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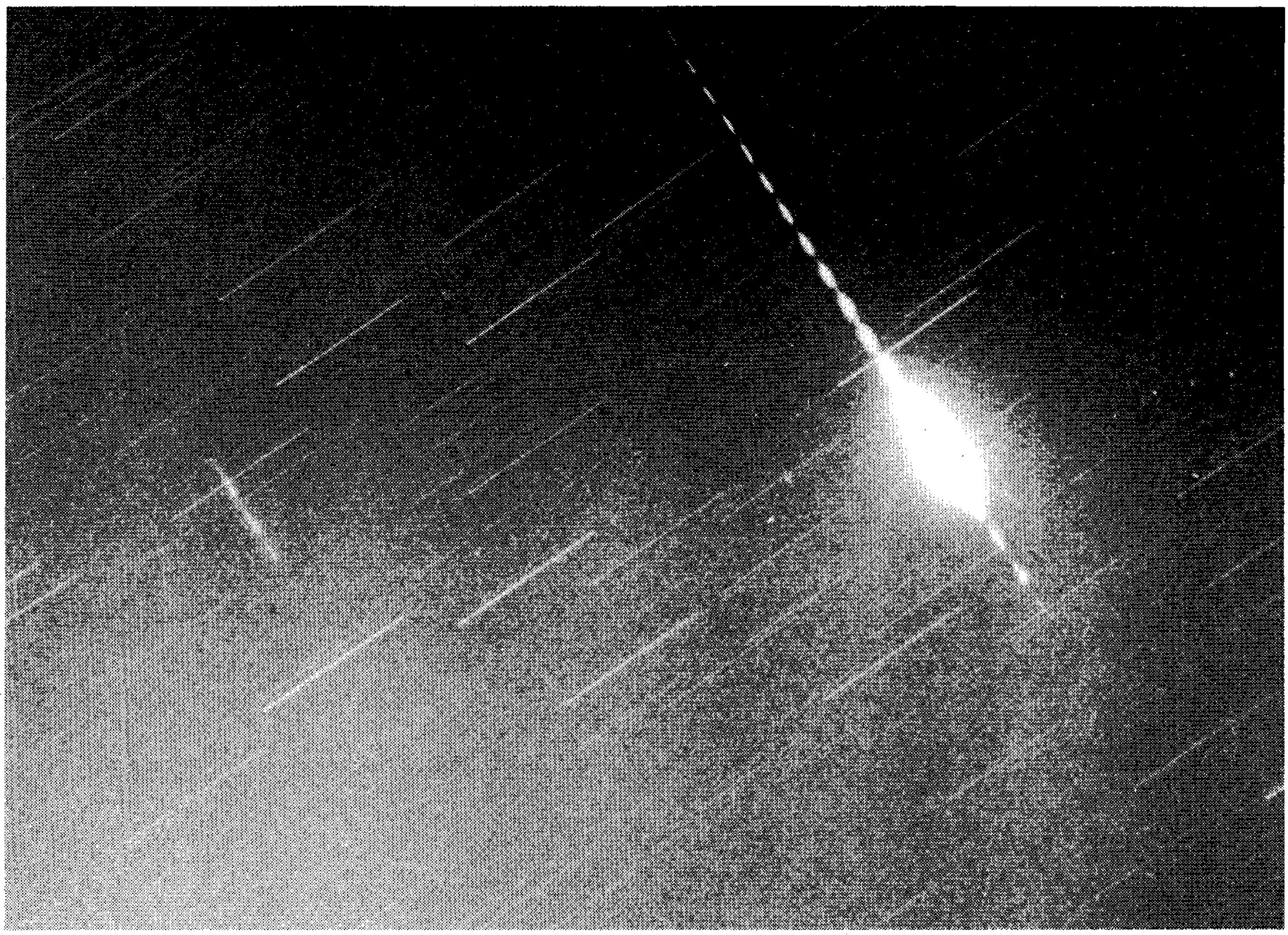

Magnitude −10 Perseid photographed by S.J. van Leverink from Cabasse in Southern France during the night of August 12-13, 1993, with an $f = 50$ mm, $f/1.8$, camera. The photograph was exposed from 4^h16^m to 4^h29^m UT with a short interruption at 4^h23^m UT. The meteor itself appeared at $4^h20^m50^s$ UT. A fainter Perseid is also visible.

In case of non-delivery, return postage guaranteed. Please return to:
v.u.: Marc Gyssens, Heerbaan 74, B-2530 Boechout, Belgium

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Contents

Useful Information

The August Issue *(WGN 23:4)*

The *August issue* is anticipated to be a thick issue and will be mailed towards the end of August. In view of obligations of the Editor abroad, contributions are nevertheless due on *July 21* at the latest. They should be sent to *Marc Gyssens*. Only contributions covering very recent news can still be considered for the August issue if they arrive at a later date.

WGN Subscription/IMO Membership 1995

The subscription rate for Volume 23 (1995) of the *Bimonthly Journal* is 35 DEM for six issues which are anticipated to contain over 220 pages in total. A combined subscription with the *Report Series* and *FIDAC News* costs 70 DEM. You can also become a Supporting Member by paying at least 15 DEM extra.

Administrative Correspondence

Ordering *IMO* publications is done in the same way as paying subscription/membership fees. Complaints about not receiving *WGN* or changes of address should be sent to *Paul Roggemans*.

All addresses can be found on the inside of the back cover.

From the Editor-in-Chief

Marc Gyssens

Many northern hemisphere observers will receive this issue around the beginning of their summer holidays, which usually means a lot of time for observing. I wish them many clear nights, much succes in their quest and remind them that not only the major showers need to be covered...

Nevertheless, the major showers attract most of our attention, and rightfully so. Over the last couple of years several major showers produced outbursts, which adds to the excitement. More importantly, however, these outbursts teach us something about the structure of the shower. Therefore it is important that the Perseids this year are monitored around their maximum period, even though the moon will not be cooperative. Quantitatively useful observations during that period will probably be impossible, but we should be able to find out at least qualitatively if the 1995 Perseids, too, will produce an outburst, and if so, when. Therefore, Jürgen Rendtel wrote some notes in this issue about how you should monitor the maximum Perseid activity. Please read these notes carefully!

This number is of normal size, but the August issue will, most likely, be a thick issue again. Some contributions are therefore postponed to the following issue. Also, if you have a contribution either lying around or almost ready, get it to me quickly, so that it can also be included! Also photographs for the front cover are more than welcome! Meanwhile, enjoy reading this issue.

Letters to WGN

compiled by Marc Gyssens

Seeking quality

In reviewing Rainer Arlt's article on "The Present Visual Meteor Database" [1], I want to agree with the concept that observations done with limiting magnitudes of less than 5.0, not be entered into the *VMDB*. Seeking quality in our data only enhances the status of the *IMO* in the scientific community. If we do less and accept less, the *IMO* will only become another floundering meteor society with a tarnished reputation. I do not want to refer to any particular organization. This is their failure and they will have to deal with it. In the past, the meteor societies that people looked upon with pride usually cover the periods where stringent efforts were made to enhance the quality of data. It is the concept of the *IMO* that I believe in and my intent to perpetuate its existence. To do this, I like to think that my efforts are done with quality in mind. If I'm lacking somewhere, I am grateful when someone points it out. I hope others will look upon this 5.0 as the lower limiting magnitude limit the same way. If your skies are too bright due to light pollution or strong Moon, change your location and or observation timing in relation to the Moon. Try not to observe within 5 days before or after a Full Moon unless the appearance of a major shower leaves you no choice. Quality is something we all should strive for.

[1] R. Arlt, "The Present Visual Meteor Database", *WGN* 23:1, February 1995, pp. 4–5.

George J. Zay, April 26, 1995

Automated radio meteor monitoring

In regards to the April *WGN* article by Jim Richardson [1] about the automated computer radio meteor monitoring set up at Poplar Springs, I must say that it would be ideal to have an automated method to monitor meteor activity. The method described seems simple enough, but I am concerned about it producing reliable data.

In the recent 1993 Annual Report published by *AMS* [2], the daily radio meteor totals for that year were listed. It disturbs me to note the data for dates of traditionally high meteor activity is not supported by the automated set-up. For example, on August 12, the Perseid maximum shows 2196 radio meteors, but this represents no significant increase to meteor activity when compared to the activity levels for days approximately 2 weeks before and after the Perseid maximum. I noted on the days for August 2 and 7, meteor activity was greater. And on August 1, 3, 8, 11, 13, 15, 17, and 18, meteor activity is nearing the activity levels for the 12th.

As a 2nd example, the Geminids with maximum activity for December 14 show 893 signals. Again on dates of December 2, 4, 5, 15, and 18, meteor activity appears to be more active than on the peak of the Geminids.

I indicated these two examples, because they should be examples of successful recording if everything is working properly. These data tell me that there must be some kind of problem that has yet to be worked out. With my experience in monitoring radio meteors as I observe visually, I have the opportunity to witness things that may cause problems for totally automated systems. I often note aircraft will duplicate a short meteor signal within

1.5 minutes of the aircraft becoming visual. Then the aircraft often produces long, strong signals. I am concern that some if not all automated systems are recording aircraft activity as well. I once used a chart recorder to record my radio meteor pulses. When I counted the signals gathered this way, I frequently counted signals a lot higher during mornings of not so exceptional activity. Without the recorder, I will record activity a lot lower. This tells me that automated systems are recording more than just meteor activity. Possibilities may be aircraft, sporadic-E, and spurious radio spikes. I suspect other unknown possibilities also. The main thing I want to point out for automated monitoring stations, however, is not to get too entrenched with what seems a simple way to replace the more tedious and humanly difficult method in recording meteor activity. Oversimplifying a system may be counterproductive. If however the systems can be made to produce reliable data, this would indeed be an asset.

[1] J. Richardson, "Poplar Springs Meteor Patrol: A General Description", *WGN* 23:2, April 1995, pp. 56–59.
[2] W. Simmons, K. Simmons, and D. Meisel, "American Meteor Society Annual Report 1993", p. 14.

George J. Zay, May 5, 1995

On dark meteors, electrophonic meteors, mysterious noises, and a UFLO

George Zay's letter in the previous issue sparked a reaction from Alastair McBeath, below. Alastair also wrote an article about dark meteors, which you can find elsewhere in this issue.

On reading George Zay's comments on strange sonic booms in *WGN* 23:2, pp. 27–28, I was reminded of some notes on apparently similar phenomena that I found while carrying out other researches recently. These concern the phenomenon of "Barisal guns" or "mist pouffers," discussions concerning which were extremely popular around the turn of this century, and I am not at all certain that the mystery concerning their occurrence has ever actually been resolved. With more modern vehicles and the military capable of generating similar noises, however, I suspect that many now go unreported because of assumptions that this is what is at fault.

Barisal guns were (still are?) dull concussion noises, resembling the "thud" of distant artillery guns. The term "mist pouffers" was used to describe similar sounds heard near the Belgian coast, and was apparently in usage in 1895. There seems to be a world-wide distribution of sites where such unexplained sounds could be heard, however, from Europe to Africa, North America, Australia, and India. Some of the most famous were the "moodus sounds" of Connecticut, USA, which were sharp earth shocks and dull booming sounds, heard at irregular intervals since colonial times, and indeed before according to native American legends—"moodus" derives from the native word *morehemoodus*, meaning "place of noises." The noted American supernatural fiction author H.P. Lovecraft, wrote these mysterious "hill noises" into several of his tales, most famously *The Dunwich Horror*, set in the unpleasant backwoods region of his invented part of Massachussetts in New England.

