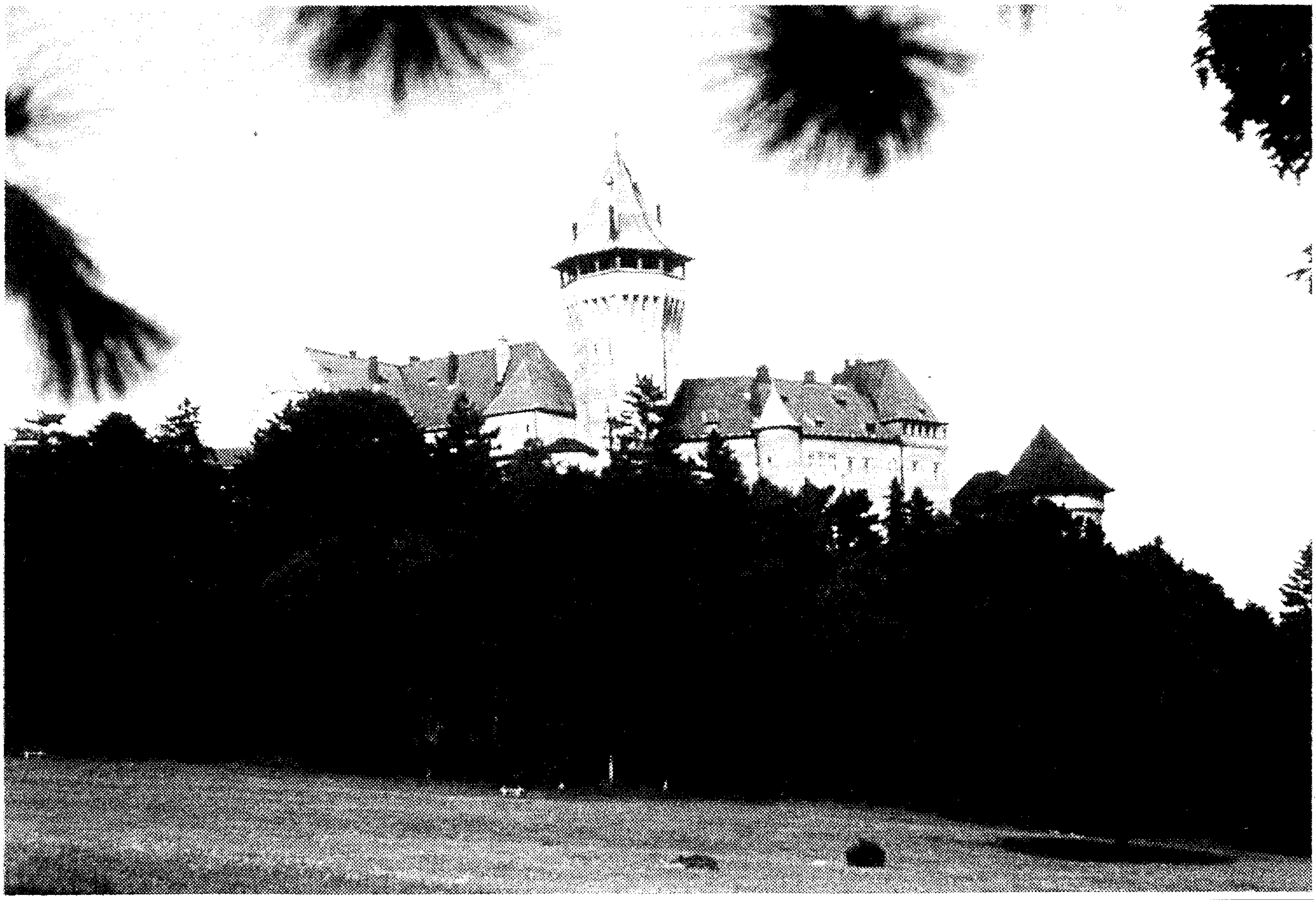
ISSN 1016-3115

wgn

20 - 4
august 1992

bimonthly journal of the international meteor organization



The castle of Smolenice, in the Lower Carpathian Mountains, 40 km north of Bratislava, is owned by the Slovak Academy of Sciences. It was the site of the 1992 *International Meteor Conference*, the most successful ever. Read more about this extraordinary event in this issue!

In this issue:
- The 1992 IMC in Smolenice
- Practical information for observers
- Observations of electrophonic fireballs
- Visual and radio observational results

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Useful Information

The October Issue *(WGN 20:5)*

The *October issue* is expected to be mailed during the first or second week of October 1992. Therefore, contributions are due *September 11*. They should be sent to *Marc Gyssens.*

WGN Subscription/IMO Membership 1992

The subscription rate for volume 20 (1992) is 25 DEM for six issues. Additional gifts are of course welcome. It is anticipated that volume 20 will contain over 240 pages.

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

Long-time WGN *readers may find it unusual to receive such a thin August issue; they should not forget, however, that we started this volume with three thick issues in a row. Therefore, as was already announced in the previous issue, this had to be a normal, 26-page issue. That it is still 2 pages thinner is due to a administrative document that had to be sent with this issue to the* IMO *members.*

Although financial considerations were the main reason to produce a normal issue now, we nevertheless received a rather small number of contributions for this issue, particularly when compared to the high number of articles that were sent to me during the first half of the year. I hope the rate of articles is going to pick up again shortly. In particular, I urge all observing groups to communicate to me—and thus, through the journal, to all your fellow-observers elsewhere in the world—the results you obtained during the northern-hemisphere summer.

Since the last issue appeared, we had the 1992 International Meteor Conference in Smolenice, Slovakia, ČSFR. Although you can read more about this extraordinary event elsewhere in this issue, I want to emphasize that it was beyond doubt the most successful IMC *ever. Especially the combination with a professional conference resulted in both the presence of a lot of professional meteor workers and a very international audience, with participants from all over Europe, but also from North America, Japan, and Australia. Several professionals were obviously very impressed by the work of* IMO. *Many new contacts were made while existing ones were further strengthened.*

I feel it to be my duty, however, to warn against too much euphoria. While we may be rightfully proud by what has been achieved during the first four years of the IMO*'s existence, a lot of work remains to be done. Although the* IMO *is fairly strong as far as visual work is concerned, the other disciplines of meteor work lag behind. As a consequence, a lot of potentially very useful results that might be achieved in photographic, radio, and video work remain wishful thinking at present. Also, the workload within the* IMO *is still shared by too few shoulders. As the* IMO *is an organization both for and by the members, each of you should give this a few thoughts: your organization needs committed meteor workers!*

Finally a few words about WGN. *The last* IMC *of course also gave the possibility to discuss the contents of the journal with several meteor workers. It was decided to have the refereed section as a regular item starting 1993. At the same time, arrangements were made to ensure that each issue of volume 21 will contain a global analysis of visual material. Meanwhile, we hope to be able to report about the 1992 Perseids in the October issue!*

Letters to WGN

compiled by Marc Gyssens

Observing put in practice

Every observer probably has developed his own solution to several of the practical aspects of observing. In the two letters below, George Zay describes his way of dealing with them.

Alertness is a very important aspect of meteor observing and plotting, and through the long eye-popping nights, it often becomes difficult to maintain. I have concluded that the more senses you can keep stimulated, the more alert you will be. We all have five senses (I think my wife has six. She always seems to know when I am going out for the night and leave her and the kids home while I do my "star-gazing.") A little trick that I do to help stay alert during my meteor observing is to observe with a partner. It does not matter if that partner looks up in the sky or not, just as long as he or she will talk to you or just grunt once in a while. Take your dog or cat with you. They do not talk, but wondering where Fluffy or Fifi went will help keep your mind active. You definitively do not want to lullaby your brain. Before I did meteor observing, I used to make 90 minute plus photographic exposures of galaxies, nebulae, and the sort through my telescope all the while making corrections as I kept it on track with my guide star. Now, this phase of astrophotography is about as exciting as watching grass grow, and it was easy to let the brain drift off every now and then. What I did here was listen to music while I tracked my star. When I do meteor observing, I want to get all I can out of each hour. So... I do simultaneous visual and radio observing! If you are lucky enough to have a source of electricity at your observing site, you can set your FM radio up and tune to that frequency that will give you meteor reflections. I noticed that if a meteor is visible, usually a radio reflection is also heard. So, I now have at least two senses on active duty here. Sometimes I think I saw something, but I am not so sure. If the radio gives off a reflection simultaneously, then the doubt is lessened.

Other things that help to improve your alertness is to add a few unknown variables... such as viewing in a field that has a 300-pound mean ram grazing nearby. I do my viewing at my father-in-law's place and they have this ram aptly named Rambo. You turn your back on him and without notice he will lower his head and butt you unexpectedly. This alone keeps you alert; but your total effective viewing will most likely be reduced somewhat. If you do not enjoy sudden attacks by an aggressive ram, pay a little attention to those strange noises in the brush or grass nearby. I recently did this. I knew these animals would not hurt me, but I wondered what they were all the same. The magnitude of everything seems to get bigger in the dark. After a couple of hours of insatiable curiosity, I stood up suddenly and it sounded like a stampede... it was! It was a stampede of about a dozen bunny rabbits that I startled while they fed.

Not long ago I went on a family back packing trip up in the Sequoia wilderness area in California. At an elevation of 9000 feet (that is 2300 meters for the rest of the world), the skies were very dark and inviting. It was a very strenuous hike and fatigue threatened to cut my night viewing short. But, the thought of numerous bears that frequent the area kept me clear-minded. And if I had any complacency about the bears, all I had to do was recall the notice, as I entered the park earlier, about what to do when attacked by a mountain lion. A few times during the night I reminded myself of that "Wizard of Oz" phrase: "Lions, tigers and bears... Oh My!" As it turned out, I had no trouble with local wildlife... but I was definitely alert and very clear-headed.

At that elevation, I had hoped there would be no mosquitos. I figured they would get at least altitude sickness or something. But they did not and they were big. I would have sworn some had aircraft tail numbers... the bottom line here is that they kept me too alert. But my wife's handy dandy bottle of mosquito repellent saved the day, or, I should say, night! There were a lot of them hovering about a foot above me, but they did not land. I felt like one of Dracula's potential victims wearing garlic.

I hope some of these ideas will improve alertness, thus accuracy in meteor plotting for someone else... or at least give you something to think about.

George J. Zay, July 2, 1992

As everyone knows, some nights during the long, tedious observing session, it may be somewhat difficult to get a fairly accurate fix on that meteor that just zipped by. I know a good percentage of the stars in the sky; but when I see a meteor and then take my eyes off that now invisible path to see exactly what stars are nearby and then try to find that same exact path again, I often find myself with doubt. Sometimes I'll say to myself, "Now did that meteor go to the left or right, above or below so and so star?" As I think about it, the doubt grows. Just as I thought I have a mental fix on the meteor's path, another doubt sometimes jumps out like a bogey man in the dark. Which way was that thing going? It's like having a mental arrow in the sky with its point in your hand. A little mental error here can make that thing travel 180° from where it did! After a few hours observing and many meteors behind you and even many different nights of observing in the past; it does not take much to start having you think about these possibilities. So... what I do to help reduce my confusion and errors is this: I simply hold a pencil in my hand with its writing end being the point of an arrow. The moment I see a meteor, I outstretch my arm and align the pencil to match the meteor's path, with the pencil point, pointing in the direction of the meteor's travel. While holding the pencil aligned, I then take my eyes off to see where in the sky I am exactly at and then plot it when I am sure of my fix. This helps me and it may help others who experience the same problems.

