III.

Observations of Meteors in the years 1911—1920.

By Prof. **K. Pokrovsky.**

The present paper contains a summary of the observations of meteors, made by myself and my collaborators: Messrs V. Berg, J. Djukov, K. Kupffer, S. Sokolov, B. Stankevitsch, A. Tamm and G. Shaïne in 1911, 1914, 1915, 1916, 1917, 1918, 1919 and 1920. The observations refer chiefly to the following showers: the Bielids, Lyrids, γ Aquarids, δ Aquarids, Orionids and Geminids. A total number of about 1450 meteor paths was obtained.

The meteors were traced on star-maps which were copied from the corresponding charts of my "Stellar Atlas".

For each radiant the *mean local time* is given computed as the average of the time of observation of the meteors used in the derivation of the radiant.

The coordinates of the beginning and the end of the paths were read by the aid of the transparents of my "Stellar Atlas".

The radiants were determined by the aid of a map of Lorenzoni in gnomonic projection; the meteors were traced on transparent paper placed on this map.

As a rule, the observations of one day were treated separately, and only when the number of meteors was small the observations of several consecutive days were joined together.

The numbers in Roman figures, accompanying the radiants, refer to Denning's "General Catalogue of the Radiant Points of Meteoric Showers . . .", Memoirs of the Royal Astronomical Society, Vol. LIII, 1899.

The observers were denoted by their initial letters:

V. Berg	B.
J. Djukov	D.
K. Kupffer	K.
K. Pokrovsky	P.
G. Shaïne	Sh.

S. Sokolov . . . . . S.
B. Stankewitsch . . . . . St.
A. Tamm . . . . . T.

1. Bielids and Simultaneous Showers in 1911.

Observing Station: Astronomical Observatory Tartu (Dorpat).
Observers: B., K., P., S., St.

	November, 1911.						
Date:	the 17th	the 18th	the 24th	the 25th	the 27th	the 28th	All Days
Time of Observation[1])	8h8m—11h32m	11h56m—13h18m	10h59m—13h40m	8h4m—9h42m	6h42m—10h40m and 15h8m—17h15m	10h25m—15h50m	
Number Traced by B.	3	6	7	—	26	—	
K.	—	3	3	—	—	—	
P.	8	5	7	8	—	22	
S.	8	—	—	—	—	—	
St.	8	—	—	—	—	—	
Total	27	14	17	8	26	22	114

The following radiants were deduced:

Date 1911	*Mean* Moment	Coordinates α	δ	Number of Meteors	Remarks and Identification.
Nov. 17	9h.4	24°.0	42°.0	11	Principal shower of Bielids
„	11 .0	48 .0	55 .0	5	η Perseids XXXIX
„	11 .1	55 .0	38 .0	7	ζ Perseies XLVIII
Nov. 18	13 .4	44 .0	53 .0	5	η Perseids
„	12 .4	27 .0	33 .0	6	β Triangulids XXV
„	12 .7	40 .0	30 .0	3	XXXIII ?
Nov. 24	12 .8	50 .0	17 .0	6	ζ Arietids XLIV
„	12 .1	26 .0	40 .0	4	β Triangulids
„	11 .6	80 .0	28 .0	3	i Aurigids LXVII
„	12 .3	7 .0	61 .0	2	δ Cassiopeids XV[2])
Nov. 25	8 .7	20 .0	60 .0	6	δ Cassiopeids[2])
Nov. 27	14 .0	15 .0	62 .0	7	δ Cassiopeids[2])
„	10 .5	40 .0	45 .0	7	—
„	10 .1	15 .0	30 .0	4	β Andromedids XIII
„	11 .6	32 .0	30 .0	3	β Triangulids
Nov. 28	12 .3	25 .0	56 .0	5	δ Cassiopeids
„	13 .6	50 .0	32 .0	5	XLVIII ?
„	13 .6	68 .0	34 .0	3	LVIII ?
„	13 .3	13 .0	22 .0	2	—

1) From *first* to *last* meteor noted.
2) Very large area of radiation.

2. Lyrids in 1914.

Observer: G. Schaïne.