The noises were frequently heard in multiples, two or three "detonations" together being very common, and in some places, they seemed to vary according to the weather. The Australian sounds were said to be brought on by rain, whereas the Lake Seneca (New York, USA) Gun was apparently more prevalent in hot, dry weather. Several authors suggested that earthquakes might be responsible, although no definite conclusion seems to have been reached, as far as I can ascertain. Anyone who is interested in doing further research should start with the collection of notes in [1], especially pp. G1-207 to G1-231.

[1] W.R. Corliss, comp. and publ., "Strange Phenomena—A Sourcebook of Unusual Natural Phenomena", Maryland, 1974.

Alastair McBeath, April 26, 1995

Frequently Asked Questions on Observing Methods

compiled by Rainer Arlt

Can I send data on diskette, and how should they be stored?

When sending the results of visual observing campaigns of amateur groups, very high postages are due for the packages. Therefore, it may be much less expensive to send a single diskette instead of a thick package of paper. The following guidelines should be observed when sending data on a diskette.

Both $5\frac{1}{4}''$ and $3\frac{1}{2}''$ DOS-formatted diskettes are accepted. I cannot read 2.88 Mbyte diskettes, however. The diskette must be carefully wrapped, particularly the large ones, which turn out to be quite sensitive to pressure and folding. Put the diskette between two pieces of cardboard and glue everything together with tape. It is also recommended to strengthen the edges of the envelope since the diskette might damage the envelope when it moves inside.

The files should be saved as ASCII characters only, and the format of the presented data should be similar to an *IMO* report form. I would appreciate separate tables for the radiant positions as used, the table of the observing periods, and the magnitude distributions. In case you have your own database on a computer already, these tables will be fairly easy to create.

The disadvantage of computer media is that nation-specific characters are generally not properly represented by ASCII codes. If you know how to typeset these characters in TEX, you may give proper names of observers or sites in TEX-spelling. This ensures that your and your fellow observers' names will be correctly spelled in forthcoming publications.

You can also send your data through electronic mail to the internet address **100114.1361@compuserve.com**. If you are a member of *CompuServe*, the address is **100114,1361**. Note that any character code above 127 is filtered when sending e-mail messsages to *CompuServe*, whence you should not use special characters (accents, umlauts) in names or special line-drawing characters in tables.

The Meteor Train Observing Project in 1994

Mark Vints

1. Status report of the observing project

1994 was again a successful year for the meteor train project, thanks to the efforts of many dedicated observers. Their names are listed below, with the number of reports received from each included between brackets:

Luc Bastiaens (3), Lieve Bresseleers (1), Koen Clement (3), Eric Crauwels (1), Johan De Hert (5), Werner Depoorter (2), Bert Everaert (2), Shelagh Godwin (1), David Holman (24), Tom Hoppenbrouwers (1), Alberto Latini (16), Robert Lunsford (40), Alastair McBeath (6), Tom McEwan (8), An Pelckmans (3), Kristiaan Pelckmans (1), Simon Pelckmans (1), Jürgen Rendtel (13), James Riggs (31), Ian Rigney (4), Tom Roelandts (2), Dirk Rombauts (1), Siegfried Stapf (4), Geert Van de Weyer (1), Cis Verbeeck (2), Roy Watson (2), Graham Wolf (12), and George Zay (52).

In all, 28 observers submitted 242 reports, covering over 10 000 meteors seen in 870 hours on 136 different nights. A breakdown by month is presented in the table below.

Table 1 – Statistical data on train reports in 1995.

Month	Days	Reports	Observers	Hours	Meteors	Trains
Jan	11	15	4	64.20	425	45
Feb	6	7	3	30.12	134	14
Mar	8	11	3	49.31	241	41
Apr	11	15	5	44.93	364	49
May	17	24	4	61.74	341	99
Jun	7	7	2	31.52	211	18
Jul	17	23	5	89.95	856	80
Aug	18	80	24	272.76	5781	1366
Sep	13	21	5	88.58	1018	76
Oct	16	20	6	77.88	625	86
Nov	6	11	8	21.59	116	14
Dec	6	8	4	37.54	243	34
Tot	136	242	28	870.15	10355	1922

As always, reports on older train observations are very welcome, as I do have several sets going back into the '80s. Observers wishing to participate can obtain the report form from *WGN* 21:3 (June 1993) or by writing me. Make sure not to omit full magnitude and train duration distributions for the minor showers and the sporadic meteors.

2. The Visual Meteor Train Database

As intended from the outset, I have now programmed a database structure to contain all reports submitted to me. It was written in `FileMaker Pro` on a Macintosh computer, but is fully compatible with a Windows environment on PCs. For simplicity, I have one file per year, and one record per shower per night per observer. Thus the 242 reports summarized above translate into 674 records, which take 651 kbyte of disk space (390 kbyte in the compressed mode which the program supports). At the time of writing, the *VMTDB* contains all 1994 and 1995 reports received thus far, as well as a good portion of the 1993 data.

All this means that general statistical studies should become fairly easy, and the readers can expect summary articles regularly in *WGN*. Now is also the time to submit your older data to make sure they are included in the analysis. Within the next few months, all reports in my possession should have been entered.

Visual Observers' Notes: July–August 1995

Jeff Wood and Marc Gyssens

1. Introduction

The period July–August is the most consistently rich period for meteor rates of the whole year. On a dark night an observer can expect to see over 20 meteors per hour for much of this time. During the last few days of July and around August 12 with the maxima of the major showers the δ-Aquarids and the Perseids respectively, the total number of meteors exceeds 50 per hour and rates much higher than this are not uncommon at these times. With all this activity then, meteor workers are encouraged to get out and observe the many showers that occur. Table 1 below lists the more important showers that occur during July and August. Table 2 shows moonlight and observing conditions. The illuminated part of the Moon is always given for 0^h UT on the date indicated. The dates of the phases of the Moon are also given in UT.

Unfortunately, the Moon interferes greatly with the Perseid maximum and will prevent quantitative observations of both Perseid peaks. Nevertheless, we like qualitative observations to find out whether an outburst would yet again occur in 1995. More details about this can be found in the following article.

Table 1 – A list of some of the meteor showers to be seen in July–August 1995.

Shower	Activity	Maximum		Radiant			Drift		V_∞	r	ZHR
		Date	$\lambda_\odot$	α	δ	D.	$\Delta\alpha$	$\Delta\delta$			
Pegasids	Jul 07–Jul 11	Jul 09	107°.7	340°	+15°	5°	+0°.8	+0°.2	70	3.0	8
Phoenicids (Jul)	Jun 24–Jul 18	Jul 15	112°.7	21°	−43°	7°	+1°.0	+0°.2	47	3.0	
Piscis Austrinids	Jul 09–Aug 17	Jul 28	125°.7	341°	−30°	5°	+1°.0	+0°.2	35	3.2	8
δ-Aquarids S	Jul 08–Aug 19	Jul 28	125°.7	339°	−16°	5°	Table 3		41	3.2	20
α-Capricornids	Jul 03–Aug 25	Jul 29	126°.7	307°	−10°	8°	Table 3		23	2.5	8
ι-Aquarids S	Jul 15–Aug 25	Aug 03	131°.7	333°	−15°	5°	Table 3		34	2.9	3
δ-Aquarids N	Jul 15–Aug 25	Aug 12	139°.7	337°	−05°	5°	Table 3		42	3.4	5
Perseids	Jul 17–Aug 24	Aug 12	139°.9	46°	+58°	5°	Table 3		59	2.6	95
κ-Cygnids	Aug 03–Aug 31	Aug 18	145°.7	286°	+59°	6°			25	3.0	5
ι-Aquarids N	Aug 11–Sep 20	Aug 20	147°.7	327°	−06°	5°	Table 3		31	3.2	3
π-Eridanids	Aug 20–Sep 05	Aug 29	155°.7	52°	−15°	6°	+0°.8	+0°.2	59	2.8	
α-Aurigids	Aug 24–Sep 05	Sep 01	158°.6	84°	+42°	5°	+1°.1	0°.0	66	2.5	15
Piscids S	Aug 15–Oct 14	Sep 20	177°.7	8°	00°	8°	+0°.9	+0°.2	26	3.0	3

Table 2 – Moonlight and observing conditions in July–August 1995.

Date	k	Date	k
Friday June 30	0.04+	Friday August 04	0.49+
Friday July 07	0.63+	Friday August 11	1.00−
Friday July 14	0.96−	Friday August 18	0.51−
Friday July 21	0.35−	Friday August 25	0.02−
Friday July 28	0.00+	Friday September 01	0.35+

New Moon:	June 28, July 27, August 26
First Quarter:	July 5, August 4, September 2
Full Moon:	July 12, August 10, September 9
Last Quarter:	July 19, August 18, September 16

2. Perseids

This shower is active from July 17 to August 24 and reaches an annual maximum ZHR of about 100 on August 12. The last few years also showed outbursts with a ZHR of 200 and more about 12 hours prior to the regular maximum. Due to the Full Moon on August 10 observing conditions are most unfavorable. Useful observations are possible from July 17–August 7. Nevertheless, we have to know whether an outburst will occur in 1995, and therefore we need some qualitative information around the time of maximum. More information about this can be found in the next article.

3. Aquarids/Capricornids

This rather complex group of showers were subject to intense scrutiny since 1989. Several thousand meteors have been recorded. Nevertheless, more data on this poorly covered complex are still required. The visual observing program requires good observational experience and an observing site south of 45° N. Looking at Table 3, it is obvious that the observer has to look at a point between the radiants of the δ-Aquarids N and the ι-Aquarids S in order to distinguish between meteors of these southern showers. This will be quite impossible for observers situated north of 45° N. Observations of this program should start only when the radiants have reached a sufficient altitude. If possible, two observers should look at the same field simultaneously. This may allow estimates of the accuracy of the data. Only meteors possibly radiating from the Aquarius/Capricornus-region should be plotted. It is necessary to consider the direction, trail length, and angular velocity. All other meteors are counted only. Any Aquarids or Capricornids appearing outside the map's field are also counted after they are associated with the radiants given in Table 3.

In doing so, we are able to calculate ZHRs based on the tabulated radiant positions, and to analyze the radiant position using the plotted meteor trails only. We want to draw attention to the relationship between the angular velocity of shower meteors, the altitude of their beginning point h_b and the distance D between their end point and their radiant. This criterion is as important as the alignment and the trail length and has to be used carefully when using the counting method. The relationship between these quantities has last been published in [1].

Your reports must include the following for each date:

1. copies of your *Atlas Brno* maps with the meteors plotted on them (X and Y coordinates should be measured with respect to the frame of the map), and
2. a report using the *IMO* Visual Observing Forms.

The shower association should be done at a desk using all criteria, including path length, position with respect to the radiant and angular velocity. For more details, we refer the reader to [2].

Table 3 – Radiant drifts for the α-Capricornids, the δ-Aquarids South and North, the ι-Aquarids South and North, and the Perseids.

