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Fireballs

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Administrative

Editorial — A couple of major showers near the year-end *Javor Kac* 171

Zdeněk Ceplecha (1929–2009) *Jiří Borovička* 171

Letter — Website statistics for the Geminids 2009 *Geert Barentsen* 172

Solar Longitudes for 2010 *Compiled by Rainer Arlt* 173

Conferences

International Meteor Conference 2009 report *Antal Igaz* 175

Ongoing meteor work

2008 Ursid maximum from Croatian Meteor Network video data *Željko Andreić, Damir Šegon, and Klaudio Gašparini* 177

Fireball over Denmark on 17 January 2009 *Przemysław Żołądek, Mariusz Wiśniewski, and Krzysztof Polakowski* 182

Preliminary results

Results of the IMO Video Meteor Network — September 2009 *Sirko Molau and Javor Kac* 185

Results of the IMO Video Meteor Network — October 2009 *Sirko Molau and Javor Kac* 188

Meteor Beliefs Project: Meteoric imagery associated with the death of John Brown in 1859 *George J. Drobnock, Alastair McBeath, and Andrei Dorian Gheorghe* 191

Front cover photo

A monstrously bright Geminid fireball was captured on 2009 December 14 at $11^h28^m44^s$ UT from Mohave Desert. The camera used was a Canon 5Di, equipped with 24-mm f/1.4 lens set at f/2.2, exposure 25 seconds at ISO 1600. This was one shot out of 1522 that night with 48 images containing fainter meteors.
Photo credit: Wally Pacholka (AstroPics.com, TWAN / www.twanight.org).

Writing for WGN

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

Cover design

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Editorial — A couple of major showers near the year-end

Javor Kac

As the year comes to an end, the meteor activity intensifies again. This is mostly due to the Leonid maximum in November and the Geminids in December.

The Leonids have been putting on nice shows around the last return of comet 55P/Tempel–Tuttle to perihelion, showing enhanced rates since the mid 1990's. Their performance culminated with several meteor storms at the turn of the millennium. Since 2002, the maximal activity is decaying, but is still above the background level. This year, the Earth was to encounter the 14- and 16-revolution old trails, both around the same instant in the late UT hours of November 17. The weather in my country has been quite acceptable this year during the Leonids for a change. The main focus has of course been on the maximum night. I joined a rather large group of meteor observers in a chase for clear sky that night. It took some effort to get to reasonably clear sky, however we succeeded. Sadly, the shower was not overly exciting. We started observing around the rising time of the Leonid radiant, and the first Leonid was spotted only about 40 minutes later. Every single shower member was nice and long, but their number was quite low. My best count was 7 Leonids in 15 minutes under LM 6.3 mag sky. The IMO automated ZHR graph shows the maximum ZHR of about 90 was reached on November 17 between 20^{h} and $21^{\mathrm{h}}30^{\mathrm{m}}$ UT. Therefore, the enhancement was mostly over by the time the radiant rose for our location.

The second major shower late in the year are the Geminids. In my opinion, they are the best annual shower, constantly delivering ZHR rates well above 100, with a broad maximum, and can be observed all night long. What else could a meteor observer wish for? Of course, as it is the start of winter in the northern hemisphere, one has to put up with extreme weather sometimes. Such was the situation this year in Slovenia. Again, there were only a few spots that had clear sky and were suitable for observation. We therefore spent a couple of nights in sub-zero temperatures and 100+ km/h winds. The night before the maximum, the Geminids were quite active, but relatively faint. I could count up to 60 Geminids per hour under LM 6.3 sky. Unfortunately, the maximum night was missed due to bad weather. However, we were back in the field again the night after, again under brutal observing conditions, plus significant light pollution. Right after we arrived at the location, we witnessed a bright −7 mag Geminid fireball. Later, the Geminids were not overly active — at most I counted 14 shower meteors per hour. Wally Pacholka was lucky to catch a much brighter Geminid fireball from Mojave Desert in California. His photo of that monstrous fireball is featured on the front cover.

I hope you will enjoy reading this issue of *WGN*. As always, any report on your observations, analyses and presentation of results, or even photographs alone, will be welcome for the publication in our Journal. My best wishes for a happy and prosperous New Year, and clear skies!

IMO bibcode WGN-376-editorial NASA-ADS bibcode 2009JIMO...37..171K

Zdeněk Ceplecha (1929–2009)

Jiří Borovička

Received 2009 December 18

Well-known Czech meteor astronomer Dr. Zdeněk Ceplecha passed away on December 4, 2009, at the age of 80 years.

Zdeněk Ceplecha was born in Prague on January 27, 1929. As a boy, he became interested in mathematics and astronomy. He was admitted as a member of the Czech Astronomical Society at the age of 15. At the beginning he was involved in the observations of the Sun. Nevertheless, he was very impressed by the Draconid meteor storm he witnessed in 1946. This experience guided his decision to devote his scientific life to the study of meteors.

Zdeněk Ceplecha graduated from Charles University in Prague in 1952. In 1956 he received his Ph.D. in astronomy, and in 1967 received his D.Sc. in Astrophysics. From 1951 until the end of life, he worked at the Ondřejov Observatory, now the headquarters of the Astronomical Institute of the Academy of Sciences of the Czech Republic. He became world famous for the observation and analysis of the Příbram meteorite fall in 1959 — the first photographed meteorite fall and the first meteorite with a known orbit. He nevertheless contributed to many fields of meteor astronomy, e.g. classification of fireballs and meteors, atmospheric fragmentation of meteoroids, fireball spectroscopy, dark flight of meteorites, influx of meteoritic material on Earth, and others. The European fireball network, which he founded in 1963, is still working today and the methods he invented are in use. His review article Meteor Phenomena and Bodies, which he published with several co-authors in 1998, is

Figure 1 – Zdeněk Ceplecha holding the largest recovered Příbram meteorite during the opening of the exhibition Bolides and Meteorite Falls at the Academy of Sciences of the Czech Republic in Prague on May 10, 2009.

Figure 2 – Zdeněk Ceplecha during the discussion session at the conference Bolides and Meteorite Falls in Prague on May 14, 2009.

among the most cited papers in the field.

I had the privilege to work with Zdeněk for more than 20 years. As my teacher, he was always very helpful, inspiring, and friendly. He retained deep interest and enthusiasm about meteors and bolides until his last days. The attendees of the conference Bolides and Meteorite Falls, which was held on the occasion of the 50th anniversary of the Příbram meteorite fall and Zdeněk's 80th birthday in Prague in May 2009, can surely confirm it. Although he will be missed by many, both home and abroad, his legacy is thriving.

IMO bibcode WGN-376-borovicka-ceplecha NASA-ADS bibcode 2009JIMO...37..171B

Letter — Website statistics for the Geminids 2009

Geert Barentsen [1]

Received 2009 December 22

As of the Geminids 2009, we started keeping detailed usage statistics for the IMO website. Between December 8 and 20, the automated ZHR graph of the Geminids (`http://www.imo.net/live/geminids2009`) received 33 917 views from roughly 27 786 visitors in 110 different countries. Other popular pages in this period were the main frontpage (27 446 views) and the shower calendar (15 695 views).

Most visitors came through prominent links on the websites of the Hamagin Space Science Center in Japan (`http://astro.ysc.go.jp/geminid.html`) (41%) and the NASA Spaceweather portal (`http://www.spaceweather.com`) (31%). Only a small amount of users found the ZHR graph through a search engine (4%) or the IMO frontpage (1%). Visitors came predominantly from Japan (49%), North America (26%) and Europe (19%), followed by other parts of Asia (4%), Australia (1%), South America (1%) and Africa (0.2%).

It is interesting to note that half the pageviews came from Japan, while only one observer from this country submitted visual data. Although we would need statistics for multiple years to exclude factors such as bad weather and prominent links, it is a well-known problem that most of the information provided by the IMO is only available in English, which forms a language barrier for some people.

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Table 1 – The number of visits per country for the Geminid live ZHR graph.

Country	Visits
Japan	13 071
United States	6 550
United Kingdom	1 276
Germany	715
Canada	583
Netherlands	408
Poland	369
Australia	324
China	282
Spain	232
Czech Republic	220
Belgium	210
Finland	205
Italy	180
France	158
Russia	155
India	137
Hong Kong	129
Mexico	129
Israel	115
Norway	108
Slovenia	96
Sweden	90
Hungary	86
Greece	86

There is a need for the observing instructions on the IMO website to be updated (based on the new IMO Handbook), to be made more attractive (e.g., adding illustrations) and to be translated in multiple languages by volunteers. This valuable task could be coordinated by someone who is not yet involved in maintaining the website, but would like to contribute. Candidates are very welcome to contact us.

IMO bibcode WGN-376-barentsen-webstats NASA-ADS bibcode 2009JIMO...37L.172B

Solar Longitudes for 2010

Compiled by Rainer Arlt

A conversion table of dates to solar longitudes using (Steyaert, 1991) is given as every year. The longitudes are given on the next page; they are only valid for 2010. The conversion formulae for any time of the day are repeated here for your convenience.

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

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

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

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

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

References

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

IMO bibcode WGN-376-arlt-solarlong
NASA-ADS bibcode 2009JIMO...37..173A

Solar longitudes 2010. Dates refer to 00^h UT.

