OBSERVATIONS OF THE GEMINIDS 1974 AT THE SKALNATÉ PLESO OBSERVATORY. INTERCOSMOS PROGRAM

V. PORUBČAN, J. ŠTOHL

Astronomical Institute of the Slovak Academy of Sciences, Bratislava, Czechoslovakia

Abstract. The visual observations of the Geminid shower, carried out at the Skalnaté Pleso Observatory in 1974 according to a special Intercosmos program, have been analysed to determine the activity and the magnitude distribution of the shower. Total of the data amounts to 1006 individual records of 734 meteors, including 868 records of 634 Geminid meteors. Corrected hourly rates show a maximum at the solar longitude $\odot_{1950.0}$= 261.32. The activity of the bright meteors ($m \leqslant 2$) is, however, more complex and shows two maxima occurring around the main maximum of the Geminids. The first maximum is also confirmed by the course of the mean magnitudes of the Geminid meteors, corresponding to lower values of their population index. The magnitude distribution of the Geminids is otherwise not showing any significant variation. The probable error of a magnitude estimate was $e = \pm 0.37$.

1. Introduction

The question of micrometeorite streams and their possible connection with known meteor showers is one of the controversial problems arised by the results of micrometeorite measurements. In spite of some evidence of an enhanced flux of micrometeorite particles connected directly with the activity of meteor showers (e.g. Dubin, 1960; Nazarova, 1967; Alexander et al., 1971) there are definite arguments against reality of such showers even in the range of extremly faint meteors, at least because of the well-known difference in the population index for the shower and the sporadic meteors (Millman, 1970; Hughes, 1973; Štohl, 1976).

Unfortunately, there are no methods of observations and effective in situ measurements of meteoroids in the same intermediate range of masses in between the faintest observable meteors and the detectable micrometeoroids. On the other hand, we can obtain at least some information on the nature and changes in fluxes of micrometeorites and showers, as well as on their possible relation, by observational programs involving different techniques of observations and measurements, used simultaneously in the same periods.

The present paper summarizes the results of visual observations of the Geminid meteor shower, obtained at the Skalnaté Pleso Observatory in 1974, according to a special Intercosmos program, carried out at the time of micrometeorite measurements on board of the 2-IK-4 satellite, and involving simultaneous observations by different techniques at other observatories.

2. Distribution of the Hourly Rates

Owing to not very good weather conditions during the period of the 1974 Geminid shower, it was possible to carry out visual observations of the shower at the Skalnaté Pleso Observatory (20.2 E, 49.2 N) only in two nights around the maximum of the shower activity on December 13/14 and 14/15. Even these two nights were not completely free from cloudiness and strong wind. Meteors were recorded by a group consisted mostly of four observers and a recorder. They observed a total of 734 meteors, 634 of which were Geminids, in 6 hours and 48 minutes of the net observational time.

A list of observers with their abbreviations, total net time of observation (in minutes), the number of recorded shower meteors (n^+) and sporadic meteors (n^-) are summarized in Table 1.

To find out the hourly rates of meteors and their possible changes, the observations were divided into approximately 30-minute periods for which the total number of shower meteors n^+ and sporadic meteors n^- for each observer were determined. From these data the observed 30-minute rates for each observer were calculated separately for shower and sporadic meteors, in a usual way:

$$f_+ = \frac{n^+}{t}; \quad f_- = \frac{n^-}{t}. \tag{1}$$

In order to obtain actual hourly rates, the observed numbers of meteors were corrected for cloudiness by introducing a coefficient k_1, and reduced to ideal observing conditions with the shower radiant in zenith by introducing coefficient k_2. Cloudiness occurred mainly during the first and the last period of observations, and for k_1 the values were applied, published by Guth (1941). Coefficient k_2 was calculated using the formula

$$k_2 = (\cos z)^{-1}, \tag{2}$$

where z is the zenithal distance of the apparent shower radiant. The resulting numbers of meteors reduced to 30-minute interval of standard observing conditions, N^+, N^-, were obtained by applying the reduced coefficients k_1 for the mean cloudiness during the observing period and k_2 calculated for the middle of the observing period to the observed numbers using the following formulas:

$$N^+ = k_1 k_2 f_+; \quad N^- = k_1 f_-. \tag{3}$$

The observed data together with the computed 30-minute rates for individual observers are listed in Table 2. In the first four columns there are given: data of the observations, the abbreviations of the observers, the period of observations (CET — Central European Time) and the corresponding duration of observations. In the next two columns there are given direction of the field of view and percentage of the average cloudiness. Centres of the fields of view of individual observers were situated at the zenith distance of about 45° with azimuths separated 90° from one another (E — East, S — South, W — West and Z — Zenith). The next three columns contain the observed numbers of meteors in the respective periods: n_2^+ — the Geminids with apparent magnitude $m \leq 2$, n^+ — total number of the observed Geminids and n^- — sporadic meteors. In the last two columns of Table 2 there are shown the corrected numbers of the Geminids N^+ and sporadic meteors N^- according to (3), and reduced to half-hour intervals.