Date	α-Cap		δ-Aqr S		δ-Aqr N		ι-Aqr S		ι-Aqr N		Per	
	α	δ	α	δ	α	δ	α	δ	α	δ	α	δ
Jul 05	290°	−14°	321°	−21°								
15	296°	−13°	329°	−19°	316°	−10°	311°	−18°			12°	+51°
25	303°	−11°	337°	−17°	323°	−09°	322°	−17°			23°	+54°
Aug 05	312°	−09°	345°	−14°	332°	−06°	334°	−15°			37°	+57°
15	318°	−06°	352°	−12°	339°	−04°	345°	−13°	322°	−07°	50°	+59°
25	324°	−04°			347°	−02°	355°	−11°	332°	−05°	65°	+60°
Sep 05									343°	−03°		
15									353°	−02°		

4. κ-Cygnids

This shower is active from August 3 through to August 31 and reaches a maximum ZHR of 5 on August 18. The radiant position of $\alpha = 286°$ and $\delta = +59°$ is virtually constant throughout the activity period due to its proximity to the North Ecliptic Pole. Its diameter is 6°. Unfortunately, the Moon will seriously interfere during the maximum of this shower. The κ-Cygnids are noted for their slow-moving often bright meteors. All possible shower members should be plotted. Observers should ensure that the center of their observing field is located at a distance less than 40° from the radiant.

5. Piscis Austrinids

The Piscis Austrinids are active from July 9 to August 17 and reach a maximum ZHR of 5 to 10 meteors per hour on July 28, when it is nearly New Moon. shower. Observers can watch this shower as part of their Aquarid/Capricornids observations. They should plot all Piscis Austrinids occurring in the part of the sky covered by the map and count those appearing outside the map's field after careful consideration of path length and angular velocities.

Table 4 – Radiant positions of the Piscis Austrinids.

Date	α	δ	Date	α	δ	Date	α	δ
Jul 13	326°	−33°	Jul 28	341°	−30°	Aug 12	356°	−27°
Jul 18	331°	−32°	Aug 02	346°	−29°	Aug 17	1°	−26°
Jul 23	336°	−31°	Aug 07	351°	−28°			

6. The π-Eridanids

The π-Eridanids radiate out from the "Loop of Eridanus" during the latter part of August and early September. They reach maximum on August 29. Observations to date indicate that activity varies from year to year. At best they produce ZHRs of around 10 and at worst they are almost non-existent. π-Eridanids are fast meteors and they frequently produce trains. Observers should watch for these meteors in the pre-dawn hours when the radiant is high in the sky and the First Quarter Moon has set. They are best seen in the Southern Hemisphere.

Table 5 – Radiant positions of the π-Eridanids.

Date	α	δ
Aug 20	46°	−17°
Aug 28	52°	−15°
Sep 05	60°	−13°

All π-Eridanids should be plotted.

7. The α-Aurigids

The α-Aurigids are active from August 24 to September 5. They reach maximum on September 1. The α-Aurigids produce variable activity from year to year and urgently require attention from meteor workers in the Northern Hemisphere where they are best seen. The α-Aurigids are fast moving meteors comparable to the Perseids in speed. Intending observers should take into account that the radiant reaches its greatest elevation during the latter part of the night. Around the maximum, the First Quarter Moon allows good viewing of this shower, mainly in the second half of the night. Unless the α-Aurigid maximum exceeds a ZHR of 10, all possible shower meteors should be plotted. Observing fields should be centered no further than 40° from the radiant.

Table 6 – Radiant positions of the α-Aurigids.

Date	α	δ	Date	α	δ
Aug 24	75°	+42°	Sep 01	84°	+42°
Aug 28	80°	+42°	Sep 05	88°	+42°

Reference

[1] J. Wood, "Visual Observers' Notes: March–April 1995", *WGN* 23:1, February 1995, p. 9.

[2] R. Koschack, J. Rendtel, "Aquarid Project 1989", *WGN* 17:3, 1989, pp. 90–92.

Hints for Visual Perseid Observations in 1995

Jürgen Rendtel

In recent years, the return of the narrow but dense Perseid peak some 12 hours prior to the main maximum kept the observers alert. While the conditions in 1993 and 1994 were favorable for all kinds of observations, the 1995 return leaves almost no chance for systematic and useful *optical* observations to determine rates. The Full Moon lits the sky all night and coincides almost precisely with the Perseid maximum. Consequently, the achievable limiting magnitudes for visual observations will be poor. Moreover, the mathematical correction which is used to reduce the ZHR to standard conditions is not valid for reduction of magnitude due to interfering light. Under such circumstances the rates are "overcorrected." Some of the problems have been discussed in the 1992 Perseid analysis [1]. The uncertainties in the ZHR can not be solved by using a huge amount of individual observations, because a major effect is caused by a systematical error. If it were only for the lower numbers of meteors, statistical methods could be applied.

Although we cannot expect to gather ZHR data allowing to determine an activity profile from visual observations, careful observers can help to answer the following questions.

Analyses of the ZHR profiles indicate that the "new peak" of the Perseids observed in the 1990s became narrower in 1994. Some model calculations hint on a reduction of the rate or even its disappearance [2]. First, we have to find out *whether a peak re-occurs*. If it does, we can try to find the *time and approximate duration of the peak activity*. As already pointed out, the activity level can hardly be determined.

In 1994, the peak occurred close to the expected time (August 12, just before 11^h UT). If the peak remains at this position—which is not necessarily the case—it should occur on August 12 at about 17^h UT. Data of the previous years showed "shifts" of about 3 hours from one year to the next. Since we also need information about the ascending and descending branches, the period between 12^h UT and 22^h UT on August 12 is of interest. Observers in Japan and China are best placed to see a possible Perseid outburst.

If you once start an observation, continue for some hours (if possible) because the relative profile may help to draw some conclusions which are more reliable than single intervals. This also holds for the broader, regular maximum of the Perseids centered around 5^h UT on August 13, 1995: observations of this night may be used for calibration of the (possible) primary peak.

Since there is no expectation of a meteor storm, there will be no coordination center as in the recent years. However, we want to inform all interested people immediately after the event. Therefore we ask all people having access to e-mail to send quantitative reports to `jrendtel@aip.de` for both nights. We will prepare a summary of the results as soon as possible: if your information comes in quickly, we might be able to publish this summary already in the August issue.

References

[1] J. Rendtel, R. Koschack, R. Arlt, "Global Analysis of the 1991 and 1992 Perseids", *WGN* 21:3, June 1993, pp. 152–167.

[2] I.P. Williams, Z. Wu, "The Current Perseid Meteor Shower", *Monthly Notices of the Royal Astr. Soc.* 269, 1994, pp. 524–528.

Photographic Observers' Notes: July–August 1995

Jürgen Rendtel

The meteor activity level generally increases in this period. Furthermore, there are some meteor showers which are well suited as a target for photographic observations.

First, the complex of ecliptical radiants moves through Sagittarius and Capricornus. In July we note the α-Capricornids. Their atmospheric entry velocity of 23 km/s indicates an orbit which slightly differs from the average of the ecliptical complex. It is known that there are occasionally α-Capricornid fireballs. This also holds for the branches of the δ-Aquarids. The analysis of plots from visual meteor observations in the Aquarid project showed the existence of several radiants. Using photographic images taken through rotating shutters, the association to the respective radiants should be more reliable. If possible, you should try to organize synchronous photography with other observers in some tens of kilometers distance. We recommend to center the camera field some 30° to 40° west or east from the radiant (α-Capricornids in July, δ-Aquarids in August). The begin and end times of the exposures need to be known precisely.

You may wonder that the Perseids have not been put in first place. Since the time of the Full Moon almost exactly coincides with the maximum of the shower, there are not too many chances for systematic work (see also the hints for the visual Perseid observer). In order to keep the amount of scattered light low, you need to point the edge of the camera field at least 20° from the Moon. In larger distances from the radiant, particularly towards the zenith, the angular velocity of the Perseids is quite high. The bright sky background does not permit using very high speed films. Depending on the lens end the conditions at your site, you might choose ISO 200/24° film and an $f/2.8$ lens. Both choices, of course, reduce the photographic efficiency and probably you can hope for some very bright Perseids only. Since long exposures seem to be problematic, you may try to catch long enduring persistent trains. For this purpose a fast lens and a high speed film are useful. Since the brightness of trains fades quickly, you must not lose any time after a bright fireball appeared. A slightly wide angle lens can be easier pointed into the respective direction than a standard lens with its narrower field. You may already keep the camera shutter open and cover the lens with a small cloth which has to be removed only, or hold a cable release in your hand ready to start the exposure immediately.

I look forward to hearing from your results. Good luck!

Photographs requested!

After a fairly long period in which we were regularly supplied with photographs for the front cover, it has become considerably quieter the last couple of months.

Please do not forget us and send in photographs of which you think they might be suitable for the front cover!
(Editor)

Telescopic Observers' Notes, July–August 1995

Malcolm J. Currie

The weather changed in April and relatively few observations have been made in comparison with the first quarter, though some were secured for the Lyrids, with best rates of a few per hour around April 23.1, and for the Virginids. Contributions have been received from Javier Méndez Álvarez, Chris Hall, Alberto Latini, Joseph Lawrence, Jeroen van Wassenhove, and the Director.

Forthcoming Events

These two months are undoubtedly the most popular for meteor watching. The *Perseids* immediately spring to everyone's mind, especially following the fervor of recent Perseid campaigns. In 1995, however, strong moonlight moon will ruin any attempt to observe its maximum telescopically. A few Perseids may still be seen in late July and early August, as the relative number of faint meteors is greater away from the maximum.

More profitable for our attention during the holiday period is the cluster of radiants in the southern ecliptic known as the *Aquarid-Capricornid Complex*. Their orbits lie close to the ecliptic plane and thus have suffered from planetary perturbations causing the showers to split into weaker components. Another characteristic of these ecliptic complexes are long durations—in this case through most of July and August. The individual-shower properties, such as radiant motions, are subject to debate. This is not surprising because the sheer proximity of the radiants and their low elevation at the sites of the majority of observers makes shower identification problematic even for experienced observers, and subject to strong biases to the "known" showers, and frequently observers have made no allowance for radiant motions. Therefore plotting and video techniques are vital tools to resolve what is really going on. All but the α-Capricornids are rich in faint meteors, and so the telescopic observer can make an important contribution.

Although best seen by those in the southern hemisphere, the Telescopic Commission has accumulated most information on the showers from data collected at mid-northern latitudes, so only those north of 55° N should feel left out. Our aims are to see which of the apparent radiants are present every year, those which are ephemeral, and those which are due to chance alignments. For the annual showers we may also be able to determine radiant motion and estimate duration. The data are fewest in the week prior to the δ-Aquarid maximum on July 29. The minimal interference from the Moon in 1995 offers a chance to fill this gap in our coverage, as well as to compare the week after with results for 1988–1991. Using just positional information in crude analyses the complexity of the region is readily apparent in these earlier data. A strong (and when found in 1989 unexpected) Sagittarid radiant is present in late July and early August. We badly need more information about this shower, especially from those south of 40° N latitude.

For these southern showers it is important to plot each meteor's path and estimate its speed as carefully as possible. This will increase the signal to noise. It also vital to use several field centers; only if a radiant is seen from at least three locations and by different observers (and yields sufficient number of meteors) can we be confident about its reality. Multiple fields reduces the problems introduced by radiant occlusions. The magnification of meteor angular speeds calls for observing centers that are closer to the radiants. Besides reducing the contribution of orientation errors, this geometry means that not all the paths are oriented nearly north-south as might be the case for those located north of 40° N; this makes pinpointing of the radiants' declinations more reliable too. Nevertheless observations from those located south of latitude 40° N are especially welcome not only because of the higher rates resulting from the Complex's higher elevation, but also the ability to observe from the east or west of the radiants. Those north of 40° N should use chart numbers (west to east) 150, 133, 151, 137, 152, 138/153, and 139; and those south of that latitude use charts 161, 162, 151, 163, 152, 153, and 154.