George J. Zay, July 2, 1992

The reappearance of P/Swift-Tuttle

*In last year's October issue (*WGN *19:5, pp. 181–184) we mentioned Dr. Marsden's hypothesis that the Perseids' parent comet P/Swift-Tuttle might be identical to comet Kegler, yielding a return in 1992. In a letter in* WGN *20:2, pp. 57–58, Andrey Grishchenyuk expressed scepticism towards Marsden's ideas, arguing the Perseids show periodic activity independent of the Comet's return. In a subsequent comment (same issue, pp. 58–59), Paul Roggemans argued that there is no evidence for periodic Perseid activity. Below is a reply by Grishchenyuk and Levina to Roggemans's comments.*

We were glad to read the good and detailed comments of Paul Roggemans about the existence of periodic Perseid activity. However, we do not agree with his comments and will be glad to continue the discussion. We fully agree that we have to be critical about "old" observations. We only analyzed observations made in the 20th century. I have two main comments:

Firstly, the structure of the Perseids must have a 12-year period. In [1], Hamid establishes that the shower passed 8 times the orbits of Jupiter, Saturn, Uranus, and Neptune.

Secondly, we present some details regarding the analysis reports of the observations we used:

- *1921:* Besides observations of Öpik, we have observations of some observers in the USSR. Astapovich gives a report of Feolynskiy: 5 observers observed 119 Perseids during 5 minutes! The conditions were average (limiting magnitude of 6.0). [2]
- *1932:* Olivier [3] saw hourly rates near 160 on August 12-13, 1932. This information was not confirmed by others.

- *1956:* We have observations from Simferopol and Ashkabad. The method of observation differs from *IMO*'s method, so we reconstructed the activity indirectly. In Simferopol, some observers watched the whole sky during photographic observations and mentioned meteors of magnitude 0 or brighter only (see Table 1). In Ashkabad, Astapovich and Terentjeva counted meteors in certain frames (double count). The observations in Simferopol were analyzed according to the method of Bel'kovich [4]. This method allows us to obtain the rate of meteors of magnitude +3 or brighter. The result can be seen in Table 2.

Table 1 – Cumulative magnitude distribution for the Perseids on August 11, 1956

Magnitude	−6	−5	−4	−3	−2	−1	0	+1	+2	+3	κ	S
Perseids	1	2	5	12	19	47	70	77	77	77	7.78	1.48

Table 2 – Values of N_z for the night of August 11-12, 1956, based on meteors of at least magnitude 0.

Time (UT)	N	T_{eff}	N_z	$\log N_z$
18^h30^m	7	1.00	303	2.48
19^h30^m	18	1.00	556	2.74
20^h30^m	17	1.00	383	2.58
21^h30^m	13	1.00	222	2.35
22^h20^m	10	0.67	210	2.32

- *1968:* We have a report from an observer in Yaroslavl, which indicates that the Perseids showed little activity then.
- *1980, 1991:* Good activity!

We examined the observations of 1921, 1932, 1956, 1968, 1980 and 1991. We found that the Perseid returns of 1921, 1956, 1980 and 1991 were extraordinary. The opposite phenomenon was observed in 1910. In this year, only 3–4 Perseids per hour were seen! Conclusion: We found 5 extraordinary Perseid returns: 1910, 1921, 1956, 1980 and 1991. Each time, the maximum occurred near solar longitude $\lambda_\odot = 139.^\circ1 \pm 0.^\circ1$ (Eq. 1950.0). Adding 1970 in this row instead of 1968, we have inserted yet another year with very high rates (ZHR = 200).

In the row above, we did not include the 1928 observations of the Perseids, but we cannot neglect the very high activity that occurred in that year. This phenomenon was observed in Tashkent on August 13-14, 1928. During one hour (21^h–22^h UT), six observers recorded a "rain" of Perseids: 2960 Perseid meteors! This number is even an underestimation, as the observers were inexperienced. In [5], the author mentioned the number of meteors for each one-minute interval, but other details are unknown. The meteors were about equally bright and the limiting magnitude was 5.5. Perseids ZHRs must have been at least 500–600. It is possible that the Earth met very big clouds of Perseids in that year. One problem remains: how were those clouds formed so far away from the associated comet?

[1] Hamid S., "The formation and evolution of the Perseid meteor stream", *Astron. J.* 56:5, pp. 126–127.
[2] Astapovich I.S., "Mirovedeniye", (in Russian).
[3] Lovell B., "Meteor astronomy", Oxford, 1951.
[4] Bel'kovich O.I., "The activity and structure of the Perseids", *WGN* 19:2, April 1991, pp. 53–58.
[5] Subbotin A.F., "Count of meteors, 1928, August 13", *Mirovedenye* 18:1, 1929, p. 53.

A. Grishchenyuk and A. Levina, May 13, 1992

A statistical note

Malcolm Currie has the following remark regarding a term used by Rainer Arlt in his article on the Radiant *program on p. 62 and following of* WGN *20:2.*

In his article, Rainer Arlt mentioned the term "probable error" without being able to define its meaning. This is an old-fashioned term, meaning the dispersion within which half the sample lies. In other words the true mean value of a sample is equally likely to lie beyond the observed mean plus or minus the probable error as within it. It is fortunately little used these days: fortunately because it corresponds to approximately 0.73 times the standard deviation for a normal distribution, and has been abused to make error bars appear smaller than they really are.

Malcolm J. Currie, June 20, 1992

The International Meteor Conference

Smolenice, Slovakia, ČSFR, July 2–5, 1992

Peter Brown and Trond Erik Hillestad

This year's *IMC* was organized in connection with the *International Astronomical Symposium "Meteoroids and their Parent Bodies"* which followed immediately after the *IMC* in the same building (the building being a magnificent castle owned by the Slovak Academy of Sciences and set in the foothills of the Lower Carpathian mountains, about 40 km north of Bratislava). This combination offered the rare opportunity to attend a wide variety of lectures and to see a number of amateur and professional meteor workers, to discuss our mutual interests.

In total over 70 participants attended the *International Meteor Conference.* Nearly the entire *IMO* Council was present: Peter Brown, Malcolm Currie, Marc Gyssens, Robert Hawkes, Masahiro Koseki, Detlef Koschny, Casper ter Kuile, Ina and Jürgen Rendtel, Paul Roggemans, Duncan Steel and Gabor Süle. Czechoslovakia was very well represented amongst the attending meteor workers as were Bulgaria and Germany. Several groups attended the *IMC* for the first time, and their presence greatly enriched the event, in particular, Anna Levina and Andrey Grishchenyuk from Crimea and Valentin Grigore from Romania.

Past *IMC*'s have traditionally had some professional involvement and this year's *IMC* was no exception. In fact, this amateur meteor conference likely had the largest retinue of professional meteor astronomers of any amateur conference yet held. As a result, this year's *IMC* saw more than half the lectures given by professional astronomers. The number and diversity of the lectures do not permit a complete description of each to be presented here and hence we will describe only a small "random" sampling of the talks.

The conference began with M. Currie giving a presentation on the results of some radiant analysis using the program *Radiant* from telescopic observations. He presented results from the 1990 Geminids and described some of the pitfalls he encountered in trying to derive radiant structure from the observations.

M. Šimek gave a detailed picture of the activity of several meteor streams as observed by the Ondřejov radar. In particular, Šimek described the activity of the Perseids which he showed to have a double peak in the radar profile from the last few years. He also pointed out other sources in the literature which indicate double and even multiple peaks for the Perseids from past years.

Continuing the Perseid theme at this year's conference, J. Watanabe presented the radar results of the 1991 Perseid outburst as seen by the MU radar located at Shigaraki, Japan. He showed that the outburst lasted only a couple of hours and that the activity was rich in large particles. From the radar records he concluded that the outburst had 3–4 times the flux of the regular Perseid peak.

D. Steel and G. Elford gave enjoyable talks about radar meteor work in Australia and New Zealand. The radar activities started in the early 1950s, with the first observation making use of an illegal transmitter to detect meteors. Today, the University of Adelaide group use 2, 6 and 54 MHz radars for meteor detection in addition to a modern over-the-horizon surveillance radar used occasionally at Jindalee in central Australia. With a transmitting power of 0.5 MW, it is one of the most powerful ever built, and able to detect meteor head echoes. Typical (body) echo rates during a shower are 10 meteors per second. The installation can detect meteors down to about magnitude 15, corresponding to a mass of roughly 0.2 micrograms. These meteors are all sporadic, and they tend to move in increasingly circular orbits as the echos get smaller. The main purpose of the Jindalee radar, however, is to detect small refugee boats in the ocean around Australia, thereby preventing exotic microbes and diseases from reaching the Australian continent.

P. Babadzhanov presented two interesting papers relating to meteor streams associated with P/Machholz and the density of meteoroids. He found that the Quadrantids, Arietids and several other smaller streams were genetically linked to P/Machholz and had evolved from the cometary orbit due to planetary perturbations over a long period of time. Babadzhanov also presented results from observations made in Dushanbe and linked these to a fragmentation model which suggested that the currently-accepted values for meteoroid densities were too small.

From the amateur corps, several *IMO* members presented results of ongoing projects. J. Rendtel presented evidence from visual plots of activity from the δ-Aurigids in September and October and was able to connect the shower to some photographic meteors listed in the *IAU* Meteor Data Center. He suggested from the orbits of the photographically determined members that there may be a connection to the Kreutz group of Sun-grazing comets, but this is still uncertain. A. Knöfel presented some results from the *FIreball DAta Center (FIDAC)* of *IMO*, and R. Koschack presented a novel method he invented to calculate spatial number densities of showers during times of very high activity (such as during the 1992 Quadrantids).

D. Koschny and K. Junghans presented early results from remote sensing in the Tunguska region.

Figure 1 – Peter Zimnikoval and Daniel Očenáš, the organizers of the very successful 1992 *IMC*.

Figure 2 – Of course, there were many Czechoslovakian participants to the last *IMC*. From left to right, we see Jiri Borovicka, Vladimir Znojil, Vladimir Padevet and Pavel Spurný.

Figure 3 – On Saturday afternoon, the *IMC* excursion brought us to the Driny cave. Waiting to enter the cave, the impressive delegation of the Varna Astroclub in Bulgaria is relaxing on a bench.