The observations were carried out during eight half-hour periods. The last period of the first night was finished at 6:03 of local time. The depression of the Sun at this time was $-16°$, so no correction for the twilight effects on the observed hourly rates of meteors derived by Slančíková (1975) was necessary to apply.

Table 1
List of the observers

Observer	Abbr.	Total time	n^+	n^-
Antal, M.	An	324	232	37
Porubčan, V.	Po	348	186	41
Slančíková, J.	Sl	408	278	33
Svoreň, J.	Sv	338	172	27
Kapišinský, I.	Ka	recorder		
Total		1418	868	138

The hourly rates reduced to an average observer, are listed in Table 3 and plotted in Figure 1. The table lists the mean solar longitude, the date, the time interval of observations in CET and the number of observers recording meteors in the interval. In the last four columns there are given resulting hourly rates for the Geminids F^+ and for the sporadic background F^-, as well as their corresponding mean square deviations σ^+, σ^-.

The calculated values of the hourly rates F^+ for the Geminids 1974 are plotted in Figure 1 (full curve). They show a rapid increase in the rate of the Geminids during the first night, and a slower decrease during the second night of the observations. The durations of the observational periods are shown by the lengths of the horizontal heavy dashed lines. The vertical dashed lines give the errors $e = \pm F \cdot n^{-\frac{1}{2}}$, where F is the hourly rates and n the number of individual meteors observed in the particular period. Moreover, the rates of meteors brighter or equal to the apparent magnitude $+2$ are shown in Figure 1 by dashed lines, with their error bars as before. There appears an apparent difference between the two frequency curves both in the position of the maxima, as well as in the general tendency of the activity.

The maximum of the activity occurred on December 14, at about 2:30 CET (the solar longitude $\odot_{1950.0} = 261.32$). The observations around the maximum were made under very good weather conditions, without any cloudiness, and the peak rate was about 76 meteors per hour.

The activity of meteors equal or brighter than the apparent magnitude $+2$ (dashed curve) shows two maxima. There appears a maximum which exhibits peak at the beginning of the first night, but for this particular period the largest value of the correction factor for cloudiness had to be adopted. On the other hand there appeared enhancement of brighter meteors especially in the second half of this period (21:04—21:34), where 9 of the 22 meteors

Table 2. List of the observations

Day	Obs.	Time (CET)	t	D	Cl	n_2^+	n^+	n^-	N^+	N^-
13	Po	20:34 21:04	30	Z	50	7	9	2	29.5	3.7
13	Sl	20:34 21:04	30	E	40	2	3	1	8.4	1.6
13	Sv	20:34 21:04	30	S	55	2	3	—	10.9	—
13	Ań	20:34 21:02	28	W	60	5	5	—	21.5	—
13	Po	21:04 21:34	30	Z	40	5	9	1	22.5	1.6
13	Sl	21:04 21:34	30	E	40	6	11	—	27.5	—
13	Sv	21:04 21:34	30	S	40	5	13	—	32.5	—
13	Ań	21:22 21:34	12	W	65	1	2	—	19.8	—
13	Po	22:26 22:56	30	Z	—	8	15	5	18.8	5.0
13	Sl	22:26 22:56	30	E	—	6	23	1	28.8	1.0
13	SV	22:26 22:56	30	S	—	8	19	2	23.8	2.0
13	Ań	22:26 22:56	30	W	5	9	28	2	36.8	2.1
13	Po	22:56 23:26	30	Z	—	5	14	2	16.6	2.0
13	Sl	22:56 23:26	30	E	5	6	24	2	29.8	2.1
13	sv	22:56 23:26	30	S	5	7	19	2	23.6	2.1
13	Ań	22:56 23:26	30	W	5	4	25	3	31.0	3.2
14	Po	00:38 01:08	30	Z	—	7	33	3	34.8	3.0
14	Sl	00:38 01:08	30	E	—	11	41	1	43.2	1.0
14	Ań	00:38 01:08	30	S	—	7	37	3	39.0	3.0
14	Po	01:08 01:38	30	Z	—	13	34	6	35.5	6.0
14	Sl	01:08 01:38	30	E	—	11	40	3	41.7	3.0
14	Ań	01:08 01:38	30	S	—	9	25	3	26.1	3.0
14	Sl	03:17 03:35	18	E	—	6	21	2	38.7	3.3
14	Sv	03:17 03:34	17	S	—	5	20	2	39.0	3.5
14	Ań	03:17 03:35	18	Z	—	7	19	2	35.0	3.3
14	Po	04:42 05:12	30	W	—	12	26	6	33.7	6.0
14	Sl	04:42 05:12	30	E	—	9	23	7	29.8	7.0
14	Sv	04:42 05:12	30	S	—	12	30	9	38.9	9.0
14	Ań	04:42 05:12	30	Z	—	16	33	6	42.8	6.0
14	Po	05:12 05:42	30	W	—	9	21	7	29.4	7.0
14	Sl	05:12 05:42	30	E	—	6	30	1	42.0	1.0
14	Sv	05:12 05:42	30	S	—	7	23	7	32.2	7.0
14	Ań	05:12 05:42	30	Z	—	8	25	8	35.0	8.0
14	Sl	21:08 21:38	30	E	10	4	13	3	21.9	3.3
14	Sv	21:08 21:38	30	S	10	4	12	1	20.2	1.1
14	Po	23:34 00:04	30	S	—	5	13	4	14.5	4.0
14	Sl	23:34 00:04	30	E	—	1	17	3	18.9	3.0
14	Sv	23:43 00:04	21	Z	—	2	8	1	12.6	1.4
15	Po	00:04 00:34	30	S	—	4	12	5	12.9	5.0
15	Sl	00:04 00:34	30	E	—	3	15	5	16.2	5.0
15	Sv	00:04 00:34	30	Z	—	4	11	2	11.9	2.0
15	Ań	00:04 00:32	28	W	—	4	16	3	18.5	3.2
15	Sl	01:38 02:08	30	E	50	1	5	1	9.8	1.9
15	Sv	01:38 02:08	30	S	60	1	3	—	7.1	—
15	An	01:38 02:08	30	Z	40	1	6	1	9.9	1.6
15	Sv	02:08 02:38	30	E	20	3	12	3	15.6	3.7
15	Sv	02:08 02:38	30	S	40	3	11	1	18.4	1.6
15	An	02:10 02:38	28	Z	10	3	11	6	13.6	7.1