While investigating the southern showers, you can monitor and detect northern minor showers too. Our data of a few years ago appear to show several radiants in Cygnus and neighboring constellations but these do not tally with Czechoslovakian data of two decades earlier or a shower seen by an Italian group in 1981. Now it is evident that sporadic meteors dominate and any minor showers barely protrude above this noise, and so some of these apparent radiants may be statistical artifacts, or are only detectable if they have a stronger return than normal. Regular monitoring and statistical analyses should indicate the genuine showers. One of the phantoms appears to be the α-Cygnids—ironically one of the better known minor showers. It is no longer believed to be a real shower, most likely being a artifact of the high radiant elevation. Certainly it is not visible in the telescopic data. However there could certainly be a number of short-duration minor showers with high population indices in the vicinity that have contributed to the illusion of the α-Cygnids. The better-known κ-Cygnids do show up at telescopic magnitudes even though this shower is famed for its slow-moving fireballs. In addition to the late-July to early-August period, we know even less about what is active during August 20–28, and some long sessions looking for minor showers during this interval would be especially welcome. For example, last year there was a diffuse area in Lacerta that needs confirmatory data. During the first dark-moon period just use the southern-shower charts. In the second I suggest 131, 135, 137, 114, 116, 87, 46, and 48.

Although having a population index as low as 2.5, the *α-Aurigids* of late August and early September are evident at telescopic magnitudes. They are swift moving and therefore the selected fields (39, 54, and 76) lie close to the radiant to reduce the angular speed. The radiant is low in the north-east until after midnight, so watches to dawn are required. The aims are to find the radiant size and motion. Judging by last year's data some early δ-Aurigid meteors radiating from Perseus may be seen too.

Theoretical Radiants of Minor Planets and Comets

Dirk Artoos

Below is a list of theoretical radiants of minor planets and comets, some of which may cause meteor activity during July and August.

Table 1 – Theoretical radiants of asteroids and comets in July–August 1995.

Name	$\lambda_\odot$	Date	α	δ	V_∞	Distance
1986 LA (3988)	100°.13	Jul 02	256°	−73°	14 km/s	0.18583 AU
P/1969 IX	100°.98	Jul 03	308°	+21°	49 km/s	0.06400 AU
P/1861 II	101°.05	Jul 03	54°	−39°	53 km/s	0.11563 AU
1995 CS	101°.11	Jul 03	290°	−19°	28 km/s	0.02582 AU
P/1915 III	101°.38	Jul 03	208°	+59°	18 km/s	0.02546 AU
P/1770 I	104°.59	Jul 07	277°	−21°	24 km/s	0.01349 AU
Dionysus (3671)	105°.50	Jul 08	220°	+44°	18 km/s	0.09486 AU
Adonis (2101)	106°.13	Jul 08	296°	−22°	27 km/s	0.02133 AU
1994 NE	107°.05	Jul 09	284°	+25°	24 km/s	0.02806 AU
P/1964 VIII	107°.52	Jul 10	32°	+ 8°	70 km/s	0.04448 AU
P/1889 IV	107°.53	Jul 10	64°	−50°	41 km/s	0.05518 AU
P/1979 X	107°.93	Jul 10	347°	+10°	67 km/s	0.05842 AU
P/1926 VII	109°.40	Jul 12	321°	+42°	52 km/s	0.11425 AU
P/1886 III	109°.55	Jul 12	20°	−41°	57 km/s	0.05189 AU
1994 ND	110°.76	Jul 13	284°	+41°	20 km/s	0.15415 AU
1990 MF	110°.81	Jul 13	248°	−30°	14 km/s	0.03170 AU
1994 AW1	110°.97	Jul 13	61°	−65°	17 km/s	0.03602 AU
P/770	113°.73	Jul 16	45°	+46°	59 km/s	0.12862 AU
P/1946 II	114°.27	Jul 17	356°	+21°	72 km/s	0.04268 AU
P/568	115°.02	Jul 18	262°	−32°	22 km/s	0.00868 AU
1986 TO	115°.31	Jul 18	92°	+51°	21 km/s	0.07917 AU
P/1770 II	116°.06	Jul 19	353°	+13°	66 km/s	0.05008 AU
1991 BB	116°.62	Jul 19	89°	−52°	25 km/s	0.09555 AU
P/1987 III	118°.45	Jul 21	36°	+19°	72 km/s	0.11699 AU
Aten (2062)	118°.71	Jul 21	212°	+64°	17 km/s	0.18426 AU
P/1764	120°.75	Jul 24	50°	+45°	64 km/s	0.08453 AU
1994 CB	126°.24	Jul 29	98°	−43°	15 km/s	0.06899 AU
P/1909 I	126°.44	Jul 29	79°	−67°	38 km/s	0.15533 AU
P/1909 I	129°.95	Aug 02	85°	−65°	38 km/s	0.16935 AU
P/1939 III	131°.05	Aug 03	19°	−12°	64 km/s	0.02341 AU
P/1951 II	131°.27	Aug 04	23°	−38°	51 km/s	0.04416 AU
P/1881 V	132°.75	Aug 05	306°	−31°	23 km/s	0.10915 AU
1994 CN2	133°.66	Aug 06	276°	−16°	13 km/s	0.01427 AU
1994 RC	134°.52	Aug 07	159°	− 6°	16 km/s	0.04398 AU
P/1472	134°.89	Aug 07	71°	+18°	67 km/s	0.06080 AU
P/1457 II	135°.96	Aug 08	295°	− 8°	24 km/s	0.10155 AU
P/1737 II	136°.44	Aug 09	121°	+80°	42 km/s	0.01825 AU
P/1945 VI	136°.81	Aug 09	110°	+ 4°	45 km/s	0.19900 AU
1982 BB (3103)	138°.23	Aug 11	308°	+35°	18 km/s	0.08922 AU
P/1978 XIX	138°.39	Aug 11	306°	−36°	22 km/s	0.14987 AU
Ra-Shalom (2100)	138°.70	Aug 11	93°	+52°	17 km/s	0.17896 AU
P/1852 II	139°.13	Aug 12	43°	−12°	66 km/s	0.00730 AU
Mithra (4486)	139°.87	Aug 12	156°	+17°	20 km/s	0.04487 AU
P/1833	140°.11	Aug 13	138°	+ 9°	33 km/s	0.01245 AU
1989 QF	141°.10	Aug 14	137°	+ 7°	17 km/s	0.02801 AU

Table 1 – continued.

Name	$\lambda_\odot$	Date	α	δ	V_∞	Distance
Toro (1685)	141°36	Aug 14	331°	−36°	17 km/s	0.12441 AU
1991 AQ=1994 RD	141°48	Aug 14	138°	+12°	27 km/s	0.02050 AU
P/1862 II	141°53	Aug 14	45°	+12°	72 km/s	0.02088 AU
P/1875 I	142°79	Aug 16	184°	+27°	20 km/s	0.10951 AU
P/1827 II	142°79	Aug 16	50°	− 9°	71 km/s	0.16645 AU
P/1990 XIV	143°94	Aug 17	329°	−18°	27 km/s	0.06018 AU
P/1985 III	144°12	Aug 17	329°	−18°	27 km/s	0.06015 AU
1994 PM	144°25	Aug 17	336°	+ 7°	29 km/s	0.02489 AU
1987 OA (5513)	144°39	Aug 17	322°	+ 1°	22 km/s	0.09363 AU
P/868	144°78	Aug 18	113°	−16°	47 km/s	0.18541 AU
P/1858 IV	145°65	Aug 19	28°	−23°	54 km/s	0.17810 AU
P/1618 III	146°17	Aug 19	282°	− 9°	25 km/s	0.08474 AU
P/1780 II	146°85	Aug 20	4°	+38°	60 km/s	0.14208 AU
Khufu (3362)	147°21	Aug 20	139°	+34°	19 km/s	0.01732 AU
P/1808 I	147°49	Aug 20	92°	+ 6°	62 km/s	0.03873 AU
P/1871 IV	149°12	Aug 22	4°	+47°	56 km/s	0.04250 AU
Asclepius (4581)	149°54	Aug 23	335°	+ 3°	16 km/s	0.04504 AU
P/1797	149°62	Aug 23	90°	+ 0°	64 km/s	0.06847 AU
Geographos (1620)	150°19	Aug 23	139°	−24°	16 km/s	0.03703 AU
Castalia (4769)	153°76	Aug 27	354°	−19°	19 km/s	0.02252 AU
P/1506	156°72	Aug 30	39°	+57°	64 km/s	0.13156 AU
P/1964 VI	157°04	Aug 30	276°	−15°	66 km/s	0.15426 AU
P/1499	157°17	Aug 30	318°	−55°	21 km/s	0.05496 AU

Ongoing Meteor Work

Good Prospects for α-Monocerotid Outburst in 1995

Peter Jenniskens, NASA/Ames Research Center

This year is one of the best opportunities to try and observe an outburst of α-Monocerotids, because of a near New Moon, a favorable radiant position for Europe, and a similar relative position of the major planets as in 1935, which was the year of the strongest α-Monocerotid outburst yet recorded. This event is very spectacular when the observing conditions are favorable, and quite unique, because of its short duration. Prospects for this year's event are given.

1. Historic outbursts

An outburst of α-Monocerotids was first reported in 1925 by F.T. Bradley from Crozet, Virginia [1]. He noticed 37 meteors in 13 minutes from a radiant below Orion. Excited by the event, he ran inside to get his observing form and starmaps, only to be disappointed when he returned. Not a single meteor was seen from this radiant after that. Olivier, the founder of the *American Meteor Society*, saw a few slow and bright meteors around that time, but these were not likely α-Monocerotids (later α-Monocerotids were fast and weak). The event was confirmed by two occasional observers in Charlottesville.

The next event was observed in 1935 and first reported by Prof. Mohd. A.R. Khan from Begumpet, India [2,3]. In two successive periods of twenty minutes, he saw "more than 100" and 11 meteors respectively. Several meteors were of first magnitude, suggesting that the average magnitude was not high. The sky was hazy and the radiant low in the sky. Khan reported a radiant close to α-Monocerotis. This event was confirmed by the Commanding Officer of the US steamer Canopus from Manila Harbor.

Excitement struck again in 1985, when Rick Ducoty from Capitola, California, saw suddenly 36 meteors from a radiant at $\alpha = 109°$ and $\delta = -07°$ [4]. The meteors were quite fast and only a little slower than the Leonids. The brightest meteors were of magnitude 0 to −2. Again, the event was of very short duration: in four-minute intervals starting at 11^h41^m UT, Ducoty saw 27, 5, 2, 2, and 0 meteors. His observation is the best from such outburst to date! The event was confirmed by Keith Baker from Lick Observatory, who saw 18 meteors in 7 minutes with a radiant in Canis Minor. Next night, only one possible stream member was seen between 11^h15^m and 12^h15^m UT. The meteors were of magnitude 2–4, quick and of short duration with no persistent trains.

