Walter Boschin *et al.*; the lower symbol-line curve gives counts for longer-duration echoes, $D > 1$s; (c), *bottom left:* Europe (SKiYMET radar, which preferentially detects many underdense echoes, normally expected to be due to fainter meteors); and (d), *bottom right:* North America (Stan Nelson, whose system was offline after 17^h UT on November 22). Drops to zero in the echo count lines generally show times when interference or equipment problems prevented accurate data collection.

to November 19, finding ZHRs of the order of 15–20 on most dates, at least as good as the maximum rates in many years well away from the strong to storm returns associated with Comet 55P/Tempel-Tuttle's perihelion passages.

November 18/19 produced the strongest visual peak, but without a clear, single maximum. IMO data indicated elevated, if again variable, activity, ZHRs $\sim$ 30–65, between 00^h to 22^h UT, perhaps with a main peak near 15^h UT on November 19, when ZHRs were $\sim 63 \pm 4$. Conditions at the time reduce confidence in the actual ZHR values further than the standard error implies. SPAMS results allowed mean ZHRs to be computed in hourly bins for most hours between 00^h–13^h UT on November 19, although with fewer contributing observers, the span of values was rather greater, between $\sim$ 15–65 for the most part. A mean from all these would give a ZHR for November 19 of $\simeq 40 \pm 2$. A similar roughly-worked mean from the IMO data gave $\simeq 45 \pm 2$.

After this peak, activity seemed to fall away quite steadily, with the last definite Leonids reported from November 23 in both IMO and SPAMS data, rather later than is usually seen with this shower. While the Leonid activity seen certainly covered the full range of possible dates and times suggested for peaks earlier, specific maxima could not be singled out from the visual results. Partly this will have been due to observing circumstances. However, part may well have been due to superposition of activity from various of the contributing Leonid stream encounters, blurring the activity produced by each.

Figure 2 gives a selection of the radio results across the Leonid epoch, which overall suggested that even had conditions been perfect, visual watchers might well still have struggled to define many maxima within the 2003 Leonids.

A minority, some 41%, of the available datasets found a maximum on November 13/14, as suggested by Figures 2 (a), (b) (longer-duration counts only) and (d). The majority of these fell during the Leonid radiant's radio-visibility for Europe and North America, with only a very small, somewhat earlier, enhancement on this date and before, attributable to the Taurids. Kenji Fujito's results gave the clearest Japanese signature for a peak on this date, but his count numbers are more suggestive of typical longer-duration hourly totals than most of the Japanese systems (which otherwise operate fairly similarly, producing hourly counts of the order of tens of events). Although they were not noted as being of longer-duration in his results, this may be significant. The European SKiYMET radar garners counts typical for a high proportion of underdense echoes and, from results at other times of year, may well be detecting a fainter meteor population generally. There is very little in this graph to imply a peak on November 13/14. Similarly, the all-echo count line in the data collected by Walter Boschin's group show no clear peak signature then. Their longer-duration echo counts do give a peak at that time, however. Naturally, these graphs have been chosen to help highlight this point, but others of the radio results not illustrated also hint towards this possibility. If longer-duration echoes are indicative of generally brighter meteors, as is often supposed, this may be how the elevated visual rates on this date were so relatively easily seen.

Unfortunately, this concept appears to be at variance with the preliminary Japanese reports posted on IMO-News on November 14 and 16 by Hiroshi Ogawa, which suggested the field impression from observers was that many meteors seen on November 13 over Japan were faint. It is difficult to be sure how 'faint' this meant, since observations where the LM was worse than +4.0 were excluded, and the November 16 posting indicated that the LM value was fainter than the average Leonid meteors by 2.38 magnitudes. The implied uncorrected mean magnitude of around +1.5 to +2.5 is not what most people would consider faint, yet from it an r-value of 3.74 ± 0.26 was computed, yielding a very sizeable correction factor. This is perhaps more indicative of the problems in trying to calculate such data from moonlit sky observations, than in giving accurate results. Meng (2003) had indicated the Leonid r-values for the predicted November 13 maximum might be of order 4.6–4.9, which, if correct, should have meant most meteors would have passed unseen in the bright skies, especially given that we would not normally expect to find any visually-detectable background Leonid activity on that date. Overall, it is perhaps more probable the Japanese observers' comments about many 'faint' meteors referred to the fact they were difficult to see in the moonlight, a relative, rather than an absolute, impression. If the assumptions about the radio data are right (longer-duration echoes = brighter meteors), then the suggestion that this maximum was expected to contain many faint meteors must also be wrong, especially as the radar data and other systems which preferentially detected more fainter events showed no peak on this date at all.

As indicated by several of the radio graphs here, Leonid activity between November 14–18 seems to have been present, if fairly unremarkable. There are indications in just over half the datasets that rates were generally lower around November 16 (possibly between approximately midday UT on November 15 to the same time on November 17 in a very few results), perhaps because of decreased Leonid numbers then, although the few IMO visual datapoints around this date are unclear on this point.

November 19/20 brought the strongest peak in 71% of the viable radio graphs although, as Figure 2 indicates, this was often stronger by only a slight margin from other dates during this year's Leonid epoch. The peak seemed to coincide with the Leonids' best radio-visibility for the sites which registered it, and it has not been possible to identify a specific time more accurately than this. The peak was certainly nowhere near as dominant as seen at recent returns, when strong to storm Leonid rates have manifested, although the longer-duration echoes — most obvious in Figure 2 (b) — provided a somewhat clearer picture. These also implied that an increased proportion of brighter meteors may have been apparent from November 18–20, and may even have peaked somewhat after the main all-echo maximum.

