One-Hour Outburst of the 1991 Perseids Surprises Japanese Observers!

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While overall Perseid activity was rather normal in 1991, a short one-hour outburst was witnessed in Japan at $\lambda_\odot = 139^\circ\!.56$ (2000.0), yielding ZHRs of over 400. The position of this outburst in the Perseid activity profile coincides with the first peak of the double maximum found in 1988 and 1989 and points towards the presence of a new filament of particles connected with the return of the Perseids' parent comet P/Swift-Tuttle.

Japanese observers witnessed a short outburst of Perseid activity at $\lambda_\odot = 139^\circ\!.56$, almost exactly at the position of the first peak of the double Perseid maximum, first found in *IMO*'s global analysis of the 1988 data [1] and convincingly confirmed in 1989 [2,3].

It should be mentioned that the time of the first peak was announced by the first author in an article in the August issue of *Sky and Telescope* [4], as a consequence of which several observers paid special attention to this event. However, nobody could ever have reasonably expected the exceptional strength of this peak in 1991, which is the highest level of Perseid activity recorded this century.

Although the outburst was seen by many observers at several sites independently, most observers lost track of the activity because it was simply too strong, as was kindly reported to us by Mr. Yasuo Taguchi and Mr. Yasuo Yabu.

Especially the results of the Shinshu University Astro OB Club, who had obviously prepared for a sharp maximum, are interesting. Between 15^h20^m and 16^h20^m UT, they obtained an hourly rate of 352, from an observing site in the Nagano Prefecture, at a height of 1720 m. They observed under very good circumstances, with a limiting magnitude of +6.5 in the center of the field of view. This count corresponds to a ZHR value of over 400! Before and after this period the activity was much lower: hourly rates of 64 and 62 respectively were recorded in the intervals 14^h20^m–15^h20^m UT and 16^h20^m–17^h20^m UT.

Also Mr. Yabu's observations under lm = +5.2 yielded rates between 16^h and 17^h UT that were 3 to 5 times stronger than at the beginning or the end of the night. From Mr. Yabu's data, the ZHR values of Table 1 could be computed.

Table 1 – Perseid ZHR values obtained by Yasuo Yabu on August 12, 1991.

Interval (UT)	T_{eff}	Lm	Per	Other	ZHR
14^h00^m–15^h00^m	$0^h\!.94$	4.8	12	6	128 ± 37
15^h00^m–16^h00^m	$0^h\!.86$	5.2	39	7	254 ± 41
16^h00^m–17^h00^m	$0^h\!.80$	5.3	62	10	335 ± 43
17^h00^m–18^h00^m	$0^h\!.88$	5.1	35	7	182 ± 31
18^h00^m–19^h00^m	$0^h\!.93$	5.0	19	6	94 ± 22

The difference in maximal ZHR value between Mr. Taguchi and Mr. Yabu is most probably due to a difference in perception; nevertheless, both observations are very well in agreement.

The outburst seen in Japan was rich in bright meteors. Of the 352 meteors observed by the Astro OB Club, eleven were brighter than −5. The negative of the all-sky photograph shown on the front cover shows no less than 26 meteors of which the 16 still visible on the print are brighter than −3, the brightest being −8! On the photograph shown in Figure 1, 12 meteors were captured.