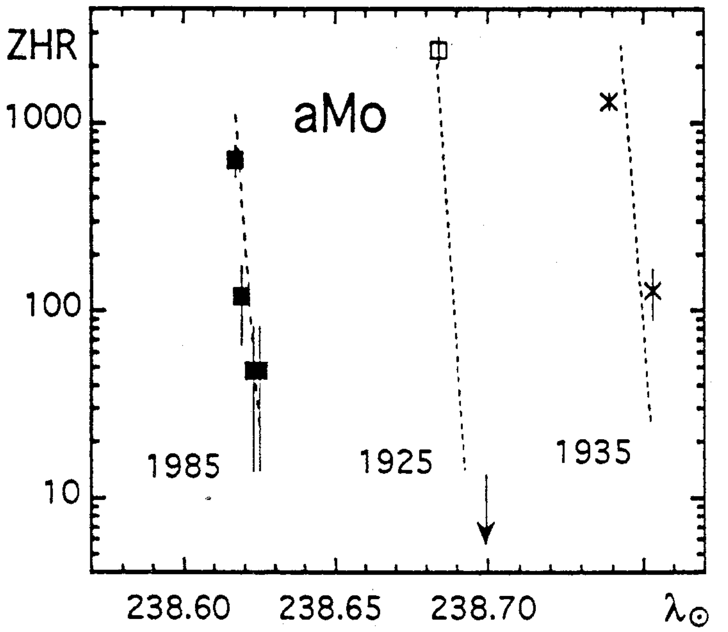

Figure 1 – Three outbursts of α-Monocerotids had a characteristic short duration and high peak activity. One tenth in solar longitude (eq. 1950.0) is about $2^h\!.4$. This graph from [5] summarizes the available counts from the outbursts in 1925, 1935, and 1985.

The activity curves of these events are given in Figure 1 [5]. All events were of very short duration. Peak ZHRs were above 1000 in a very short period. The slope of the curves is such that the duration at $1/e$ times the peak activity is only six minutes! This is a surprisingly short duration and makes the event very spectacular to watch: all night nothing happens and then suddenly meteors are pooring down. And it is over as quickly as it started.

In order to see the most of it, one should be at a dark and clear site with the radiant as high as possible in the sky. There are only a few locations on Earth that are favorable and also have some good prospects of clear weather. It is clear that observing the α-Monocerotids is very much like the hunt for a solar eclips, except that the event is more difficult to predict.

2. What causes the periodicity?

It has been suggested that α-Monocerotid outbursts occur at regular intervals of 10 years [2]. However, there is no short-period comet that is with certainty responsible for the stream. Only Comet 1944 I (Van Gent-Peltier-Daimaca) is thought to be a good candidate [6]. This comet too is not of short period and has not been observed again since 1944.

The meteor outbursts are typical examples of "far-comet type" outbursts, which include such events as the Lyrid and Aurigid outbursts [5]. These outbursts typically occur at much shorter intervals than the period of the comet and occur when the comet is far from the Earth. Far-comet type outbursts have some characteristic features. Amongst others, they tend to have some scatter in the time of maximum, tend to occur with peak rates of similar magnitude, and have a typical width.

Guth [7] noticed that Lyrid outbursts occur typically when the major planets Jupiter and Saturn are in conjunction with the stream. He suggested that the major planets are responsible, perhaps, for density variations in the stream. I have recently proposed another possibility [5]: the planets cause perturbations of the orbits of individual particles that bring the orbits only occasionally in collision with the Earth. The magnitude of the perturbations are such that they can account for the scatter of times of maximum meteor activity in the path of the Earth. And such scatter should occur perpendicular to the Earth's orbit in the ecliptic plane also, which can cause the stream to intersect with the Earth's orbit only on occasion. Best chance to see another meteor outburst of this stream is when the planets Saturn and Jupiter are at certain positions in their orbit.

3. Observing conditions in 1995

I have calculated the location of the planets Jupiter and Saturn in November 1995 and find that the planets are close to the positions of November 1935, the year of the highest reported α-Monocerotid rates. Therefore, prospects for another outburst of α-Monocerotids are very good this year. What is more, the observing conditions are favorable with a near-New Moon.

4. The time of maximum

Needless to say that nothing may happen at all. This type of meteor outbursts have not yet been successfully predicted. However, one needs to be prepared in order to be successful. So, what if the planets cooperate and this year's event will indeed occur?

The scatter in the time of the outbursts in 1925, 1935, and 1985 suggest that the outburst will happen again somewhere between solar longitude $\lambda_\odot = 238\overset{\circ}{.}55$ and $\lambda_\odot = 238\overset{\circ}{.}80$ (eq. 1950.0). This interval falls on November 22 between 0^h UT ($\lambda_\odot = 238\overset{\circ}{.}561$) and 6^h UT ($\lambda_\odot = 238\overset{\circ}{.}864$), hence during the night of November *21* on 22 for locations at European longitudes. The radiant altitude is between 16° and 28° at +55° N, 23° and 39° at +44° N, 41° and 83° at the equator, and 48° and 67° at −30° S. Therefore, all observing sites in the middle and south of Europe and in Africa are good when weather permits. It is prudent to continue observing for some time after the given interval, because the 1935 outburst occurred last of the three recorded events.

5. What to do?

The type of observations that are necessary and different from other outbursts include meteor counts in periods of 1 minute (not the regular 10 minutes or one hour!). In a period of 30 minutes or so, a total of up to hundred, a few hundred, meteors may appear. The meteors will be fairly faint which is why TV image intensifier observations are most suitable for recording this event. Telescopic observations should also be attempted. The occasional 0 to −2 meteor may occur, which offers a few chances to capture an orbit of an α-Monocerotid by multi-station photography. Such an orbit may help find the parent comet. Radio MS observers may be hampered by the fairly fast speed of the meteors.

6. An observing campaign in Spain

Members of the *Dutch Meteor Society* are organizing a multi-station photographic campaign in the south of Spain to cover both a possible recurrence of last year's Leonid outburst on November 16–19 and the possible α-Monocerotid outburst on November 22, 1995. At this moment, four houses have been rented for the occasion and it is anticipated that from those locations photographic and TV image intensifier equipment will be operated. Visual observers are cordially invited to participate. Other such campaigns should be organised at different locations in order to spread the hamoc of bad weather. The weather in the middle and end of November is notorious. Some mobility of the observing sites, to be able to move to a clear area, may be necessary. People that want to participate in the Spain Leonid/Monocerotid campaign can contact Hans Betlem in the Netherlands (phone: +31(71)223817; e-mail: `betlem@strw.leidenuniv.nl`).

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An Investigation of Limiting Magnitude Determination: A Pilot Study

Sandro Lanfranco and Godfrey Baldacchino

Three methods for determining the stellar limiting magnitude are compared: counting the stars in a pre-designated area, looking for the faintest star using direct vision, and looking for the faintest star using averted vision. Concerning the latter two methods, averted vision yields significantly better limiting magnitudes than direct vision, as may have been expected. Furthermore, the results of the averted vision method and the "star count" method are comparable, indicating that observers tend to use this method with averted vision. Obviously, there is a need to make explicit which viewing technique must be used for determining the limiting magnitude.

1. Determining the limiting magnitude

Traditionally, indications of stellar limiting magnitude (in short, SLM) used to be taken by identifying the faintest visible star in one's field of view and then looking up its apparent magnitude by looking it up in an authoritative atlas. This "faintest star method" presented its difficulties, especially when the identity of the faintest star was in doubt or when it turned out to be a variable. Nowadays, thanks not least to the stadardization which the *IMO* has introduced in meteor work, it has become fairly standard procedure to estimate SLM using the method whereby one counts the number of stars visible in one or more pre-designated areas. This "star count" technique, once established, never had any serious contenders. Admittedly, for a time, observers based in the United Kingdom did hold a preference for a polar sequence method. This was, in many respects, a variation of the star count method, with the all important difference that the region close to the north celestial pole was the one and only area; it was selected, irrespective of the area of the sky being observed. The limitations of this procedure have been quickly acknowledged since, obviously, the relevant stellar limiting magnitude reading must refer to that area of the sky being observed.

The star count method has been described as a "very unprejudiced and convenient method to determine the limiting magnitude." Star regions are selected for embracing the following set of characteristics: *(i)* a fairly regularly spaced sequence of stars with different apparent magnitudes in the visual range; *(ii)* the relative absence of variable stars in the visual range; and *(iii)* the absence of spectral class M stars whose apparent magnitude is difficult to determine. Once these conditions are met, then the identification of a number of stars in any one star region may be expected to translate into a fairly good representation of the extant SLM. The technique, dependent as it is on the judgment of individual observers, is therefore also sensitive to individual differences in perceptual ability, even in cases where observers are carrying out watches of the same general field from the same site at the same time.

There are 27 such star regions scattered all over the gnomonic meteor plotting maps in use round the world today. Their relatively large number means that 3 or 4 are typically within, or very close to, any observer's field of view at any one time. This also permits observers to count star numbers in more than one area; this serves as a cross-checking device, allowing a fair degree of corroboration as well as permitting a sensitivity to different SLM conditions which may be obtained in different parts of an observer's field.

2. Aims

One detail which seems to have been overlooked in these discussions is the use of direct or averted vision in determining SLM readings. No one appears to have raised any concern as to how individual observers should identify the number of stars in any "star count" area, for the purpose of determining SLM. The present study aims to investigate the differences, if any, in SLM determination using three different methods: the star count method; the faintest star method using direct vision; and the faintest star method using averted vision.

3. Method

The data for this preliminary study was accumulated between April 30 and May 8, 1994, during the observations of the η-Aquarid meteor shower. The 4 participating observers were all seasoned with many years of meteor watching experience. They estimated the SLM using each of the three methods mentioned above at various times during each watch.

Table 1 – SLM estimates according to three methods.

Observer	Star Count	Faintest Star (Direct Vision)	Faintest Star (Averted Vision)
BALAN	5.1	3.2	4.4
	3.4	3.8	4.4
	5.0	4.2	4.9
	4.8	4.2	5.0
	6.0	4.4	5.4
	5.1	3.8	4.4
	5.2	4.4	5.4
	5.1	4.4	5.4
	5.0	4.3	4.4
	5.3	4.4	5.4
	5.3	4.4	5.4
	5.3	5.0	5.4
	5.3	5.0	5.4
BALGO	3.4	3.0	3.2
	3.1	3.1	3.6
	4.7	3.0	4.6
	4.8	3.2	4.9
	5.0	3.4	4.6
	5.0	3.2	4.9
	5.0	3.4	4.9
	5.2	3.9	4.9
	5.1	4.0	4.4
	5.1	4.4	4.2
	5.6	3.7	5.6
	5.3	3.7	5.1
MULUM	5.7	5.3	5.7
	5.4	4.7	5.4
	5.4	4.6	5.3
	5.2	4.5	5.0
	5.7	5.1	5.6
	5.5	4.8	5.3
	5.5	4.9	5.4
	5.4	4.9	5.4
	5.9	5.6	5.9
	6.2	5.9	6.2
	6.3	6.0	6.1
	6.2	6.0	6.3
CAMED	3.4	3.4	5.5
	3.4	3.4	5.5
	3.4	3.5	5.5
	4.6	3.7	4.4
	4.6	3.7	4.4
	4.6	3.7	4.4
	4.6	3.7	4.4

Fourty-four sets of estimates were eventually submitted by the four observers for analysis as follows:

> Anna Baldacchino (**BALAN**; 13 estimates), Godfrey Baldacchino (**BALGO**; 12 estimates), Umberto Mule' Stagno (**MULUM**; 12 estimates), and Edwin Camilleri (**CAMED**; 7 estimates).

The data-set collection is tabuled in Table 1.

The data were then analyzed with a statistical package (SYSTAT Version 5.03) on a personal computer.