Station: on April 15, 17, 18, 20 .... Akkerman, $\varphi = 46^{0}12'$ $\lambda = 2^{h}01^{m}$
April 21 .... Odessa, $\varphi = 46^{0}29'$ $\lambda = 2^{h}03^{m}$

Date	April 15	17	18	20	21	Total
Time of Observation	$10^{h}30^{m}$—$12^{h}0^{m}$ and $13^{h}0^{m}$—$14^{h}30^{m}$	$12^{h}0^{m}$— —$14^{h}0^{m}$	$11^{h}25^{m}$—$13^{h}0^{m}$ and $14^{h}0^{m}$—$15^{h}30^{m}$	$11^{h}30^{m}$— —$14^{h}15^{m}$	$11^{h}45^{m}$— —$14^{h}0^{m}$	
Number of Meteors traced	12	6	6	9	11	44

Radiants deduced:

Date	*Mean Time*	α	δ	Number of Meteors
April 15	$12^{h}.9$	$261^{0}.0$	$28^{0}.0$	3
„	13 .6	263 .6	29 .7	2
April 17	13 .0	269 .0	32 .5	3
April 18	12 .2	269 .1	32 .0	2
April 20	12 .4	274 .0	36 .0	6
April 21	13 .0	275 .0	36 .0	8

3. Lyrids in 1915.

Observers: G. Shaïne and A. Tamm.

Station: Observatory Tartu (Dorpat).

Observations of T.

Date	April 17	18	20	21	Total
Time of Observation	$12^{h}0^{m}$— —$14^{h}15^{m}$	$11^{h}30^{m}$— —$13^{h}0^{m}$	$11^{h}0^{m}$— —$14^{h}30^{m}$	$11^{h}0^{m}$— —$14^{h}0^{m}$	
Number of Meteors traced	7	8	14	8	37

Observations of Sh.

Date	April 13	14	15	17	18	20	21	Total
Time of Observation	$10^{h}15^{m}$— —$13^{h}0^{m}$	$10^{h}45^{m}$— —$13^{h}15^{m}$	$10^{h}45^{m}$— —$14^{h}0^{m}$	$10^{h}0^{m}$— —$14^{h}0^{m}$	$10^{h}20^{m}$— —$11^{h}30^{m}$	$10^{h}45^{m}$— —$14^{h}0^{m}$	$10^{h}30^{m}$— —$14^{h}0^{m}$	
Number of Meteors traced	10	6	12	12	13	10	12	75

Radiants, deduced for each observer separately:

I. Observations of T.

Date	Mean Time	α	δ	Number of Meteors	
April 17 / „ 18	— Not Lyrids, radiants not certain.				
„ 20	13h.2	271°.0	35°.0	4	(Mean of a large area).
„ 21	11 .6	271 .6	34 .0	2	
„ „	13 .0	278 .0	38 .3	4	

II. Observations of Sh.

Date	*Mean* Time	α	δ	Number of Meteors	
April 13, 14	12h.1	258°.3	32°.2	5	(On April 13 three, April 14 two meteors)
„ 15	12 .5	264 .0	32 .5	10	(6 meteors converging on a very small area)
„ 17	11 .4	267 .0	30 .4	2	
„ „	12 .6	269 .0	35 .0	3	
„ 18	12 .1	271 .0	35 .5	3	
„ „	11 .0	263 .0	31 .0	2	
„ „	12 .9	251 .0	38 .5	4	(a notable Non-Lyrid radiant)
„ 20	12 .3	266 .8	34 .5	3	
„ „	12 .0	274 .0	36 .0	3	
„ 21	12 .5	272 .0	34 .0	4	
„ „	12 .5	268 .7	33 .0	3	
„ „	13 .5	274 .0	35 .0	2	
„ „	12 .5	275 .0	36 .7	3	

The observations of 1914, as well as of 1915 show a displacement of the radiant towards East, though with a somewhat greater speed than found by *Denning*. A small displacement towards North can be perceived also.