Jan	1	280.31	Mar	1	340.15	May	1	40.38	Jul	1	98.93	Sep	1	158.32	Nov	1	218.31
Jan	2	281.33	Mar	2	341.15	May	2	41.35	Jul	2	99.88	Sep	2	159.29	Nov	2	219.31
Jan	3	282.35	Mar	3	342.15	May	3	42.32	Jul	3	100.84	Sep	3	160.25	Nov	3	220.31
Jan	4	283.37	Mar	4	343.15	May	4	43.29	Jul	4	101.79	Sep	4	161.22	Nov	4	221.31
Jan	5	284.39	Mar	5	344.16	May	5	44.26	Jul	5	102.74	Sep	5	162.19	Nov	5	222.31
Jan	6	285.41	Mar	6	345.16	May	6	45.23	Jul	6	103.70	Sep	6	163.16	Nov	6	223.32
Jan	7	286.43	Mar	7	346.16	May	7	46.20	Jul	7	104.65	Sep	7	164.13	Nov	7	224.32
Jan	8	287.44	Mar	8	347.16	May	8	47.16	Jul	8	105.60	Sep	8	165.10	Nov	8	225.32
Jan	9	288.46	Mar	9	348.16	May	9	48.13	Jul	9	106.56	Sep	9	166.08	Nov	9	226.33
Jan	10	289.48	Mar	10	349.16	May	10	49.10	Jul	10	107.51	Sep	10	167.05	Nov	10	227.33
Jan	11	290.50	Mar	11	350.16	May	11	50.06	Jul	11	108.47	Sep	11	168.02	Nov	11	228.34
Jan	12	291.52	Mar	12	351.16	May	12	51.03	Jul	12	109.42	Sep	12	168.99	Nov	12	229.34
Jan	13	292.54	Mar	13	352.16	May	13	52.00	Jul	13	110.37	Sep	13	169.97	Nov	13	230.35
Jan	14	293.56	Mar	14	353.15	May	14	52.96	Jul	14	111.33	Sep	14	170.94	Nov	14	231.36
Jan	15	294.58	Mar	15	354.15	May	15	53.93	Jul	15	112.28	Sep	15	171.91	Nov	15	232.36
Jan	16	295.60	Mar	16	355.15	May	16	54.89	Jul	16	113.24	Sep	16	172.89	Nov	16	233.37
Jan	17	296.62	Mar	17	356.14	May	17	55.86	Jul	17	114.19	Sep	17	173.86	Nov	17	234.38
Jan	18	297.63	Mar	18	357.14	May	18	56.82	Jul	18	115.14	Sep	18	174.84	Nov	18	235.39
Jan	19	298.65	Mar	19	358.13	May	19	57.78	Jul	19	116.10	Sep	19	175.81	Nov	19	236.39
Jan	20	299.67	Mar	20	359.13	May	20	58.75	Jul	20	117.05	Sep	20	176.79	Nov	20	237.40
Jan	21	300.69	Mar	21	0.12	May	21	59.71	Jul	21	118.01	Sep	21	177.77	Nov	21	238.41
Jan	22	301.71	Mar	22	1.12	May	22	60.67	Jul	22	118.96	Sep	22	178.75	Nov	22	239.42
Jan	23	302.72	Mar	23	2.11	May	23	61.63	Jul	23	119.92	Sep	23	179.72	Nov	23	240.43
Jan	24	303.74	Mar	24	3.10	May	24	62.59	Jul	24	120.87	Sep	24	180.70	Nov	24	241.44
Jan	25	304.76	Mar	25	4.09	May	25	63.55	Jul	25	121.83	Sep	25	181.68	Nov	25	242.45
Jan	26	305.77	Mar	26	5.08	May	26	64.51	Jul	26	122.78	Sep	26	182.66	Nov	26	243.46
Jan	27	306.79	Mar	27	6.07	May	27	65.47	Jul	27	123.74	Sep	27	183.64	Nov	27	244.47
Jan	28	307.81	Mar	28	7.06	May	28	66.43	Jul	28	124.69	Sep	28	184.62	Nov	28	245.49
Jan	29	308.82	Mar	29	8.05	May	29	67.39	Jul	29	125.65	Sep	29	185.60	Nov	29	246.50
Jan	30	309.84	Mar	30	9.04	May	30	68.35	Jul	30	126.60	Sep	30	186.58	Nov	30	247.51
Jan	31	310.85	Mar	31	10.03	May	31	69.31	Jul	31	127.56						
Feb	1	311.87	Apr	1	11.01	Jun	1	70.27	Aug	1	128.51	Oct	1	187.57	Dec	1	248.53
Feb	2	312.88	Apr	2	12.00	Jun	2	71.23	Aug	2	129.47	Oct	2	188.55	Dec	2	249.54
Feb	3	313.90	Apr	3	12.99	Jun	3	72.19	Aug	3	130.43	Oct	3	189.53	Dec	3	250.55
Feb	4	314.91	Apr	4	13.97	Jun	4	73.14	Aug	4	131.38	Oct	4	190.52	Dec	4	251.57
Feb	5	315.92	Apr	5	14.96	Jun	5	74.10	Aug	5	132.34	Oct	5	191.50	Dec	5	252.58
Feb	6	316.94	Apr	6	15.94	Jun	6	75.06	Aug	6	133.30	Oct	6	192.49	Dec	6	253.60
Feb	7	317.95	Apr	7	16.93	Jun	7	76.02	Aug	7	134.26	Oct	7	193.48	Dec	7	254.61
Feb	8	318.96	Apr	8	17.91	Jun	8	76.97	Aug	8	135.22	Oct	8	194.46	Dec	8	255.63
Feb	9	319.98	Apr	9	18.89	Jun	9	77.93	Aug	9	136.18	Oct	9	195.45	Dec	9	256.64
Feb	10	320.99	Apr	10	19.87	Jun	10	78.89	Aug	10	137.14	Oct	10	196.44	Dec	10	257.66
Feb	11	322.00	Apr	11	20.86	Jun	11	79.84	Aug	11	138.10	Oct	11	197.43	Dec	11	258.68
Feb	12	323.01	Apr	12	21.84	Jun	12	80.80	Aug	12	139.05	Oct	12	198.42	Dec	12	259.69
Feb	13	324.02	Apr	13	22.82	Jun	13	81.75	Aug	13	140.02	Oct	13	199.41	Dec	13	260.71
Feb	14	325.04	Apr	14	23.80	Jun	14	82.71	Aug	14	140.98	Oct	14	200.40	Dec	14	261.73
Feb	15	326.05	Apr	15	24.78	Jun	15	83.67	Aug	15	141.94	Oct	15	201.39	Dec	15	262.74
Feb	16	327.06	Apr	16	25.76	Jun	16	84.62	Aug	16	142.90	Oct	16	202.38	Dec	16	263.76
Feb	17	328.07	Apr	17	26.74	Jun	17	85.58	Aug	17	143.86	Oct	17	203.37	Dec	17	264.78
Feb	18	329.08	Apr	18	27.72	Jun	18	86.53	Aug	18	144.82	Oct	18	204.36	Dec	18	265.80
Feb	19	330.08	Apr	19	28.69	Jun	19	87.49	Aug	19	145.78	Oct	19	205.35	Dec	19	266.81
Feb	20	331.09	Apr	20	29.67	Jun	20	88.44	Aug	20	146.74	Oct	20	206.35	Dec	20	267.83
Feb	21	332.10	Apr	21	30.65	Jun	21	89.39	Aug	21	147.71	Oct	21	207.34	Dec	21	268.85
Feb	22	333.11	Apr	22	31.62	Jun	22	90.35	Aug	22	148.67	Oct	22	208.34	Dec	22	269.87
Feb	23	334.12	Apr	23	32.60	Jun	23	91.30	Aug	23	149.63	Oct	23	209.33	Dec	23	270.88
Feb	24	335.12	Apr	24	33.57	Jun	24	92.26	Aug	24	150.60	Oct	24	210.33	Dec	24	271.90
Feb	25	336.13	Apr	25	34.55	Jun	25	93.21	Aug	25	151.56	Oct	25	211.32	Dec	25	272.92
Feb	26	337.13	Apr	26	35.52	Jun	26	94.16	Aug	26	152.52	Oct	26	212.32	Dec	26	273.94
Feb	27	338.14	Apr	27	36.49	Jun	27	95.12	Aug	27	153.49	Oct	27	213.31	Dec	27	274.96
Feb	28	339.14	Apr	28	37.47	Jun	28	96.07	Aug	28	154.45	Oct	28	214.31	Dec	28	275.98
			Apr	29	38.44	Jun	29	97.02	Aug	29	155.42	Oct	29	215.31	Dec	29	277.00
			Apr	30	39.41	Jun	30	97.98	Aug	30	156.39	Oct	30	216.31	Dec	30	278.02
									Aug	31	157.35	Oct	31	217.31	Dec	31	279.03

Conferences

International Meteor Conference 2009 report

Antal Igaz [1]

Received 2009 December 13

My name is Antal (39) and I would like to share in WGN some of my thoughts as a first time participant at the International Meteor Conference (IMC).

I have always been interested in astronomy and have tried various observations including deep sky photography and webcam photography of planets. I also very often placed my Zenit film camera under the sky during the big meteor showers. In the last couple of years my attention focused even more on meteors and I participated in some visual observation campaigns of the local astronomy society. I became more and more disappointed with my photographic results and with the help of Sirko Molau I started my first video station in April this year. I discovered slowly various information sources, mailing lists and finally also the IMC. The conference fitted well into my calendar and also the location was convenient from Hungary so I registered without hesitation. Having no experience I was awaiting the conference with expectations to learn about state of the art techniques, build relationships and find friends. Luckily my sister could join me so I did not travel alone. A few days before the conference the organizers surprised me with their special attention and hospitality: I received an email from Željko with all the details, contact addresses and phone numbers in case of any trouble. The Istrian peninsula was not unknown to me; however, it was the only location where I have never been along the Croatian coast.

We jumped into the program immediately on the first day. It surprised me how many different aspects exist in meteor astronomy and how specific knowledge is necessary to follow the presentations. It is difficult to pick any of the presentations and topics but still let me list here some of the presentations. I was especially interested in still camera photography hardware. Two participants, Felix Bettonvil and Przemysław Żołądek, shared with us important details about shutter technology and long term operation of photo stations. I also found very valuable the interpretation and analysis of photographic results since not all of us involved in meteor photography complete the process by undertaking the subsequent interpretation. I would also mention here the presentation of Jean-Louis Rault about ELF/VLF detection. I only heard about this topic before but never had the chance to understand the necessary setup. As a video newcomer I was happy to supply some data to the first 10 years of the IMO Video Network as was presented by Sirko Molau. Other presentations about orbit calculations, radio meteor stations and meteor research history were also very interesting and once more showed the variety of meteor science. Some topics were actually unexpected for me: I never thought about spectral analysis of meteors as Javor Kac did just placing the right grating in front of his camera. Some of the take-home messages were to improve and continue with visual observation. This field attracts less interest in my country at the moment. I wrote detailed instructions to our local mailing lists and encouraged Hungarian amateurs to observe and upload their visual data based on Rainer Arlt's recommendations and presentation.

Another surprise was the various backgrounds of participants: professional astronomers and amateurs fit together very well. I felt myself becoming a part of a small but powerful community with an extremely good atmosphere. It was also great to meet some of my

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Figure 1 – Antal (HU) and Przemysław (PL) discuss about the video cameras. Photo courtesy of Comets and Meteors Workshop.

Figure 2 – The conference hall just before the opening of the IMC. Photo courtesy of Casper ter Kuile.

Figure 3 – IMC 2009 participants in front of the hotel. Photo courtesy of Javor Kac.

friends from Poland, as we already spent some great days together in Urzędów this summer. Together we might find some ways to overlap our meteor cameras from Hungary and the south of Poland.

Not to forget the less scientific but more artistic part of the conference. Everybody was amazed by the photo exhibition, I have found myself looking at the photographs again and again. The astropicture show was again an unexpected event but impressed me and others as well.

The organizers found some excellent destinations for the group excursion. The Višnjan observatory was obviously the best choice, we can only congratulate our Croatian friends on the results and the beautiful building. I hope the telescope will operate soon. The atmosphere of the surroundings, especially the nearby vineyard, created the right conditions for some cloudless and some serious discussions with friends. I think all the participants enjoyed this part of the event and only time pressure did not let it run a little longer.

On the way back we also had a great time, because Kamil and Ada from Poland joined us on the way back home and to spend some days in Budapest. Among many things we also talked about meteors, observation camps and methods, so it was just great to lead me back slowly to my civil life. But we did not stop working; based on the advice of Sirko Molau, Mariusz Wiśniewski and others we installed the 3rd and 4th video stations in the south and middle of Hungary and run them in test modes.

To be a bit personal, the conference and the community exceeded all my expectations and I enjoyed it very much. Hopefully we can also join the next one in Armagh.

Handling Editor: Javor Kac

Figure 4 – A special surprise was picking grapes in the observatory vineyard. Photo courtesy of Javor Kac.

Figure 5 – IMC participants in front of Višnjan Observatory at Tićan. Photo courtesy of Comets and Meteors Workshop.

Ongoing meteor work

2008 Ursid maximum from Croatian Meteor Network video data

Željko Andreić [1], Damir Šegon [2], and Klaudio Gašparini [3]

The maximum of the Ursid meteor shower for 2008 has been successfully observed by six CMN cameras. Altogether, 133 Ursids were recorded, 28 of them by two or more CMN stations, resulting in 15 new Ursid orbits. Results for radiant position, spread and radiant drift in RA and Dec (2000) for Solar longitude interval 270°2–270°6 are presented. No unusual activity (outburst) can be seen in the data.

Received 2009 September 23

1 Introduction

The Croatian Meteor Network (CMN) video observations were used to analyze the Ursid meteor shower of the year 2008. Hourly meteor rates were determined using video data from six CMN cameras that had clear skies during the observations (Figure 1). Other cameras were at least partly clouded out due to the passage of a cyclone over Croatia that night. In total, 305 meteors were recorded, out of which 133 were Ursids. Forty meteors were recorded simultaneously by two stations, 28 of which were Ursids. Fifteen of the 28 shower meteors with recorded trail lengths greater than 3° provided good orbits.

The video meteor data at each station were obtained with modified 1004X cameras and the SkyPatrol software (Vornhusen, 2003). The postprocessing started with corrections for optical distortion, done using PIXY_2 software (Yoshida, 2005). Next, positions of points on the meteor trail were refined and extracted from images using the MTP meteor detector software, written by P. Gural (Gural & Šegon, 2009). Afterwards, the data were checked manually with our SkyPatrol-Analyser software which is in the meantime modified to work with MTP output files. Finally, all relevant trail data (positions of beginning/end of the meteor in question, its duration and observing uncertainties, etc.) were extracted with the help of CMN Metmath and Metrad software and stored in the CMN database. At the end, UFOOrbit (SonotaCo, 2008) was used to determine orbits for double station meteors. Observation summaries are presented in Table 1.

2 Ursid activity

To determine the Ursid activity, the recorded Ursids were sorted into 1-hour bins (i.e., all meteors recorded by a given station during one hour). After that, the mean number of Ursids seen by all six stations was calculated and corrected for the radiant altitude using the standard formula:

$$A_{\text{corr}} = A/\sin(\text{alt}) \tag{1}$$

Here, A_{corr} is the corrected activity, A is the observed activity and alt is the radiant altitude for the middle of the observing bin. The standard deviation of the mean value is used as an uncertainty measure. The results are summarized in Table 1 and graphically shown in Figure 2. As usual, the time of observation (the middle of the bining interval) is given as the Solar longitude (J2000).