A later peak on November 21/22, found in a minority of radio results, was probably due to the α-Monocerotids. A careful inspection suggested the Europeans found their higher counts roughly between 02^{h}–04^{h} UT on November 22, perhaps beginning as early as 23^{h}–00^{h} UT according to some Japanese data. Rates were sometimes enhanced similarly near the same time on the next night, all coincident with the radiant's highest. The enhancement seemed to be additional to any waning Leonid activity, with the echo-count curves subtly different on November 22. In addition, peaks were suggested around the same local time in North America, implying a general increase in α-Monocerotid activity, rather than a short, sharp, strong peak such as that seen in 1995 during their outburst overnight for Europe. So while the expected α-Monocerotid maximum was due around $02^{h}45^{m}$ UT on November 22 (McBeath, 2003, p. 13), apparently comparably-timed for the peak in European data, just a normal return is implied. Several visual datasets were presented from around this time, in which α-Monocerotid activity was uniformly very low, and no peak could be derived thus in 2003.

The end of the Leonid activity was not readily detectable in the radio results, but there was no obvious sign of any substantial maxima after November 20/21 apart from that probably due to the α-Monocerotids. The rising activity around November 24, seen in those graphs of Figure 2 where observing was still continued, has been found before, in the FSMY results, where a peak between $\lambda_{\odot} = 240°$–$248°$ (2003 November 22–30) was commonly present. It probably relates to the starting of several minor showers which have maxima in early December, but perhaps was somewhat raised by the last Leonids as well on this occasion.

4 December

Visual work in December concentrated around the moonlit Geminid maximum, and the moonless Ursid peak, with greater observer activity for the former than the latter, partly due to the northern winter weather, as so often. The LM constraint for magnitude and ZHR results during the near full Moon phase of the month was relaxed to +5.0 from its more normal +5.5, in order to still allow a reasonable Geminid evaluation,

Table 2 – Global magnitude distributions for the 2003 Geminids and December sporadics seen under better sky conditions (cloud cover < 20%, LM = +5.0 or better), including mean LMs and corrected mean magnitudes.

Shower	≤ -3	-2	-1	0	+1	+2	+3	+4	$\geq +5$	*Tot*	LM	$\overline{m}_{6.5}$
GEM	7	10	15	34	61	96	93	45	9	370	+5.16	+3.22
SPO	0	2	0	5	7	12	17	16	0	59	+5.21	+3.70

while making the analysis rather less reliable than usual. Table 2 has magnitude distributions for the Geminids and December sporadics. Numbers of trained meteors were small, but suggested 3.5% of Geminids and 7% of sporadics left persistent trains.

Geminid ZHR values, computed with an assumed $r = 2.6$, were somewhat erratic, largely because of the unhelpfully high correction factors bright moonlight brings. However, the mean for December 13/14, based on results collected between $\sim 18^{\rm h}$ and $08^{\rm h}$ UT, was distinctly higher than that for December 14/15 (between $20^{\rm h}$–$06^{\rm h}$ UT), at 116 ± 6 compared to 88 ± 5. This inferred the predicted maximum, scheduled for $11^{\rm h}40^{\rm m} \pm 2.5^{\rm h}$ UT on December 14 (McBeath, 2003, p.12), may well have been correct. Rates seemed to be falling overnight on December 14/15, and were back to 12 ± 2 the next night, fading away by December 16/17, much as normal.

Figure 3 provides some views of the radio data over the Geminid maximum. Strong peaks were apparent on either December 13, 14, or both, dependent on where the observers were located in relation to the likely peak time, and the radiant's best radio-visibility for each site and system. A carefully weighted mean of the available results was taken, to help allow for the otherwise dominant number of European datasets, and taking account of the observed activity profiles when Geminids could be observed. This suggested a probable main Geminid maximum time of $10^{\rm h}55^{\rm m} \pm 1^{\rm h}$ UT on December 14 ($\lambda_\odot = 261\overset{\circ}{.}969 \pm 0\overset{\circ}{.}042$). This was pleasingly close to the predicted peak and, although not absolutely certain due to the vagaries of the techniques involved, is probably a reasonable fit to reality.

Few viable longer-duration echo count results were available. Although many of the Japanese observers routinely provide data for echo counts with durations greater than 20 s, because such events are normally extremely few in number, it is usually impossible to sensibly analyse them. Thus it was not practical to estimate whether the broader peak in counts greater than 10 s long, seen in Figure 3 (d), was a general radio effect on December 14/15 or not. The overall counts had dropped significantly by this time over Europe, but some of the European visual data from the first half of this night indicated ZHRs may have still been over 100, which would tally with when the most significantly enhanced longer-duration echo counts were detected by this one system as well. Assuming, as before, that longer echo durations are produced by brighter meteors, this might explain the still-good visual rates reported then. While the sample was small (145 Geminids), the corrected mean magnitude for December 14/15 was +2.66, compared to the overall value of +3.22, with 62% of magnitude 0 or brighter Geminids spotted on this one night. Since the magnitude distributions then were all amassed before $23^{\rm h}15^{\rm m}$ UT, this does seem to confirm that more brighter meteors were present on December 14/15, supporting the scant radio findings.

Later in December, the Ursids produced a generally weak radio maximum, with almost equal numbers of systems yielding a peak on either December 21/22 or 22/23. No more obvious consensus could be achieved than that, which at least implies no unusual activity came from the source this year. Visual reports featured some Ursids from December 17–19, and all nights from December 21–24. Best ZHRs of $\sim 7 \pm 1$ were recorded on December 22/23, calculated assuming $r = 3.0$. Overall, as far as the data permits, an apparently unexceptional Ursid return.

Acknowledgements

As ever, it is with great pleasure that I thank again all the observers and correspondents for their efforts during the quarter.