recorded were of the magnitude $m \leq 2$ and 4 of them were brighter than $m = 0$. Two meteors with $m = -2.0$ and -2.5 were only 6 minutes apart from each other. The rest of periods in the first night shows an increasing activity of the brighter Geminid meteors, until the end of the observations.

The observed activity of the sporadic background listed in Table 3 is plotted in Fig. 1 by dots. It is consistent with the mean hourly rates of sporadic meteors, derived for the whole set of data available since 1944 from the Skalnaté Pleso Observatory (Štohl, 1969).

Table 3. The observing periods and hourly rates

⊙	Day	Time (CET)	$n_{obs.}$	F^+	F^-	σ^+	σ^-
261.44	13	20:34—21:34	4	43.0	1.7	6.7	2.5
261.52	13	22:26—23:26	4	52.3	4.9	14.0	1.7
261.61	14	00:38—01:38	3	73.4	6.3	10.3	2.5
261.71	14	03:17—03:35	3	75.1	6.7	4.5	0.2
261.78	14	04:42—05:42	4	71.0	12.8	6.0	3.4
262.47	14	21:08—21:38	2	42.1	4.4	2.4	3.1
262.58	15	23:34—00:34	3.5	31.0	6.7	6.0	2.4
262.67	15	01:38—02:38	3	24.8	5.3	1.1	3.6