Table 1 – Summary of the Ursid activity in 2008 determined from 6 CMN stations. A_{corr} is the corrected activity (mean value for 6 stations), and σ is the standard deviation of the A_{corr}.

Solar long.	A_{corr}	σ
270.236	0.6	1.0
270.279	1.5	1.8
270.321	0.9	1.0
270.364	2.5	1.4
270.406	4.4	3.0
270.448	3.9	2.9
270.490	5.0	3.1
270.533	4.3	3.9
270.575	3.5	2.3
270.618	0.6	0.7

The question of visual ZHR remains open, for several reasons. First, our cameras have limiting magnitudes of about 4 mag. Second, they are sensitive to the whole visible–near IR spectrum, thus their sensitivity curve is quite different from the sensitivity curve of a dark adapted eye. And third, the FOV of the cameras (64° × 48°) is smaller than the FOV of the eye. Thus, only the correction for the radiant altitude was applied to the raw number of Ursids captured by the cameras. We can, however, assume that the EZHR is a few times larger than the hourly number of meteors seen by the CMN cameras.

Positions of the Ursid radiant in the Solar longitude interval 270°2 – 270°6 were calculated using two methods: the standard method of weighted intersections proposed by Ceplecha (1952), and Plavec (1949), and an alternative method based on normal distribution probability sum for 0°1 sample (Andreić & Šegon, 2008).

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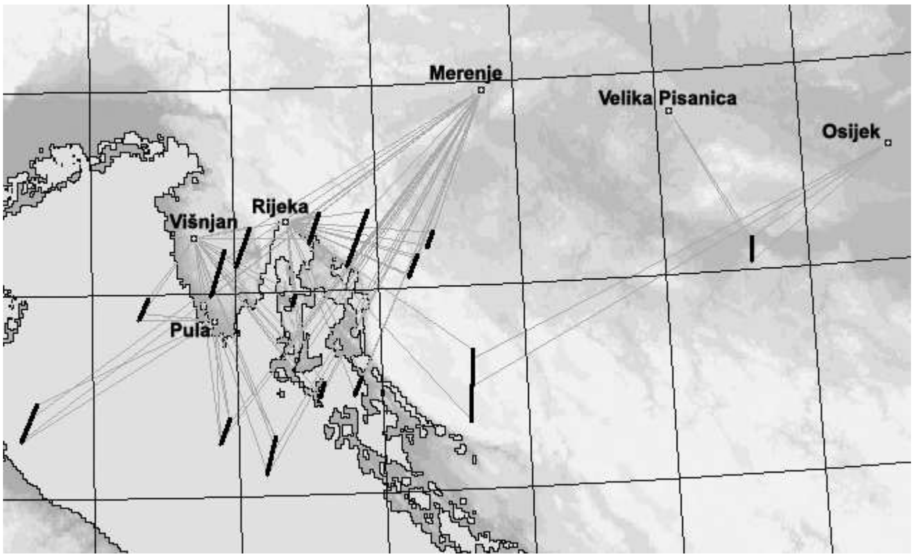

Figure 1 – Positions of six CMN stations whose data were used to analyze the 2008 Ursids. Superimposed are lines of sight and groundtracks of double station Ursids.

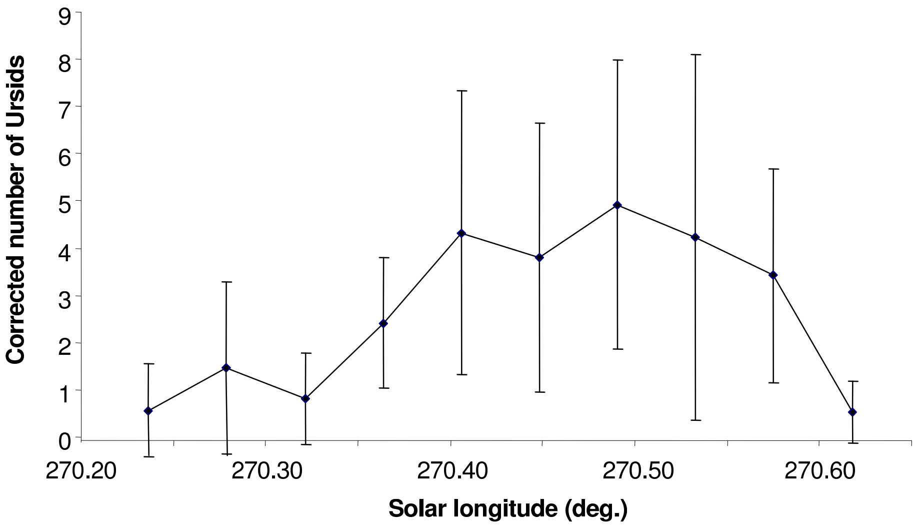

Figure 2 – Ursid activity in 2008 over the Solar longitude interval 270.°2 – 270.°6 as observed by the CMN.

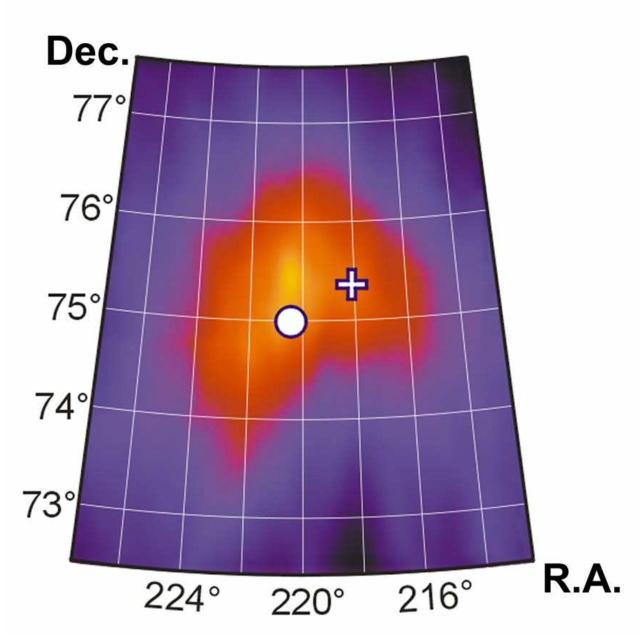

Figure 3 – Radiant spread of the 2008 Ursids over the Solar longitude interval $270^{\circ}\!.2 - 270^{\circ}\!.6$ as observed by the CMN. The grey-coded picture represents the probability of the radiant position being at particular celestial coordinates, as obtained by the probability sum method. Superimposed is the radiant position (circle) determined with the standard Ceplecha and Plavec method, and the radiant position determined by the UFOOrbit software (cross). The first two methods use the full set of single-station meteors (133), while the UFOOrbit radiant was determined from individual radiants of 15 double-station Ursids.

Table 2 – Comparison of the Ursid radiant position in 2008 determined in three different ways. Ceplecha refers to the standard Ceplecha and Plavec method, ProbSum to our method of probability sums and UFOorbit to the UFOOrbit software. The last column gives the Solar longitude for which the radiant position is determined. All values are in degrees.

Method	RA	DEC	Solar long.
Ceplecha	220.6	+75.0	270.3
ProbSum	220.5	+75.4	270.3
UFOorbit	218.1	+75.3	270.4

Additionally, results from UFOOrbit program (SonotaCo, 2008) are included for comparison. The results are shown in Figure 3 and summarized in Table 2. All three methods include all meteors recognized as Ursids (single station data).

All three methods produce very similar results. The difference of about $2^{\circ}\!.4$ in the radiant right ascension between UFOOrbit and the other two methods stems from a different way of applying correction for zenithal attraction. While both the Ceplecha & Plavec and the Probability sum method use estimated mean meteor geocentric velocity when applying this correction, UFOOrbit uses the velocity of each particular meteor. In reality, this difference is only about $0^{\circ}\!.6$ in the sky, because the right ascension grid is quite dense at such a high declination. Also, the first two methods use all single station meteors (133 of them), while UFOorbit radiant was deduced from the 15 individual Ursid radiants obtained from double-station detections.

Table 3 – Mean Ursid orbit with the error margins (in the same units) for the 2008 maximum, as determined from 15 triangulated Ursids. Full orbital parameters for each of them are listed in Table 4.

Date	Dec. 22.00589	±0.2
V_g	32.9 km/s	+0.8 −2.1
RA_g	$218^{\circ}\!.1$	+4.7 −2.7
DEC_g	$75^{\circ}\!.3$	+5.3 −0.5
a	4.79 au	+0.74 −0.79
e	0.802	+0.028 −0.036
q	0.9373 au	+0.0045 −0.010
P	10.5 yr	±2.5
ω	$206^{\circ}\!.6$	+2.8 −1.4
Ω	$270^{\circ}\!.4$	+0.1 −0.3
i	$52^{\circ}\!.5$	+1.3 −4.8

Last, but not least, the time of the maximum activity can be inferred from the Figure 2. The maximum occurred at about $\lambda_{\odot} = 270^{\circ}\!.5$. This is a little earlier than predicted by the IMO 2008 meteor shower calendar. The position of the radiant is also a few degrees off (IMO gives RA=217° and DEC=+76°). On the other side, Jenniskens (2006) predicted a ZHR of about 50 with its maximum at $\lambda_{\odot} = 270^{\circ}\!.54$ from an 8P/Tuttle filament. This position is quite close to our data, while the ZHR seems to be a few times lower than the predicted value. The CMN data also agree very well with the IMO Video network data (Molau & Kac, 2009).

3 Orbits of double station Ursids

The presented orbits are the result of the UFOOrbit V2.21 software, for 15 Ursid meteors longer than 3° with no additional filtering.

The mean orbital elements are very similar to those reported by Jenniskens (2000) for the 8P/Tuttle dust filament in 1997, which is a previous case of perihelion activity of the filament (8P/Tuttle passed perihelion on 2008 Jan. 27).

4 Conclusions

In the night of 21.–22. December 2008, six CMN cameras had clear skies and recorded 305 meteors of which 133 were Ursids. 28 Ursids were recorded simultaneously by two stations, resulting in 15 good orbits of Ursid meteoroids. The observed radiant position agrees well with existing data on the Ursids and the observed Ursid numbers indicate normal activity (no outburst).

Acknowledgements

This work is result of CMN observations from stations operated by Željko Andreić (Merenje – MEA), Maja Crnić (Višnjan – VAA), Ivica Ćiković (Rijeka – RIA, RIB), Luka Oskoruš (Velika Pisanica – VPA), Damir Šegon (Pula – PUA) and Krunoslav Vardijan (Petrovsko – PEA).

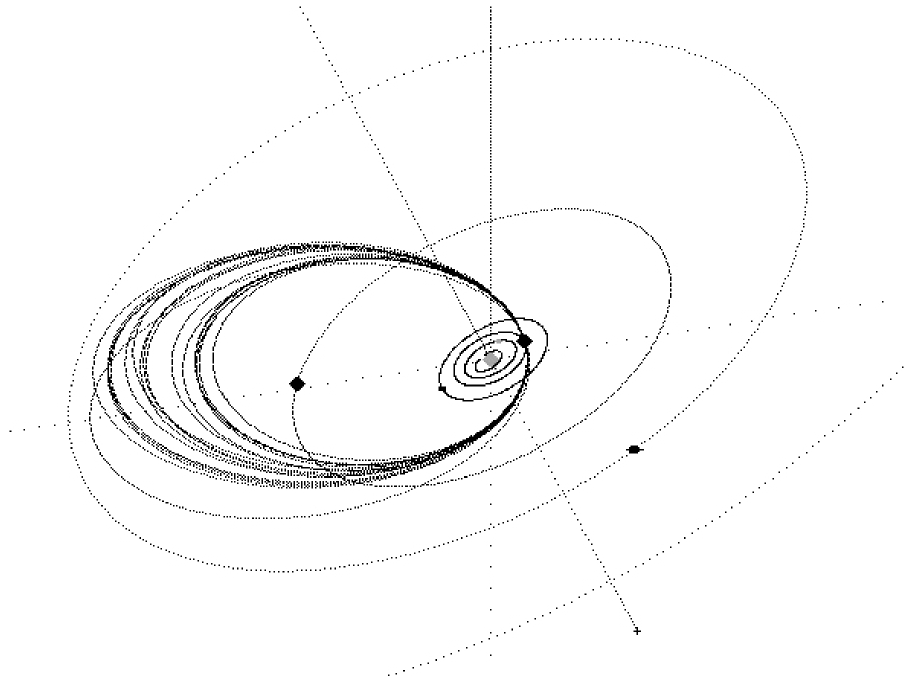

Figure 4 – Visualization of the Ursid orbits obtained from triangulation of double-station observations.