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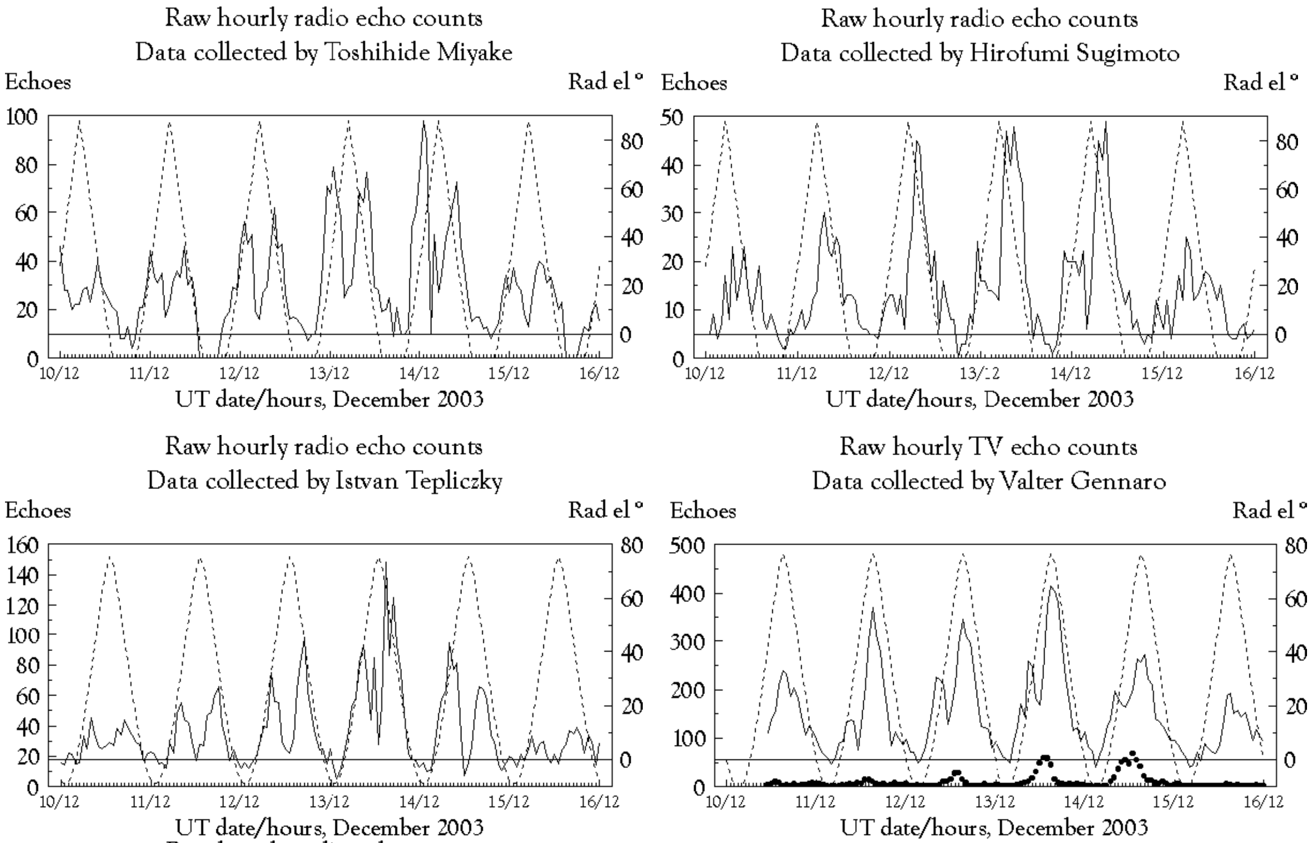

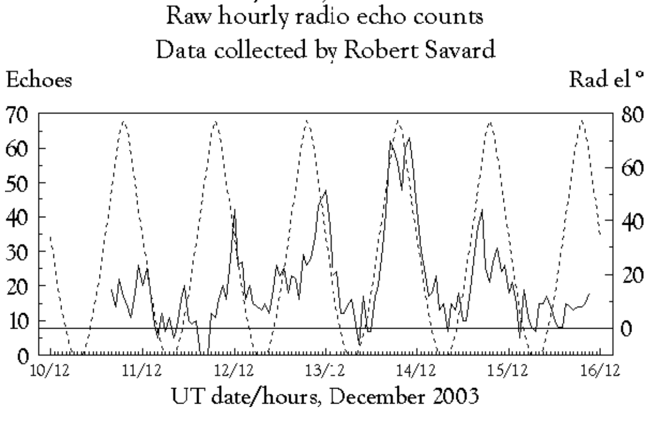

Figure 3 – Five sample raw radio or TV echo count graphs, from the 2003 Geminid near-maximum period. The various traces and other details are as for Figure 2, except that the daily-symmetrical curves give the Geminid radiant elevations for each site, and that the observers were located in the following geographic regions: *top row* (a and b): Japan (Toshihide Miyake and Hirofumi Sugimoto); *middle row* (c and d): Europe (Istvan Tepliczky and Valter Gennaro; for the latter, the lower symbol-line curve gives counts for longer-duration echoes, D > 10s; and *left* (e): North America (Robert Savard, whose system was operational only from 04^{h} UT on December 11).

History

Meteor Beliefs Project: Meteoric imagery in SF, Part I — Introduction

Alastair McBeath[1] *and Andrei Dorian Gheorghe*[2]

A fresh aspect to the Meteor Beliefs Project is announced, concerning films and TV programmes. A preliminary list of such items with notable meteoric content is given, along with two examples of brief meteoric appearances.

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1 Introduction

One of the main ways people modernly gain information beyond their daily experiences is through films or TV programmes. Such information in a fictional context need not be accurate or reliable, but elements of it can be taken as genuine by non-specialists, and become part of the beliefs held by the public at large. Although not originally conceived as a specific facet of the Meteor Beliefs Project, we have decided to begin exploring this subject too.