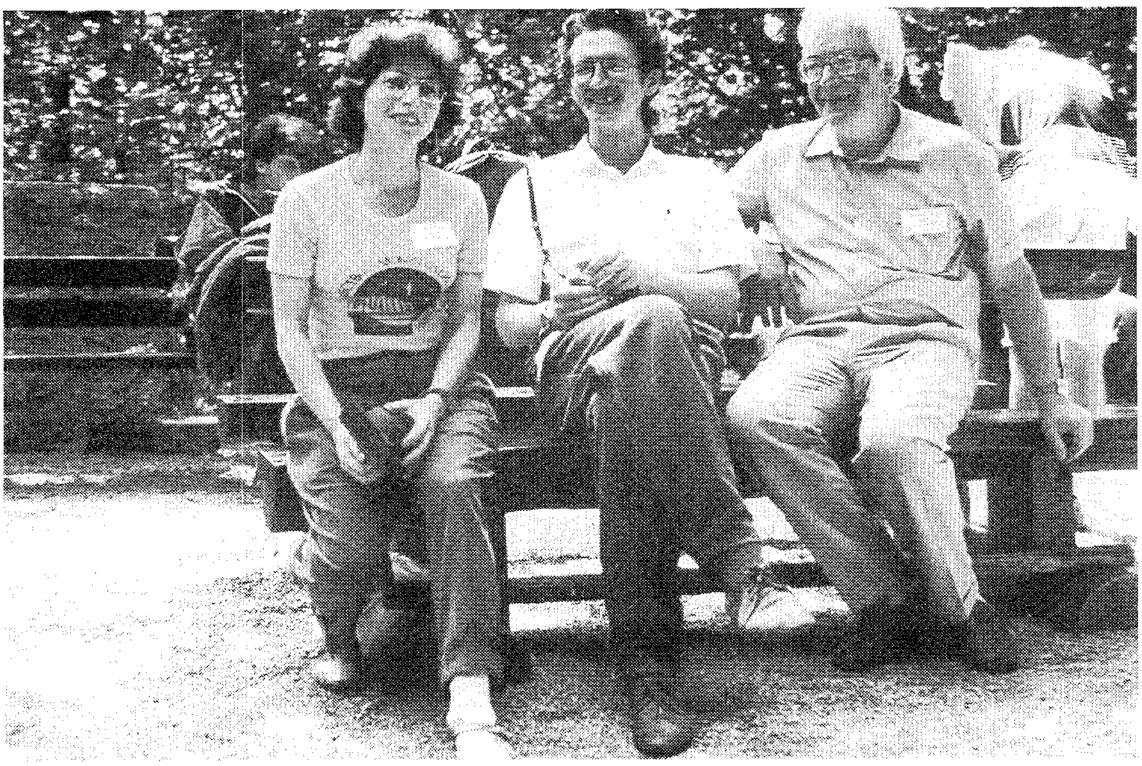

Figure 4 – Also waiting to enter the cave are Anna Levina, Andrey Grishchenyuk and Oleg Bel'kovich. Later that day, we also visited the Modra observatory. After the excursion and before the General Assembly, the organizers surprised us with an impressive banquet.

The true nature of what happened in this area in 1908 is still not clearly understood. Detlef and Karin hope that satellite data can help reveal the secrets of this region. By applying digital picture-processing techniques to multi-spectral scans of the area obtained with the *Landsat* remote sensing satellites, Detlef and Karin have found traces of an elliptical structure with young vegetation near the center of the region. Detlef cautioned against premature conclusions emphasizing that we do not know for sure how to interpret this finding. He concluded that remote sensing should be carried out in connection with a ground study of the area to better understand the region. This work is to be carried out by Karin, who left a few weeks after the *IMC* to travel to Tunguska to take ground pictures and soil samples.

In addition to the lectures several formal and informal discussions and workshops were held.

In this regard, the *IMO* General Assembly took place on Saturday evening. With the exception of a few people who unfortunately were not able to attend the conference, almost all Council Members and Commission Directors were present. During the past few years, the *IMO* has grown to be a strong organization. The general feedback from professionals reflected this fact and the overall health of the *IMO*, both financially and administratively was reported as being good. During the General Assembly meeting, the *IMO* members were informed that Ann Schroyens and Gabor Süle had resigned as Council members.

A workshop on radio work by amateurs was held on Friday evening. The input of several professional radio meteor astronomers proved helpful in outlining a coherent strategy for obtaining scientifically useful data from radio observations. Emphasis was made of the fact that radio forward scatter observations are affected by a large number of factors such as upper-atmospheric conditions, Faraday rotation and numerous geometrical effects. As a result, small to moderate increases in echo rates from one station cannot be directly interpreted as an increase in activity from a given meteor stream. Additional work will be done in this regard to permit amateur radio workers to more fully contribute to meteor science.

Also on Friday, a demonstration of the software *Radiant* was given and a workshop on visual observations was held with R. Koschack chairing the session.

As well, during the *IMC* and carried over to the *IAS* in the following week was extensive discussions of the amateur-professional relationship in meteor astronomy. This was also the first chance for the *IAU 22 Working Group on Amateur-Professional Cooperation* to meet and no less than three times in the next week did the group convene to discuss various issues. From all the discussions, several concrete proposals were made. The highest priority was given to the construction of an *IAU*-approved radiant list. Since much headway has been made in the international standardization of meteor work in the past few years, this was seen as a logical continuation of the process. The radiant list is to be broken up into a working list with well-established meteor showers which may be used by visual observers and a more complete list to contain single observation showers, periodic streams and smaller minor showers for which sufficient observational evidence exists. The list is to be ready in time for the 1994 *IAU* General Assembly to be held in the Netherlands. The Working Groups also proposed closer cooperation between radio amateurs and professional radio meteor astronomers to help the former carry out useful scientific programs of research.

The *IMC* provided much opportunity for informal contact amongst the participants and many people met at this conference for the very first time. The discussions and the hospitality were superb. In particular, the organizing committee of the event led by D. Očenáš is to be heartily congratulated for a tremendous job and their flawless execution of the event can serve as a good model for future *IMC*s.

Electronic-Mail Addresses for Some Meteor Workers

compiled by Peter Brown

Below is a working list with the e-mail addresses of various people working in all different aspects of meteor astronomy. Only InterNet and Bitnet addresses have been given.

Name	*Country*	*E-mail address*
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Visual Observers' Notes: September–October 1992

Jeff Wood

1. Introduction

Following the excellent activity of the previous two months, observers tend to feel let down when rates return to normal during September and October. Because of this, nowhere near as much observational work has been carried out during this time even though there is much to see.

Table 1 – A list of meteor showers to be seen during September and October 1992.

Shower	Activity	Maximum		Radiant			Drift		V_∞	r	ZHR
		Date	$\lambda_\odot$	α	δ	Diam.	$\Delta\alpha$	$\Delta\delta$			
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
δ-Aurigids	Sep 05–Oct 10	Sep 10	166.°7	60°	+47°	5°	+1.°0	+0.°1	64	3.0	7
Piscids S	Aug 15–Oct 14	Sep 21	177.°7	8°	00°	8°	+0.°9	+0.°2	26	3.0	3
κ-Aquarids	Sep 08–Sep 30	Sep 22	178.°7	339°	−02°	5°	+1.°0	+0.°2	16	3.0	3
Capricornids (Oct)	Sep 20–Oct 14	Oct 03	189.°7	303°	−10°	5°	+0.°8	+0.°2	15	2.8	3
σ-Orionids	Sep 10–Oct 26	Oct 05	191.°7	86°	−03°	5°	+1.°2	0.°0	65	3.0	3
Draconids*	Oct 06–Oct 10	Oct 10	197.°0	262°	+54°	5°			20	2.6	storm
ε-Geminids	Oct 14–Oct 27	Oct 20	296.°7	104°	+27°	5°	+1.°0	0.°0	71	3.0	5
Orionids	Oct 02–Nov 07	Oct 21	208.°4	95°	+16°	10°	+1.°2	+0.°1	66	2.9	25
Taurids S	Sep 15–Nov 26	Nov 03	220.°7	51°	+13°	10°/5°	Table 6		27	2.3	10
Taurids N	Sep 13–Dec 01	Nov 13	230.°7	59°	+23°	10°/5°	Table 6		29	2.3	8
Puppid/Velids	Oct 15–Jan 22	several		120°	−45°	20°/5°			40	2.9	

Table 2 – Moonlight and observing conditions in September–October 1992.

Date	k	Date	k
Friday August 28	0.00–	Friday October 2	0.35+
Friday September 4	0.51+	Friday October 9	0.93+
Friday September 11	0.99+	Friday October 16	0.82–
Friday September 18	0.69–	Friday October 23	0.11–
Friday September 25	0.03–	Friday October 30	0.19+

New Moon:	August 28, September 26, October 25
First Quarter:	September 3, October 3, November 2
Full Moon:	September 12, October 11, November 10
Last Quarter:	September 19, October 19, November 17

Table 1 gives a list of the active showers that occur in these months and Table 2 shows the observing conditions moon-wise. 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.

For more details, we refer to the *IMO 1992 Meteor Shower Calendar*. Here we highlight some of the showers visible during September and October.

2. Southern Piscids

This weak ecliptic stream is active from August 15 through to October 14. Rates are generally one or two meteors per hour, but on occasions have passed 5 per hour around the maximum which occurs on September 21. With a Full Moon occurring on September 12, the Piscids can best be observed under dark sky conditions from the southern hemisphere during the periods September 1–6 and September 19–October 6. Observers should face the radiant area and plot all Southern Piscids seen taking care to distinguish them from the sporadic background. In particular, the angular velocity must be taken into account.

Table 3 – Radiant positions of the Southern Piscids.

Date	α	δ	Date	α	δ
Sep 15	0°	−02°	Sep 30	13°	+01°
Sep 20	4°	−01°	Oct 05	17°	+02°
Sep 25	9°	00°	Oct 15	26°	+04°

3. κ-Aquarids

This minor ecliptical stream has an activity period from September 8 to 30. It reaches a maximum ZHR of 3 on September 22. Since its period of activity and its radiant position is similar to that of the Southern Piscids, both showers can be observed simultaneously. In 1992, the Full Moon on September 12 means that the κ-Aquarids can be observed under dark sky conditions from September 17 to 30. Southern hemisphere observers should make their center of field of view somewhere around $\alpha = 345°$ to $0°$ and $\delta = -20°$ to $+20°$. All possible shower meteors should be plotted. Shower association should be carried out very carefully taking note of direction of travel, path length and appropriate angular velocity.

4. 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 in speed to the Perseids. Intending observers should take into account that the radiant reaches its greatest elevation during the latter part of the night. At maximum, the Moon is at New Moon phase and so there will be dark skies. Unless the α-Aurigid maximum exceeds a ZHR of 10, all possible shower members should be plotted. Observing fields should be centered no further than 10° from the radiant.

5. October Capricornids

The October Capricornids were discovered in 1972 and provide variable activity from year to year. They are active from September 20 through to October 14 with an overall maximum on October 3. With a Full Moon on September 12, the maximum period of their activity will have dark skies. Intending observers should ensure that they face the radiant position and plot all possible shower meteors. Care should be taken in identifying these meteors.

6. Comet Findlay radiant

Observations during September and October have indicated that there is some evidence of meteor activity from the area of the predicted Comet Findlay radiant. Although there will be some interference from the Moon during mid October, southern hemisphere observers are requested to make observations of the Comet Findlay radiant a priority in 1992. Since they can be observed simultaneously with the October Capricornids, southern observers should endeavor to monitor both. To do this they should have a center of field of view situated around $\alpha = 285°$ and $\delta = -20°$. which is midway between both shower radiants. The Comet Findlay radiant should be monitored from September 20 through to October 6. The radiant area is from $\alpha = 260°$ to $280°$ and $\delta = -30°$ to $-42°$. All possible shower members should be plotted and great care should be taken in identifying any meteors coming from the radiant area as such.