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Table 4 – Summary of Ursid orbits obtained from triangulation by UFOORBIT software. The errors are in the last digit of the quoted value. In the first column, T.no. denotes the number of detections (stations) that were used for triangulation of meteor trail in question.

Nr.	Time (UT)	T. no.	V_g [km/s]	+	−	RA [°]	+	−	DEC [°]	+	−	a [au]	+	−	e	+	−	q [au]	+	−	P [yr]	+	−	ω [°]	+	−	Ω [°]	i [°]	+	−
1	270.190613	2	31.87	17	17	222.78	1	0	76.33	3	2	4.38	23	20	0.785	11	10	0.94177	0	3	9.15	72	62	205.43	10	10	270.19083	50.86	17	18
2	270.219299	2	33.23	10	10	216.36	6	1	75.91	1	5	5.11	18	18	0.817	6	7	0.93468	13	0	11.57	60	61	207.22	2	7	270.21948	52.91	10	8
3	270.363281	2	33.67	5	5	217.59	6	0	74.99	0	0	5.32	10	9	0.823	3	3	0.93893	13	0	12.27	35	30	205.94	2	7	270.36346	53.76	5	5
4	270.371155	3	33.38	41	47	215.77	14	14	75.38	2	2	4.89	69	59	0.809	24	26	0.93497	2	7	10.82	236	191	207.22	28	22	270.37134	53.36	43	50
5	270.399445	2	30.65	13	13	219.76	7	19	80.52	0	0	5.02	18	18	0.815	7	7	0.92682	3	14	11.24	63	61	209.39	6	3	270.39969	47.64	15	14
6	270.407257	2	33.09	17	17	218.24	0	5	75.52	0	0	4.92	27	25	0.809	10	10	0.93822	2	14	10.93	91	83	206.27	13	10	270.40747	52.83	19	18
7	270.471466	2	33.65	43	42	218.57	11	18	75.03	0	0	5.53	90	68	0.830	24	24	0.94022	2	10	13.02	329	234	205.50	24	20	270.47168	53.63	46	46
8	270.480530	2	32.92	11	11	217.16	3	3	74.88	0	0	4.18	12	11	0.776	6	6	0.93795	3	4	8.56	37	34	206.67	7	7	270.48071	53.02	12	13
9	270.487671	3	32.83	33	48	215.40	6	9	75.03	0	0	4.00	34	41	0.767	18	26	0.93466	10	25	8.02	103	119	207.73	36	21	270.48785	52.96	36	53
10	270.518158	3	33.38	19	10	217.00	2	4	75.06	0	1	4.85	28	13	0.807	11	5	0.93755	7	7	10.70	94	44	206.49	7	12	270.51837	53.43	20	11
11	270.521240	2	33.59	22	22	219.12	5	8	74.83	1	2	5.35	40	35	0.824	12	12	0.94148	5	8	12.38	140	121	205.17	13	12	270.52145	53.63	25	24
12	270.544739	3	31.89	21	33	219.79	8	6	76.49	1	2	4.21	22	31	0.778	11	18	0.93721	7	11	8.65	70	95	206.87	21	13	270.54495	50.93	23	37
13	270.570038	3	33.70	26	24	218.12	5	4	74.79	1	1	5.34	49	38	0.824	15	13	0.94010	13	11	12.35	173	129	205.58	15	16	270.57025	53.82	28	27
14	270.576782	2	32.42	4	4	217.66	1	0	75.82	0	0	4.22	5	4	0.778	3	2	0.93610	3	2	8.68	15	14	207.19	3	3	270.57700	51.96	4	5
15	270.588531	2	32.77	14	14	218.38	5	2	75.50	3	1	4.52	18	15	0.793	8	7	0.93816	7	8	9.62	57	48	206.44	9	9	270.58875	52.45	15	17

Fireball over Denmark on 17 January 2009

Przemysław Żołądek [1], *Mariusz Wiśniewski* [1,2], *and Krzysztof Polakowski* [1]

A spectacular fireball crossed the sky over Denmark on 17 January 2009. It was observed by many eyewitnesses across northern Europe, but only recorded by a single camera from Sweden. Two Polish Fireball Network cameras managed to indirectly record the fireball due to changes in sky brightness. As a result of careful analysis of video footage and reports from the eyewitnesses we were able to determine the trajectory of the object. The velocity of the fireball was estimated at 50 km/s. A meteor event with such a rapid velocity should not produce any meteorites.

Received 2009 August 1

1 Introduction

On the evening of January 17, 2009 at about $19^{\rm h}08^{\rm m}30^{\rm s}$ UT bright flashes in the sky were observed over Denmark, southern Sweden, northern Poland, Germany and the Netherlands. The first signs of the unusual phenomenon reached us several minutes after its occurrence. Krzysztof Polakowski, an operator of fireball station PFN24 in Gniewowo found a very clear 3.5 s increase of the sky brightness while revieving past records. Judging that it is likely to be a fireball, he informed participants in the operation of the Polish Fireball Network (PFN) (Polakowski, 2009).

During the next hours we began to receive further reports from eyewitnesses. German and Dutch observers reported loud thunder-like sounds a few minutes after the visual effects had appeared. Reports even came to us from aircraft pilots, who observed the very rare phenomenon during flight. Preliminary estimates indicated that we were dealing with a very bright fireball which appeared over the Baltic Sea and Denmark.

2 Observations

Unfortunately, the fireball was not directly recorded by any of the PFN cameras. Therefore, any additional information could be valuable to determine the trajectory of the body in the atmosphere. The sky over Europe that night was dominated by two weather fronts. One of them was over Germany. Belgium, Holland, part of Germany and the western and central parts of Poland were clear. Unfortunately the region of Denmark where the fireball appeared over was covered by clouds. The analysis of the likely trajectory has been constructed on the basis of observations from eyewitnesses and photo and video materials available on the internet.

3 Video record from southern Sweden

The only available direct video recording of the fireball was made by a security colour camera located in the Skåne region of southern Sweden about 30 km south-west of Kristianstad. The video, published on the internet, gave the initial impression that the fireball was moving unnaturally fast. We originally believed that the slow motion video was created from a typical PAL recording with 25 frames per second. After analysis we found that this is a real-time movie but with only 4 frames per second. Direct measurement of the velocity based on this recording was not possible without knowing the frame rate of the camera.

Figure 1 – Video record from southern Sweden. Credit: Läsarbild / Roger Svensson.

In the final phase of flight a huge flash was observed which may have exceeded magnitude −20 in brightness. A trace of plasma with a length of at least a few dozen kilometers is clearly visible. The path of the fireball seems to end just after the main flash. Contrary to some visual reports we do not see fragments falling towards the horizon. A visible green glow was visible low on the northern horizon. Some frames from this video are presented in Figure 1.

The estimated directions of the beginning and end of the phenomenon were determined. The beginning was measured at 200° in azimuth and 45° in elevation. The

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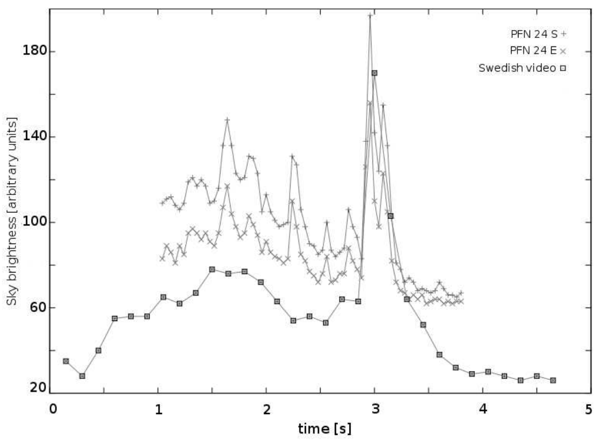

Figure 2 – Comparison of the light cuves obtained from the Swedish camera and PFN24 Gniewowo.

fireball ended at 240° in azimuth and 30° in elevation. These measurements were supplied by the owner of the camera. We don't know the method and the precision with which these measurements were made.

3.1 Recordings from video cameras of PFN24 station in Gniewowo

Valuable data helpful in determining the velocity of the fireball and the exact moment of its appearance came from changes in the sky brightness recorded in Gniewowo, Poland. Flashes were detected on January 17, 2009, at $19^h08^m30^s$ UT $\pm 1^s$.

The PFN24 station in Gniewowo consists of 2 identical systems equipped with Mintron MTV-23X11 cameras and Ernitec 4-mm f/1.2 lenses. The typical field of view is $60° \times 40°$. One camera points towards the south (PFN24 South) while the other camera points towards the east (PFN24 East).

Based on the analysis of changes in sky brightness recorded by the PFN24 cameras, the brightness curve of the fireball was estimated (see Figure 2). Due to the lack of any reference objects, brightness was expressed in units of luminous intensity recorded by the cameras facing the south and the east. Our light curves were compared with measurements taken from the video recording from Sweden.

Both cameras began their detection when the fireball was already visible in the sky and was bright enough to cause an apparent increase in the background brightness. The light curve was very jagged, displaying some clear flashing during regular flight and ending after a powerful flash. The analysis proved the final flash to be double peaked. The time delay between the peaks of the final flash was 0.12 s. We decided not to express the fireball brightness in magnitude. We set the brightness value of the sky background, during the full Moon at a distance of 90° from the Moon, to about 100 of our arbitrary units which gives some idea about the brightness. Due to the location of the fireball in the sky, it is appropriate to compare the background for the south facing camera (PFN24 South).

Comparison of the graph obtained from the Swedish camera shows that our data covers only about half of the duration of flight. The Swedish Camera grabbed only 4 frames per second and it could not record many short flashes that might have been accurate reference points on the trajectory. Taking into account the fact that the early phases of the fireball are not visible in the Swedish video, we assume that the whole phenomenon had a duration of ~ 4 s.

3.2 Image recorded by Klaas Jobse from EN 97 Oostkapelle

The only known photographic record of the fireball of January 17, 2009 is an image obtained by station 97 of the European Network (EN) in Oostkapelle, Netherlands. The fireball appears very low near the horizon and exact astrometry was not possible due to a lack of reference stars close to the edge of the image. This observation could only be used as a fairly precise indication of the azimuth at which the fireball appeared. The EN 97 station is a convex mirror system with a camera mounted above it. Similar systems are described in Oberst et al. (1998), however at present the systems use digital cameras.

3.3 Eyewitness reports

On the 32 km long Afsluitdijk dam in the Netherlands, which separates the North Sea from Ijsselmeer lake, there is a perfectly straight part of highway A7/E22. A fireball was observed by many drivers going on the highway towards Groningen. The direction of the road indicated a specific azimuth. Drivers claimed that the fireball appeared to be ideally in front of them. They had a feeling that the fireball could possibly hit somewhere in the distance on the motorway.

Based on guidelines set by the drivers, Gerard Kuiper found the azimuth of the event with relatively good accuracy. These data relate mainly to the middle and final parts of the fireball which was visible from a distance of 850 km.

A number of Polish eyewitnesses sent us very detailed information about the fireball. Observer Piotr C. from Reda in Poland estimated the duration of the phenomenon at 4–5 s. The fireball was seen in the west or north-west. It may have appeared three times brighter than the full Moon. He observed fragmentation of the fireball into one main and two smaller fragments. The phenomenon leaving behind an intense straight green ion wake, reminiscent of a green laser beam.

Valuable observations were made by Bogdan D. He took a picture from the place he was standing at the time of the event and noted the path of the fireball. As reference points he used a dense network of tree branches behind which the fireball appeared. Brightness was estimated to be clearly greater than the full Moon. He also observed the fragmentation as described by the observer from Reda.

A visual observer from Rostock in Germany remembered the flight path among the background stars. On this basis he estimated beginning point at 50° and 32° and the ending point at 322° and 15° in azimuth and height respectively. About 5 minutes after the flight he heard a few seconds of distant thunder.