Comparing the observations of one person — G. Shaïne — in 1914 and 1915 we find that in 1914, from April 15th to April 21th during 13 hours were traced the paths of 24 meteors belonging undoubtedly to the Lyrid shower, whereas in 1915, on the same dates, during 14 hours 38 Lyrids were traced. Yet in 1914 the conditions were more favourable than in 1915, the former being made in South Russia on days without moonlight, the latter — under the less clear sky of Dorpat and with the Moon 1—7 days old; the latter should reduce the number of meteors seen, especially for the Lyrids, among which there are a great number of faint ones. Thus, with respect to the number of

meteors, 1915 was richer than 1914. *Denning* gives for the Lyrids a 16-year period and predicts a maximum on 1915—1916.

4. Lyrids in 1916.

Observer: G. Shaïne.

Station: Petrograd. $\varphi = 59^0 57'$; $\lambda = 2^h 1^m E$.

On account of cloudy weather and moonlight the number of meteors observed was small. Before the maximum no observations could be made; on April 20 the sky was partly covered; during 1 hour only one meteor was noted. Better observations were made on April 24, 25 and 26 (the sky being clear), with a total number of 25 meteors traced, of which one-half were doubtless Lyrids. The meteors were generally faint; no bright meteor was observed.

	April			
Date:	20	24	25	26
Time of Observ.	9^h10^m— —10^h45^m	11^h0^m— —13^h0^m	10^h45^m— —13^h0^m	10^h0^m— —12^h45^m
Number of Meteors	1	10	6	8

Because of the small number of meteors the days of April 24, 25 and 26 were joined together; an area of radition of 6^0—7^0 diameter was found with the approximate centre at

$$\alpha = 285^0.4 ; \quad \delta = +40^0.3$$

(11 meteors, of which 3 on the 24th, 5 on the 25th and 3 on the 26th).

These values confirm the displacement of the radiant towards East and, partly, towards North; this was noted for 1914 and 1915, when the observations comprised the period of April 12—20. The present observations of April 24—26 complete the series, so that the interval covered by the observations attains 14 days.

A secondary radiant was found, too, at $\alpha = 273^0.2$; $\delta = +20^0.8$ (3 meteors).

5. η—γ Aquarids in 1914.

Observer: G. Shaïne.

Station: Odessa. $\varphi = 46^0 29'$; $\lambda = 2^h 03^m E$

On May 3, 14^h20^m—15^h15^m, at dawn, 4 meteors of the average magnitude 1.5 were noted. The impression was of an intense shower; taking into account the small height of the radiant,

the low transparency of the air and the illumination by the dawn, which only allowed meteors brighter than magnitude 2 to be perceived, the number of meteors observed must be considered as high. The colour was chiefly red.

The radiant:

Date	Mean Time	α	δ	
May 3	$14^h.9$	$333^0.8$	$-4^0.3$	(4 meteors converging approximately at one point).

6. δ Aquarids in 1911.

Observer: S. Sokolov with 3 assistants.

Station: Armavir. $\varphi = 45^0 00'$; $\lambda = 2^h 45^m E$.

From July, 28, to August, 4, 225 meteors were traced, among which 150 were Aquarids. The meteors are rather dispersed, and the separate radiants cannot be determined with great precision.

Date	July 28	July 29	July 30	July 31	Aug. 1	Aug. 2	Aug. 3	Aug. 4	
Time of [1] Observ.	12^h51^m— -14^h12^m	10^h48^m— -13^h50^m	11^h22^m— -13^h52^m	?(11^h)— -13^h57^m	11^h25^m— -14^h25^m	11^h32^m— ?	10^h50^m— -11^h53^m	11^h17^m— -11^h50^m	
Number of Meteors traced	19	48	44	51	36	5	13	9	225

Radiants deduced:

Date	Mean Time	α	δ	Number of Meteors	Numbers used on Separate Days	
July 28,29	$12^h.6$	$338^0.0$	$-11^0.0$	11	4+7	
„	11 .9	341 .0	−6 .8	7	0+7	
„	12 .4	335 .0	−12 .7	5	1+4	
„	13 .2	331 .4	−14 .2	4	1+3	
„	11 .5	320 .5	−1 .3	12	3+9	
„	12 .5	305 .6	−1 .3	4	1+3	
„	12 .2	334 .5	+2 .2	4	1+3	Not Aquarids
„	12 .1	336 .0	+48 .0	3	0+3	„
July 30	12 .5	334 .8	−3 .3	7		
„	12 .6	339 .0	+0 .9	5	Not Aquarids.	A considerable radiation is indicated, too, from a southern direction.
„	13 .6	333 .5	+9 .3	4		
„	12 .3	350 .0	+4 .3	3		
„	13 .0	339 .0	+14 .6	4		

1) From *first* to *last* meteor noted.