7. σ-Orionids

This shower is active from September 10 through to October 26. Its maximum ZHR of 3 meteors per hour occurs on October 5 which means that the Moon does not interfere with the strongest period of activity in 1992. The σ-Orionids have their radiant in the Belt of Orion and so after maximum great care needs to be taken to distinguish them from the October Orionids. This year, the *IMO* is particularly interested in the σ-Orionid activity profile for the period September 21 to October 7 when the skies should be moon-free. Observers in both hemispheres should watch during the last few hours before sunrise and have a center of field situated no more than 30° west or northwest of the radiant. All possible shower members should be plotted and care taken in identifying them.

Table 4 – Radiant positions of the σ-Orionids.

Date	α	δ	Date	α	δ
Sep 15	71°	−03°	Oct 15	93°	−03°
Sep 25	79°	−03°	Oct 25	101°	−03°
Oct 05	86°	−03°			

8. Orionids

This major shower has favorable Moon conditions in 1992 and is a must on the meteor observer's calendar. The Orionids have a complex radiant structure with the center of activity being located just north of the star Betelgeuse at maximum. The Orionids are associated with Comet Halley and, like the η-Aquarids, display a plateau-like maximum. This can vary from year to year but is generally from October 20 to 25. The Orionid maximum occurs on October 21 with a ZHR that is usually in the range of 20 to 30 meteors per hour. Orionids are best observed during the latter part of the night when the radiant altitude rises above 20°. They are observable in both hemispheres and all possible Orionid meteors should be plotted unless the ZHR exceeds 10. Thereafter, classified counts may be taken.

Table 5 – Radiant positions of the Orionids.

Date	α	δ	Date	α	δ
Oct 10	80°	+14°	Oct 25	98°	+15°
Oct 15	86°	+15°	Oct 30	104°	+16°
Oct 20	92°	+15°			

9. Taurids

This shower is broken up into several substreams, the most important of which are called the Northern and the Southern Taurids respectively. The Taurids have one of the longest periods of activity known and last from September 13 through to December 1. They reach a broad maximum in late October and early November. The maximum of November 3 (Southern Taurids) and November 13 (Northern Taurids) given in the radiant list were derived from radio meteor and photographic meteor orbital elements and not visual observations. The latter give an uncertain picture. At maximum, Taurid activity is often very erratic with rates ranging from 1–2 meteors per hour to as high as 10 or 15 meteors per hour.

In September and October, the Taurids are best observed during the middle and latter parts of the night. They are noted for their many fireballs. These are frequently yellow and orange in color, but all of the other colors are also well represented. This together with their relatively low geocentric velocity means that they can be recorded more easily on film than most other showers. Perhaps you could try and photograph some for the *IMO Photographic Meteor Database*.

Since they have a great longevity of activity, the Taurids have parts of their activity period moon-free and others greatly affected by the Moon. They can be easily seen from both hemispheres. When observing the Taurids, all possible shower members should be plotted. In order to distinguish meteors from the both branches the center of field of view should be located between 20° and 40° east or west of the radiant at the same declination.

In September the most favorable center of field of view is around $\alpha = 0°$ and $\delta = +10°$ to $+15°$. This way, κ-Aquarid, Southern Piscid, Northern Taurid and Southern Taurid radiants can all be observed simultaneously. In October the most favorable field of view is located at $\alpha = 80°$ and $\delta = +20°$ which enables both the Taurid radiants together with the Orionid, σ-Orionid and the ε-Geminid radiant to be monitored at the same time. The *IMO* is particularly looking to obtain Taurid ZHR profiles and to investigate the population index during the 1992 Taurid watch.

Table 6 – Radiant positions of the Taurids.

	Taurids North		Taurids South	
Date	α	δ	α	δ
Sep 20	29°	+16°	25°	+10°
Sep 30	37°	+17°	29°	+10°
Oct 10	41°	+18°	36°	+10°
Oct 20	46°	+19°	41°	+11°
Oct 30	51°	+20°	48°	+13°

10. ε-Geminids

This shower is active from October 14 to 27 with a maximum of 5 meteors per hour on October 20. As with the Orionids, Moon conditions are favorable in 1992 and the shower is to be targeted for investigation by the *IMO*. The ε-Geminids can be seen during the last few hours before sunrise in both hemispheres where they often produce fast blue or white trained meteors. The ε-Geminids have angular velocities similar to those of the Orionids and the table in the preceding article should be consulted when identifying possible shower members. The ε-Geminids should only be observed when the radiant reaches an elevation of 20° or more.

All possible shower members should be plotted. In order to effectively distinguish Orionids, σ-Orionids, Taurids and ε-Geminids, the center of the observer's field of view must be located around $\alpha = 80°$ and $\delta = +20°$.

Erratum

Marc Gyssens

There was a very unfortunate error in my comment in the previous Visual Observers' Notes. The first Perseid peak was predicted for August 11, 22^h UT, not *August 12! We hope the error did not cause too much confusion. We also intend to report in the next issue whether or not the first peak reoccurred.*

Telescopic Observers' Notes: September–October 1992

Malcolm J. Currie

At the *Meteoroids and their Parent Bodies* Symposium there was a strong contingent of *Nippon Meteor Society* observers present. In one of their poster papers, by Masahiro Koseki, mention was made of a minor shower seen during late May, believed to be associated with Comet IRAS-Araki-Alcock and which has a radiant between Vega and the Hercules keystone. Regular readers will recall that Mark Vints found a compact radiant in 1990 at $\lambda_\odot = 67\overset{\circ}{.}5$. The fact that in Japan it has been recorded by radio, only by some visual observers, and not photographically, supports the view that the shower has a high population index, and is suited to telescopic investigation. In 1992, I was able to observe the shower at $\lambda_\odot = 69°$ from $\alpha = 272°$ and $\delta = +37°$ giving rates comparable to the sporadic background. There was no evidence of activity at $\lambda_\odot = 65°$ or $\lambda_\odot = 76\overset{\circ}{.}5$ in Chris Hall's hour-long watches (8.5 x 44 binocular, $8\overset{\circ}{.}2$ field). The IRAS-Araki-Alcockids is a bit of a mouthful—I suggest that the shower be called the θ-Herculids. I should be interested to receive any telescopic or visual plots from late May early June for this year or earlier years to learn more about this shower.

Chris Hall made additional watches during February and March totaling 4.52 hours. Virginids were only apparent on February 28-29, but given their low rates, an hour per night is not long enough to be confident that the shower is inactive from a null observation. One other interesting sighting was that of two meteors seen five seconds apart traveling in parallel paths separated by 0°.7 on March 31, 23^h15^m UT.

Contact has been made with groups in Bulgaria and Croatia. They are keen to participate in the Telescopic Commission's program. Already Gordan Bartolić of the Astronomical Society of Čakovec has submitted 1989 Perseid observations that give support to Mark Vints's Perseid subradiant. [1]

1. Forthcoming events

September is not known as a meteor month because it lacks the pulling power of a major shower. It is only recently that showers like the δ-Aurigids have been drawn to our attention. Yet there are a number of minor radiants worthy of scrutiny, and the sporadic rates are at their annual best.

The *δ-Aurigids* are fast-moving meteors. They form an established minor stream of long duration that appears to have some radiant structure and multiple maxima from the substreams. It would be beneficial to combine telescopic data with visual plots [2], and to correlate with the filaments identified by Gary Kronk mostly from radar orbits [3].

Besides the δ-Aurigids, other radiants are present in this region during September and October, such as those apparently in Michael Nolle's telescopic data, and the *September Perseids* whose radiant lies 5° south of the δ-Aurigids in the visual data [2]. Dirk Artoos requested data around September 27–30 to correlate with a peak in radio reflections [4]. This may simply have been caused by the δ-Aurigids, but we should look. It is best to avoid preconceptions and make observations on each clear dark night. From careful plots it should be possible to disentangle the various radiants in the Auriga sector.

At the start of the month the swift and faint *β-Cassiopeids* seen in 1988 [5] have yet to be confirmed. Combined watches with the α-Aurigids and δ-Aurigids are possible, but at least three field centers are needed. Some suggested centers are the following: $\alpha = 52°$, $\delta = +60°$; $\alpha = 43°$, $\delta = +39°$; and $\alpha = 23°$, $\delta = +41°$. Before around 23^h local time, it may be necessary to select fields at a higher elevation, e.g., $\alpha = 348°$ and $\delta = +74°.5$.

To my knowledge, telescopic data for the *κ-Aquarids* are virtually non-existent. The Moon will be around Last Quarter at maximum, so watches can be undertaken before midnight local time. Particularly desirable are watches made by southern observers where the radiant attains a respectable altitude. κ-Aquarids should be readily distinguishable from the sporadics by their low velocity—the second lowest on the *IMO* list.

Moving to October, it is that time again where some pundits are suggesting that there may be enhanced *Draconid* activity. Previous predictions for a storm, such as in 1972, only disappointed observers. However, in 1985 a burst of two hours' duration was detected [6]. If there is a similar outburst in 1992 at the same solar longitude, its appearance would be on October 8.2, so favors western North America. It is certainly worth making watches throughout the night of October 7-8, even though the radiant grazes the horizon towards dawn.

The *Orionids* are a "must" for the telescopic observer because of their complicated radiant structure. See [7] for details. Although moonlight interferes until October 21, there is still a week of fascinating activity to monitor and correlate with the various sub-centers.

There are several minor showers during October. In 1992, the *σ-Orionids*, *October Capricornids* and *ϵ-Geminids* are well-placed. The last is observable during the Orionids. The first two can be studied in early October. Concentrate on the Capricornids before midnight and the σ-Orionids after.

References

[1] M. Vints, "A New Telescopic Perseid Subradiant?", *WGN* 16:5, October 1988, p. 171.

[2] J. Rendtel, "The δ-Aurigids", presented at the *IMC* at Smolenice, Slovakia, ČSFR, 1992.

[3] G.W. Kronk, "Meteor Showers: a Descriptive Catalog", Enslow, Hillside, NJ, 1988, pp. 185–188.

[4] D. Artoos, "Enhanced Activity around September 27–30", *WGN* 17:4, August 1989, p. 121.

[5] M.J. Currie, *BAAMS Newsletter* 30—*Telescopic Appendix*, 1988.

[6] B.A. Lindblad, "The 1985 Return of the Giacobinid Meteor Stream", in *Proc. 20th ESLAB Symposium on the Exploration of Halley's Comet*, 1986, pp. 229–231.

[7] M.J. Currie, "Telescopic Observers' Notes: 1990 November-December", *WGN* 18:5, October 1990, pp. 180–182.

Fireballs and Meteorites

Observations of Electrophonic Meteor Fireballs

S.F. Maslenitsyn and M.A. Voronina, Yaroslavl Pedagogical Institute

Observations of electrophonic fireballs collected by the authors and not published in electrophonic fireball catalogues are described.