Andre Norup Sorensen from Denmark has collected dozens of reports from accidental eyewitnesses from Denmark, Sweden, Germany and Poland. Most of these reports describe a strong flash in the sky which lasted longer than a typical lightning flash. The sky over a greater part of Denmark was covered by clouds and only a few reports described the fireball. In villages on Loland island and southern Falster island a powerful long-lasting thunder-like sound (duration of 8–10 s) was heard. The place of explosion was determined by the German observers on the basis of the view lines observed visually and the time of arrival of the sound effects.

The most unexpected report was received from a Polish pilot who was flying over Germany. The pilot reported that at one moment the whole sky became very bright. It was well after sunset, so he was blinded for the moment, but noticed in the left window (on the Captain's side) a large ball of fire with a long trail.

4 A roughly calculated fireball trajectory

We have one video security camera recording, with 0.25 s frame integration, with accurate bearings for the beginning and end; one photographic observation from the Dutch station EN97 Oostkapelle with the fireball about 4 degrees above the horizon; and a few more or less useful visual observations from Poland, Germany, Denmark and the Netherlands. The map in Figure 3 is based on the available observations. In spite of the limited precision of the trajectory determination, our analysis shows the approximate picture of the phenomenon.

A fireball occurred January 17, 2009 at $19^{h}08^{m}30^{s}$ UT $\pm 1^{s}$. The beginning was just to the west of Bornholm, the end — a few dozen kilometers south of Odense. The meteor moved almost exactly from east to west on a shallow trajectory inclined at an angle of approximately 20°. The initial point of the trajectory was at a height of between 115 and 120 km, which is relatively high. In the end the fireball descended to a height of approximately 30–35 km. The length of the trajectory is $\sim$ 240 km. The speed of entry into the atmosphere was greater than 50 km/s. Such a high speed entry calls into question the possibility of any fall of meteorites.

The sounds effects were heard mostly in the villages on Loland island. The main flash probably occurred over this area. The quite large initial velocity goes hand in hand with the length of the trajectory given by the witnesses and the time of the phenomenon.

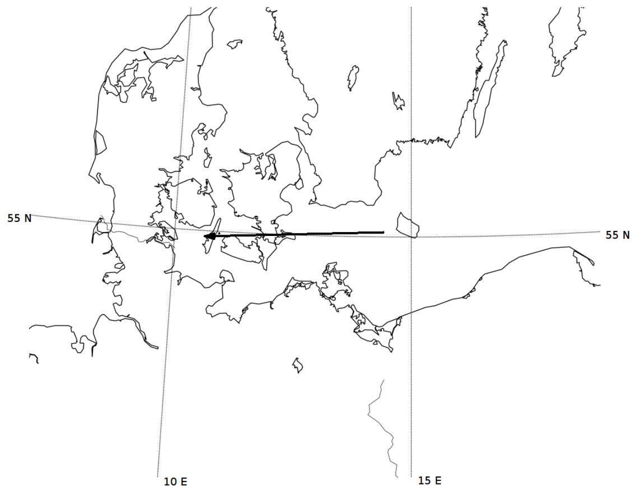

Figure 3 – Trajectory of the 17 January 2009 fireball.

5 Conclusions

Despite the very poor observational material based solely on highly compressed video from a security camera and eyewitnesses reports, it was possible to obtain information about this event. Parameters of the trajectory were obtained. Our result indicates that the velocity of the body was too high for meteorites to survive atmospheric flight and reach the ground. Nevertheless, there have been reports from Denmark that very small fresh meteorites were found and may have originated from this fireball.

Acknowledgements

We are grateful to Roger Svensson and Klaas Jobse for making available their records of the January 17, 2009 fireball. We would like to thank all the eyewitnesses for their reports which made this analysis possible.

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Preliminary results

Results of the IMO Video Meteor Network — September 2009

Sirko Molau [1] *and Javor Kac* [2]

September 2009 was a successful month for the IMO Video Meteor Network observers. More than 15 000 meteors were captured by 37 Network cameras in more than 4 000 hours effective observing time. Two newly discovered minor showers, the ν-Eridanids and September ι-Cassiopeids, were detected this year as well. The activity profile in 2009 September is presented for both showers.

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1 Introduction

Before we concentrate on the September results, let's first have another look back at the August data (Molau & Kac, 2009). Because of a storage quota at our ftp server, a few data from STG38 got lost, and the observations of REMO1 and REMO2 were incomplete as well. After these data were added, we reached a total of more than 4 400 hours of effective observing time and 30 000 meteors.

September was a pleasant month as well, that presented many observing nights to the observers. Around mid-September there was briefly rainy weather, but before and thereafter we had clear skies at most observing sites. So more than half of all cameras collected more than 100 hours of effective observing time in 20 or more nights. We could not reach the August totals, but with over 4 000 hours it was comfortably the second best month of the camera network. The average number of meteors per hour was cut in half compared to August. Still, 15 000 meteors is the third best monthly result and naturally far more than we ever recorded in a September (Table 1 and Figure 1).

By the end of the third quarter of 2009 we had collected already as many observing hours and meteors as in all of 2008, and we also passed the limit of half a million meteors in the IMO database.

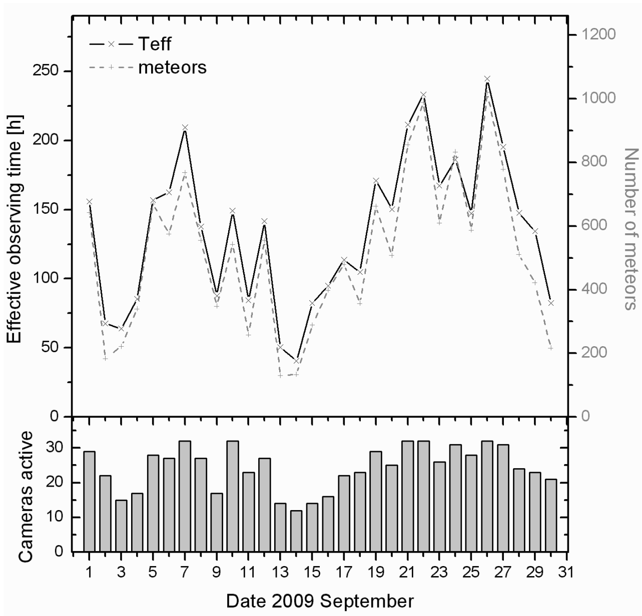

Figure 1 – Monthly summary for the effective observing time (solid black line), number of meteors (dashed gray line) and number of cameras active (bars) in 2009 September.

2 Minor showers in September

There are several minor meteor showers in September — some of these originating from the Perseus Auriga region (with the Aurigids and the September ε-Perseids as most prominent representatives). The Southern Taurids are also noticeable. Still, we want to analyse two other showers in more detail this month.

The ν-Eridanids (NUE) have the number 337 and a "working status" in the MDC list (Jopek, 2009). In our most recent analysis (Molau & Rendtel, 2009), we detected this shower between September 3 and 24 with 1185 meteors overall. During the full activity interval it showed an almost constant video rate of three to four with a minor peak on September 7. The second shower, dubbed September ι-Cassiopeids (SIC), was newly detected by us based on 278 shower members. It got number 416 on the MDC list and showed also an almost constant video rate with a peak of nearly 1 on September 11.

Could these two showers be detected in September 2009 as well? To answer this question, the meteor shower assignment was recomputed based on the shower parameters obtained by Molau & Rendtel (2009). Then, the number of shower meteors per night was summed over all cameras, and divided by the number of Sporadics to account for the variable effective observing time. Nights with less than 200 sporadic meteors were omitted.

Between September 4 and 25, we recorded 611 NUE beside 7849 sporadic meteors. Between September 6 and 16 it was 80 SIC beside 2707 Sporadics. Figure 2 shows the ratio between NUE/SIC and SPO per night. The profile fits well to the results published in WGN (Molau & Rendtel, 2009), given that we are talking about very weak showers here. The ν-Eridanids show an almost constant rate of nearly 10% of the sporadic counts. For comparison: that is about the number of

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NASA-ADS bibcode 2009JIMO...37..185M

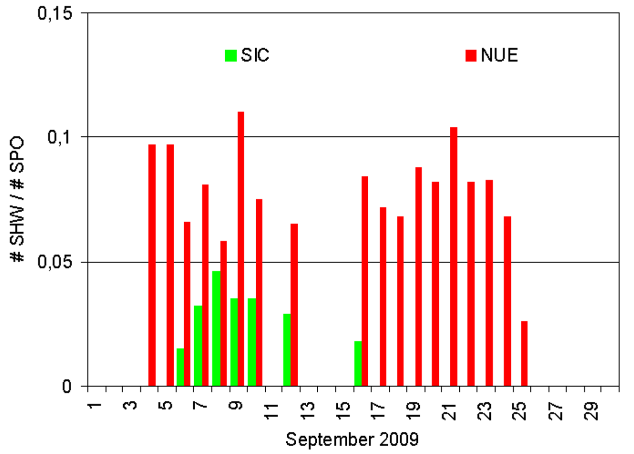

Figure 2 – Activity profile of the ν-Eridanids and September ι-Cassiopeids in September 2009.

Southern Taurids in end-September. The September ι-Cassiopeids show a steep rise between September 6 and 8, reaching 5% of the sporadic count at maximum. Thereafter, the activity slowly falls until September 16. Hence, both showers could be detected in the 2009 data set as well.

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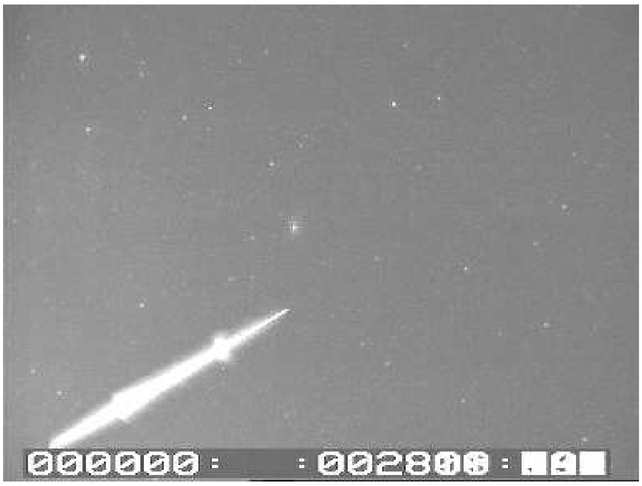

Figure 3 – Sporadic fireball, captured on 2009 September 1 at $20^h17^m06^s$ UT by the IMO Video Meteor Network camera Templar1 from near Tomar, Portugal. Photo courtesy: Rui Goncalves.

Figure 4 – Magnitude 0 sporadic meteor, captured by the IMO Video Meteor Network camera Times5 (Watec 905-H with 6-mm f/0.8 lens) from Vecindario, Gran Canaria. Photo courtesy: Orlando Benítez Sánchez.

Figure 5 – This September Perseid fireball was captured on 2009 September 10 at $01^h25^m51^s$ UT by the IMO Video Meteor Network camera Orion1 from Ljubljana, Slovenia. Photo courtesy: Javor Kac / Orion Astronomical Society.

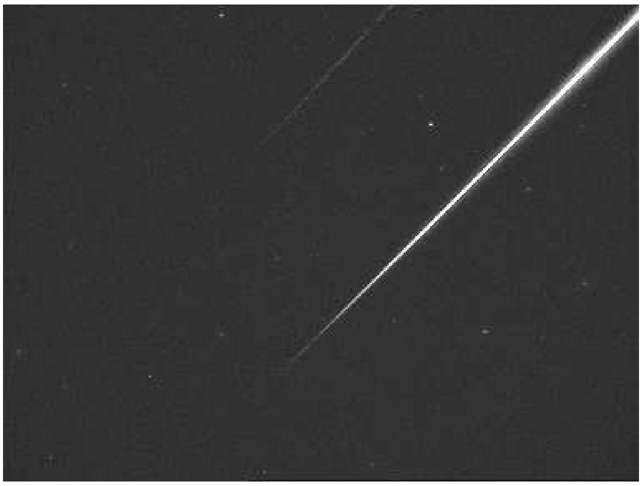

Figure 6 – A slow, magnitude −1 sporadic meteor, captured on 2009 September 22 at $22^h31^m44^s$ UT by the IMO Video Meteor Network camera Orion2 from Središče ob Dravi, Slovenia. A strong line in the meteor spectrum can be seen to the left of the meteor. Photo courtesy: Mitja Govedič / Orion Astronomical Society.