Date	Mean Time	α	δ	Number of Meteors	Numbers used on Separate Days
July 31	13h.0	335 .0	—11 .0	8	
„	12 .5	345 .3	—9 .3	8	
„	12 .6	332 .0	—15 .0	5	
„	13 .0	348 .5	—4 .5	4	
„	11 .5	354 .8	—9 .0	5	
August 1	13 .2	341 .0	—9 .8	7	
„	12 .6	327 .0	—1 .8	4	
„	12 .6	324 .0	—4 .5	5	
„	13 .0	319 .0	0 .0	4	
„	13 .2	329 .8	—10 .5	4	
„	12 .8	355 .5	+19 .5	4	Not Aquarids
„	12 .2	347 .5	+24 .5	4	
„	12 .9	343 .8	+26 .7	4	
Aug. 2,3,4 joined	11 .3	335 .3	—13 .5	5	0+3+2
„	11 .4	340 .0	—6 .3	7	1+4+2
„	11 .6	332 .0	0 .0	5	3+2+0
„	11 .5	349 .5	+0 .7	3	0+2+1

7. δ Aquarids in 1915.

Observer: G. Shaïne.

Station: Akkerman. $\varphi = 46^{0}12'$; $\lambda = 1^{h}59^{m}E$.

The observations were made between July, 21, and August, 7. The Moon did not permit of observation near the maximum of the shower (Full Moon on July, 26). On July, 28, and August, 1, 3, 5 and 7, clouds stopped the observations at their beginning. Notwithstanding these unfavourable conditions, 163 meteors were traced on the map, of which about 130 were certainly Aquarids.

The Aquarid shower in 1915 was, evidently, intense; on August 4, 5, 6 and 7 the number per hour was 15—20.

The general characteristics of the Aquarid meteors were their small speed and the reddish-yellow colour of the majority.

Date:	July 21	July 22	July 23	July 24	July 28	July 29
Time of[1]) Observations	12h30m— —13h23m	12h36m— —14h34m	12h39m— —14h47m	12h53m— —14h49m	11h6m— —38m	10h7m— —15m
Number of Meteors traced	10	12	13	16	2	2
				Moon near Horizon		Moon near Radiant

1) From *first* to *last* meteor noted.

Date :	Aug. 1	Aug. 2	Aug. 3	Aug. 4	Aug. 5	Aug. 6	Aug. 7
Time of[1]) Observ.	9h43m— —10h14m	11h15m— —14h7m	9h35m— —10h0m	10h54m— —13h41m	11h2m— —27m	9h19m— —13h54m	10h15m— —11h6m
Number of Meteors traced	3	19	3	32	6	35	11

At the first glance on the meteor-maps the dispersion of the meteor-paths can be perceived. For the case of such a diffused radiation it is difficult to find definite radiants.

Sometimes the same meteor could be ascribed to two different groups, so that, contrary to the general rule, such a meteor was regarded as belonging not to a single radiant, but to two at once.

Radiants deduced.