The present article contains descriptions of the observations of electrophonic meteor fireballs which were gathered by the authors and were not included in the existing catalogues of electrophonic meteor fireballs. This information on electrophonic meteor fireballs provides useful observational material for the research of the electric and electromagnetic phenomena in meteor astronomy which so far have not sufficiently been studied. Of particular interest are therefore electronic phenomena the nature of which is closely connected with electromagnetic processes accompanying the flight of a meteor fireball in the Earth's atmosphere.

Every observation of electrophonic meteor fireballs is supplied with the date, the time (local), the place of the observation, the observer, a description of the meteor fireball and the nature of anomalous sounds according to the observer's words, and the reference.

1. *1957, the end of October, about 8^h p.m., Yaroslavl region, Nekouz area, the village of Kalinovtsy, observed by P.I. Pakhomov.*

   "On a moonless and clear evening, a meteor fireball of fiery color with a tail and a head of about $20''$ maximal size flew from east to west, nearly through the zenith. At the beginning of its trajectory, it quickly grew in size. The duration of the flight of the meteor fireball was about 5–6 seconds. When it crossed the zenith, the observer heard a rustle and noise as if it came from a shell."

   (P.I. Pakhomov's letters, February, 18, 1991; May, 30, 1991)

2. *1975, the beginning of August, Saturday or Sunday, 10^h30^m – 11^h00^m p.m., Brest region, Lupinets area, the village of Yazvinky, observed by N.D. Brodnitsky.*

   "A soft hissing rustle came from the sky and grew into a cracking noise or vice-versa. It made me look up into the moonless night. At the same time, I saw a flash of a meteor fireball which was flying from the south-east at a height of about 70–80° with the size of 2–3 Polar Stars. At this moment, our dog as well as the dogs in the village started barking. The sound reminded that of a DC welding and stopped immediately as the meteor fireball disappeared. The duration of the flight was 1–2 seconds. The meteor fireball disappeared from sight above. There was neither sparking nor crushing. The color was white and blue like that of an electric welding arc."

   (N.D. Brodnitsky's letters, March, 19, 1991; April, 17, 1991)

3. *June, 2, 1982, about midnight, Kirghiz SSR, Talass region, the village of Togtogul, observed by R. Zulpukarova.*

   "We were looking at the sky in the evening. Suddenly above our heads, a bright lemon-colored luminous ball crossed the sky from the south to the north-west as if it had broken away from something. The ball was spreading firework—like sparks. During the flight one could clearly hear a cracking hissing. The sparks spread far away, then gradually ended closer to the ball, and finally everything disappeared. The flight lasted about 8 seconds."

   (R. Zulpukarova's letter, June, 5, 1982)

4. *June, 22, 1982, about 11^h p.m., Kazakh SSR, Karatal region, 24 km from the village of Dzshambul, observed by L.E. Scherbin.*

   "We were in the steppe 24 km from the village with chabans (shepherds). Suddenly, my friend saw a fireball. He was facing the fireball while I was standing with my back to it. I turned around immediately and saw a nearly horizontally-flying meteor fireball. It was hissing and bursting. The sparks flew away from it and the most interesting fact was that during this flight the front part broke away and flew forward with a velocity exceeding that of the body of the meteor fireball. The color of the light it produced was bright white, but not that bright that it was impossible to look at it. Perhaps this was due to the fact that the sky background was still lit by the rays of the set Sun. I traced its trajectory. When it came to the ground I didn't hear any explosion or stroke. Its velocity was less than that of regular meteor fireballs. During the flight one could see that the meteor fireball was obviously slowing down."

   (L.E. Scherbin's letter, September, 8, 1982)

5. *July, 31, 1982, 10^h54^m p.m., the city of Abakan, observed by A. Korobtsov.*

   "A meteor fireball flew from the west to the east nearly horizontally at an angle not exceeding 5°. The sound appeared after the meteor fireball disappeared, 0.5–1 second later. The duration of the flight was nearly 2 seconds."

   (A. Korobtsov's letter, October, 4, 1983)

6. March, 24, 1990, Saturday, 7^h p.m., Kostroma region, Galich area, the village of Kabanovo, observed by I.Z. Basyrov.

   "From the corner of my eye, I saw a meteor fireball flying in the cloudless sky. It was very windy. At the same time, I heard a crackle and hissing which were reminiscent of the sounds of firewood burning in a stove or Bengal light. The power of the sound was nearly three times less than that of an electric shaver. The sparling meteor fireball had a bright white color and was observed during 2–3 seconds. It flew from the north-west at a height of 45° to the north-east to a height of 25°. The sound was coming from the meteor fireball during the whole flight and caused a feeling of anxiety and uneasiness."

   (I.Z. Basyrov's letters, October, 2, 1991; December, 28, 1991; January, 15, 1992)

Visual Observational Results

1991-92 Winter Observations from the ALPO

Robert Lunsford

A summary is given of the observational results obtained by the *ALPO* Meteor Section during the 1991-92 winter season.

Ten different observers counted 754 meteors during 102.47 hours of observing on 33 different nights this past winter season. This is a significant improvement over 1991 when only 5 observers counted 177 meteors in 27.6 hours on 11 different nights during the same season.

As expected, the morning of January 4 provided a majority of the data with 341 Quadrantids and 71 sporadics being seen during 14.55 hours of observing time that morning. The highest rates were seen from the east coast of North America where one observer counted 52 shower members between 8^h47^m and 9^h47 UT. By the time the radiant had risen for west coast observers, only a fraction of the intense activity seen by European observers remained.

Minor showers that were well covered during this period included the δ-Cancrids, δ-Leonids, and Virginids.

The 1991 Geminids in Hungary

István Tepliczky and Péter Spányi

In mid-December 1991, Hungarian amateurs observed the maximum of the Geminids under favorable conditions. Nearly 4000 meteors were recorded during four very cold but clear nights. An unusual fireball event on December 11, $22^h51^m20^s$ UT, is described.

In Hungary, the winters are generally misty and cloudy. This is the reason why only few valuable results can be archived about the winter streams. Last December, however, featured some wonderfully clear nights, following a cold front.

A small observing exercise was organized to observe the shower, at Kötcse (46°45′ N, 17°52′ E), the observing site of the Hungarian Amateur Astronomical Society. On December 11, only two observers started to work; on the following three nights 4–7 persons performed observations. The temperature was below −10°C, so we needed special equipment and endurance to stay outside for 4–7 hours per night. In the first night, we plotted the meteor paths. The estimated radiant position is $\alpha = 111°$ and $\delta = +32°$, calculated by György Szolcsányi.

Due to the large number of meteors, they were merely counted the following nights, according to the *IMO* standard. The time measurement and registration of the data had to be centralized, due to the difficult circumstances. This was well organized, so the observation was running efficiently. The following table summarizes the statistics of the camp. During four nights, 1634 different meteors were seen (many meteors were seen by several observers).

Table 1 – Numbers of meteors seen during the 1991 Geminid campaign.

Night (Dec)	Period (UT)	T_{eff}	Nr. Obs.	Met.	Lm
11-12	22^h20^m–04^h20^m	12.0	2	155	6.2
12-13	22^h00^m–04^h00^m	30.0	5	826	6.5
13-14	00^h30^m–04^h30^m	22.0	5	1263	5.8
14-15	23^h15^m–05^h00^m	36.7	6	1760	6.5

The average brightness of the observed meteors was magnitude +2.7; the population index was 3.43.

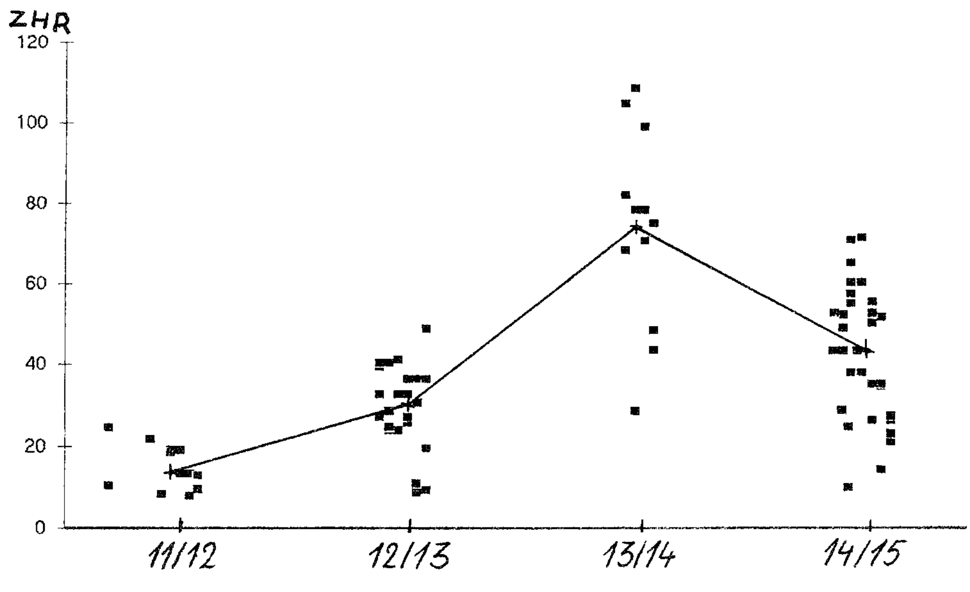

Figure 1 – 1991 Geminid ZHR estimates based on Hungarian observations.

In the first half of the third night, the sky was covered by thin cirrus clouds, so only a shorter observation was carried out that night. The last night yielded the highest number of meteors in spite of the decreased activity of the Geminids (but the limiting magnitude was better). Figure 1 shows ZHR estimations calculated from the raw data (the points connected with lines represent night averages).

Between December 11 and 19, János Szűcs carried out radio meteor echo countings every morning in Makó, between 5^h00^m and 5^h30^m UT (technical data: 9-element Yagi antenna with amplifier, 88.3 MHz, 120° azimuth, 0° elevation). The result of the observation series can be seen in Figure 2. It seems to be worth-while to start the radio work at least 10 days before the expected maximum, and to continue for another 10 days after the maximum. We cannot know whether the high peak in the morning of December 11 was produced by the Geminids.