2 Sub-Project details

We have chosen the topic title 'Meteoric Imagery in SF', since we are naturally interested chiefly in how meteors and meteoric events are portrayed. While many of the obvious sources of such material might be classed as science-fiction, we have deliberately avoided this term as being too constrictive. The common abbreviation, 'sci-fi', is frowned upon by those most closely involved with the subject, in the same way as meteoricists we disapprove of the use of 'meteor' to mean 'meteoroid' or 'meteorite'. Instead the abbreviation 'SF' is preferred. It does the same job, but it also allows the alternative interpretation of 'speculative fiction', which seems to us an altogether more satisfactory concept, in keeping with the broadly-based inception of the Meteor Beliefs Project. It also prevents us having to justify including some items which might not fit comfortably under the 'science-fiction' banner.

That said, most of the notes we have compiled so far are from science-fiction sources. Initially, we have identified almost 40 films or TV programmes with some interesting meteoric content, and which we hope to discuss in future articles in this series. Not all will be dealt with in equal depth but, as usual, we would welcome input from anyone wishing to contribute comments on films on our list, adding new ones, or even providing details from films or TV programmes in which a meteor or two features only relatively peripherally. Please contact us if you think you have found something useful. We are also interested in the books or stories on which these films and programmes were based, where those are also meteorically relevant.

3 Film list

Our initial review of the material uncovered so far has suggested splitting the list of films and TV programmes into three. Firstly, we have several items we wish to explore in more detail, in some cases also drawing on the stories on which they were based. These include:

- 'The Blob' (1958 film)
- 'The Day of the Triffids' (1962 film, 1981 TV series)
- 'Die, Monster, Die!' (1965 film; also called 'Monster of Terror')
- 'It Came From Outer Space' (1953 film)
- 'Monolith Monsters' (1957 film)
- 'Quatermass II' (1955 TV series, 1957 film also called 'Enemy From Space')
- 'Spearhead From Space' (1970 'Doctor Who' TV series)
- 'This Island Earth' (1955 film)
- 'The War of the Worlds' (1953 film)

Then there are items which have some interesting aspects, but which do not seem to warrant especial scrutiny at present, such as:

- 'Alien Dead' (1980 film)
- 'The Astounding She-Monster' (1958 film)
- 'August in the Water' (1995 Japanese film)
- 'Cat-Women of the Moon' (1953 film)
- 'Conquest of Space' (1955 film)
- 'Crater Lake Monster' (1977 film)
- 'First Spaceship on Venus' (1960 East German/ Polish film)
- 'Invasion of the Animal People' (1962 US/Swedish film)
- 'The Phantom Creeps' (1939 film serial)

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- 'Project: Alien' (1990 US/Australian/Yugoslavian film)
- 'Riders to the Stars' (1954 film)
- 'Teenage Monster' (1958 film; sometimes known by its working title, 'Meteor Monster')
- '12 to the Moon' (1960 film)

Our third category consists of items concerning the impact of some large extraterrestrial object with the Earth, which appears to form a significant sub-genre of its own. We have exercised some selectivity in constructing this list, trying to include only those films or programmes which we either knew contained some specifically meteoric or meteoritic aspects, or which seemed to have such in the synopses we used. If you think there are items missing from this list, please let us know:

- 'Armageddon' (1998 film)
- 'Asteroid' (1997 TV series)
- 'City Beneath the Sea' (1970 film)
- 'The Day the Sky Exploded' (1958 Italian/French film)
- 'Deep Impact' (1998 film)
- 'Doomsday Rock' (1997 TV film)
- 'End of the World' (1916 French film)
- 'The End of the World' (1930 French film)
- 'Judgment Day' (1999 film)
- 'Meteor' (1979 film)
- 'Meteorites' (1998 TV film)
- 'When Worlds Collide' (1951 film)
- 'Without Warning' (1994 TV film)

In addition to these, we have the titles for three other films on which we would very much like more information, but which have so far proven most elusive:

- 'The Comet' (1910)
- 'The Comet's Comeback' (1916)
- 'Meteors' (1947; Russian)

Please note that the above lists give only the English-language titles, and that US or UK produced items have no noted country of origin given. The dates are approximate, as some are the US/UK release dates, not necessarily those of the earliest showings.

4 General comments and two examples

In our early examination of this topic, we have been somewhat surprised by the very negative view of meteors and meteorites portrayed. Typically, such appearances from the above lists herald, or are the agents of, destruction, from an individual up to an entire planet. None of these items show meteoric events positively.

The science-fiction involved is often more fiction than science, but as most SF requires at least a mild suspension of disbelief for the story to work at all, this is not unexpected. Even so, some is so far removed from reality to provide a few choice specimens for the 'traditional' offbeat or humorous April anniversary Meteor Beliefs Project article, as will be shown in due course.

To provide a slight counterpoint to the meteoric negativity, we have chosen two minor examples to close this introductory article with. The first is a more positive meteoritic event, the second just a very silly one.

Return to Oz (1985 US film, directed by Walter Murch, Walt Disney Pictures).

While lying awake with insomnia well after 1 a.m., gazing out of her window at the starry night sky, the young girl Dorothy Gale (played here by Fairuza Balk in her first movie role) sees a very plausible-looking special effects bright meteor suddenly dart downwards across the sky. She tells her little dog Toto it was a shooting-star. Next morning, while checking for eggs from the chickens in the farmyard, she finds a mysterious key, with the word 'OZ' on its handle. Dorothy claims to her aunt that it was sent by her friends in the Land of Oz on a shooting-star. Once magically transported back to Oz later in the film, the key naturally turns out to be of great importance in Dorothy escaping from trouble, and finding help to free the land and her friends from the evil creatures who had taken control of it since she was last there. Eventually, we discover the key had indeed been sent to her by meteor, and that the adventure the key's arrival began has cured her insomniac illness.