The available data were used to test the null hypothesis that there is no difference between the SLM determined using the direct and averted vision techniques. The SLM determined by each of these two methods was also compared with that obtained by the "star count" method.

Testing of conformity to a normal distribution using a χ^2 test indicated that the data for the direct vision deviated significantly from normality. Tests for statistically significant differences between the three datasets were therefore carried out using Wilcoxon's Signed Ranks Test for pairs of variables. This was used in preference to other techniques (such as the t-test) since this is a non-parametric test and therefore is reliably applicable to data which is not normally distributed. A cut-off level of 0.05 was established for tests of significance. Similar tests and criteria were subsequently applied to the data of each observer in order to detect any individual trends.

4. Results

Entire data set

An inspection of the means obtained for each set of readings immediately indicated a disparity between SLM readings obtained by direct and by averted vision (Table 2). This difference is statistically significant.

Table 2 – Mean SLM values obtained by the three methods.

Star Count Method	Faintest Star Method (Direct Vision)	Faintest Star Method (Averted Vision)
5.0	4.2	5.0

Comparison of the mean SLM obtained by the "star count" method with the means of the other two groupings suggests a high affinity between the "star count" and the "averted" data. In simpler terms, it appears that observers in this pilot study systematically resorted to averted vision in determining the number of stars visible in the "pre-designated" star areas, from which the SLM reading is eventually derived. Analysis actually confirms that there is no statistically significant difference between the means of these two groups.

Individual observers

The data available were further broken down by observer as shown in Table 3.

Table 3 – Mean SLM values obtained by the three methods.

Observer	Star Count Method	Faintest Star Method (Direct Vision)	Faintest Star Method (Averted Vision)
BALAN	5.1	4.3	5.0
BALGO	4.8	3.5	4.6
CAMED	4.1	3.6	4.9
MULUM	5.7	5.2	5.6

Firstly, it can be noted that, for all observers, the mean SLM using averted vision is better than that using direct vision. This difference is statistically significant for all four observers.

Secondly, the mean SLM resulting from the "star count" method is better than that obtained using direct vision. This also holds for all four observers. This difference is statistically significant for BALAN, BALGO, and MULUM. The aberrant result for CAMED may be a consequence of the small sample size (only seven estimates); or of poor observing conditions which make any SLM determination technique unreliable.

Finally, the difference in mean SLM between the "star count" method and the averted vision method is within 0.2 magnitude for all observers except CAMED (where the difference is 0.8 magnitude). The differences in the case of BALAN, BALGO, and MULUM are statistically insignificant. This confirms the observation made earlier that each observer is likely to have undertaken the "star count" method of SLM determination using the averted vision method.

5. Discussion

It would be intuitively expected that averted vision permits a higher number of stars to be seen than does direct vision. The reason for this is physiological.

The retina of the human eye comprises two forms of photosensitive cells: these are known as rods and cones. Rods are stimulated by low-light intensities and therefore contribute to night vision. Cones respond to high-light intensities and are therefore most useful during daytime. The distribution of these two types of cells is not uniform and indeed approximates the mutually exclusive: cones are concentrated on the central part of the retina directly perpendicular to the lens. In contrast, rods are distributed throughout the retina, although at lower densities at the center.

Averted vision would therefore predominately stimulate rod cells at the sides of the retina. Since the concentration of rods is greatest away from the center of the retina, use of averted vision in conditions of low light is more likely to elicit a visual response than is direct vision.

Such information is of course staple knowledge to other amateur astronomers such as comet and nova hunters as well as variable star observers.

The results obtained are consistent with the hypothesis that SLM determination using direct vision gives significantly brighter (that is, weaker) limiting magnitudes than does the averted vision method. This implies that use of direct vision data would contribute towards an apparent increase in estimates of zenithal hourly rates relative to rates calculated using the averted vision or "star count" methods. The similarity between data collected using the latter two techniques suggests that the observers concerned calculated their "star count" SLM using averted vision.

6. Implications

If averted vision is indeed the basis for calculating SLM using the "star count" method, this needs to be made explicit; the limited sample used in this preliminary investigation is suggesting that the difference between direct an averted vision techniques amounts to a mean of 0.8 magnitude. This is a very considerable discrepancy for meteor work and carries serious implications for the derivation of activity rates.

The results of this pilot study confirm that SLM readings may vary from observer to observer according to individually favored methods of SLM determination rather than simply as a consequence of perceived different sky conditions. Inadvertent errors of this kind need to be weeded out of the rate reduction process. It is therefore not desirable but necessary that clear and unambiguous guidelines be established and circulated regarding the standardized determination of the all-important SLM statistic.

Dark Meteors

Alastair McBeath

An examination of objects which appear as "dark" meteor-like objects, occasionally reported by visual observers for some years, and some possible explanations for them, are presented. Several classes of these objects seem to occur, some of which may be the result of features within the eye, but some may be genuinely separate phenomena.

1. Introduction

Two recent letters by Zay to *WGN* [1,2] have commented on his sightings of "dark" meteors, that is, objects that look like meteors, but which are darker than the background night sky, not brighter, as is the case with most visible meteors. Other observers have also reported objects which appeared as dark or "black" meteors from time to time. The present author conducted a survey of *JAS Meteor Section* (*JASMS*) observers on this subject in 1990–1991 [3,4]. In this relatively small scale survey, 8 out of 11 people who responded, including the author, had seen "black" meteors at some point while meteor watching visually, this from about 30 active observers in the Section at this time. Their notes essentially confirmed the irregular nature of dark meteor sightings which had been reported previously. Some authors have dismissed the phenomenon as purely illusory, but it is unclear whether this is an adequate explanation or not.

2. Dark meteor appearances

Zay initially described his dark meteors [1] as "of a roughly broad rectangular shape moving at a very fast velocity" which tended to appear near his peripheral vision, generally moving in a horizontal plane with respect to his eyes. He also indicates he may have been somewhat fatigued at the time, though he gives this more as a potential explanation than as a description of his mental/physical state. His later sightings were seen nearer his central vision, when he felt "clear-headed and alert," but were otherwise similar, with the exception of one elongated rope-like object, which moved slightly slower than his other objects in a direction at right angles to its elongation. His final sighting reported in [1] describes a brighter, third magnitude, meteor, but which had a nebulous, briefly sparkling in places, appearance. He suggests its head diameter may have been about 1° across, "a thumbnail-size look to it with an outstretched arm." This object is of interest, since Zay notes that apart from producing light, this last meteor "seemed similar to the broad 'dark meteors'."

Notes from the *JASMS* survey indicated that the observers who had seen "black" meteors most often described them as meteor-like objects that were "emitting darkness," rather than light. There seemed little pattern in when the objects were detected, and most were caught well within the field of vision, not near the edges. One or two people indicated they were suffering from fatigue at the time of their sightings, and one observer developed mild cataracts after making the report, but no other comparable problems were mentioned. There were no reports of rectangular bodies similar to Zay's observations, however.

The author's own experiences of witnessing dark meteors suggests he can see them at any time of night, under any fatigue conditions from fully alert to near-exhaustion. They usually appear singly, like most meteors, and generally within a field about 40° across in the center of vision. Using a simple "A, B, C" reliability scale from "A" = well-seen to "C" = poorly-seen, almost all are class "A," with only a very few class "B." They seem to favor nights when the sky is particularly dark and transparent, although even then, one or two is a good maximum total, and none at all is very frequent. Although no statistics have been kept to date on these sightings, a rough estimate implies around 40–50 such objects to have been seen over the past ten years of meteor watching (1985–1994; approximately 725 visual hours; approximately 8000 meteors), which is, very approximately, one dark meteor to every 160–200 "normal" meteors.

3. Earlier records

The descriptions above made by visual observers do not seem to have been widely reported for any length of time, perhaps because there has been an inclination to automatically dismiss them as purely illusions, or perhaps because they are a relatively recent phenomenon. Looking back into the historical records, there are numerous reports of dark meteor-like objects being seen to pass across the disc of the Moon or the Sun as viewed through telescopes. The earliest of these reports found to date are Muller's [5] from April 4, 1892. Steavenson [6] gives a particularly detailed description and suggests several explanations for his 1920 observation of a possible dark meteor crossing through his telescope field while observing the Moon as well, and there are other examples to be found in the literature from the 1890s until the late 1920s, when interest in the topic seems to have fallen off.

A paper by Carrington [7] describes two small dark objects seen telescopically in swift transit across the solar disc, one in 1847, the other in 1849, although the latter object is given an estimated size of 30″ across, and it is not clear that either object really qualifies as a dark meteor, since Carrington's paper discussed possible planetary transits of the Sun.

The fact that all of these objects were seen in transit against a brighter body suggests that they may not be the same as the objects we are here discussing as dark meteors. Most of the reports of these earlier events make notes to the effect that these may be meteors or larger bodies (we would now refer to them as asteroids or minor planets) beyond the Earth's atmosphere. Indeed Muller actually calls them "cosmic meteors" [5].

One other report is of some value here, a lengthy note by Schafarik on telescopic meteors generally [8]. Although he was primarily a variable star observer, he recorded a great many telescopic meteors, and even makes the comment that such events "are so common that it would be difficult to pass a night at a low power telescope of large aperture without having caught sight of a couple of them." He defines four classes of telescopic meteors, the first two of which are fairly standard, luminous points and those with larger, wedge-shaped meteor heads, but his second two classes are rather more curious. Class 3 are "well-defined discs of a very perceptible diameter, almost invariably brighter at the border than at the center, which gives them the aspect of hollow transparent shells, or luminous bubbles," while Class 4 are "faint diffused nebulous masses of irregular shape, considerable size, and different colors." Class 3 descriptions could perhaps well be applied to the dark meteors generally (see Section 4 below), with Class 4 prime candidates for encompassing the nebulous meteor sighting by Zay noted above.

It is perhaps strange that with so much interest expressed in pursuit of natural phenomena of all types in the late 19th and early 20th centuries, no real records of visual dark meteors seem to exist from this period. Many of the more recent sightings are, however, preserved only in verbal, often anecdotal, form, and there seems to be a reluctance, almost an embarassment, among observers to admit to actually seeing them. The ready skeptical comments by those always happy to dismiss anything they cannot instantly conceive of have scarcely helped matters, but perhaps this paper will help others feel more comfortable about sharing their own observations.

4. Possible explanations

There are only three possible explanations for dark meteors. Either they result from some physical defect in the eye, or they are an illusion caused by the eye-brain system, or they are real. The next four subsections deal with each of these possibilities.

Eye defects

Examining the possible physical defects which may occur in the human eye, there is really only one item of interest to us here, since no other known defect can produce anything even closely resembling small, dark meteor-like lines of irregular occurrence, particularly when such a sizable proportion of observers find that they can see them: muscae volitantes, more popularly referred to by opticians as "floaters" [9]. "Floaters" are irregular chains of dead cells that lie in the vitreous humor of the eye, inside the main eyeball itself. They are the remnants of atrophied fine blood vessels, which supplied blood to the front of the eyeball before and after each of us was born. The blood vessels have usually disintegrated in this way by the time we are about 8 months old, but unfortunately, the disintegration is not complete, as short pieces are left in the eye. These fall naturally under gravity to the base of the eyeball, but any sudden movement of the eyeball (such as the natural saccadic motion of the eye even at rest) can throw them up into our field of vision. Technically, they are not a true visual defect, since everyone has these in their eyes, and they are quite harmless, if somewhat annoying at times.