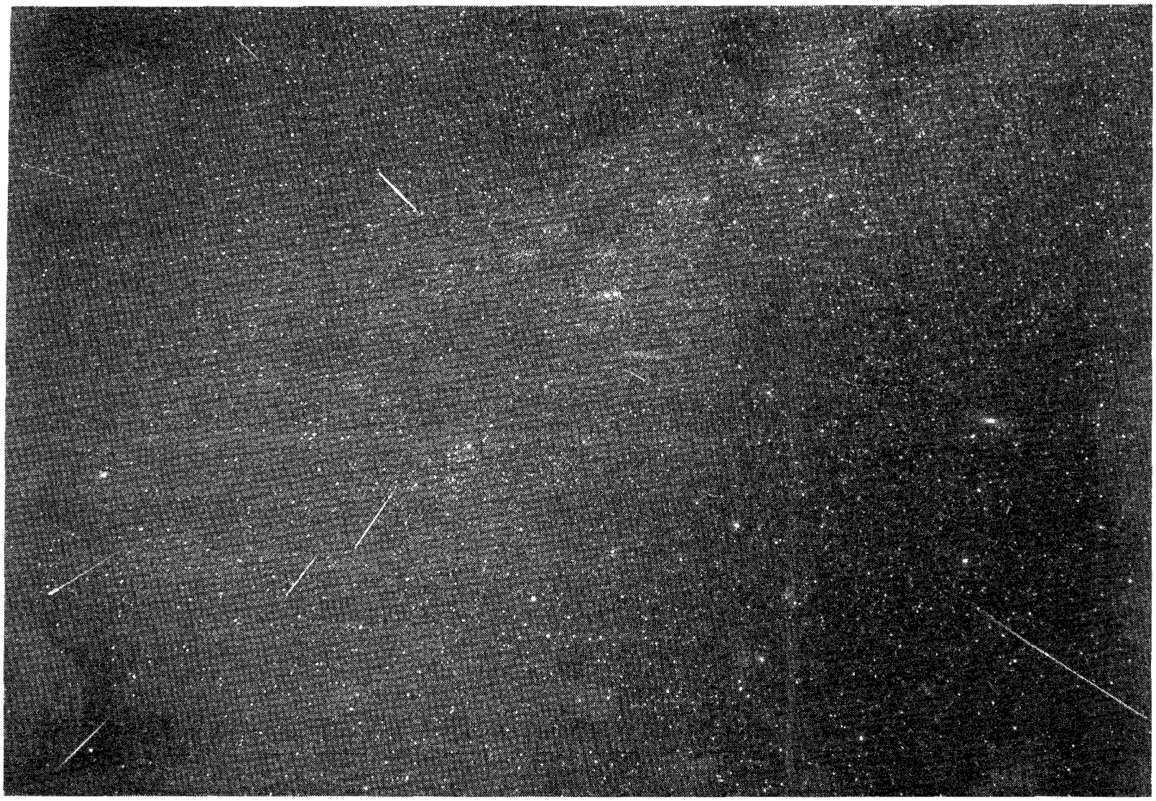

Figure 1 – This guided exposure of the Perseid radiant region (h and χ Persei and M31 can easily be distinguished) was taken by Mr. Tatsuo Nakagawa (Shinshu University, Astro OB Club) from Takane Village ($\lambda = 137°29'25''$ E, $\varphi = 35°57'09''$ N, $h = 1710$ m) between 15^h45^m and 16^h16^m UT on August 12. Twelve meteors were captured using an Asahi Pentax 67 camera with a 50 mm $f:4$ lens and a Sakura 3200 film.

The Japanese outburst was also confirmed by some radio observations in other parts of the world. Shelby Ennis, an American radio observer from Kentucky, reported that he recorded increased Perseid activity from August 12, 14^h onwards. By 15^h30^m UT, the activity level was so intense that only the Leonids in 1966 performed better. Everything was pretty much over by 17^h UT, although it took until 19^h UT before the level had reached normal rates for a Perseid maximum. A UK-based radio amateur, Colin Morris, noticed a small peak between 15^h and 17^h UT [5], despite the very low radiant elevation of the Perseids at that time.

At 19^h UT, a team of *IMO* observers, members of the *Arbeitskreis Meteore*, was already monitoring the sky in Bulgaria, where the radiant was still at a very low position in the sky. Many Perseids were seen, despite the low radiant elevation. Unfortunately, such low radiant position do not favor calculations. Although it is known that ZHR calculations become unreliable for radiant elevations below 20°, we did make an attempt anyway. Surprisingly, the values obtained by the six observers of the Mt. Rozhen team agree very well among each other. For the interval 18^h50^m–20^h00^m UT, with a radiant elevation of about 20° in the middle of the interval, a ZHR of 93 ± 10 and a population index of 2.2 were found. The limiting magnitude was 6.5 or slightly better. For each observer, the Perseid sample on which the calculations were based contains at least 30 Perseids and may thus be regarded as statistically significant. It is interesting to note that this ZHR value agrees very well with the ZHR obtained from Mr. Yabu's observations during the last hour of his night.

All reports received thus far from the contiguous United States and Canada indicate a good maximum, but nothing extraordinary, neither on August 11-12, nor on August 12-13. So far, also the European observers consistently reported "normal" maximum rates for the Perseids.

Over 4000 meteors were observed by 6 observers in Bulgaria during the night of August 12-13. Furthermore, we also received reports from Belgium, France, Germany, the Netherlands, Romania, Spain, the United Kingdom and Yugoslavia. All in all, the European observing window was very well covered and showed no sign of exceptionally high activity. The ZHR stayed around 100 all through the night (19^h00^m–02^h00^m). The most one can say is that activity was maybe slightly above average (ZHRs of 100 compared to an average 90 for the last few years), but this needs further confirmation.

An abundance of fainter meteors however was apparent, explaining the somewhat disappointing rates reported by people observing under poorer sky conditions. This is consistent with Japanese radio observations indicating that the August 12.7 UT peak was due to large particles, although more small particles were observed 24 hours later [6].

In view of this general picture, we were very surprised to see *IAU Circular 5330* mention that P. Aneca, B. de Pontieu, J. Deweerdt and J. Van Wassenhove of the *Vereniging voor Sterrenkunde (VVS)* observed ZHRs of up to 200 under good conditions in Southern France. This puzzling message was in contradiction with all other data from Europe. Fortunately, the confusion was resolved at the *International Meteor Conference* in Potsdam where Mr. Aneca presented the *VVS* observations in a poster session. Probably due to the limited experience of most of the observers, Mr. Aneca's graphs showed a very large spread on the data points, with ZHR-values varying roughly between 50 and 200. The average value of about 100–130 however was consistent with the other European observations.