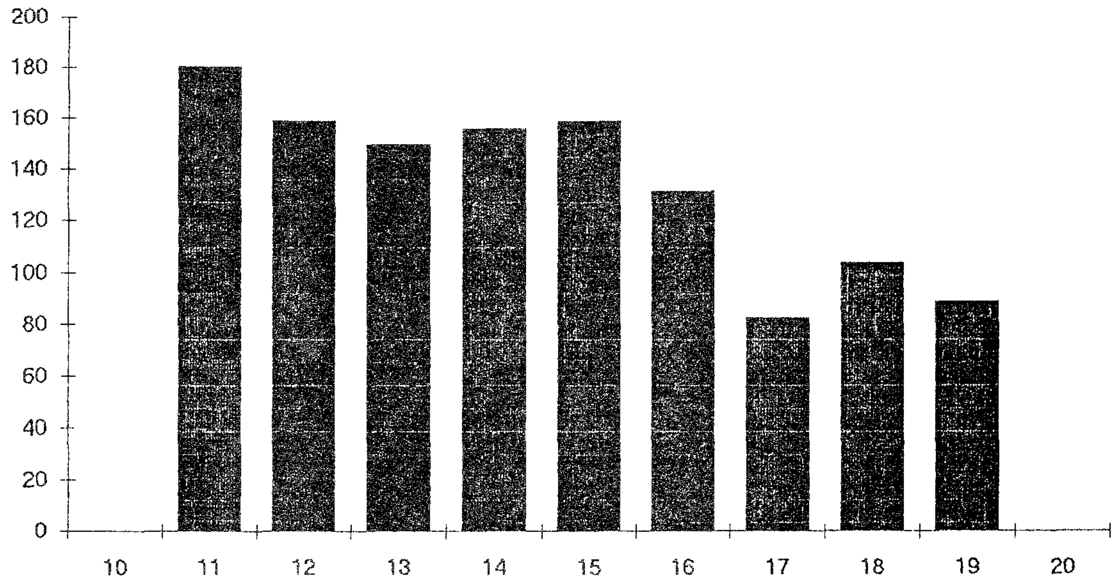

Figure 2 – Radio observations by János Szűcs from December 11 to 19, between 5^h00^m and 5^h30^m UT.

Finally, we should mention a fireball event which is unrivaled in our experience of more than 20 years of meteor observations. On December 11, at $22^h51^m20^s$ UT, the sky suddenly became bright with a definitely greenish color. One could read a book in its presence, it was so bright! The rise and fall time of the event was about a second. We immediately started to search for the fireball in the sky, which may have caused the light, but we found neither the fireball, nor its train. We had a clear view in every direction and a perfect sky. This means that the fireball might have exploded below the horizon, or very close to it. In this case, however, it must have been very bright. Is there anybody else who saw it? The phenomenon was seen by two observers (SARKR and TEPIS).

The 1992 η-Aquarids in Crimea

A.I. Grishchenyuk

A summary is given of the 1992 η-Aquarid observations in Simferopol, Crimea.

The η-Aquarids were observed in Simferopol from May 2 till 7, 1992. In total, 25 η-Aquarids were observed during 8 hours. In the night of May 5-6, we suspected a minor shower near μ Cygni, at $\alpha = 21^h20^m$ and $\delta = +33°$, with a diameter of 3°. From this radiant, we saw 4 weak, red-colored meteors in a period of 1.5 hour.

The 1992 Quadrantids in Sliven, Bulgaria

Peter Dalakov and Ivanka Getsova

On overview is given of Bulgarian 1992 Quadrantid observations. High activity was seen in the early morning of January 4.

It is always exciting to observe a given shower for the first time, and since the Quadrantids have not been an object of our attention before, we started the 1992 meteor campaign in Sliven by observing that shower.

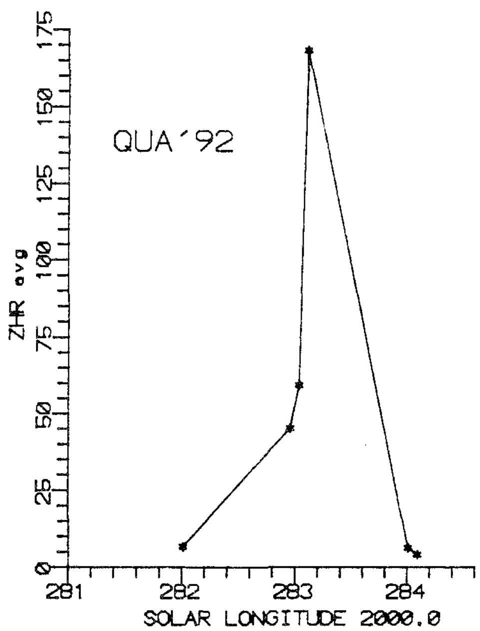

Figure 1 – ZHR estimates.

The observations were held during a three-day period: January 2-3, 3-4, and 4-5. The participants in the campaign were Kremena Baltova (`BALKR`), Ivanka Getsova (`GETIV`), Krasimir Manov (`MANKR`), Atanas Nikolov (`NIKAT`) and Peter Dalakov (`DALPE`). During the observations, the data have been written down by a secretary in the person of Daniela Savova. Through the first night, the shower did not offer us something interesting, and each of us saw (on average) about 5 or 6 Quadrantids. Nevertheless the observation was not boring, for, despite the clear skies and the comparatively warm weather, there was wind, strong enough to offer us the thrill of chasing Atlas Brno charts round the observation site.

On the following night, the weather was perfect, and so was the shower. The number of meteors rapidly increased with the approach of dawn. This magnificent firework was comparable to the 1991 Perseids. You can imagine the hard work of the secretary, who had to cope with 5 or 6 meteors per minute. Sadly, the average magnitude of the meteors was only +2.51. At 4^{h} UT, the observation was over.

We wondered whether it would be cloudy over Western Europe, and hoped the other *IMO* members would see the real maximum.

The next night, the meteor rate was again quite poor, so serious conversations about the anatomy of Ursa Major were held.

Radio Observational Results

The Quadrantids from 1989 to 1992

Cis Verbeeck

Around-the-clock radio observations of the 1989–1992 Quadrantids from Urania, the Public Observatory of Antwerp, Belgium, are analyzed and compared. Some tentative conclusions regarding the maxima of this shower are proposed.

The observing team from Urania, the Public Observatory of Antwerp, observed the latest four returns of the Quadrantid stream with a 5-element Yagi antenna on a frequency of 66.39 MHz. These are their results.

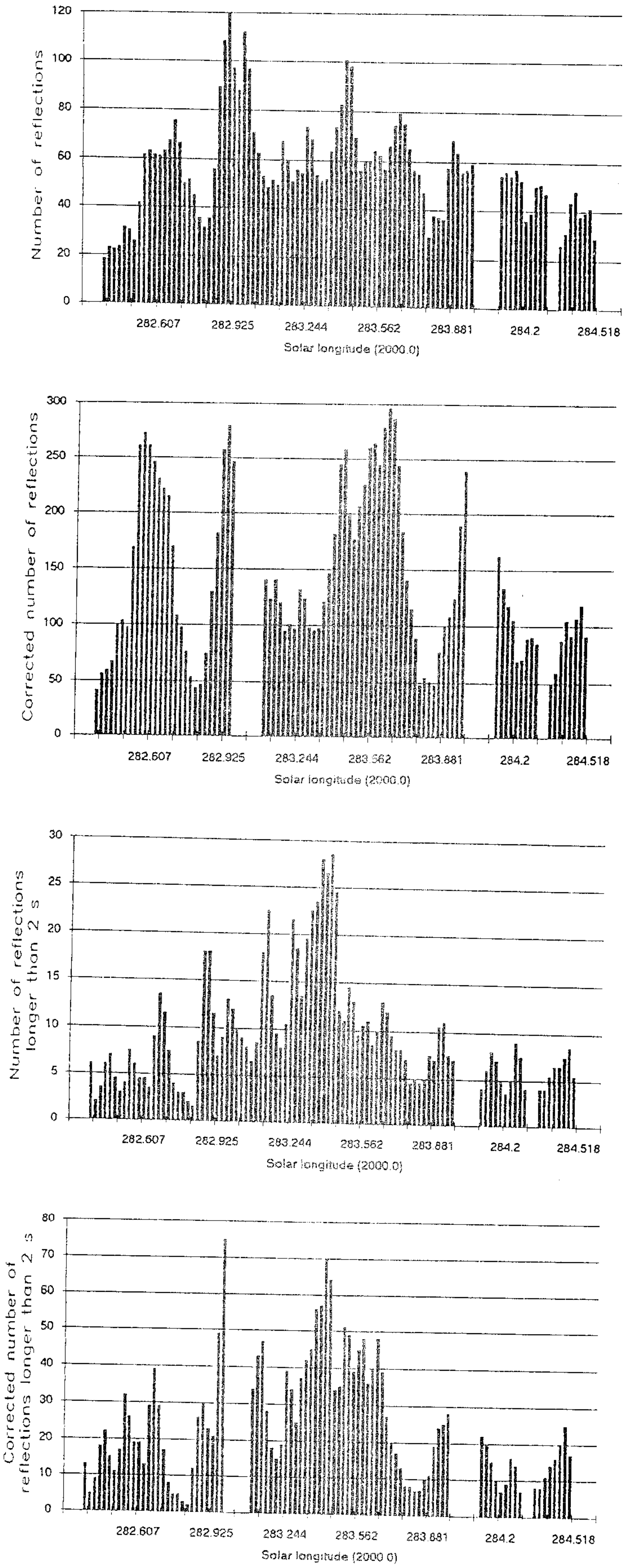

Figure 1 – 1989 Quadrantid counts in 30-minute intervals. Solar longitudes refer to eq. 2000.0. From top to bottom: total number of reflections (uncorrected), total number of reflections (corrected), number of reflections longer than 2 s (uncorrected), and number of reflections longer than 2 s (corrected).

1. The 1989 Quadrantids

Figure 1 (top) gives the number of reflections per 30-minute interval, averaged taking into account the following 30-minute interval, for the 1989 Quadrantids. The horizontal axis gives the solar longitude (Eq. 2000.0). The next graph in Figure 1 shows the corrected number of reflections (also averaged). By this, we mean the real number of reflections, divided by the Observability Function obtained by the program *FORWARD* [1,2], and multiplied by 1000 to get a satisfactory scale. Gaps mean that either we did not observe at that time, or that the Observability Function was less than 150, in which case the circumstances for observing the shower are too bad for a valuable analysis.

If you look closely to the top-two graphs in Figure 1, you will see that the Observability Function sometimes overcorrects. Observe the dips which occur around $\lambda_\odot = 282^\circ\!.80$ and $\lambda_\odot = 283^\circ\!.80$ in the graph with the corrected numbers. The second dip occurs exactly a day later than the first one, and their geometries are identical. In this case, it seems that the corrected rates do not depend on the real rates, but only on the Observability Function! So it is clear that caution needs to be taken when interpreting the results. The comparison between the corrected and real rates will probably tell more than either of these two separately.

We observe a maximal peak for the real as well as the corrected rates between $\lambda_\odot = 282^\circ\!.88$ and $\lambda_\odot = 282^\circ\!.99$. Furthermore, immediately after this peak, the observing conditions for the Quadrantids become very poor, and the real rates drop accordingly, whereas the corrected rates are not displayed since they were growing astronomically high due to overcorrection of the Observability Function. Also notice that the two other candidates for a maximum in the graph with the corrected numbers (around $\lambda_\odot = 282^\circ\!.57$ and $\lambda_\odot = 283^\circ\!.60$) differ almost exactly by one day, indicating an artifact caused by *FORWARD*. We conclude that the Quadrantid radio maximum in 1989 took place between $\lambda_\odot = 282^\circ\!.88$ and $\lambda_\odot = 282^\circ\!.99$. This agrees well with the radio maximum mentioned in [3]: $\lambda_\odot = 282^\circ\!.8 \pm 0^\circ\!.2$.