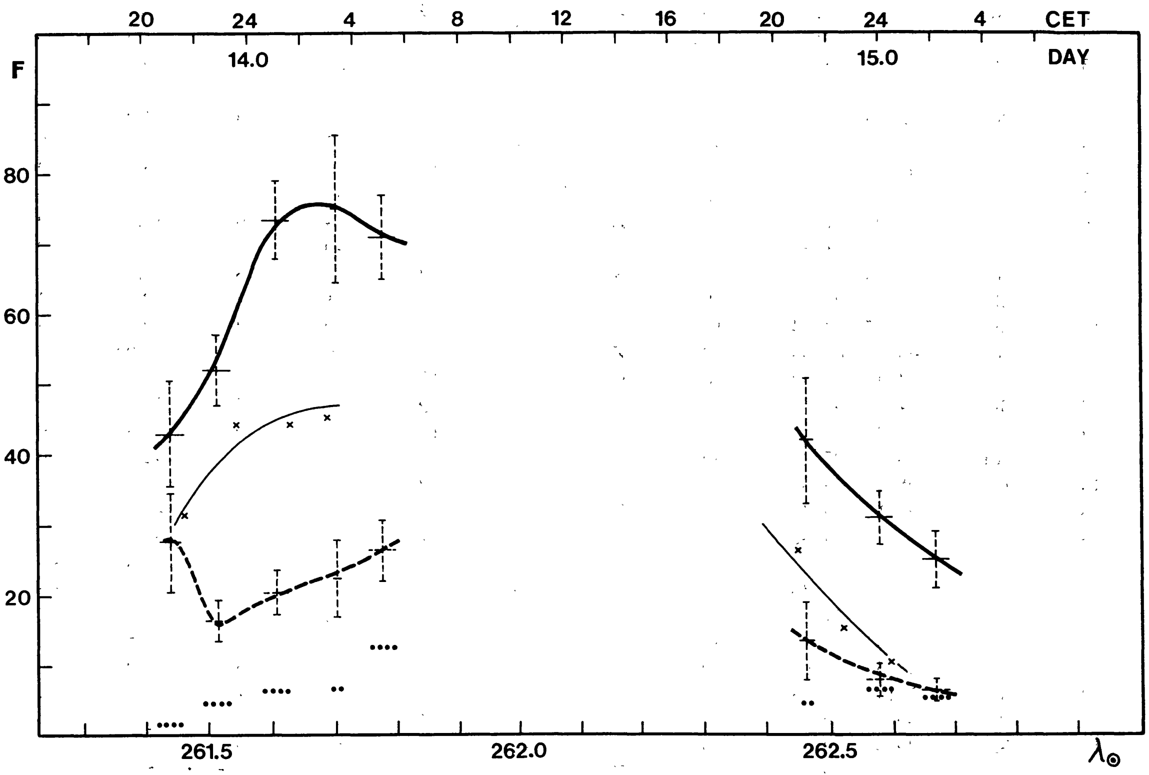

Fig. 1. The curve of the activity of the Geminids 1974 observed at the Skalnaté Pleso Observatory on December 13—15 (heavy line). The dashed heavy curve represents the activity of the bright meteors ($m \leq 2$). The horizontal lines are the zenithal hourly rates and their lengths are adequate to the individual observing periods. By dots the observed sporadic background rates are presented, by crosses with light lines the observed zenithal hourly rates at Vartovka station are shown.

3. The Magnitude Distribution

The magnitudes of meteors, as estimated by the observers, were rounded off to the nearest half-magnitude. The observed distribution of the magnitude estimates of Geminids is given in Table 4. The corresponding relative values of the observed magnitude distribution are shown in Fig. 2. The distribution of the Geminid meteors recorded is shown in Fig. 3.

The personal coefficients v and μ, whose meaning is fully described in the paper by Štohl and Millman (1973), were calculated for each observer. As standard the estimates of the observer An were used, as for an observer with the greatest experience in observing meteors, allowing at the same time direct comparison of the results with previous series of meteor observations from the Skalnaté

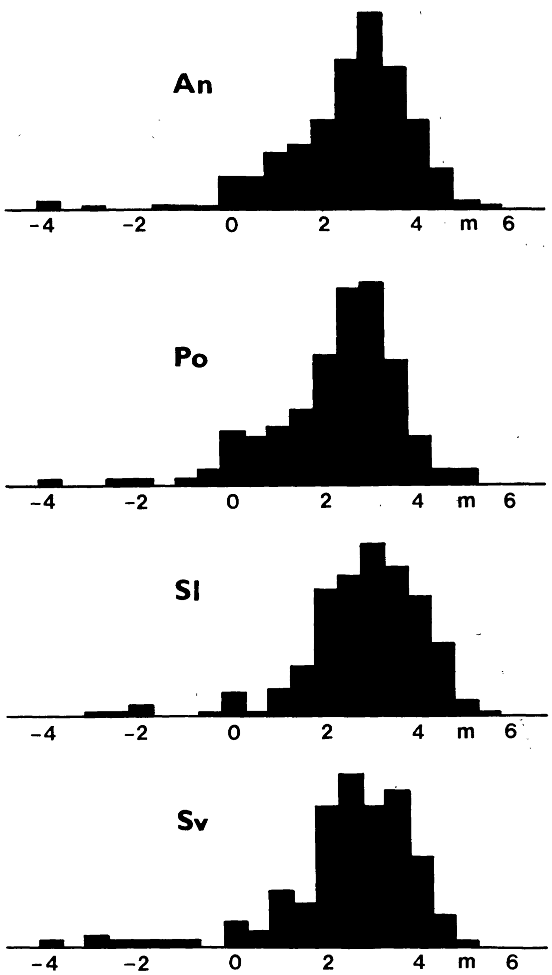

Fig. 2. The observed relative magnitude distributions of the Geminids according to the estimates of individual observers.