Although most of these are irregular, often twisted or curved, chains of cells, some round, dark spots can be found by most people. These may be short cell chains seen end on, or small cell groups. The swift motion of the eye can easily cause apparently meteoric velocities to be briefly imparted to these objects, which disappear as soon as they move out of our visual field, or as soon as they move against a background which no longer lets them show up clearly. Such a background is generally lighter than the dark "floaters," but not exclusively. Personal experience suggests they are rather difficult to see against the background night sky, however. If they appear at all, it is usually as a small, short-lived distortion of a star, and is best noted using some form of optical aid.

Diffraction effects at the edges of individual "floaters" can give them an apparently brighter, sometimes slightly sparkling, limb, but again, this is best observed under daylight conditions with a light background. It is also difficult to imagine how the near-stationary eye of a relaxed visual observer could produce the observed dark meteor velocities, since the apparently high velocity of the "floaters" damps to a much slower speed as soon as the eye ceases to flick from one part of the field of view to another.

Nevertheless, some dark meteors may be the result of muscae volitantes. It is possible that Zay's report of a linear object moving perpendicularly to its long axis may have been one such event.

Optical illusions

The brain's processing of optical images is still very poorly known, and there are many oddities concerning the eye-brain system which have yet to be properly examined, let alone explained. This makes it quite impossible to be exhaustive in looking for potential illusory causes for dark meteors.

Bright, or sometimes bright-edged but dark, star-like objects can be seen drifting across the field of view after a blow to the head on occasion, and similar effects have been recorded when sudden changes of blood pressure or fainting occurs. Physiological changes due to increasing fatigue or mild exposure could bring about such visions too, and some migraine sufferers have frequently observed small, bright or dark objects near the edges of their vision. Any of these might give rise to something resembling dark meteors, but most seem to involve brighter, much more "ordinary," meteor-like objects; it is common to say one is "seeing stars" under these circumstances, for instance.

There is then the question of synaesthesia, where non-visual senses (smell, taste, touch, sound) may be perceived as visual signals, in some cases across the entire field of the visual system, albeit this seems to occur most pronouncedly in certain individuals. In some cases, the linkage appears to be both ways, with sights being able to influence the other senses. Current understanding of the phenomenon suggests that it may be normal for this to occur from when we are born for some months, perhaps even years, and it has been speculated that synaesthesia may be latent in all of us to a greater or lesser extent, after it has been effectively suppressed or broken-down in early childhood. There are even reports that sensing colors by touch can be learnt [10, Chapter 2]. So little detailed work has been carried out in this particular sphere that it is not practical to say whether or not this effect may be important in generating dark meteors. This is especially so if synaesthesia is actually present in all of us in a generally subdued state. Providing the observer when alert does not normally experience such an effect, however, it seems unlikely that the act of meteor observing alone should suddenly bring it on.

The visual system generally is a highly complex one, and other factors cannot be easily ruled out. To take one example, try this experiment while out in the field observing under a clear sky. Concentrate your vision on one spot (a star is a good target) and hold your eyes still. You will find this is very difficult to do at first, but it is worth persevering. The human eye does not naturally like to stay viewing one spot for very long, for reasons that will become apparent. After only a short time of holding your eyes still, you will find your vision losing definition, and the sky ceases to be dark, instead assuming an overall grey color. If you are able to carry on for a minute or two, you will find your entire field of view becomes a uniform grey. This is known as a ganzfeld [10], and some people can find it rather frightening. As soon as you move your eyes, this greyness vanishes. What seems to happen is that the visual sensors within the eye become "bored" very quickly if they are looking at the same thing all the time, and "switch off" until something new comes along. Even if you do not quite reach the full ganzfeld state, you should be able to notice that, around each star you can still see, there is a thin, dark aureole before the grey background takes over. On a very few occasions, the author has even managed to generate images of dark stars with a brighter aureole around them in this state, and these are a little like stationary dark meteors. However, for normal meteor observing, the ganzfeld state is unlikely to be approached at all closely, so this can probably account for only a tiny percentage of fatigue-affected cases.

Some colors can be artificially generated in the eye, depending on the color of the object and its background. This feature was used to explain some of the perceived visual meteor color proportions in [11], for instance. Whether black, or perhaps a dark violet, bearing in mind the fact the dark meteors are only perceived as dark against the background night sky, which is itself not black but a very dark blue, can be generated in this way is uncertain, but brown can be. Wolf [12,13] reported two brown fireballs from *SEAN* data between 1979 and 1990, a tiny percentage of the overall fireball number, and one which many observers and analysts might have overlooked—or preferred to overlook—but brown can be generated in the human eye when a small orange or yellow source is surrounded by a brighter annulus of white light [10, Chapter 1], especially with a dark background.

Atmospheric objects

Observers who work from sites affected by light pollution frequently report seeing meteor-like objects which generally follow erratic, non-rectilinear paths in crossing the sky. Sometimes these events are rather nebulous in appearance. These are birds, bats, insects, or windblown debris (leaves, litter, etc.) reflecting the streetlights. Many nocturnal flying animals are dark in color, but when illuminated, however faintly, even these appear brighter than the background night sky. The author has encountered reports from rural areas where this is the case, despite the lack of large numbers of unshielded lamps in such places, so the amount of stray light required to illuminate these creatures is clearly not great. Where such animals make sounds whilst in flight, either the noise of their wings, or calls and cries (particularly owls and bats), it frequently happens that the sound will be heard, but there will be no sign of the animal producing it. The author's experience suggests it is possible for some of these creatures to be very close-by, but still remain unseen, and that this is true regardless of the presence of nearby lights. It thus seems most improbable that nocturnal flying animals can explain any but a minute fraction of the dark meteors reported.

Debris, whether natural (leaves, seeds, dust) or man-made shares a similar problem to living creatures, in that it will generally only be noticed if it is illuminated. Seeds and even pollen have been used as explanations for some dark objects seen against the Sun or Moon before now, but against the dark night sky, they will not readily show up. In addition, debris must be caught by the wind to become airborne, and so will tend to be noted only on windy nights, then tending to move in the direction of the prevailing wind. There is little evidence to support such selectivity in the occurrence of dark meteors, so this can probably be discounted as a possibility almost entirely.

Genuine dark meteors

As noted in [14], purple or violet appears to be exceedingly rare in meteor colors. It may also require unusual circumstances to assist in its production. If at least some dark meteors are actually deep violet in color (the possibility that they may be generating much of their light in the ultra-violet range cannot be excluded), this might account for the relative infrequency of dark meteors and the difficulties in spotting them. Perhaps the observers who do note dark meteors are actually spotting rare ultraviolet meteors on the threshold of human detection limits. The recent discovery of gamma-ray bursts from the upper atmosphere by the *Compton Gamma Ray Observatory* [15] might perhaps be linked to this, albeit the energy levels for gamma-ray production are exceedingly high, and that the gamma-ray bursts have already been tentatively linked with terrestrial thunderstorms.

It is not easy to visualize how else black or deep violet might be generated by an actual meteor, unless what is being perceived is the result of a meteor too faint to be seen visually, perhaps only just so, producing some form of barely-illuminated wake around itself. Schafarik's Class 3 telescopic meteors described under Section 3 above might be potentially being viewed in these cases. Such faint wakes might be produced by sound waves or as some form of shock wave, perhaps passing through some type of tenuous high level clouds, or some physical process may be occurring at the meteroid's surface, such as sputtering or spraying, which happens with some meteorites. Noctilucent clouds form at heights comparable to the lower levels of meteor ablation, around 80–90 km altitude, for example, although they are currently regarded as being present over any given site only during that location's summer months. There is some evidence that they may occasionally be found away from this time, however, and if so, dark meteors might well be one way of detecting their presence from the Earth. Regrettably, the sky over sites from where noctilucent clouds can be readily detected during the summer "season" is liable to be too bright to easily observe dark meteors, assuming they are most obvious when the sky is apparently dark and clear, as suggested earlier.

5. Other similar phenomena

Following on from above, it is interesting that blue "trains" or "wakes" have been seen to precede meteors as reported by several other workers, most notably Terentjeva [16], commenting on the findings of Astapovich, and Grigore [17,18] from his own observations. Astapovich recorded faint, bluish luminous trains preceding the appearance of a number of meteors from an especially clear, high altitude site in Turkmenistan during 1947. These resembled a meteor flight producing a faint train without there actually being a meteor present, and disappeared a few degrees behind where a meteor subsequently appeared, lasting up to 1–2 s. There is the possibility that occasional nights when certain observers have reported the feeling that they sometimes seemed to "know" just where a meteor was going to appear, if not some manifestation of déjà-vu, might be comparable events to this, with the "pre-meteor trains" going unrecorded. The author has been fortunate enough to encounter this particular sensation, and has tended to associate it with a very few of the clearest nights. Grigore noted a bright, almost semi-circular arc, which he described as rather like a shock wave in appearance, immediately preceding a magnitude −6 Geminid on 1990 December 13 at 1^h50^m UT. The "pre-meteor arc" lasted for almost the entire meteor's track (16° out of the whole flight of 18°). He gave its color as blue-mauve or purple. The meteor itself was recorded as blue, and illuminated the sky near it. The mean sky limiting magnitude was +5.74. Although this is clearly not quite the same phenomenon as Astapovich's "pre-meteor trains," there is similarity in appearance and positioning with regard to the meteor.

6. Conclusion

Whether dark meteors are real or not remains an unknown factor. There is some evidence to support either a real or an illusory view. What is clear is that observers recording unusual events of the nature of those outlined above, or others, should not be afraid to report their findings. The best approach for now seems to be to maintain an open mind until we have more evidence.

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Fireballs and Meteorites

Meteoric Sonic Boom over Perth, Australia

April 30, 1995, 17^h57^m UT

communicated by Cis Verbeeck

A sonic boom from a meteor was heard by thousands of Perth residents. The object was extemely bright, and short-lived, and no falls were observed.

Via the Internet, Peter Birch of Perth Observatory communicated that, at 17^h57^m UT on April 30, 1995, thousands of Perth (Western Australia) residents were awakened by the sonic boom from a meteor.

Eyewitness reports indicate a track of SW to NE, and timings between sight and sound indicate a height of 15–20 km. The object split into 4 bits around 50 km NE of Perth above the National Forest. The object was extemely bright, and short-lived. No falls were observed. Reports have come from around 100 km either side of Perth.

Telescopic Observational Results

Spanish Telescopic Observations in 1994

Javier E. Méndez Álvarez

1994 has been the first observational year of the Telescopic Commission of the *Spanish Meteor Society* (*SOMYCE*). An overview of its activities and observations is given.

1. Introduction

The Telescopic Commission of the *Spanish Meteor Society* (*SOMYCE*) was founded in January 1993. Since then a first phase of disseminating the correct methodology and distributing enough material for observation has been developed. During this period some objectives were achieved, such as the publication of the first manual of telescopic observations in Spanish [1], spread all over the country, and a lecture at the XIth *Spanish National Amateur Astronomy Conference* (Lleida, November 1994). Although in 1994 very few observers reported observations, the expectations for the future are very optimistic. A summary follows of the 1994 telescopic observations.

2. Virginids

The campaign of the Virginids lasted from March 14 until April 15. In total, 17.55 hours of effective observing time were gathered in 6 nights and 108 meteors were registered with a limiting magnitude of 11.2. All of these observations were made by the author (MENJA) with a 80 mm binocular at 11 times magnification. Table 1 presents the results (see also Table 3 for field centers).