Father Ted: Speed 3 (an episode from the third series of this often rather surreal Irish TV comedy, 1998, Hat Trick Productions/Channel 4).

At the end of this episode, whose plot revolved around the activities of a highly promiscuous milkman, the eponymous Father Ted (played by the now sadly deceased Dermot Morgan) gazed up at the night sky. Suddenly, an eminently believable special effects fireball passed slowly across a small part of the sky. Just after, Ted was struck on the head by a smoking, chipped, house-brick. The brick, which had featured repeatedly during the episode, on almost each occasion causing injury to Father Ted, fell to the grass as Ted passed-out yet again. This time, the brick had been supposedly blasted into orbit by the explosion of a huge bomb on a milk float.

5 Conclusion

We would welcome more peripheral meteoric events from films and TV programmes for the Project, as well as additional notes for our listed films. If you have found something you think might be suitable, please tell us.

Meteor Beliefs Project: Meteoric imagery in SF, Part II — H. P. Lovecraft's *The Colour Out Of Space*

Alastair McBeath[1] *and Andrei Dorian Gheorghe*[2]

A brief biography of American horror-fiction writer H. P. Lovecraft (1890–1937) precedes details from his story 'The Colour Out Of Space', concerning a deadly life-form brought to Earth in a meteorite. This allows a comparison with details from the 1965 film derived from this tale, 'Die, Monster, Die!', featuring the great horror actor Boris Karloff in one of his last, best roles.

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1 Introduction

Howard Phillips Lovecraft (1890–1937) was born in Providence, Rhode Island, USA, where he spent much of his life. He suffered from frequent illnesses as a child, developing both his lifelong passions for reading literature, and writing macabre and fantastic tales, as a result. In this, he was spurred on by the imaginary worlds he created to amuse himself with, and by the very vivid dreams he had almost continually from the age of six. He was fascinated by science too. Some of his earliest writings were in his self-published journals, *The Scientific Gazette* (from 1899) and *The Rhode Island Journal of Astronomy*, which he sold door-to-door.

His father was institutionalized in 1893, and died there five years later, while his mother sadly ended her days in the same Butler Hospital, in 1921. A voluminous letter-writer (an estimated lifetime's 100,000 letters have been suggested), Lovecraft eked out his dwindling private finances by selling some of his supernatural stories to pulp magazines, like *Weird Tales*, in 1917 and after, as well as extensive ghost-writing and revision of the works of others. A disastrous marriage to New Yorker Sonia Greene followed in 1924–26, although divorce proceedings were not begun until 1929, and were never completed.

His best writings came from 1927 on, the year 'The Colour Out Of Space' was first published. Into the 1930s, he travelled more, enjoying his antiquarian interests, largely in the southern USA, and gradually published less. The quality of his horror stories remained high, though he moved more towards science-fiction latterly. He died of cancer in the spring of 1937.

In his own day, he was relatively obscure, except among afficianados of the supernatural literary genre, and his numerous correspondents. Thanks to a growing number of interested readers, he is far better-known and more widely-read today than ever before. He was one of the greatest American horror authors, and probably the most influential writer of such tales in the 20th century[1].

Although several of his tales have been adapted for various media, including film, none have been especially well-received, by critics or, more importantly, by Lovecraft's readers. His story 'The Colour Out Of Space' was the basis for the 1965 film 'Die, Monster, Die!' (American title), which was retitled, equally inaccurately, as 'Monster of Terror' in Britain. While it deviates considerably from Lovecraft's original, 'Die, Monster, Die!' is an excellently atmospheric film, and is probably the best of all the Lovecraftian films to date. We shall discuss the story first, then the film.

2 'The Colour Out Of Space' (1927)

This short story revolved around the arrival of a meteorite which contained a form of life composed largely of electromagnetic energy — light — from which the title derived. We learn very little of this life-form, but it may have arrived on Earth by accident. After a time, when it had been gradually rebuilding its strength, by feeding on various living earthly organisms, it shot back into space. Or most of it did. It acted similarly to radiation, but in a more organic, fungal, fashion, while the absence of a clear explanation all helped build up the atmosphere of the tale, which for all it was set in the open countryside of upstate Massachusetts, USA, was extremely claustrophobic.

This brief synopsis cannot do full justice to the tale, one of Lovecraft's finest, and one of the most scientifically correct of any we shall examine, nor can our more detailed notes and quotations from it below. For those who feel they would enjoy it, we would wholeheartedly recommend reading the complete story, for instance on pages 236–271 of (Lovecraft, 1985), from which source all the following citations were drawn.

The tale opened with one of the best-known Lovecraft lines, setting the tone for the whole (p. 236): *West of Arkham the hills rise wild, and there are valleys with deep woods that no axe has ever cut.* Arkham was Lovecraft's main invented Massachusetts town, which combined elements of real places in that state, such as Boston and Salem, with his own imaginary embellishments, while the real countryside was similarly adapted

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[1]The Lovecraft biography here is based on details in 'An Introduction to H. P. Lovecraft' by August Derleth, pp. 7–10 of (Lovecraft, 1985), 'A Timeline for H. P. Lovecraft' from p. 188 of (Petersen, 1986), and the biography on pp. 186–187 of (Petersen & Willis, 1992).

to suit the needs of his works.

Out among these hills and woods lay a 'blasted heath' (p. 238): *...but why had nothing new ever grown over those five acres of grey desolation that sprawled open to the sky like a great spot eaten by acid in the woods and fields?* Five acres is roughly two hectares.