The bottom-two graphs of Figure 1 show the numbers and corrected numbers of reflections that lasted at least 2 seconds. These longer reflections are thought to correspond with the larger particles and thus the brighter (visually observable) meteors. We do not find back much of the previously derived maximum, which took into account all reflections. Here, we have a high isolated peak around $\lambda_\odot = 282^\circ\!.95$ in the graph with the corrected numbers, but this peak must be attributed to overcorrection, as it is completely absent in the graph showing the real numbers. We do see a peak in both graphs, however, between $\lambda_\odot = 283^\circ\!.33$ and $\lambda_\odot = 283^\circ\!.44$, confirming we are dealing with a real maximum here. This maximum agrees quite well with the visual maximum mentioned in [3]: $\lambda_\odot = 283^\circ\!.4 \pm 0^\circ\!.2$.

2. The 1990 Quadrantids

The top-two graphs of Figure 2 give a picture of the numbers respectively corrected numbers of meteor reflections per 30 minute-interval during the Quadrantid observations of 1990. Alas, our observing time was much smaller than in 1989, so we cannot confirm nor disprove the 1989 radio maximum. We do however find a "local" maximum (i.e, the maximal activity during our observations) around $\lambda_\odot = 283^\circ\!.39$, coinciding with the visual maximum according to [3] and the maximum of the reflections longer than 2 seconds in 1989. Contrary to 1989, this visual maximum is obvious in the 1990 graphs showing the total activity. Possibly this could be explained by a higher relative number of large particles in 1990.

The bottom-two graphs of Figure 2 tell us all about the number and corrected number of reflections which lasted longer than 2 seconds in 1990. The maximum that clearly stands out in both these graphs falls a little earlier than the total maximum: between $\lambda_\odot = 283^\circ\!.28$ and $\lambda_\odot = 283^\circ\!.35$.

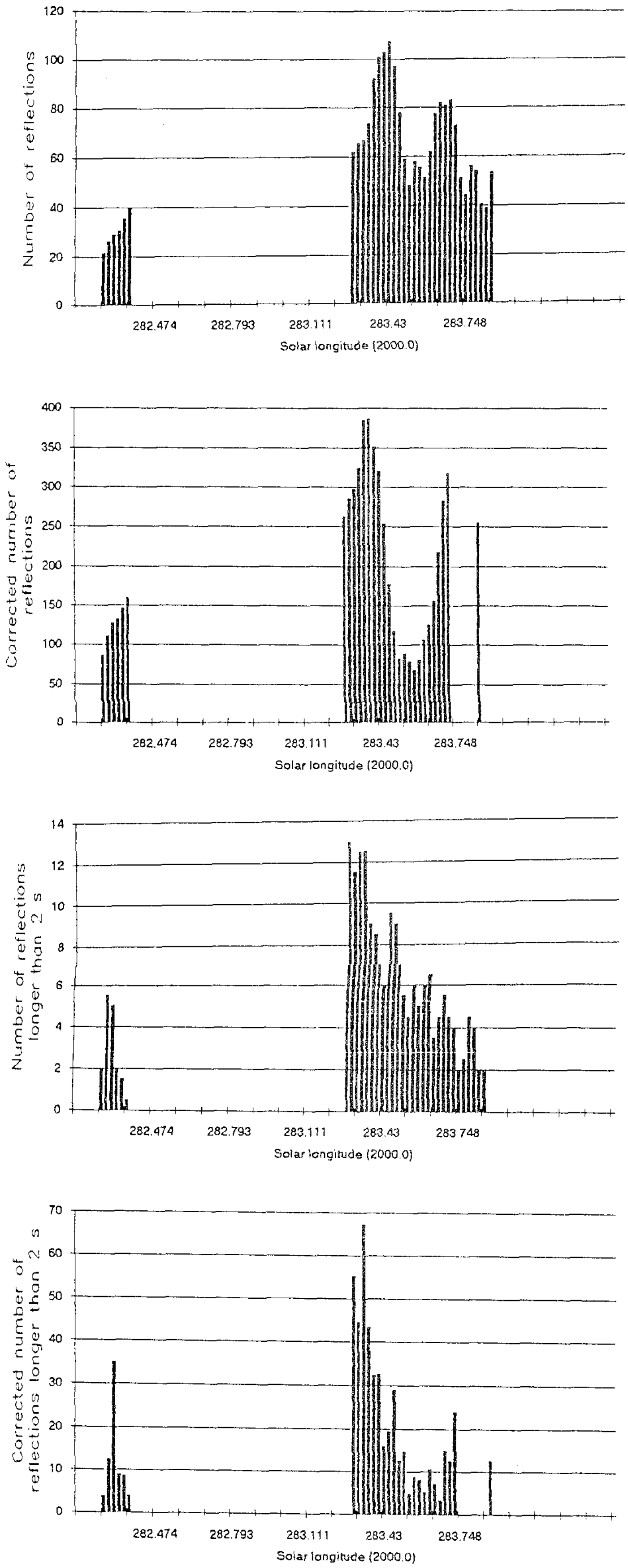

Figure 2 – 1990 Quadrantid counts in 30-minute intervals. Solar longitudes refer to eq. 2000.0. From top to bottom: total number of reflections (uncorrected), total number of reflections (corrected), number of reflections longer than 2 s (uncorrected), and number of reflections longer than 2 s (corrected).

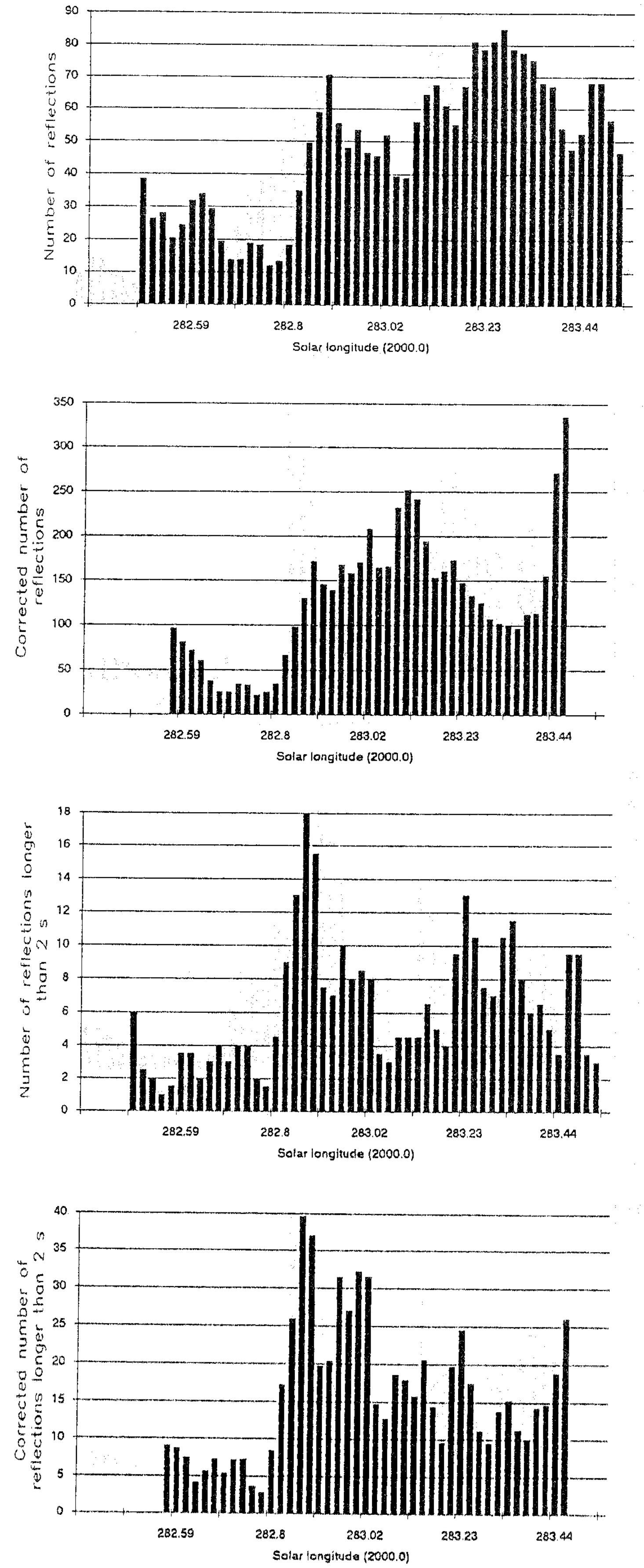

Figure 3 – 1991 Quadrantid counts in 30-minute intervals. Solar longitudes refer to eq. 2000.0. From top to bottom: total number of reflections (uncorrected), total number of reflections (corrected), number of reflections longer than 2 s (uncorrected), and number of reflections longer than 2 s (corrected).

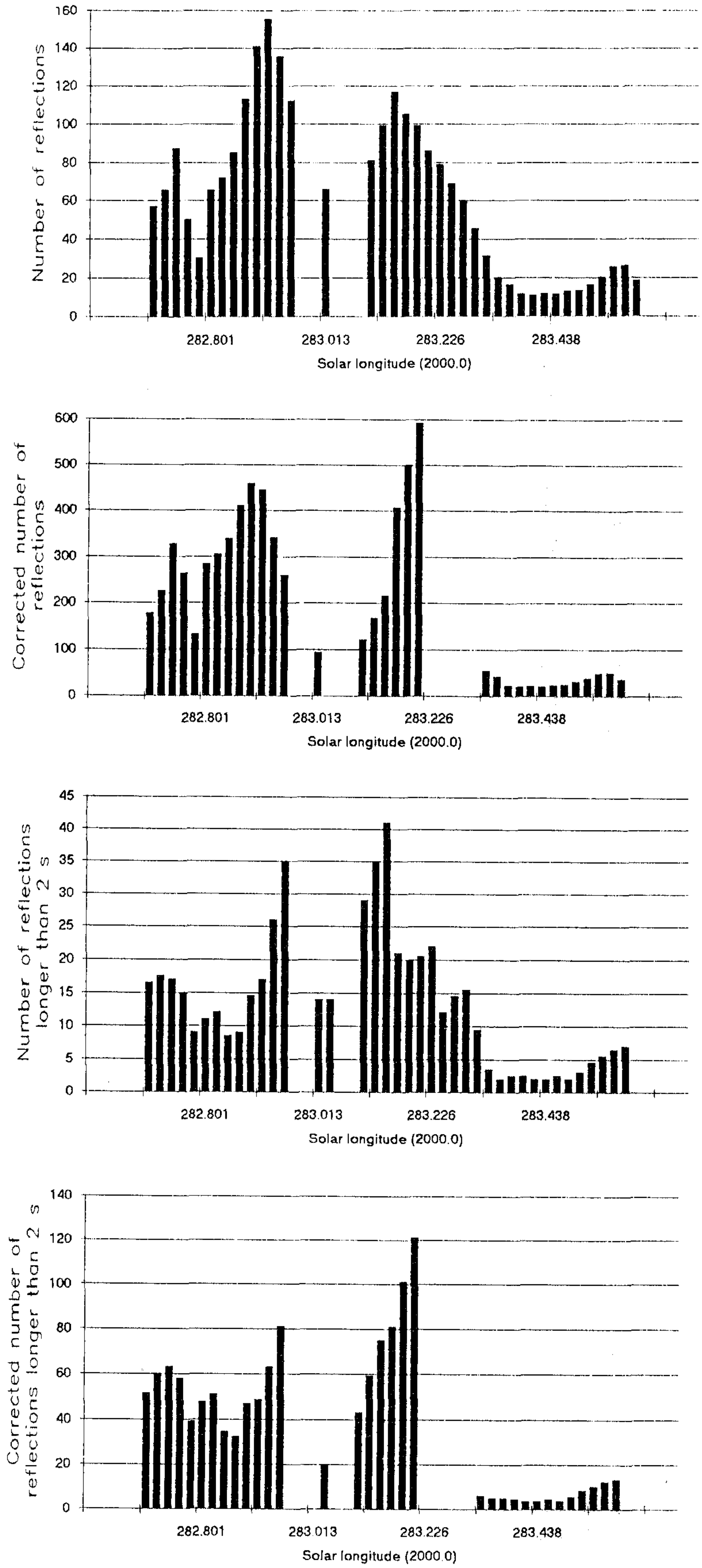

Figure 4 – 1992 Quadrantid counts in 30-minute intervals. Solar longitudes refer to eq. 2000.0. From top to bottom: total number of reflections (uncorrected), total number of reflections (corrected), number of reflections longer than 2 s (uncorrected), and number of reflections longer than 2 s (corrected).