Table 4. The observed magnitude distribution

m \ Obs.	An	Po	Sl	Sv	Total
−4.0	2	1	0	1	4
−3.5	0	0	0	0	0
−3.0	1	0	1	2	4
−2.5	0	1	1	1	3
−2.0	0	1	3	1	5
−1.5	1	0	0	1	2
−1.0	1	1	0	1	3
−0.5	1	3	1	0	5
0.0	8	10	7	5	30
0.5	8	9	1	3	21
1.0	14	11	8	11	44
1.5	16	14	15	8	53
2.0	22	24	38	26	110
2.5	37	36	42	32	147
3.0	49	37	52	26	164
3.5	35	23	45	29	132
4.0	22	9	36	17	84
4.5	10	3	22	6	41
5.0	2	3	5	1	11
5.5	1	0	1	0	2
	230	186	278	171	865

Table 5. Personal coefficients of the observers

Obs.	$\bar{m}$	σ_m	v	μ
An	2.53	1.40	1.00	0.00
Po	2.26	1.36	1.03	+0.20
Sl	2.83	1.28	1.10	−0.58
Sv	2.47	1.46	0.96	+0.16

Table 6. The probable errors of magnitude estimates

Obs.	n	e
An	35	±0.36
Po	26	±0.38
Sl	29	±0.35
Sv	22	±0.40
Total indep.	56	±0.37

Pleso Observatory, in which the observer An participated since 1952. Table 5 shows personal coefficients v and μ for each observer.

From the estimates of magnitudes of the same meteors, observed and recorded independently by at least two observers, probable errors e in magnitude estimates were derived for each observer. The results are given in Table 6. We can see that the errors in determining the magnitudes are reasonably low, in good accordance with the previous series of meteor observations from the Skalnaté Pleso Observatory (Kresáková, 1966; Štohl and Millman, 1973), as well as with analogous series of the visual observations from other observatories (Lindblad, 1956; Millman and McKinley, 1963).

Table 7 shows the mean magnitudes of the Geminids for each period of the observations, based on the observed estimates of magnitudes; the corresponding number of magnitude estimates for each observer and period is given in table, as well. Table 8 shows for each period the mean magnitudes corrected according to the personal coefficients of the observers. We can see that there is no significant change in magnitude distribution for different time periods, except for the first period, in which the mean magnitude $\bar{m}_{obs} = 1.33$ is unusually low. The poor weather conditions in the

Table 7. The mean observed magnitudes

Period \ Obs.	An $\bar{m}$	An n	Po $\bar{m}$	Po n	Sl $\bar{m}$	Sl n	Sv $\bar{m}$	Sv n	Total $\bar{m}$	Total n
I	0.79	7	0.89	18	1.50	14	1.94	16	1.34	55
II	2.68	53	2.21	29	2.77	47	2.22	38	2.52	167
III	2.86	62	2.79	67	2.65	81	—	—	2.76	210
IV	2.42	19	—	—	3.05	21	2.72	20	2.74	60
V	2.29	56	2.04	47	3.08	53	2.52	52	2.49	208
VI	—	—	—	—	2.38	13	2.58	12	2.48	25
VII	2.56	16	2.66	25	3.25	32	2.55	19	2.83	92
VIII	2.50	17	—	—	2.82	17	2.75	14	2.69	48
Total	2.53	230	2.26	186	2.83	278	2.47	171	2.55	865