In answer to further inquiries, Mr. Aneca told us that the message to Dr. Marsden was sent out by Mr. C. Steyaert, only basing himself on preliminary impressions of Aneca and ignoring the request of the observers not to publish anything yet. Moreover, Mr. Steyaert neglected to verify the result or to consult other observers for confirmation. Although the confusion caused by Mr. Steyaert's message has now been cleared, the fact remains that erroneous information has been disseminated to the astronomical press, yielding the possibility that a completely false picture of the 1991 Perseids will be given to the astronomical community, which is very unfortunate. To avoid similar problems in the future, *IMO* will stay in close touch with Dr. Marsden to prevent incorrect information on meteor showers from being spread.

We deeply regret the acts of Mr. Steyaert, who is also an *IMO* Council Member. However, Mr. Steyaert acted on behalf of the Belgian *VVS* which is solely responsible. It should be clear that the *IMO* cannot always prevent unexperienced or irresponsible amateurs in local or in national societies from making big mistakes. Of course, the *IMO* will continue to work on the reliability of amateur work and to act as an interface between the amateur and the professional community, thus trying to minimize the chances that similar situations reoccur in the future.

Returning to the 1991 Perseid activity profile, we can say in summary that the observations support the conclusion of the 1989 Perseid analysis [2], where the first peak of the Perseid maximum was described as a rather recent feature on the activity, probably caused by the intersection of the Earth with a new young stream of meteoroids, formed parallel and very near to the old core of the Perseid meteor stream, and probably connected with the return of the parent comet P/Swift-Tuttle.

Although many astronomers believe that P/Swift-Tuttle may have passed unnoticed several years ago, it is interesting to note that Dr. Marsden has another opinion regarding this matter [6]. Dr. Marsden is becoming more and more convinced that P/Swift-Tuttle might be identical to the comet observed by Kegler in 1737, yielding a return in 1992 (perturbations increase the period by 5 years). This hypothesis is further strengthened by the fact that the nodal longitude of this comet is only about $0^\circ\!.1$ from the solar longitude of the Japanese peak. (Also the Leonid peak in 1966 was practically identical with P/Tempel-Tuttle's nodal longitude in 1965). Furthermore, Chinese chronicles report that high Perseid activity was also seen in 1861 and in 1862, the year that P/Swift-Tuttle passed perihelion [7]. The records mention that *countless numbers of meteors were seen*, a description that matches very well the impression most Japanese observers got from the most recent Perseid outburst.

Hence it is very important that, despite the poor conditions moonwise, the Perseid maximum is closely monitored in 1992, especially by the European observers who will have the honor of witnessing the first peak next year.

References

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The 1990 Geminids

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A global analysis of the 1990 Geminids is presented, based on 11 255 meteors seen by 83 observers from 13 countries. The results confirm the general picture of the stream's activity profile. At first, the Geminid rates increased gradually to reach a ZHR of about 87 around $\lambda_\odot = 261°.75$ (2000.0). Then, the activity stayed around the same value for about 0°.5 in solar longitude before rising sharply to a peak value of about 110 on $\lambda_\odot = 262°.26$. This maximum lasted until $\lambda = 262°.42$ after which the ZHR plunged to sporadic background levels in less than 24 hours. Noteworthy though are the facts that peak rates were reached several hours later than in past years and that overall, activity levels were at least 10% lower than "normal".

1. Introduction

The Geminids, a major stream which is so much more impressive than any other stream is by no means the most observed shower. The winter month December scares off many people at the northern hemisphere and many observing sites suffer from chronical bad weather around that time of the year. 1990 was not better compared to previous years. Despite the New Moon and all the publicity to observe the stream, only a very limited amount of data was collected by the *IMO*. Altogether, the 1990 Geminid data allowed an analysis and therefore we are grateful to the following observers:

Joe Aboud (**ABOJO**, 11, $0^h.80$), S. Anazawa (**ANZSE**, 31, $0^h.75$), Rainer Arlt (**ARLRA**, 264, $4^h.91$), Luis Rubio Bellot (**BELLU**, 42, $3^h.00$), Lance Benner (**BENLA**, 299, $5^h.34$), Guy Blackman (**BLAGU**, 129, $4^h.42$), Mark Burns (**BURMA**, 62, $2^h.69$), Beata Cabakova (**CABBE**, 151, $3^h.67$), Jiang Chang-Gui (**CHAJI**, 36, $4^h.08$), Li-Chung Chen (**CHELI**, 158, $4^h.00$), Ya-Fen Chen (**CHEYA**, 185, $4^h.00$), Martin Coroneos (**CORMA**, 470, $7^h.44$), Mark Davis (**DAVMA**, 56, $4^h.00$), Kenneth Eakins (**EAKKE**, 102, $4^h.00$), Phyllis Eide (**EIDPH**, 14, $1^h.00$), Raul Fernandez (**FERRA**, 355, $4^h.40$), K. Fukui (**FUKKE**, 106, $3^h.00$), George Gliba (**GLIGE**, 37, $2^h.00$), Daniel Glomski (**GLODA**, 89, $5^h.15$), Mark Glossop (**GLOMA**, 241, $3^h.16$), Takema Hashimoto (**HASTA**, 120, $10^h.36$), Craig Hinton (**HINCR**, 186, $1^h.57$), Chris Innes (**INNCH**, 70, $2^h.70$), Daiyu Ito