The tale's narrator, a surveyor working on a new reservoir to be built over this heath, met an old farmer, Ammi Pierce, who remembered the events from June 1882, when he was still a young man. *It all began, old Ammi said, with the meteorite, ...there had come that white noontide cloud, that string of explosions in the air, and that pillar of smoke from the valley far in the wood. And by night all Arkham had heard of the great rock that fell out of the sky and bedded itself in the ground beside the well at the Nahum Gardner place.* (Both quotes from p. 240.)

Next day, Ammi, his wife and three professors from Miskatonic University in Arkham travelled out to the Gardner farm to examine the meteorite. When they arrived, the object had shrunk to 7 feet (2.1 m) across, judging by the mound of earth and charred grass near the well in the farm's front yard, that the thing had thrown up in its landing. It remained hot, and Nahum mentioned it had glowed faintly at night. The object was soft, almost plastic, and the professors gouged out a sample for testing, but even that refused to cool.

Investigations at the University found out little except that the substance seemed metallic, was highly malleable, and showed faint traces of a Widmanstätten pattern after part was immersed in acid. It cooled slightly during these tests, especially its acid bath, and when heated under a spectroscope, *it displayed shining bands unlike any known colours of the normal spectrum* (p. 242). Lovecraft's own interest in science was demonstrated by his quite detailed description of many of the tests. Overnight, the sample and the glass beaker it was in disappeared, leaving only a charred spot on the wood shelf.

Returning to the farm the following morning, the object was found to be only 5 feet (1.5 m) in size, though still hot. A bigger sample was removed, in the process of which a glossy globule, around 3 inches (8 cm) across, coloured similarly to the indescribable hue seen in the meteorite's spectrum, was found. This was brittle and hollow, and burst when struck by a hammer, emitting nothing and leaving only a spherical hole. Drilling revealed no other globules.

Following a thunderstorm that night, the meteorite was gone. Nahum described it as 'drawing the lightning' six times in an hour, by the end of which no trace remained. The last fragment in the university laboratory survived a week more, before it too had wasted away, with nothing further established about it.

Later that summer, the fruit grew large and abundant in Nahum's orchard near the house, but all had to be destroyed as it had a disgusting, bitter taste. Nahum *declared that the meteorite had poisoned the soil* (p. 245). Over the winter Nahum's family became withdrawn from local society, while oddly deformed animal tracks were seen in the snow. Then even the snow melted quicker around the Gardner farm than elsewhere. In spring, the vegetation nearby came out larger, sometimes deformed, with strange colours like the meteorite, and unpleasant odours. Trees by the farm were seen to move when there was no wind. In late spring, odd-seeming insects were common, and the plants and flowers glowed dimly at night. By the first anniversary of the fall, the vegetation became grey and brittle. Nahum's wife Nabby went insane, and had to be shut in the attic; by late July, she too was dimly glowing at night. The well water became tainted, but Nahum and his three sons carried on with an air of stolid resignation.

Both facets — the gradual piling up of worsening details, and the inability of the participants to escape — are recurrent features in many other of Lovecraft's tales, producing a stifling, nightmare sensation, which gives great power and strength to the stories.

Eventually, as the climax approached, Nahum's mind snapped too, after all the livestock turned grey and brittle like the plants, and then died, and his sons mysteriously disappeared one by one. The house was surrounded by a grey, dusty waste by November, when his wife, and then Nahum, died, both crumbling to grey dust while Ammi Pierce was present. Just before he died, Nahum described their assailant as the colour from the meteorite, that burned even though it was cold and wet, and lived in the well.

Ammi summoned the police and coroner from Arkham, and as their investigations drew to a close in the evening, it was obvious that the trees and house were glowing, the trees moving apparently of their own volition. The men fled to some nearby high ground as the glow brightened. *Then without warning the hideous thing shot vertically up toward the sky like a rocket or a meteor, leaving behind no trail and disappearing through a round and curiously regular hole in the clouds before any man could gasp or cry out. ...Ammi stared blankly at the stars of Cygnus, Deneb twinkling above the others, where the unknown colour had melted into the Milky Way.* (Both quotes from p. 267.) With a great ripping and cracking, the remains of the farmhouse erupted up in the wake of the colour, fragments and dust falling back to Earth - and a small part of the colour fell back weakly too, that only Ammi Pierce saw.

At the end of the tale, Ammi seemed unable to leave his home, and the grey blight had slowly spread during the intervening 44 years. As the narrator concluded, *Something terrible came to the hills and valley on that meteor, and something terrible — though I know not in what proportion — still remains* (p.271).

One of us (AM) first read this story as a boy in 1971, and its impact seems no less with time. The alien being had no interest in Earth, except as a fuel supply. While ghastly and inimical to life on this planet, the colour behaved much as any creature would to survive and recover, before returning to its more natural environment, wherever that might be. Again, this idea of an uncaring universe in which mankind was an irrelevance, was a recurrent theme in Lovecraft's works. We have provided so much detail on this story because it predates a great many more which, knowingly or not, have adopted aspects of this tale, as we hope will become clear in future articles, aside from it being one of the best — perhaps even the best — which placed a meteorite in so central a role.

3 'Die, Monster, Die!' (1965)

This is an American International film, a US/UK production, made in England, directed by Daniel Haller, and adapted from Lovecraft by Jerry Stohl. It is available on video and DVD. The cinematography, effects, and music are splendidly atmospheric, while the storyline is based on the same progressive accumulation of information which is such a strength in Lovecraft's work. Unfortunately, some jumpy editing in a few places, an at times muddled script, and an unhappily wooden performance by the male lead (actor Nick Adams playing American scientist Stephen Reinhart) detract from the overall impression. This is countered by what is often reckoned as one of Boris Karloff's last really fine performances as Nahum Witley, a wheelchair-bound, partly mad, scientist[2]. Indeed, Karloff, as so often, typically out-acts most of the other players by simply appearing in a scene. The female lead, Witley's daughter Susan, Reinhart's fiancée, is played by Suzan Farmer, though her talents are scarcely exercised, as the script gives her little to do except scream, run away in panic, or pass on occasional scraps of information.