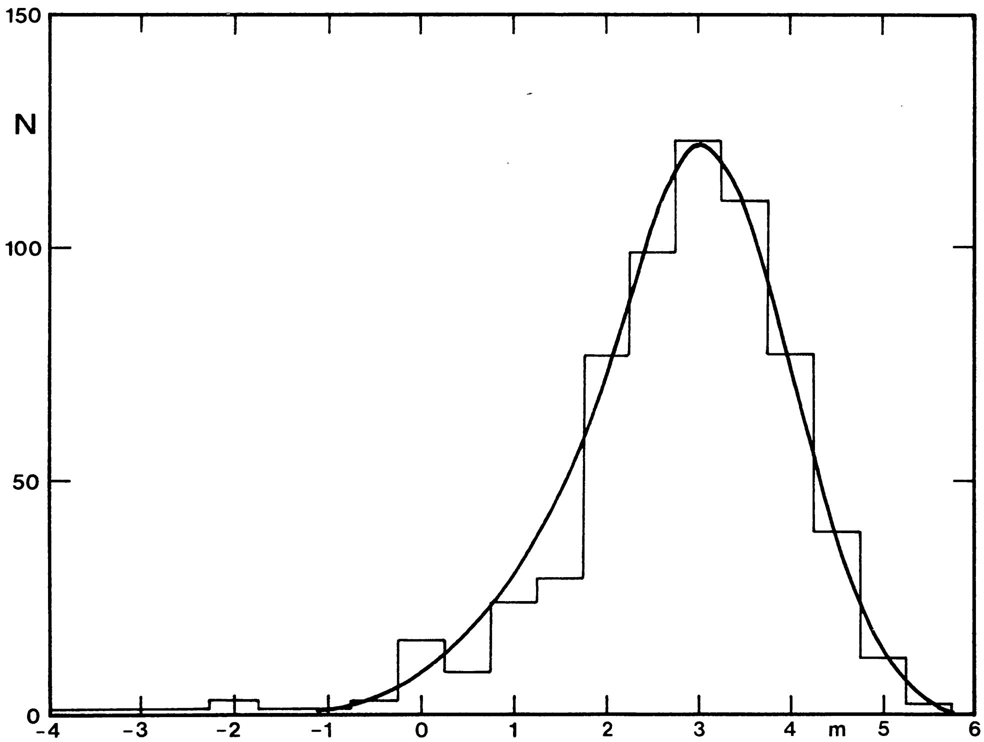

Fig. 3. The observed magnitude distribution of the Geminid meteors.

Table 8. The mean corrected magnitudes

Period \ Obs.	An	Po	Sl	Sv	Total
I	0.79	1.12	1.07	2.02	1.33
II	2.68	2.48	2.47	2.29	2.50
III	2.86	3.07	2.34	—	2.73
IV	2.42	—	2.78	2.77	2.66
V	2.29	2.30	2.81	2.58	2.50
VI	—	—	2.04	2.64	2.33
VII	2.56	2.94	3.00	2.61	2.83
VIII	2.50	—	2.52	2.80	2.59

first period can hardly be responsible for this effect, since the lower mean magnitude corresponds to an unusually high number of very bright meteors, as was stated above.

We should note that for a homogeneous set of data obtained under identical observing conditions, the mean magnitude actually represents the population index of the particular meteor shower. To the mean magnitude $\bar{m}_{obs} = 2.53$ for the Geminids 1974 a population index $r = 2.37$ corresponds (Kresáková, 1966).

The changes in magnitude distribution of the Geminids in the course of their activity on the basis of all visual data from the Skalnaté Pleso Observatory were examined earlier by Kresáková (1966). The mean magnitudes of the Geminids for different intervals of the solar longitude, derived by Kresáková, are shown in Table 9, together with the corresponding mean magnitudes of the Geminids 1974. We can see that the results are in very good agreement to each other, in spite of the fact that the observations were carried out by different groups of observers and with a large time gap elapsing between the observations. It confirms at the same time a steady character of the method of visual observations and the system of magnitude scales used at the Skalnaté Pleso Observatory.

Although there is no systematic change in the mean magnitude and the corresponding population index in the course of the activity of Geminids, as was shown by Kresáková, it seems evident that the activity of brighter shower meteors, and therefore of the larger shower particles has a complex character and enhancement around the main maximum of the shower.

Table 9. The corresponding mean magnitudes $\bar{m}_k$ and $\bar{m}_{74}$ of the Geminids

$\odot_{1974.0}$	$\bar{m}_k$	n_k	$\bar{m}_{74}$	n_{74}
261.41	2.65	831	1.33	55
261.52	—	—	2.50	167
261.60	2.65	353	2.73	210
261.70	2.59	517	2.66	60
261.76	2.50	283	2.50	208
262.43	2.29	96	2.33	25
262.55	2.77	30	2.83	92
262.68	2.82	66	2.59	48
Total	2.61	2176	2.53	865

Conclusions

1. Visual observations of the Geminids 1974 carried out at the Skalnaté Pleso Observatory during two nights on December 13/14 and 14/15, enabled to record a total of 734 meteors, 634 of which were the Geminids.

2. The observed hourly rates were corrected for cloudiness and reduced to standard observing conditions with the shower radiant in zenith; the limiting apparent magnitude for whole period of the observations was very nearly constant, about $m_{\rm lim} = 6.0$.

3. The distribution of the magnitude estimates of Geminids for individual observers shows that there is no significant difference in the personal equations of the magnitude scales of the observers; the probable error in a magnitude estimate for the whole group is $e = \pm 0.37$.

4. The course of the activity of the Geminid meteors has maximum at the longitude $\odot_{1950.0} = 261°.32$, with a peak rate of 76 meteors per hour; the activity of brighter meteors with the apparent magnitude $m \leq 2$ is more complex, showing two maxima around the main maximum of the Geminids.

5. The mean magnitude of the Geminid meteors $\bar{m} = 2.53$ corresponds to their population index $r = 2.37$. The changes in the magnitude distribution of the Geminids in the course of their activity seem to be complex, and demand a careful analysis of more extensive data.

Appendix

Similar observations of the Geminids 1974 were carried out at Vartovka station (19.2°E, 48.7°N) by a team of observers of the Public Observatory at Banská Bystrica during two nights, on December 13/14 and 14/15. These observations correspond to those from the Skalnaté Pleso Observatory as far as the period and the method of observations concerns.

The data obtained at Vartovka were treated in the same way as those obtained at the Skalnaté Pleso Observatory and are summarized in Tables A, B, C. Individual columns of the tables comprise similar parameters as above.