Number on Separate Days. July 21 22 23 24 28	Mean Local Time	α	δ	Total Number of Meteors
July 21, 22, 23, 24 and 28 Combined.				
3 + 0 + 0 + 1 + 1	12h.7	305°.5	—9°.5	5
1 + 0 + 0 + 1 + 0	13 .2	305 .5	—0 .3	2
1 + 2 + 0 + 0 + 0	13 .8	306 .0	+2 .8	3
1 + 1 + 1 + 0 + 0	13 .7	309 .1	—11 .2	3
0 + 0 + 1 + 1 + 0	14 .2	314 .8	—7 .9	2
0 + 0 + 2 + 0 + 1	13 .2	315 .5	—3 .3	3
0 + 0 + 2 + 0 + 0	13 .7	319 .0	—6 .0	2
0 + 1 + 0 + 2 + 0	14 .5	323 .8	—15 .1	3
0 + 0 + 1 + 3 + 0	13 .8	336 .7	—9 .9	4
0 + 0 + 1 + 1 + 1	13 .3	332 .2	—10 .5	3
0 + 1 + 0 + 2 + 0	13 .5	332 .9	—3 .5	3
2 + 0 + 1 + 1 + 0	13 .8	338 .8	—4 .9	4
0 + 1 + 0 + 2 + 0	13 .3	332 .1	—1 .1	3
0 + 2 + 0 + 1 + 0	13 .5	344 .0	—14 .0	3
1 + 1 + 1 + 0 + 0	13 .4	348 .2	+4 .8	3
0 + 1 + 1 + 1 + 0	13 .6	348 .2	—3 .5	3
0 + 0 + 1 + 2 + 0	14 .5	334 .3	—8 .7	3
0 + 1 + 1 + 0 + 1	12 .3	332 .5	—16 .3	3
0 + 1 + 0 + 1 + 0	13 .7	333 .9	—4 .9	2
1 + 1 + 0 + 0 + 0	13 .3	355 .8	—2 .1	2

1) From *first* to *last* meteor noted.

Number on Separate Days. July 29	August 1	2	3	4	Mean Local Time	α	δ	Total Number of Meteors
July 29, August 1, 2, 3 and 4 combined.								
0	1	0	0	2	11h.1	311°.1	—3°.1	3
0	0	1	0	1	12 .9	312 .5	0 .0	2
0	1	2	0	0	11 .8	313 .3	—6 .8	3
0	0	0	0	3	11 .8	319 .1	—5 .3	3
0	0	1	0	3	12 .2	320 .5	—2 .4	4
0	0	1	0	2	12 .1	322 .0	—7 .3	3
0	1	0	0	2	11 .1	328 .0	—12 .2	3
1	0	1	0	1	12 .3	332 .8	—7 .0	3
0	0	0	1	2	11 .7	336 .4	—3 .5	3
1	1	0	0	1	11 .0	335 .5	—10 .2	3
0	0	0	0	3	12 .3	331 .9	—0 .8	3
0	0	2	1	1	12 .2	339 .7	—15 .0	4
0	0	0	2	1	10 .7	348 .1	+6 .4	3
0	0	2	0	1	13 .1	333 .0	+9 .8	3
0	0	2	0	0	12 .1	326 .3	+3 .1	2
0	0	0	1	3	12 .2	356 .5	—4 .0	4
August 5, 6 and 7 combined.								
1	1	1			11 .1	323 .0	—3 .2	3
0	2	1			12 .1	330 .0	—11 .2	3
1	3	0			12 .6	336 .0	—8 .1	4
0	2	1			11 .0	341 .6	—8 .2	3
1	1	0			12 .1	343 .2	—12 .8	2
1	2	0			12 .1	337 .8	—3 .3	3
1	1	1			11 .8	348 .0	—4 .8	3
1	2	0			12 .3	356 .0	—6 .6	3
0	3	0			12 .2	334 .1	+5 .1	3
0	2	1			11 .8	324 .3	+2 .8	3
0	3	0			12 .0	338 .0	+6 .1	3
0	3	0			12 .8	326 .1	—1 .0	3
0	3	0			13 .1	358 .3	+24 .0	3
0	2	0			13 .6	328 .0	+13 .0	2
0	1	2			11 .5	332 .8	+10 .0	3
1	2	0			12 .0	359 .0	+1 .5	3

These lists indicate clearly a crowding of the radiants in the East part of the area of radiation with the increasing date. The charts, if examined closer, reveal the same phenomenon.

It is probable that a more pronounced effect of displacement towards the East would be obtained, if the charts comprised a greater part of the sky in the East (the limit of the chart was at 10^0 A. R.), for the observer saw on the days after maximum many meteors in the eastern part of the sky which could not be traced on the map. Moreover, on the days after maximum an intensification of the radiation from the North was indicated. It is possible that in the same region exist radiants not belonging to the Aquarid shower, for the meteors of these radiants differ somewhat in their appearance (colour, velocity) from the Aquarids. The total area of radiation is very large.