Daniel Haller was Roger Corman's art director prior to this film, Corman himself noted for his attempts at translating Lovecraft to the movie screen, as well as his efforts with Edgar Allen Poe's work. There are unsurprising parallels with some of Corman's films, notably 'The Fall of the House of Usher' (1960), with which 'Die, Monster, Die!' shares a comparably atmospheric feel.

We will not labour the similarities or differences between the movie and the story, since these should be clear enough. Why the family name was changed is probably related to its altered character, as the homonymic 'Whately' was one of Lovecraft's invented, semi-degenerate families of the wild Massachusetts hills west of Arkham, around his imaginary town of Dunwich. Several of the Whately males were powerful sorcerors.

Reinhart arrived by steam train in the 1960s village of Arkham in England, in winter or very early spring, at the beginning of the film. The locals refused to help him get to the 'Witley place', some way outside the village, where he intended to visit his fiancée at her mother Letitia's request. In the end, he had to walk, and partway there he passed close to a large crater with crumbling, near-vertical walls, around 15 m in diameter, surrounded by a grey, dusty zone with dead vegetation in it. He snapped off a twig, which crumbled to powder, to emphasize the point. (Somewhat unfortunately, the crater scene was a rather obvious special effects painting, and not especially plausible as one caused by a surviving meteorite fall.) The countryside grew mistier after this, and Reinhart found warning notices up to the padlocked gates on the drive to the house. The house exterior (at least partly a painting again), was large and rambling, decayed and crumbling, but the inside was clean, tidy and well-kept.

Various aspects of the mystery were gradually revealed at the house. Hannah the maid, occasionally seen stalking the estate as a veiled, ghostly figure, became diseased a month earlier, then 'disappeared'. Similarly, Nahum's wife became ill a few days before Reinhart's arrival, staying in a heavily veiled bed, unable to stand strong light. Nahum's father Corbin apparently went insane before he died, and practiced sorcery, which was what killed him. Merwyn the butler collapsed one evening while serving dinner, and died soon after, crumbling away to dust (off camera).

The area near the crater was passed off as due to a fire, though some of the villagers near it later vanished, and while Nahum saw it, he refused to speak of it until towards the end of the film. Deep in the cellars, Nahum had secretly stored the meteorite from the crater in a shallow stone well with a grill cover over it. The size is difficult to estimate, but was probably < 2 m. The meteorite cast a fire-like blue glow on the cellar walls and ceiling, while emitting steam and a rhythmic, electrical humming sound. Reinhart and Susan saw a similar light later coming from the large, locked conservatory one evening. Reinhart claimed the glow to be like that of a radioactive substance. Having found a way into the conservatory, full of unnaturally lush plants and blooms, small, green, warm, glassy fragments were discovered in the soil by each of the plants - fragments of the meteorite. A low, rhythmic humming pervaded the place. In a locked, darkened, part of the conservatory, the pair found a glowing, smoking, larger fragment of the meteorite in a brazier, with ghastly mutated animals in cages, exposed to what Reinhart claimed was a lump of uranium. He seemed curiously unfazed by being close to this, or to handling the smaller fragments found previously. Thankfully, the lighting during this section was especially sympathetic, since the 'mutated animal' effects seem to have been poor.

Letitia Witley went mad, and rampaged through the house with superhuman strength, before collapsing and crumbling to dust. Only after her remains were buried in the family plot beside the house, did Nahum finally explain to Reinhart what had been going on, jolted mostly back to sanity by his loss. He claimed his father Corbin's evil had taken its toll on the family, with his own misguided efforts. Much of the following explanation was transcribed directly from the film, regrettably without our being able to reproduce Karloff's particular delivery.

NAHUM: 'That stone was sent from the other side by the hand of Corbin reaching out to us from beyond the grave.' He continued that the family was cursed. Reinhart said the stone was not sent by anyone.

NAHUM: 'Ah. It's easy enough for you to say that. But you didn't see it as I did, that Sunday morning, screaming down out of the heavens, to crash and bury itself in the heath.' He illustrated the point with a hand

[2]Praise for Karloff's performance is found in, for example, Peter Haining's introduction to 'The Colour Out Of Space', presented as 'Monster of Terror', pp. 141–168 of (Haining, 1971).

gesture showing a steeply-angled descent.

REINHART: 'It fell from the sky. Then it was a meteorite.'

NAHUM: 'I thought it was a gift, from heaven. The people from the village came to see what it was, but they wouldn't come near it. Oh no, they knew; they knew because the fear of Corbin was still in them. The next morning, the heath was covered with a lush vegetation that should never have grown there.'

REINHART: 'Why did you bring it into the house?'

NAHUM: 'Why? Because I thought, as Corbin knew I would, I thought I'd found a way to turn this wasteland into a place of beauty. Great vineyards, gardens. That was my dream. I thought the name of Witley would mean something once again. And Corbin's iniquities would be atoned-for.'

Nahum then resolved to destroy the meteorite with an axe, but was attacked by Hannah, who fell into the meteorite's pen in the cellar, and was totally destroyed, as if vaporized, by it. Although Nahum smashed the meteorite, so that its humming and glow died away (in effect, it was 'killed'), he received a fatal dose of radiation in the process, and staggered off, leaving a trail of glowing handprints on the walls as he passed.