Table A. List of the observers at Vartovka

Observer	Abbr.	Total time	n^+	n^-
Chromek	Ch	180	38	16
Kotrč	Ko	180	39	16
Očenáš	Oc	360	164	19
Štubňa	St	180	80	9
Zimnikoval	Zi	360	137	15
Total		1260	458	75

Table B. The list of the Vartovka observations

Day	Obs.	Time (CET)	t	D	Cl	n^+	n^-	N^+	N^-
13	Oe	21:05—22:05	60	S	—	26	4	39.3	4.0
13	Zi	21:05—22:05	60	E	—	18	4	27.2	4.0
13	St	21:05—22:05	60	Z	—	19	3	28.7	3.0
13	Oc	22:55—23:55	60	S	—	45	5	52.3	5.0
13	Zi	22:55—23:55	60	E	—	37	4	43.0	4.0
13	St	22:55—23:55	60	Z	—	29	2	33.7	2.0
14	Oc	01:00—02:00	60	S	20	37	3	47.3	3.7
14	Zi	01:00—02:00	60	E	20	35	5	44.8	6.2
14	St	01:00—02:00	60	Z	20	32	4	41.0	4.9
14	Oc	02:30—03:30	60	S	20	37	4	48.7	4.9
14	Zi	02:30—03:30	60	E	20	32	1	42.2	1.2
14	Ch	20:30—21:30	60	W	—	16	3	27.0	3.0
14	Ko	20:30—21:30	60	N	—	16	3	27.0	3.0
14	Oc	20:30—21:30	60	S	—	16	4	27.0	4.0
14	Zi	20:30—21:30	60	E	—	15	3	25.3	3.0
14	Ch	22:15—23:15	60	W	—	10	8	12.4	8.0
14	Ko	22:15—23:15	60	N	—	13	7	16.1	7.0
14	Oc	22:15—23:15	60	S	—	17	4	21.1	4.0
14	Zi	22:15—23:15	60	E	—	10	3	12.4	3.0
15	Ch	00:00—01:00	60	W	—	12	5	12.8	5.0
15	Ko	00:00—01:00	60	N	—	10	6	10.7	6.0

Table C. The observing periods and hourly rates

$\odot_{1974.0}$	Day	Time (CET)	n_{obs}	F^+	F^-	σ^+	σ^-
261.46	13	21:05—22:05	3	31.7	3.7	6.6	0.6
261.54	13	22:55—23:55	3	44.4	3.7	9.6	1.5
261.63	14	01:00—02:00	3	44.4	4.9	3.2	1.2
261.69	14	02:30—03:30	2	45.4	3.0	4.6	2.6
262.45	14	20:30—21:30	4	26.6	3.2	0.8	0.5
262.53	14	22:15—23:15	4	15.5	5.5	4.1	2.4
262.60	15	00:00—01:00	2	11.8	5.5	1.5	0.7

The observations were carried out during 7 one-hour intervals with 3 observers in average, and list a total of 533 records of meteors, 458 of which are those of the Geminids and 75 belong to the sporadic meteors. The observations were partially disturbed by cloudiness just before the expected maximum of the shower activity. The observed hourly rates of the individual observers reduced to the zenithal hourly rates and corrected for the average cloudiness are summarized in Table B (N^+ — the Geminids, N^- — sporadic meteors). The zenithal hourly rates of the Geminids for an average observer F^+, together with the sporadic background rates F^- and corresponding mean square errors σ^+, σ^-, are listed in Table C.

The reduced hourly rates obtained at Vartovka are presented in Figure 1 by crosses and light curve. General trend of the Geminids activity curve obtained at Vartovka, it is consistent with that obtained at Skalnaté Pleso. A comparison of the corresponding curves of the hourly rates from both stations shows an average difference in the hourly rates $f^+_{s.p.}/F^+_{v.}=1.6$, which corresponds to a lower value of the limiting apparent magnitude at Vartovka $m_{lim}=5.5$ against that at the Skalnaté Pleso Observatory $m_{lim}=6.0$ (Guth, 1941).

Our thanks are due to the Observatory at Bánská Bystrica and its co-workers for the observations and enabling to use their data.

References

ALEXANDER, W. M., ARTHUR, C. W. and BOHN, J. L. (1971): Space Res., *XI*, 279.
DUBIN, M. (1960): Planet. Space Sci., *2*, 121.
GUTH, V. (1941): Mitt. Beob. Tschech. Astron. Gesell., No. 6, 9.
HUGHES, D. W. (1974): Space Res., *XIV*, 709.

KRESÁKOVÁ, M. (1966): Contr. Astron. Observ. Skalnaté Pleso, *3*, 75.