Table 1 – Distribution of telescopic Virginid observations in Spain during 1994.

Date	T_{eff}	$\overline{\text{Lm}}$	N
Mar 14-15	2.02	11.0	7
Mar 18-19	3.27	11.1	21
Apr 07-08	3.43	11.4	25
Apr 08-09	0.94	11.0	5
Apr 09-10	4.12	10.9	19
Apr 14-15	3.77	11.4	31

3. Coma Berenicids

Because of the deficiency of *IMO* charts, new ones were made from the *Uranometria 2000.0* star atlas (called *SOMTC* plus number) to observe the Coma Berenicids and the Quadrantids. Bad weather prevented us from observing the Quadrantids but nevertheless observation of the Coma Berenicids was possible during 3 nights between December 28 and January 1. We saw 38 meteors in 9.93 hours of effective time with a limiting magnitude of 11.0. These observations were made by the author (MENJA) with a 11×80 binocular. The distribution of the nights is given in Table 2. (see also Table 3 for the used charts).

Table 2 – Distribution of telescopic Coma Berenicid observations in Spain during 1994.

Date	T_{eff}	$\overline{\text{Lm}}$	N
Dec 28-29	3.52	10.9	8
Dec 30-31	2.89	11.0	11
Dec 31-01	3.52	11.1	19

4. Other showers

Máximo Suárez (SVAMX) observed on June 14-15 with a 7×50 binocular looking for June Lyrids [2], but no meteors were seen in 0.84 hours of effective time with a limiting magnitude of 9.2 (see Table 3).

Table 3 – Field centers used on each night during 1994.

Chart	Center		Night(s) used
	α	δ	
TC 124	11^h18^m	+12°	Mar 18-19; Apr 09-10; 14-15
TC 125	12^h48^m	+13°	Mar 14-15; 18-19; Apr 07-08; 09-10; 14-15
TC 126	13^h52^m	+14°	Apr 08-09
TC 127	14^h17^m	+12°5	Apr 07-08; 14-15
TC 129	15^h32^m	+11°5	Mar 14-15; 18-19; Apr 07-08; 09-10
SOMTC 009	11^h52^m	+14°	Dec 28-29; 30-31; Dec 31-Jan 01
SOMTC 010	12^h40^m	+35°	Dec 28-29; 30-31; Dec 31-Jan 01
SOMTC 011	12^h48^m	+09°	Dec 28-29; 30-31; Dec 31-Jan 01
TA 110	17^h38^m	+26°	Jun 14-15
TA 111	18^h20^m	+21°	Jun 14-15

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I would like to thank Malcolm J. Currie for his support and for sending us the *IMO* charts and other material for telescopic observation. I would also like to thank Luis R. Bellot Rubio for helping us in the development of the Telescopic Commission of *SOMYCE*.

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Visual Observational Results

SPA Meteor Section Results: January 1995

Alastair McBeath

A brief overview of results submitted to the *SPA Meteor Section* for the 1995 Quadrantid epoch is given. Poor weather made observations difficult, as often seems to happen for the shower, but a possible double or plateau peak appears to have been reported by European visual watchers between approximately 22^h and 3^h UT on January 3-4, with ZHRs around 100–120. Raw radio data from one source available at present also implies this may have been the case. Some other data from the remainder of January 1995 is discussed too.

1. Introduction

Data submitted to the *SPA Meteor Section* (*SPAMS*) for 1995 January primarily consisted of attempts to see what the Quadrantids produced in the opening days of the month, with the bulk of observations completed in the first four days of January. Overall, 135 visual hours and 1766 meteors were recorded, including 1094 Quadrantids. 274.7 photographic hours were also noted, the majority by European Fireball Network members from the *Arbeitskreis Meteore* (*AKM*) group in Germany. No photographed trails have as yet been reported, however.

Robert White from West Sussex in Britain reported 7654 radio echoes caught during 217 hours of continuous operation from late 1994 December into early January.

The list of individual observers and groups reporting data during January was as follows, visual and from the UK unless noted:

> *AKM* members (from Germany; visual and photographic), Rainer Arlt (Germany), Peter Craven (Finland), Shelagh Godwin, Richard Livingstone, Michael Maunder (Channel Islands), Alastair McBeath, Tom McEwan, Martin Plater, David Scanlan et al., George Spalding, M. Thompson, Roy Watson (visual and some photographic results), Robert White (radio data), Graham Winstanley, and Graham Wolf (New Zealand).

2. Quadrantids

With New Moon falling on January 1 this year, it was hoped that weather conditions would be equally conducive to covering the shower, but unfortunately, for many people, this was rather a forlorn hope, since the typical winter clouds did little to assist many northern hemisphere observers, particularly those in the UK. From Britain, some observers were out on most nights between January 1 and 3, most on January 3-4, the expected maximum night, but the better skies occurred before 00h UT, which is also local midnight at this time of year, a period when the Quadrantid radiant is nearest the northern horizon for the entire day. Consequently, there is something of a query over the accuracy of ZHRs calculated in the early part of the night.

Poor conditions, plus the fact that many contributors did not provide magnitude distributions with their reports meant that only 251 reliably-seen Quadrantids and 106 sporadics could be analyzed in particular detail. Global magnitude distributions for these are shown in Table 1. The mean LM for this data was +5.76.

Table 1 – Global 1995 Quadrantid and January sporadic magnitude distributions.

shower	-3^-	-2	-1	0	$+1$	$+2$	$+3$	$+4$	$+5^+$	Tot	$\overline{m}_{6.5}$
Quadrantids	2	5	12	24.5	44.5	75.5	62	21	4.5	251	3.6
Sporadics		3	7.5	5.5	16	28.5	29	13	3.5	106	3.8

Unfortunately, even fewer observers reported full train details, but both shower and sporadic sources produced train proportions of around 7%.

Despite the problems already noted, the best Quadrantid ZHRs look to have been around the 100–120 mark on January 3-4. Those lucky enough to have good skies throughout the night, notably in Germany, reported either a double peak around 22^h–23^h and 1–3^h UT, or something of a rates' plateau between these times. The earlier "peak" may be an artifact due to the low shower's radiant elevation at this time, but it is interesting that it appears in independent observations from Germany [1] and the Netherlands [2, Figure 1]. If these data are borne out by the final *IMO* analysis, it suggests that in 1995, the Quadrantids may have produced a rather less sharply-defined maximum than has been found previously. Activity looks to have been above about 90 from roughly 23^h to 5^h UT on January 3-4, for instance, with no marked peak between these times.

Radio results obtained by Robert White in England between December 30, 1994, and January 8, 1995, are illustrated in raw form as Figure 1.

These data show a peak throughout the night of January 3-4, which coincides with the best visual rates, but there are other peaks which occur later too. Robert believes these may well be the result of atmospheric problems, however, similar to what were found in the second half of 1994.

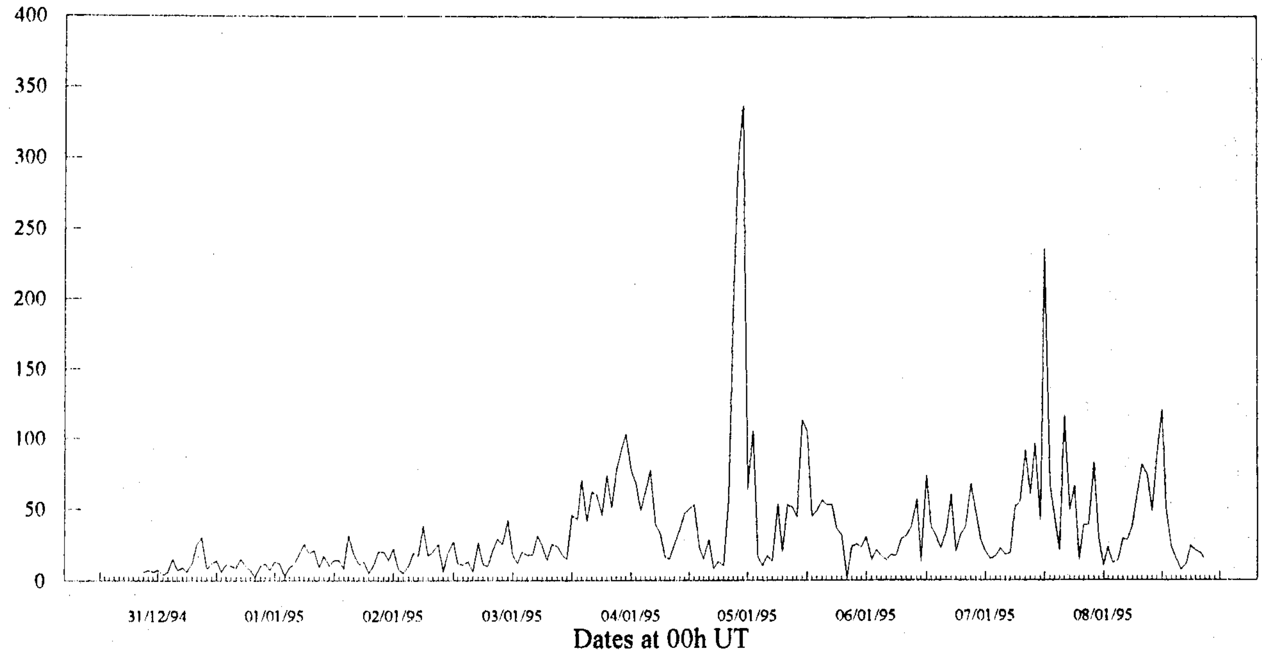

Figure 1 – Late December to early January raw hourly counts of radio meteor echoes, made by Robert White.

He also reported difficulties with some of the stations he normally expects to pick up, which could also have produced additional difficulties. He is looking into potential new radio transmitting sources for use later this year. He is hoping to further computerize the processing of his raw data as 1995 progresses too.

3. Other January observations

Although, as we have seen, the bulk of January's observations were completed during the first few days of the New Year, a percentage of data was collected at other times. Most of this came from Graham Wolf, based at Wellington in New Zealand, although as in the northern hemisphere, most January showers visible from the southern hemisphere are rather weak ones. Despite this, Graham noted quite respectable, if low, rates from the α-Crucids, particularly on January 11 (14 α-Crucids from 29 meteors in 6 hours, 9^{h}–15^{h} UT), and also a handful of possible α-Carinids towards the end of January. Unfortunately, the Quadrantids are not visible from Wellington at all.

AKM observers were not idle after the Quadrantids either, noting low Coma Berenicid, δ-Leonid and even a few early Virginid meteors. Meanwhile, in Britain, clouds or moonlit clear nights were the order of the day for virtually everyone...

4. Conclusion

As ever, I am very grateful to all the above contributors for their perseverance, good fortune and thoughtfulness in providing their results to the Section. Although small-scale reports such as this cannot hope to give anything other than a flavor of what observing at any given time was actually like, they do give something of the human element back to the subject. Global analyses, while essential for our understanding of meteor activity in a way that data collected from a handful of sites in one or two countries can never be, can seem a little impersonal at times. Please do keep making and sending in your data, and clear skies to one and all.

References

[1] J. Rendtel, "Quadrantiden 1995—AKM-Ergebnisse im Überlick", *Mitteilungen des Arbeitskreises Meteore* 20:3, 1995, pp. 6–7.

[2] M. Langbroek, "The 1995 Quadrantid Maximum in the Netherlands", *WGN* 23:1, February 1995, pp. 20–22.

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