Table 1 – Observers contributing to September 2009 data of the IMO Video Meteor Network.

Code	Name	Place	Camera	FOV	LM	Nights	Time (h)	Meteors
BENOR	Benitez-S.	Las Palmas	TIMES4 (1.4/50)	⊘ 20°	3 mag	3	16.6	39
			TIMES5 (0.95/50)	⊘ 10°	3 mag	9	38.0	60
BRIBE	Brinkmann	Herne	HERMINE (0.8/6)	⊘ 55°	3 mag	24	126.3	514
CASFL	Castellani	Monte Baldo	BMH1 (0.8/6)	⊘ 55°	3 mag	20	81.8	198
			BMH2 (0.8/6)	⊘ 55°	3 mag	18	83.1	280
CRIST	Crivello	Valbrevenna	C3P8 (0.8/3.8)	⊘ 80°	3 mag	27	165.6	703
			STG38 (0.8/3.8)	⊘ 80°	3 mag	22	112.6	299
ELTMA	Eltri	Venezia	MET38 (0.8/3.8)	⊘ 80°	3 mag	17	111.1	365
GONRU	Goncalves	Tomar	TEMPLAR1 (0.8/6)	⊘ 55°	3 mag	25	179.7	810
			TEMPLAR2 (0.8/6)	⊘ 55°	3 mag	24	142.1	421
GOVMI	Govedič	Središče ob Dravi	ORION2 (0.8/8)	⊘ 42°	4 mag	22	138.5	485
HERCA	Hergenrother	Tucson	SALSA (1.2/4)	⊘ 80°	3 mag	27	122.4	202
			SALSA2 (1.2/4)	⊘ 80°	3 mag	26	166.5	434
HINWO	Hinz	Brannenburg	AKM2 (0.85/25)	⊘ 32°	6 mag	18	87.5	287
IGAAN	Igaz	Hódmező-vásárhely	HUHOD (0.8/3.8)	⊘ 80°	3 mag	25	173.4	590
JOBKL	Jobse	Oostkapelle	BETSY2 (1.2/85)	⊘ 25°	7 mag	11	76.7	683
KACJA	Kac	Kostanjevec	METKA (0.8/8)	⊘ 42°	4 mag	17	82.7	176
		Ljubljana	ORION1 (0.8/8)	⊘ 42°	4 mag	22	84.5	241
		Kamnik	REZIKA (0.8/6)	⊘ 55°	3 mag	2	5.0	9
			STEFKA (0.8/3.8)	⊘ 80°	3 mag	7	12.0	26
KOSDE	Koschny	Noord-wijkerhout	TEC1 (1.4/12)	⊘ 30°	4 mag	17	63.7	132
LUNRO	Lunsford	Chula Vista	BOCAM (1.4/50)	⊘ 60°	6 mag	23	139.3	564
MOLSI	Molau	Seysdorf	AVIS2 (1.4/50)	⊘ 60°	6 mag	21	136.9	1508
			MINCAM1 (0.8/6)	⊘ 60°	3 mag	25	124.8	383
		Ketzür	REMO1 (0.8/3.8)	⊘ 80°	3 mag	25	142.5	434
			REMO2 (0.8/3.8)	⊘ 80°	3 mag	28	157.3	780
OCHPA	Ochner	Albiano	ALBIANO (1.2/4.5)	⊘ 68°	3 mag	22	115.4	341
SCHHA	Schremmer	Niederkrüchten	DORAEMON (0.8/3.8)	⊘ 80°	3 mag	20	103.1	256
SLAST	Slavec	Ljubljana	KAYAK1 (1.8/28)	⊘ 50°	4 mag	16	58.1	112
STOEN	Stomeo	Scorze	MIN38 (0.8/3.8)	⊘ 80°	3 mag	25	188.9	947
			NOA38 (0.8/3.8)	⊘ 80°	3 mag	25	155.6	565
			SCO38 (0.8/3.8)	⊘ 80°	3 mag	25	182.0	951
STRJO	Strunk	Herford	MINCAM2 (0.8/6)	⊘ 55°	3 mag	21	68.7	202
			MINCAM3 (0.8/8)	⊘ 42°	4 mag	17	89.8	382
			MINCAM5 (0.8/6)	⊘ 55°	3 mag	16	72.5	214
TEPIS	Tepliczky	Budapest	HUMOB (0.8/3.8)	⊘ 80°	3 mag	17	114.9	269
YRJIL	Yrjölä	Kuusankoski	FINEXCAM (0.8/6)	⊘ 55°	3 mag	26	140.3	579
					Overall	30	4 059.9	15 441

Results of the IMO Video Meteor Network — October 2009

Sirko Molau [1] *and Javor Kac* [2]

Twenty-one observers operated 35 video cameras in October 2009. More than 21 600 meteors were recorded in almost 4 000 hours of effective observing time. The Orionids presented an elevated activity for the fourth year in a row. A wide symmetrical maximum extending from October 21/22 to 23/24 can be seen in the activity profile obtained from more than 7000 Orionids recorded. The activity profile of the Southern and Northern Taurids is also presented. The minor showers, October Ursae Minorids and Leonis Minorids, were confirmed and their activity in 2009 is presented. The long-term activity profile of October Camelopardalids was updated with 2009 data. The period of activity for this shower is only about 6 hours, from Solar longitude 192°.5 to 192°.8.

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1 Introduction

While the good weather continued in October for our south European and American observers, we had the typical autumn weather conditions farther north. As a result, only 17 cameras recorded meteors in twenty or more October nights. On the other hand, nights are getting longer in October, so we almost reached the August and September results and collected nearly 4 000 hours of effective observations for the third time in a row (Table 1 and Figure 1). With respect to meteor counts, the Orionids and Taurids were clearly noticeable. With 21 500 meteors observed, we did not quite reach the August result, but recorded a few thousand meteors more than in September. Once more, there were four non-intensified cameras (Sco38, Min38, Templar1, C3P8) among the five cameras with highest meteor counts. Among the northern European observers, only Bocam was among the top performing cameras. The highest nightly counts were obtained with image-intensified cameras (Avis2: 338, Bocam: 234), but the better observing conditions in Italy and Spain more than compensated for this advantage.

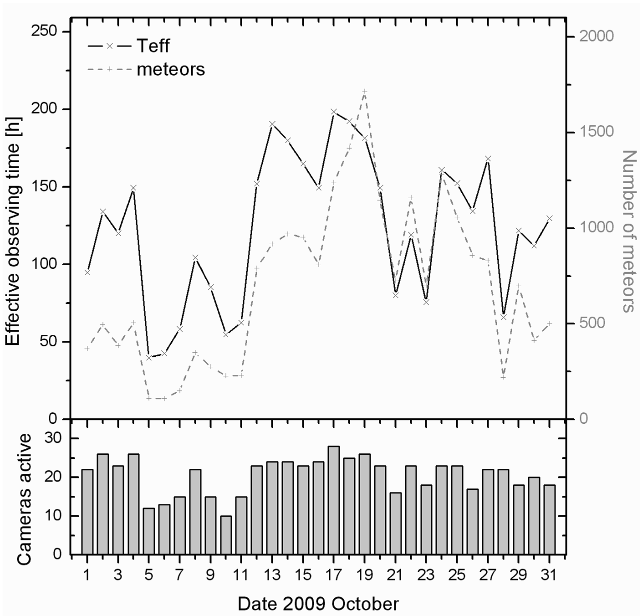

Figure 1 – Monthly summary for the effective observing time (solid black line), number of meteors (dashed gray line) and number of cameras active (bars) in 2009 October.

2 Orionids

Also in 2009, the Orionids (MDC: 8 ORI) were more active than in the years before 2006. The IMO quick-look analysis of visual observations derived ZHR values beyond 30 between the morning of October 20 and the evening of October 23 with maximum rates of 45 in the nights of October 21/22 and 22/23 (International Meteor Organization, 2009). Overall, the observing conditions were less than perfect, so that only a few observers obtained longer observing series. The same happened to the video observers — beside Salsa there was not a single camera with clear skies in the full maximum period. Thus, the analysis of the 2009 data is based on averaging the data over all cameras again. For each night, the number of Orionids (7 238 in total) and sporadic meteors (9 746 in total) was determined. The ratio between both figures is a rough measure of the Orionid activity (Figure 2). The Orionids show the typical symmetric profile, whereby the maximum between October 21/22 and 23/24 lasted somewhat longer than in the visual data. The long-term video rate profile of the Orionids obtained in the latest meteor shower analysis (Molau & Rendtel, 2009) is given for comparison. Both profiles agree well.

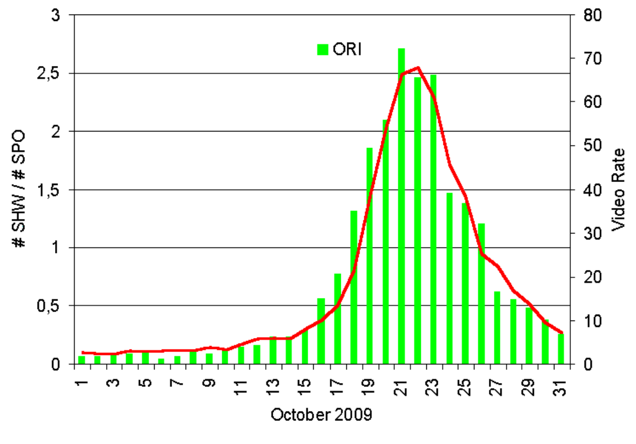

Figure 2 – Activity profile of the 2009 Orionids (bars). The line represents the long-term activity profile from the last comprehensive meteor shower analysis in autumn 2009.

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NASA-ADS bibcode 2009JIMO...37..188M

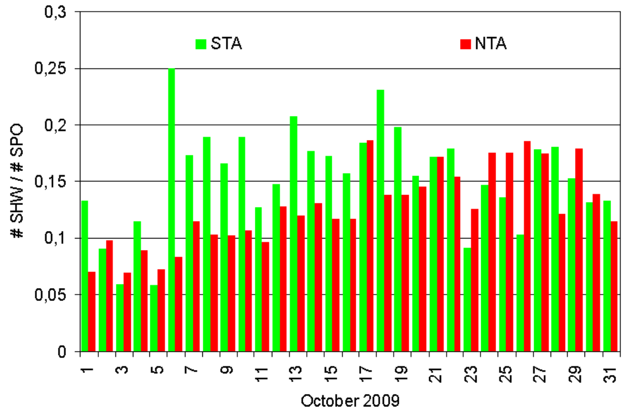

Figure 3 – Activity profile of the Northern and Southern Taurids in 2009.

3 Taurids

Figure 3 gives the same profile for the Southern (MDC: 2 STA) and Northern (MDC: 17 NTA) Taurids. Due to the smaller data set (1 537 STA, 1 297 NTA), the scatter is larger than for the Orionids. Still, the trend observed earlier — that the southern branch dominates in early October but both branches become equally strong towards the end — is clearly visible in the 2009 data as well.

4 October Ursae Majorids and Leonis Minorids

The October Ursae Majorids (in previous analyses named τ Ursa Majorids — TUM, now MDC: 333 OCU) were discovered by the Japanese observers associated with S. Uehara in 2006 and confirmed by the IMO Video Meteor Network only a few days later. In the recent comprehensive analyses of IMO video data, the shower was detected between October 12 and 20 with a maximum video rate of 2.5 on October 15 (Molau & Rendtel, 2009). Based on 327 shower members, the maximum date could be confirmed in 2009 as presented in Figure 4. Looking at the plain meteor counts (330 in total), the same graph shows that the Leonis Minorids (MDC: 22 LMI) for a few days presented the same activity. Note that the analysis procedure applied here does not account for different radiant altitudes. Thus, with respect to ZHR the LMI should have been somewhat stronger than OCU, which matches the long-term result (maximum video rate of 4.2). The maximum date of the Leonis Minoris (October 23) also agreed with the long-term value.