The right ascension of the mean centre of radiation was computed, taking as the weight the number of meteors; the result was:

July 21, 22, 23, 24, 28	$\alpha = 328^0.0$
„ 29, August 1, 2, 3, 4	330 .0
August 5, 6, 7	334 .9.

8. Orionids in 1911.

Observers: B.; D.; K.; S; St.

Station: Observatory Tartu (Dorpat).

On *October 17*, between 12^h45^m—15^h25^m 25 meteors were traced, of which 12 were by D., 4 by K., 4 by St., 3 by B and 2 by S.

Of these meteors 17 were certainly Orionids. The following radiants were deduced:

October 17.

№	Mean Time	α	δ	Number of Meteors	
1)	14h.1	$83^0.2$	$+14^0.1$	3	Orionids
2)	14 .5	85 .0	11 .0	6	„
3)	14 .2	89 .0	17 .0	4	„
4)	13 .7	96 .0	13 .7	4	γ Geminids
5)	13 .3	105 .0	25 .3	3	δ Geminids
6)	13 .8	79 .0	42 .5	5	α Aurigids

The first four radiants form a certain area; the centre of this area, computed with the weight equal to the number of meteors, was found as

$\alpha = 88^0.2$; $\delta = 14^0.2$ (October 17, 1911. Mean of № 1, 2, 3, 4).

This radiant is near the radiants 18—27, LXXVII G. C.
№ 5 is near the 10th radiant, XC G. C.
6 „ „ „ 28th „ LXV „ .

9. Orionids in 1915.

Observer: G. Shaïne.
Station: Observatory Tartu (Dorpat).

	October.				
Date:	9	12	13	14	15
Time of Observ.	11^h48^m— —14^h15^m	11^h49^m— —14^h11^m	11^h25^m— —13^h35^m	11^h43^m— —14^h4^m	11^h41^m— —15^h20^m
Number of Meteors traced	11	19	21	2 (Haze)	26

	October			
Date:	16	17	18	Total
Time of Observ.	11^h47^m— —13^h47^m	12^h38^m—13^h31^m 13^h49^m—15^h5^m	13^h42^m— —16^h2^m	
Number of Meteors traced	16	34	22	151

Radiants deduced for each day separately:

Mean Time	α	δ	Number of Meteors	Remarks
	October, 9			
13h.4	78°.0	+10°.0	3	Near 10th rad. of LXIV. G. C.
13 .8	87 .0	20 .0	2	
13 .0	106 .0	21 .5	3	Good convergence. Apparently δ Geminids. XC. G. C.
	October 12.			
12 .9	98 .8	+24 .5	5	Sharply defined radiant. Near 5th rad. LXXX G. C. (ε Geminids), but the epoch is different.
12 .9	94 .0	33 .0	3	ε Geminids.
13 .0	60 .5	20 .0	4	Near 18th radiant LIII G.C. (ε Taurids).
13 .0	87 .2	13 .8	4	Position near 7th rad. LXXVII G. C. Principal shower of Orionids.
	October, 13.			
12 .2	102 .0	+29 .9	10	A very remarkable radiant. Convergence almost into one point.
12 .1	83 .5	17 .8	5	Near 13th rad., LXXXIX G. C. α Geminids. Orionids.

Mean Time	α	δ	Number of Meteors	Remarks
	October, 15.			
13h.8	110°.9	+29°.8	5	Position near 14th rad.LXXXIXG.C. (αGeminids).
13 .1	62 .5	23 .0	6	ε Taurids.
13 .0	53 .0	21 .3	4	ε Taurids.
13 .4	84 .5	22 .0	5	Orionids.
	October, 16.			
13 .1	91 .8	+16 .1	4	Near 15th rad. LXXVII G.C. Principal shower of Orionids.
13 .0	75 .2	27 .1	5	ζ Taurids.
12 .8	56 .0	13 .0	3	ε Taurids.
13 .8	97 .5	25 .7	2	ε Geminids.
	October, 17.			
13 .8	87 .7	+17 .0	16	A remarkable radiant. Centre of a small area of about 6°. Coincides with 23th rad. LXXVII. G. C. Principal shower of Orionids.
13 .8	94 .5	15 .5	3	" " "
13 .4	99 .9	32 .0	4	α Geminids.
14 .1	110 .0	30 .0	5	α Geminids.
	October, 18.			
15 .3	88 .3	+18 .0	9	Near 23th rad. LXXVII. G. C. Principal shower of Orionids.
14 .8	83 .0	15 .1	6	Orionids.
15 .3	96 .8	18 .3	6	Near 6th rad. LXXXIX G. C. γ Geminids.