3. The 1991 Quadrantids

The top-two graphs of Figure 3 show us respectively the numbers and the corrected numbers for the Quadrantids of 1991. At first sight, the first graph merely suggests that there might be maxima around $\lambda_\odot = 282.^\circ89$ and between $\lambda_\odot = 283.^\circ14$ and $\lambda_\odot = 283.^\circ27$. The second graph gives us a clearer picture. A maximum around $\lambda_\odot = 282.^\circ89$ is still possible, but not very probable. However, as we already found evidence of a maximum around this solar longitude in 1989 and 1990, the tiny peaks around $\lambda_\odot = 282.^\circ89$ in both graphs might be due to a small sub-maximum.

The large peak at the right edge of the graph with the corrected numbers is merely an artifact due to overcorrection. Clearly, this graph pleads for a maximum around $\lambda_\odot = 283.^\circ14$. Not only the fact that we encounter the tallest peak there, but especially the clear symmetry of the graph around this peak, does away with all doubt.

So we can conclude the following for 1991: a maximum around $\lambda_\odot = 283.^\circ08$–$283.^\circ19$, and possibly a submaximum at $\lambda_\odot = 282.^\circ89$.

The bottom-two graphs of Figure 3 show the numbers and corrected numbers of radio reflections lasting at least 2 seconds for the 1991 Quadrantids. Both graphs feature a peak between $\lambda_\odot = 282.^\circ85$ and $\lambda_\odot = 282.^\circ89$. In my opinion, this is the only significant peak: the peak between $\lambda_\odot = 282.^\circ95$ and $\lambda_\odot = 283.^\circ02$ in the graph with the corrected numbers has no counterpart in the graph with the real numbers, which once more points to overcorrection. The higher activity between $\lambda_\odot = 283.^\circ21$ and $\lambda_\odot = 283.^\circ46$ in the graph with the real numbers seems to stem from the favorable radiant geometry at that moment, since the graph with the corrected numbers reduces these peaks quite heavily.

Quite remarkably, we rediscover the 1989 radio maximum using only the long duration reflections, whereas the complete data almost conceal this maximum and favor another maximum.

4. The 1992 Quadrantids

The top-two graphs of Figure 4 give the numbers and corrected numbers of reflections for the 1992 Quadrantids. Very striking in both pictures is the very low activity at the right side of the graph. This is in accordance with the well-known fact that the Quadrantids have a very short maximum and a sharp decline. The second graphs tends to suggest a maximum near $\lambda_\odot = 283.^\circ20$, but this is the result of overcorrection: the gaps you see to the right of this peak are all due to poor receiving conditions for the antenna. The real maximum has to be sought in the vicinity of the large peak in the first graph, around $\lambda_\odot = 282.^\circ93$, which remains quite a high peak in the second graph.

We can conclude with reasonable certainty that the 1992 Quadrantids had their maximum between $\lambda_\odot = 282.^\circ87$ and $\lambda_\odot = 282.^\circ97$. This agrees well with the 1989 radio maximum ($\lambda_\odot = 282.^\circ88$–$282.^\circ99$).

Finally, the bottom-two graphs of Figure 4 show the numbers and the corrected numbers of reflections lasting longer than 2 seconds. One could argue that the peak between $\lambda_\odot = 282.^\circ93$ and $\lambda_\odot = 282.^\circ95$ degrees on both graphs is genuine, but because it is merely somewhat higher than the surrounding bars, I am not convinced. The right part of the peak between $\lambda_\odot = 283.^\circ10$ and $\lambda_\odot = 283.^\circ20$ in the graph with the corrected numbers is another creation of the *FORWARD* overcorrection: normal shower activity is blown up because the geometry of radiant and antenna gives poor observing conditions. The left part of that peak, however, corresponds to a high bar in the graph with the uncorrected numbers. Hence this part of the peak might be a candidate maximum ($\lambda_\odot = 283.^\circ10$–$283.^\circ14$), but again it does not really convince me, so I choose not to conclude anything out of these two graphs.

5. Conclusions

In summary, we have the following:

- $\lambda_\odot = 282\overset{\circ}{.}85$–$282\overset{\circ}{.}99$ (Eq. 2000.0): radio maximum in 1989, radio maximum in 1992, radio maximum of long duration reflections in 1991, possible radio sub-maximum in 1991. This confirms the radio maximum, stated in [3]: $282\overset{\circ}{.}8 \pm 0\overset{\circ}{.}2$, and suggests that the radio maximum occurs after $\lambda_\odot = 282\overset{\circ}{.}8$ rather than before.
- $\lambda_\odot = 283\overset{\circ}{.}08$–$283\overset{\circ}{.}19$ (Eq. 2000.0): radio maximum in 1991. It is strange that this maximum is easily found in 1991, while not found at all in other years. In [4], Roggemans derives a visual maximum around $\lambda_\odot = 283\overset{\circ}{.}12$ from the visual Quadrantid observations from 1984 till 1990.
- $\lambda_\odot = 283\overset{\circ}{.}28$–$283\overset{\circ}{.}44$ (Eq. 2000.0): radio maximum in 1990 (actually a "local" maximum), radio maximum of the long duration reflections in 1989 and 1990. This solar longitude agrees well with the visual maximum stated in [3]: $\lambda_\odot = 283\overset{\circ}{.}4 \pm 0\overset{\circ}{.}2$.

References

[1] Steyaert C., "FORWARD: A General Program for the Calculation of the Observability Function", *WGN* 15:3, June 1987, pp. 90–93.

[2] Steyaert C., "FORWARD: Extension for Multiple Stations", *WGN* 15:6, December 1987, pp. 193–195.

[3] Roggemans P. (ed.), "IMO Handbook for Visual Meteor Observations", Sky Publishing Corporation, 1989, pp. 99–105.

[4] Roggemans P., "The 1989 Quadrantid Meteor Stream", *WGN* 18:1, Feb. 1990, pp. 12–18.

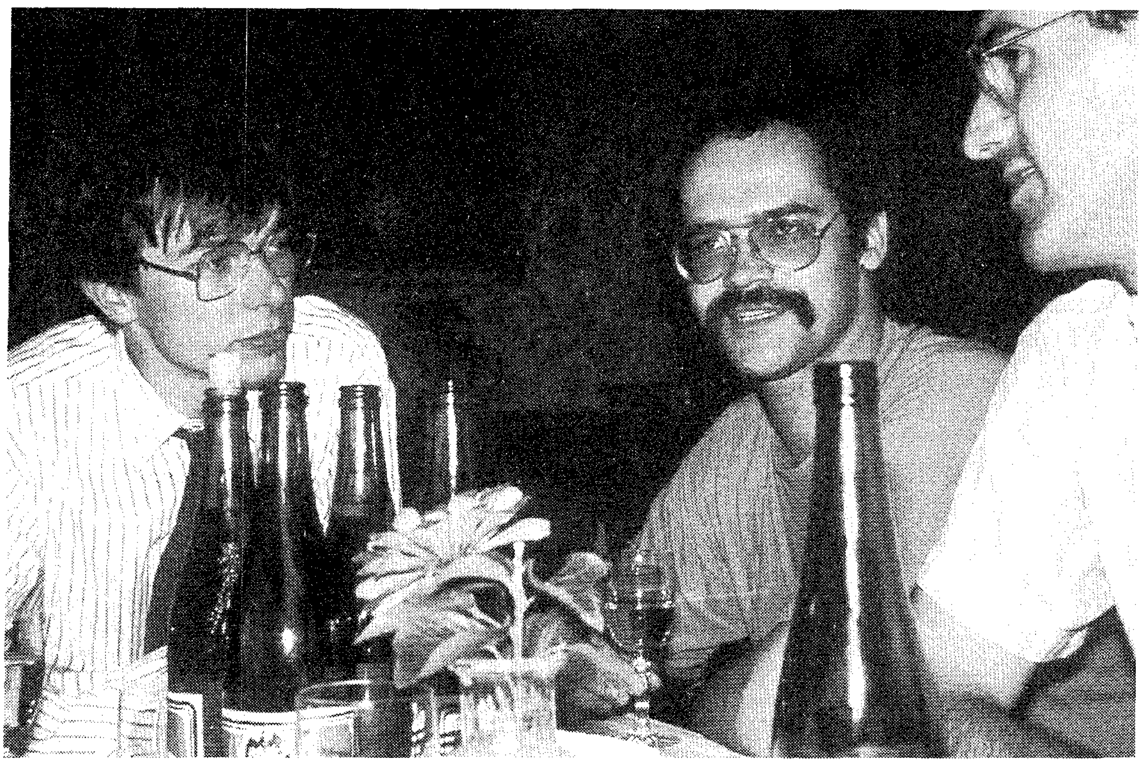

Figure 5 – Informal contacts between meteor workers are very important: Petr Pravec, André Knöfel, and Marc de Lignie are enjoying the very tasty local—ehhh, mineral water—at the 1992 *IMC*.

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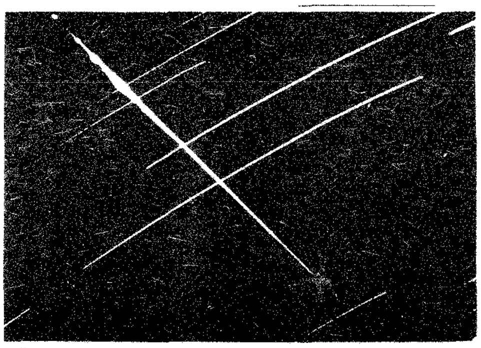

This meteor was photographed by Ulrich Sperberg in Salzwedel, Germany, on September 12, 1991. As the meteor was not seen visually, the exact time is unknown. The photograph was exposed from $20^h02^m32^s$ UT till $21^h19^m37^s$ UT. It was taken with a $f/1.8$, $f = 50$-mm lens on an ISO 400/27° film.

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