5 October Camelopardalids

We conclude with a closer look at the October Camelopardalids (MDC: 281 OCT). Finnish observers associated with J. Moilanen and E. Lyytinen noticed activity from this shower in 2005 (Jenniskens et al., 2005). In the same year, our camera network recorded about a dozen shower members — typically too few for a meteor shower identification. However, the activity was concentrated on a short time interval of roughly two hours in an evening with minimum sporadic activity, so the shower was clearly noticeable. Since it was never observed before, we first thought of a singular outburst. In

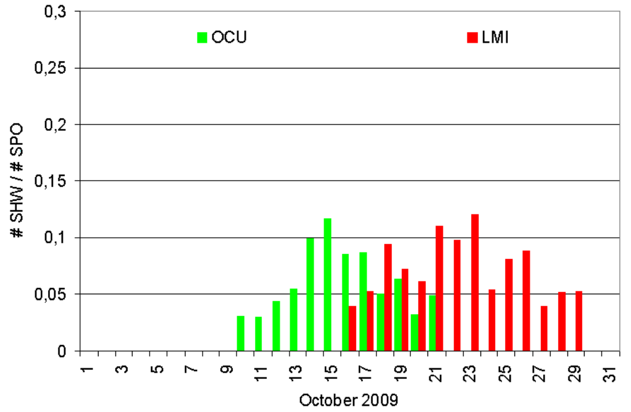

Figure 4 – Activity profile of the October Ursae Majorids and the Leonis Minorids 2009.

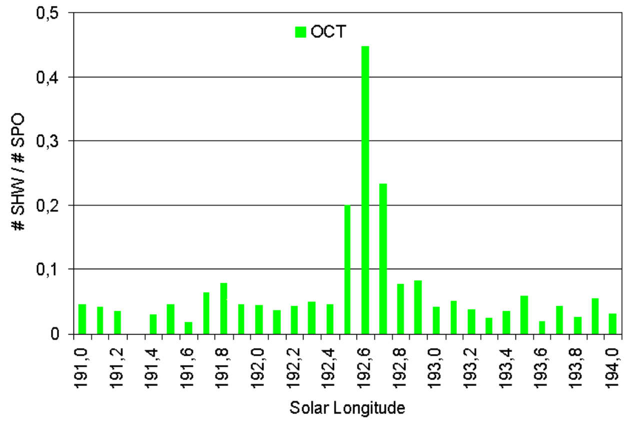

Figure 5 – Long-term activity profile of the October Camelopardalids with high temporal resolution, based on observations of the IMO Video Meteor Network including 2009.

the next year, however, we confirmed the hypothesis of E. Lyytinen, that this is in fact an annual shower. With the expected offset of 6 hours, more than 40 shower members were recorded in a short time interval. In our last full analysis of the IMO Video Meteor Database, the shower was not found with the standard parameter set, because it was much too short for the applied minimum shower duration criterion. Nonetheless, the October Camelopardalids could be identified in the Solar longitude interval 192–193 degrees with a maximum video rate of 2.0 (Molau & Rendtel, 2009).

Based on the complete IMO Video Meteor Database including the 2009 data, we have now obtained a high temporal resolution activity profile from the shower. Between Solar longitudes 191 and 194, the number of October Camelopardalids (214 in total) and sporadic meteors (3 592 in total) was determined in bins of 0.1 degrees Solar longitude (about 2.5 hours). The result is presented in Figure 5. Despite the short interval length, the profile shows remarkably little scatter. The OCT are only active between Solar longitude $192^\circ\!.5$ and $192^\circ\!.8$, i.e. within about 5 to 6 hours of time. The activity outside this interval is the sporadic background, i.e. meteors that matched only by chance the OCT radiant. At maximum (in the Solar longitude interval $192^\circ\!.6$–$192^\circ\!.7$) the shower reaches about half the sporadic meteor count. In other words, every fifth recorded meteor in that interval was an October Camelopardalid.

Table 1 – Observers contributing to October 2009 data of the IMO Video Meteor Network.

Code	Name	Place	Camera	FOV	LM	Nights	Time (h)	Meteors
BENOR	Benitez-S.	Las Palmas	TIMES4 (1.4/50)	⊘ 20°	3 mag	20	100.5	319
			TIMES5 (0.95/50)	⊘ 10°	3 mag	18	72.5	131
BRIBE	Brinkmann	Herne	HERMINE (0.8/6)	⊘ 55°	3 mag	22	109.1	633
CASFL	Castellani	Monte Baldo	BMH1 (0.8/6)	⊘ 55°	3 mag	16	101.2	453
			BMH2 (0.8/6)	⊘ 55°	3 mag	16	113.1	613
CRIST	Crivello	Valbrevenna	C3P8 (0.8/3.8)	⊘ 80°	3 mag	25	173.3	1 207
			STG38 (0.8/3.8)	⊘ 80°	3 mag	26	138.1	467
ELTMA	Eltri	Venezia	MET38 (0.8/3.8)	⊘ 80°	3 mag	16	121.0	722
GONRU	Goncalves	Tomar	TEMPLAR1 (0.8/6)	⊘ 55°	3 mag	25	188.1	1 235
			TEMPLAR2 (0.8/6)	⊘ 55°	3 mag	25	176.0	728
GOVMI	Govedič	Središče ob Dravi	ORION2 (0.8/8)	⊘ 42°	4 mag	19	84.2	354
HERCA	Hergenrother	Tucson	SALSA (1.2/4)	⊘ 80°	3 mag	26	180.0	692
			SALSA2 (1.2/4)	⊘ 80°	3 mag	27	192.2	919
HINWO	Hinz	Brannenburg	AKM2 (0.85/25)	⊘ 32°	6 mag	10	55.5	465
JOBKL	Jobse	Oostkapelle	BETSY2 (1.2/85)	⊘ 25°	7 mag	15	115.8	923
KACJA	Kac	Kostanjevec	METKA (0.8/8)	⊘ 42°	4 mag	11	62.3	200
		Ljubljana	ORION1 (0.8/8)	⊘ 42°	4 mag	23	97.6	427
		Kamnik	REZIKA (0.8/6)	⊘ 55°	3 mag	1	6.5	75
KOSDE	Koschny	Noord-wijkerhout	TEC1 (1.4/12)	⊘ 30°	4 mag	6	23.8	67
LUNRO	Lunsford	Chula Vista	BOCAM (1.4/50)	⊘ 60°	6 mag	22	155.8	1 587
MOLSI	Molau	Seysdorf	AVIS2 (1.4/50)	⊘ 60°	6 mag	9	53.1	806
			MINCAM1 (0.8/8)	⊘ 42°	4 mag	19	91.6	488
		Ketzür	REMO1 (0.8/3.8)	⊘ 80°	3 mag	22	99.1	521
			REMO2 (0.8/3.8)	⊘ 80°	3 mag	20	69.3	220
OCHPA	Ochner	Albiano	ALBIANO (1.2/4.5)	⊘ 68°	3 mag	24	164.0	794
SCHHA	Schremmer	Niederkrüchten	DORAEMON (0.8/3.8)	⊘ 80°	3 mag	18	91.9	459
SLAST	Slavec	Ljubljana	KAYAK1 (1.8/28)	⊘ 50°	4 mag	15	79.7	178
STOEN	Stomeo	Scorze	MIN38 (0.8/3.8)	⊘ 80°	3 mag	22	163.7	1 360
			NOA38 (0.8/3.8)	⊘ 80°	3 mag	23	142.8	791
			SCO38 (0.8/3.8)	⊘ 80°	3 mag	24	174.7	1 708
STRJO	Strunk	Herford	MINCAM2 (0.8/6)	⊘ 55°	3 mag	20	92.1	362
			MINCAM3 (0.8/8)	⊘ 42°	4 mag	15	76.1	309
			MINCAM5 (0.8/6)	⊘ 55°	3 mag	18	109.1	677
TEPIS	Tepliczky	Budapest	HUMOB (0.8/3.8)	⊘ 80°	3 mag	7	50.0	134
YRJIL	Yrjölä	Kuusankoski	FINEXCAM (0.8/6)	⊘ 55°	3 mag	14	100.7	598
					Overall	31	3 824.5	21 622

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Meteor Beliefs Project: Meteoric imagery associated with the death of John Brown in 1859

George J. Drobnock[1], *Alastair McBeath*[2] *and Andrei Dorian Gheorghe*[3]

An examination is made of metaphorical meteor imagery used in conjunction with the death of American anti-slavery activist John Brown, who was executed in December 1859. Such imagery continues to be used in this regard into the 21st century.

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1 Introduction

At the 2008 IMC, we presented some notes on the period around 1859–60 as part of a discussion connecting modernity to that period in terms of meteor and meteor science beliefs (McBeath et al., forthcoming). One element from that was how meteoric imagery had been introduced by various people as a metaphor for the later actions of abolitionist John Brown (1800–1859) in America, when trying to free the slaves there. Such imagery has persisted in the tales surrounding Brown even down to the present day. As hoped in the IMC article, we have returned to examine this in more detail here, timed to commemorate the 150th anniversary of Brown's execution, in December 1859.

2 John Brown

John Brown was born in Torrington, Connecticut, USA, in 1800. He worked at various trades, including as a tanner, land surveyor, shepherd and farmer. He was married twice and had 20 children. In his adult life, he believed he had been given a holy mission to free slaves and abolish slavery, and spent much of his time working towards that end, along with his sons. Groups of freed slaves were escorted to safety, for example to Canada, as Canada, being then a British dominion, had had no slavery since Britain ended it in 1807.

From about 1849, Brown became particularly prone to using force in pursuit of his abolitionist goals. In 1854, five of his sons moved to Kansas, where Brown joined them the next year, and they became embroiled in the violence of the Kansas border conflict, between groups of pro- and anti-slavery supporters. Brown became a leader in this raiding warfare, where his actions made him notorious as 'the terror of the Missouri border'. His home was burnt down in 1856, and one of his sons killed, after which he led an attack on Pottawatomie, or Ottawa, Creek in Franklin County, Kansas with four of his other sons on 1856 May 24. They killed five pro-slavery men there, in retaliation for a pro-slavery group's sacking of the slave-free town of Lawrence three days earlier. He earned the nickname 'Osawatomie Brown' or 'Old Brown of Osawatomie' after he led a stand at Osawatomie in August 1856 against a pro-slavery raid from Missouri. Overall more than 200 people were killed in Kansas alone during this unstable period, though other equally violent, if more isolated, incidents connected with slavery and its abolition took place elsewhere in America in the run-up to the 1856 presidential election and afterwards.

After the Kansas conflict ended, Brown moved to Iowa, where he was involved in training troops, before setting up a stronghold in the mountains of Virginia as a refuge for runaway slaves. The final acts of his life centred around his leading an armed group of 22 men from Pennsylvania in an attack on the town of Harper's Ferry, Virginia (since 1862 July, West Virginia) on 1859 October 17. His intention was to free slaves there, and use it as a rallying-point for the abolitionist cause. As we recounted previously (op. cit.), after seizing the US armoury and arsenal, Brown's force was besieged there by US marines, with only five of his party escaping death or capture on October 19. Though wounded, Brown was imprisoned and tried at Charlestown, Virginia, on charges of treason, murder and conspiring with slaves. He refused to defend himself at his trial, saying only that God had given him a mission to free slaves. He was found guilty, and condemned to death, a sentence that was carried out on 1859 December 2. It is said that on his way to the scaffold, his last action was to kiss a black baby.

Following his execution, he seemed to have been regarded either as an insane criminal (indeed, seventeen affidavits were presented to the Governor of Virginia during his trial to the effect Brown was believed insane), or a martyr to the cause of abolitionism. Modernly, it is primarily the latter aspect which holds sway, in that although his actions might today be seen as those of a terrorist, his cause is equally seen to have been just. Even immediately after his death, he had become an immortal figure, as Thomas B Bishop's famous marching song commemorating the Harper's Ferry raid indicated, by the line that while "John Brown's body lies a-mouldering in the grave, his soul goes marching on." A little later, Julia Ward Howe (who became an American suffragette) wrote fresh words for the tune, as "The Battle Hymn of the Republic".

Various texts have discussed John Brown's life and times in detail, but we found two 19th-century works especially interesting, as based on memories of the events, Webb (1861) and Sanborn (1885), both of which are also available online. Figure 1 shows Brown's appearance in the year of his death.