LINDBLAD, B. (1956): Contr. Lund Astron. Observ., Ser. I, No. 189.

MILLMAN, P. M. (1970): Space Res., *X*, 260.

MILLMAN, P. M. and McKINLEY, D. W. R. (1963): In: B. M. Midlehurst and G. P. Kuiper (Eds), The Solar System. Vol. IV, p. 674. The Univ. of Chicago Press.

NAZAROVA, T. N. (1967): Smithson. Contr. Astrophys., *11*, 231.

SLANČÍKOVÁ, J. (1975): Bull. Astron. Inst. Czech., *26*, 321.

ŠTOHL, J. (1969): Contr. Astron. Observ. Skalnaté Pleso, *4*, 46.

ŠTOHL, J. (1976): Acta Fac. Sci. Nat. Univ. Comenianae, Seria Astronomia et Geophysica, *2*, 21.

ŠTOHL, J. and MILLMAN, P. M. (1973): Bull. Astron. Inst. Czech., *24*, 321.

POZOROVANIA GEMINÍD 1974 NA SKALNATOM PLESE. PROGRAM INTERKOZMOS

V. PORUBČAN, J. ŠTOHL

Astronomický ústav Slovenskej akadémie vied, Bratislava, Československo

Súhrn

V práci sa analyzujú skupinové vizuálne pozorovania meteorického roja Geminíd z roku 1974, uskutočnené na observatóriu Astronomického ústavu SAV na Skalnatom Plese v dňoch 13.—15. decembra podľa špeciálneho programu INTERKOZMOS. Analyzovaný materiál pozostáva zo 734 individuálnych záznamov meteorov, z ktorých 634 patrí Geminidám.

Zoznam pozorovateľov, resp. neredukované napozorované hodnoty jednotlivých pozorovateľov v polhodinových intervaloch uvádzajú tab. 1 a 2. Rozdelenie magnitúd pre jednotlivých pozorovateľov ukazuje, že ich škály magnitúd neobsahujú väčšie rozdiely v osobných rovniciach; pravdepodobná chyba odhadu magnitúdy pre celú skupinu je $e = \pm 0,37$.

Krivka aktivity Geminíd je odvodená z pozorovaných hodinových frekvencií redukovaných na radiant v zenite a opravených o oblačnosť (tab. 3, obr. 1). Maximum aktivity Geminíd pripadá na dĺžku Slnka $\odot_{1950.0} = 261,32°$, s maximálnou frekvenciou 76 meteorov za hodinu.

Chod frekvencie jasných meteorov o zdanlivej magnitúde $m \leq 2$ sa ukázal zložitejší, s dvoma maximami okolo hlavného pozorovaného maxima Geminíd. Stredná magnitúda Geminíd vychádza $\bar{m} = 2,53$, čomu odpovedá populačný index $r = 2,37$. Zmeny rozdelenia jasnosti Geminíd počas ich činnosti sa zdajú byť dosť zložité a vyžadujú si dôkladnejšiu analýzu založenú na čo najrozsiahlejšom materiáli.

НАБЛЮДЕНИЯ ГЕМИНИД 1974 НА ОБСЕРВАТОРИИ СКАЛНАТЕ ПЛЕСО. ПРОГРАММА ИНТЕРКОСМОС

В. ПОРУБЧАН, Я. ШТОЛ

Астрономический институт Словацкой академии наук, Братислава, Чехословакия

В работе проведен анализ визуальных наблюдений метеорного потока Геминид 1974 г., полученных в обсерватории Скалнате Плесо Астрономического института Словацкой академии наук в период с 13-го до 15-го декабря 1974 г. Весь материал состоит из 734 индивидуальных наблюдений метеоров, включающих 634 наблюдений метеоров потока.

Список наблюдателей и полученные неисправленные данные наблюдений приводятся по получасовым интервалам в табл. 1 и 2. Ход активности метеоров потока Геминид получен из наблюдаемых часовых чисел, переведенных на положение радианта в зените и исправленных на коэффициенты облачности Гута (табл. 3, рис. 1). Оказывается, что

максимум активности потока Геминид наступает при долготе $\odot_{1950.0} = 261,32°$, с максимальным часовым числом метеоров 76. Ход активности метеоров ярче 2-ой звездной величины оказывается более сложным, с двумя максимумами около главного максимума Геминид. Распределение метеоров по звездным величинам для отдельных наблюдателей показывает, что их шкалы звездных величин и личные уравнения не отличаются значительным способом между собой; вероятная ошибка оценки звездной величины для всей группы оказывается $e = \pm 0,37$. Средная звездная величина Геминид равна $\bar{m} = 2,53$, и отвечающий индекс популяции $r = 2,37$. Изменения в распределении звездных величин Геминид в течение их активности оказываются значительно сложными и требуют более тщательный анализ на основе более полного материала.