The last three radiants are well determined and form an area with the centre $\alpha = 89°.2$, $\delta = 17°.2$.

The distribution of the meteors according to their radiants was:

October 9, 12, 13, 14, 15, 16, 17, 18, during 18.4 hours:

Orionids		Geminids			Taurids		Other Meteors	Total
Principal Stream	Other	α	ε	δ	ε	ζ		
59	3	24	6	3	13	5	38	151

Thus, besides the Orionids, on the days of observation the α Geminids proved to be a very consipicuous shower.

It must be regretted that the bad weather interrupted the series of observations, so that the maximum of the Orionids could not be observed.

10. δ Aquarids in 1919.

Station: Stanitza Altaïskaïa, $\varphi = 49°11'$; $\lambda = 5^h20^m$ E; $H =$ = 1000 meters above sea level.

Observers: K. Pokrovsky and G. Shaïne.

1) Observations of P. Total number traced: 79 meteors, on July 29, 30, 31, and August, 1.

Radiants deduced:

July 29, 30, 31 combined	Mean Time	α	δ	n
Mean Date [1])		337°	—12°.5	16
July 30.57	—	342	+ 9.5	6
		345	+ 19.0	5
		330	+ 4.5	5
		307	+ 9.0	4
August 1	12h.3	342°	— 11.5	10
	12.6	1	+ 1.0	5

2) Observations of Sh. Total number traced: 278 meteors, on July 22, 23, 29, 30, 31 and August 1. Among the meteors observed a great number were faint, of the 4th and 5th magnitude. This must be attributed to the high transparency of the air.

Radiants deduced:

July 22, 23 Combined	Mean date [1])	α	δ	n	
	July 22.95	319°.9	+20°.0	9	
	22 98	330 .5	— 1 .8	10	
	22.97	318 .5	+ 3 .2	5	
	22.95	336 .0	+10 .8	5	
	22.98	355 .5	+29 .0	5	
	Mean Time				
July 29	11h.6	343°.0	+18°.0	19	Very distinct.
	11 .6	334 .0	+ 2 .3	5	
	12 .8	3 .0	+27 .0	6	
	11 .6	329 .0	— 2 .0	6	
	12 .0	318 .0	+26 .5	5	
	12 .4	316 .0	— 9 .0	5	
	10 .8	306 .0	+12 .0	5	
	13 .3	356 .0	— 1 .0	3	
July 30	11 .7	2 .5	+25 .5	10	
	11 .8	316 .2	+ 9 .2	5	Very distinct.
	11 .9	339 .3	+ 5 .0	7	
	11 .6	338 .0	—11 .0	21	Centre of large area.

1) Reckoned from local noon.

	Mean Time	α	δ	n	
July 31	$12^h.1$	$6^0.0$	$+21^0.5$	12	
	12 .5	336 .0	—12 .5	17	Centre of large area.
	11 .5	310 .0	+ 9 .0	4	
	11 .8	304 .0	+28 .0	8	
	11 .7	345 .5	+ 5 .5	4	
	12 .2	341 .0	+21 .0	6	
August 1	12 .3	339 .0	—12 .0	19	Centre of large area.
	11 .9	352 .5	— 2 .5	5	
	12 .9	2 .0	+27 .0	4	
	11 .4	339 .5	+27 .0	6	
	12 .3	332 .5	— 1 .5	5	
	12 .2	350 .5	+17 .5	5	
	11 .2	14 .0	+27 .0	3	Poor radiant.

The average number of meteors observed per hour was 12, which is considerably greater than for the observations of the δ Aquarids made at Dorpat and Perm; the increase of the observed number must be attributed to the greater number of faint meteors seen.