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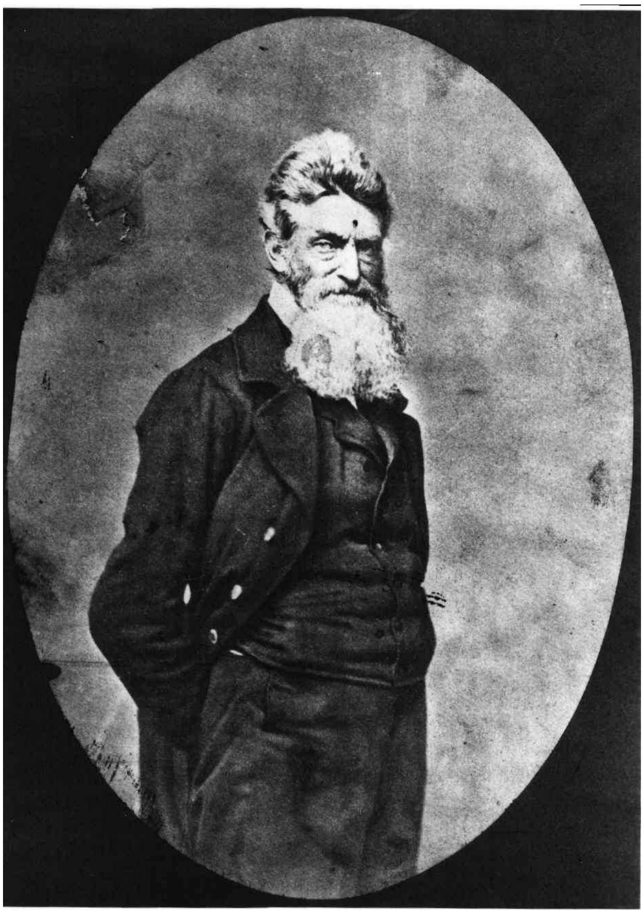

Figure 1 – A photograph of John Brown in 1859, attributed to Black & Batchelder, from the United States' Library of Congress. Brown's characteristic high-brushed hair and fan-shaped beard give him a dynamic, quite cometary or meteoric look, something that Melville's poem "The Portent" drew attention to (cf. McBeath et al., forthcoming).

3 Brown becomes meteoric

As we described before (McBeath et al., forthcoming), author Herman Melville wrote a poem in 1859, "The Portent", specifically about John Brown's execution, which described him as "The meteor of the war", that is the American Civil War of 1861–65, in the fashion from ancient times whereby meteors were seen as portentous events. We also detailed how American poet Walt Whitman had included Brown's death as one of a whole series of portents foretelling the Civil War in his poem "Year of Meteors (1859–60)", in which he also included a comet, probably C/1860 M1, and a "strange huge meteor procession", probably a brilliant, very long fireball widely seen across the northeastern part of the USA from Minnesota to Long Island, New York, and far out into the western Atlantic, on 1860 July 20, one of four spectacular fireballs seen and widely-reported from eastern America between 1859 November to 1860 August. These two items were just part of a general trend towards perceiving Brown metaphorically as a meteor for the coming conflict, in some cases a literal spark that would ignite it, as we briefly indicated earlier by mentioning in-passing comments by American essayist Henry D. Thoreau and the Reverend J. Sella Martin, to both of whom we now return.

Thoreau produced a lengthy essay "The Last Days of John Brown" which was published in his book "Miscellanies" (Thoreau, circa 1863) in which he revisited his original comment regarding Brown, written in his journal on 1859 December 5 to begin the piece:

"John Brown's career for the last six weeks of his life was meteor-like, flashing through the darkness in which we live. I know of nothing so miraculous in our history."

Towards the essay's end, he returned to the theme, but this time regarding Brown's dead body being returned home by train for burial:

"What a transit was that of his horizontal body alone, but just cut down from the gallows-tree! We read that at such a time it passed through Philadelphia, and by Saturday night had reached New York. Thus like a meteor it shot through the Union from the Southern regions toward the North! No such freight had the cars borne since they carried him southward alive."

This determination to push the limits of the metaphor was seen too in the Rev. Martin's public address, delivered at the Joy Street Baptist Church in Boston, Massachusetts on the day of Brown's execution, where a day of mourning was held commemorating the event. His speech was reported in full in the anti-slavery journal "The Liberator" for 1859 December 9 (the text available via `http://chnm.gmu.edu/lostmuseum/lm/143/`). Towards the end of his address, he made the following remarks:

"I close by saying, my friends, that John Brown... shall slay more in his death than he ever slew in all his life. It is thought by the slaves – and it is a beautiful conceit, though coming from slaves – that the meteors from the heavens are sparks that... strike upon the craters of volcanoes, and that is the cause of their eruption. From the firmament of Providence today, a meteor has fallen. It has fallen upon the volcano of American sympathies, and though, for awhile, it may seem to sleep, yet its igneous power shall communicate... to the slumbering might of the volcano, and it shall burst forth in one general conflagration of revolution that shall bring about universal freedom."

There is little doubt in the importance attached to Brown's death here, aside from a fascinating insight into a meteor belief attributed to the slaves, originating perhaps in Africa, or possibly the West Indies where many slaves were used in the production of sugar cane, and where there are still active volcanoes today.

On the day John Brown's trial began, 1859 October 27, The New York Times newspaper reprised events behind it under the heading "John Brown's Work". One passage combined the portentous meteoric imagery linked to Brown, with the raid's perceived significance to both the slave-free northern states, and the slave-holding southern ones:

"In and of itself it [the raid] is simply an angry meteor shot athwart the sky, by which slaveholders and slaves alike seem to have been not unreasonably appalled, and which has startled the North, we feel warranted in saying, quite as thoroughly as the South. It is a portent certainly not to be lightly pondered, that such a grotesquely frightful episode should have been possible in our current history; but if we are to profit by the shock it has administered, we must honestly look the fact in the face, that the occurrence shows us, as nothing else could, what vast possibilities of evil sleep in our angry sectional polities."

The 'meteor shot athwart the sky' comment seems to be a paraphrase of a line in Canto II of Alexander Pope's 1717 epic poem, "The Rape of the Lock" – "Pursue the Stars that shoot athwart the Night" (e.g. Fuller, 2008, p. 20) – which notable poem's meteoric imagery we hope to return to in future.

Another contemporary of John Brown's, David Hunter Stother, repeated a variant of Martin's 'volcanic meteor' concept in a lecture at Cleveland, Ohio in 1868, concerning his experiences at the time of Brown's raid and capture at Harper's Ferry, and where he was taken to Brown's cell to complete a sketch he had begun earlier. He was accompanied by a young Lieutenant, J. E. B. Stuart, later the famous Confederate cavalry general, who explained to Stother in forthright terms just who Brown was, linking him to the atrocities in Kansas. From his own hand-written lecture notes (Stother, 1868, p. 10):

"Now for the first time the truth flashed upon me – this was indeed an Abolition raid, a flaming meteor, discharged from the crater of that remote Volcanic Kansas and bursting in the midst of our unsuspecting & peaceful community like a red-hot aerolite falling from some distant ruined world – I understood the thing at last."

Stother, like The New York Times, saw the raid, not just Brown, as a meteoric event, but with Stother, the event was cast out as if from a volcano that way, rather than the eruption being sparked by a meteor as Martin discussed. Stother employed the concept of a hot meteorite landing with an ability to start a conflagration to conclude with how significant he realized the event to have been.

The power of the metaphorical language used in all these cases leaves a definite impression of the significance attached to Brown's attack on Harper's Ferry and what followed it, as perceived by the various commentators. The cluster of real fireballs seen in 1859–60 passed quickly into the general public consciousness thanks to articles in the popular press, including journals such as 'Scientific American' (whose article "The Year of Great Meteors" in 1860 September enabled us to identify the four, main, genuinely meteoric events of the period in our previous paper). The comets of the time too seemed to cluster, including the great Donati's of 1858–59 (C/1858 L1). With the overall turn of historical events, these celestial occurrences helped heighten the effect on the social and cultural fabric of American life of the period just before the Civil War. Whether they would have been seen so without the impending conflict is another matter, since in Europe, for instance, where no similarly major social upheaval was apparent at this time, what meteors and comet observations were made were perceived more as curiosities to excite scientific interest, than portents of any kind.

4 Brown's meteoric influence lives on

Stother's comments indicated that the metaphorical meteoric associations with John Brown's death persisted beyond the end of the Civil War, and indeed continue to do so. However, the late 1890s brought a fresh, but more physical, connection, this time with a meteorite.

In 1896, an article appeared in the American press about a 'meteor' striking a cabin near Ottawa Creek, the cabin which by then had become a monument to John Brown, as believed to be where he had stayed during his 'Bloody Kansas' days in the area. On 1897 May 29, the "Rantoul (KS) Citizen" newspaper (Page 4, Column 1; available at: `www.franklincountykansas.net/quarterlyonline.htm`; see also Nutt, 2000). published a piece of investigative journalism on this claimed event, as "Meteor fall's destroying John Brown's Cabin!" The article described the 'impact event' as having created interest from various eastern United States universities and museums, who had sent scientists and brokers to secure the meteorite. It went on to describe that the event had been a hoax, as it appeared a railway engineer had been speculating about what might have happened if a 'meteor' had hit a structure near Ottawa Creek. His thoughts were picked up by a local newspaper, and by the year's end it had become a legend!

Despite this 'hoax' claim, it seems the engineer's speculation had come about because of a genuine meteorite fall in the Ottawa Creek area, on 1896 April 9, as described in both the "Ottawa Weekly Times" and the "Ottawa Weekly Herald" for 1896 April 16, with pictures of the meteorite and where it had been found. No buildings were struck, though a farmer, Joe Black, who was nearby at the time, heard the sonic booms and grabbed onto a tree, thinking there was tornado coming, given that such events are relatively common in Kansas (cf. Mason & Wik, 1961).

Eighty years after Brown's execution, American artist John Steuart Curry (1897–1946) was working on an oil painting of Brown's 'Bloody Kansas' days, "Tragic Prelude" from 1938–1940 (Figure 2). While highly stylized, and anachronistically representative rather than wholly realistic, Brown's distinctive figure is central to the composition (period images show him with dark hair, and beardless, during his time in Kansas, for instance). The light behind him emphasizes his portentous nature, along with the background tornado and the wall of flames to his left and right as viewed. The latter pair seem to have been influenced by imagery from the two great Hollywood movies of 1939, "The Wizard of Oz", where the heroine was magically transported from her home in Kansas by a terrifying tornado, and the American Civil War epic "Gone With The Wind", which has a very famous 'wall of flames' scene in one place. The tornado works to reinforce the meteoric metaphor for Brown, since as we discussed previously (McBeath et al., forthcoming) tornadoes were still being called 'meteors' in 'Scientific American' in 1860, something not lost on commentators during that period.

Even a century later, the link between John Brown's death and meteoric imagery was still being remembered

Figure 2 – The oil painting "Tragic Prelude" by John Steuart Curry.

in America, thanks to the preserved thoughts of the various mid 19th century commentators. An item we decided to use here, rather than in our recent notes from the Project's 'Musical Meteors' strand presented at the 2009 IMC (McBeath & Gheorghe, forthcoming), came from the lyrics to a track from Rancid, on their "Rancid 2000" album, entitled "Meteor of War":

"John Brown set the tone – he was a meteor in a guilty land, Abolitionist understand freedom to the despondent man, Grant said you're either one, a patriot or a traitor's son. It's a sanguinary conclusion".

Still more recently, during the late stages of research for this article, we learnt we were not alone in modernly rediscovering this connection between John Brown and meteors, in the form of a Master of Arts thesis published online, "From Man to Meteors, 19th century American writers and the figure of John Brown" (Benigni, 2007). Benigni's third chapter was of particular interest to us, "Making Metaphors of Meteors", as dealing with Whitman, Melville and John Brown.

5 Conclusion

John Brown's own surviving writings, and those of his followers, made quite clear that he never saw himself or his actions as meteoric at all, nor was he influenced by a belief in portents in the sky. His concerns were much more earthly and human, and his driving belief was in the abolition of slavery. The metaphorical connections we have discussed were instead generated and sustained by others who took a far less active role in such matters, if at all, prior to Brown's death. In that event's aftermath however, this connection was used to help push forward the eventual abolition of slavery in all of America.

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2009 Geminids from Australia

2009 Geminids as seen from the Leon Mow Dark Sky Site in Victoria (Australia). Canon 5D mkII was used, set at ISO 3200 for 2-hours worth of 8-second exposures through a 24-mm f/1.4 lens wide open, all mounted on a Vixen GP-DX equatorial mount. These images were stacked against a single 2-minute exposure to capture the surrounding stars and the Milky Way. Bottom plot is provided to help identify 34 Geminids present in the top image. Photo credit: Phil Hart (http://www.philhart.com).