Having been in his wheelchair almost throughout the film, Nahum gained superhuman strength, and smashed his way through doors, brightly glowing green (a glow that extended even through closed doors), emitting a high-pitched electronic humming sound. Whether this was still Karloff or a double is uncertain. Karloff was increasingly frail in his latter years, but some of the moves were so very similar to those he made more than 30 years earlier in his first great role, as the Monster in James Whale's 1931 film 'Frankenstein', that some of this footage may indeed have been of him, reprising that staggering gait one last time.

Finally, the glowing Nahum fell through the bannisters to the stone floor beneath, where he 'exploded' or shattered, starting fires that burnt down the house, while Susan and Reinhart escaped.

4 Conclusion

Although the film was significantly different to the story, and had far shakier 'science' in it, it has much of interest still, and is worth seeing in its own right. Even so, we cannot help wondering what might have been had Karloff participated in a movie much closer to the original Lovecraft version.

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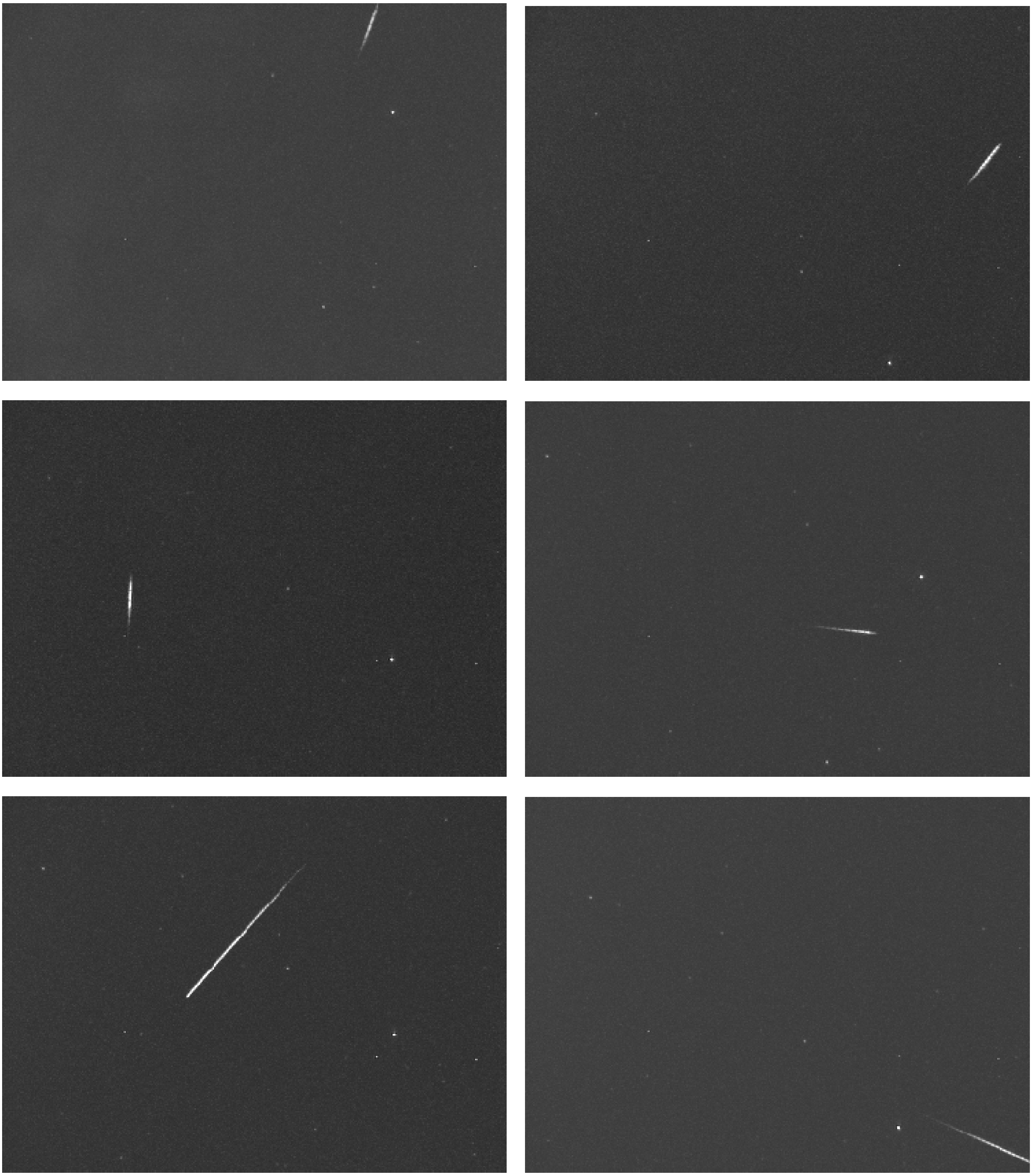
Video meteors without intensifiers



Six video meteor images recorded by Jörg Strunk from Leopoldshöhe in Germany ($8\overset{\circ}{.}32$ E, $52\overset{\circ}{.}02$ N). The equipment includes a Mintron camera (with the 1/2" Sony ExView HAD chip), an $f = 6$ mm, $f/0.8$ Computar asperical C-mount lens, and the MetRec software.
Although not as sensitive as an image-intesified system, these frames demonstrate that useful work can already be done with non-intensified systems.
Left column, top to bottom: June 24, $00^{h}43^{m}23^{s}$ UT, June 6, $00^{h}25^{m}23^{s}$ UT, June 8, $00^{h}30^{m}00^{s}$ UT; right column, top to bottom: June 6, $23^{h}22^{m}19^{s}$ UT, June 24, $23^{h}59^{m}22^{s}$ UT, June 23, $22^{h}31^{m}07^{s}$ UT; all dates in 2003.