Besides the Aquarids many other showers were observed; on July, 29, a rich shower was traced with a fair radiant at $\alpha = 343^0$, $\delta = +18^0$; apparently it is related to the comet 1770 II.

It appears that the maximum of the Aquarids takes place on July 30—31. The area of their radiation is very large.

11. Orionids in 1917.

Station: Odessa. $\varphi = 46^0 29'$; $\lambda = 2^h 03^m$ *E.*

Observer: G. Shaïne.

The observations were made on October 16, 17 and 18, during a total of 7 hours; 53 meteors were traced, of which about 30 were Orionids.

Radiants deduced:

a) Orionids

	Mean Time	α	δ	n
October 16	$12^h.4$	$89^0.0$	$+17^0.0$	7
„ 17	12 .1	90 .0	13 .0	10
„ 17	13 .6	87 .5	18 .5	8
„ 17	13 .6	86 .0	10 .5	5

b) Other radiants

Octob. 16—18	13 .9	76 .5	—3 .5	5

12. Orionids in 1919.

Station: Tomsk. $\varphi = 56^0 29'$; $\lambda = 5^h 40^m$ *E.*

Observer: G. Shaïne.

The observations were made on October 18 and 20; clouds passed over at times. The number of meteors traced was 37, of which 29 give the following sharply defined radiants:

Mean Date [1]	α	δ	n	
October 19.56	87°.0	+13°.5	16	Very distinct, nearly a point.
	77 .0	26 .5	6	Centre of small area.
	65 .0	8 .0	7	Centre of small area.

A characteristic feature of the Orionids is their small area of radiation and the convergence of meteors into few points.

13. Lyrids in 1918.

Station: Perm. $\varphi = 58^0 01'$; $\lambda = 3^h 45^m$ *E.*

Observer: G. Shaïne.

The observations were made on April 16, 17, 18 and 20; during 11 hours 52 meteors were traced; the intensity of the shower appeared low.

Radiants deduced:

			α	δ	n	
a) Lyrids.						
April 16—18	Mean Date [1]	Apr. 17.54	267°.5	+33°.2	6	
April 20	Mean Time	13h.8	269 .6	33 .7	7	
b) Other radiants:						
Mean Date [1]		April 17.54	279°.1	38°.0	3	Doubtful.
			247 .0	20 .0	4	
			308 .0	43 .0	3	
April 16	Mean Time	12h.3	225 .0	20 .0	7	Conspicuous shower.

14. Lyrids in 1920.

Station: Tomsk. $\varphi = 56^0 29'$; $\lambda = 5^h 40^m$ *E.*

Observer: G. Shaïne.

The observations were made on April 18 and 19. Weather unfavourable, clouds passed. Intensity of the shower feeble; 9 meteors were traced which indicated the following radiants:

		α	δ	n
		275°	+32°	4
Mean Date [1]	April 18.89	254	32	3
		260	56	2

1) Reckoned from local noon.

15. Geminids in 1918.

Station: Perm. $\varphi = 58^{0}01'$; $\lambda = 3^{h}45^{m}E.$

Observer: G. Shaïne.

The observations were made on December 9, 10 and 12. The number of meteors traced was 70.

Radiants deduced:

	Mean Time	α	δ	n	
December 9.	$9^{h}.7$	$113^{0}.0$	$+32^{0}.8$	3	
	9 .7	115 .0	33 .0	5	
December 10.	12 .5	104 .2	32 .6	6	
	11 .5	114 .0	34 .8	5	
December 12.	13 .7	111 .0	30 .4	29	Centre of small area.
	14 .1	119 .7	20 .2	9	

16. Geminids in 1920.

Station: Tomsk. $\varphi = 56^{0}29'$; $\lambda = 5^{h}40^{m}E.$

Observer: G. Shaïne.

Only on December, 9, observations were made. Temperature — 20^{0} C, clouds; 12 meteors were traced.

Radiants deduced:

Mean Time	α	δ	n	
$11^{h}.3$	$94^{0}.0$	$+26^{0}.3$	5	Fair.
11 .6	105 .6	21 .8	5.	