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Fireball Monitoring Observation at the Kiso Observatory

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Abstract

Sequential photographic monitor of fireballs was carried out with using an all-sky camera during the period between 1977 and 1990 at Kiso Observatory. Total number of observed fireballs is 742 and their apparent magnitude is brighter than +1 in average. The obtained data are valuable for investigating the annual variation of the number of the fireballs and for unexpected display of the meteor showers in this period. In this paper, we present the detailed data of all the fireballs detected with our system and their images as archival data. Some results of the statistical studies are also presented.

Key words: monitoring observation, fireballs, meteors, meteoroids, all sky camera, Kiso Observatory

1. Introduction

Monitoring observations of fireballs are important in two astronomical aspects. One is for estimating the influx rate of the fireball-class meteoroids into the Earth's atmosphere. This can be useful to the NEA monitoring program recommended by the IAU (Chapman 2008). In order to estimate the probability of impact hazard by the NEA objects, we should know the precise mass distribution of the NEAs, including fireball-class objects. However, the size of such objects is too small to be observed by ground-based telescopes used for the NEA monitoring programs in general. Hence the estimate of the influx rate of such objects should be done by such fireball monitoring observation. The other aspect is to determine the population index of the fireballs. This index is related to the mass index of the fireball-class meteoroids in the space near the Earth's orbit. The discontinuity of the mass index has been pointed out around the mass of fireball-class meteoroids (Chapman 2008). Because of its low flux rate, we cannot carry out any in-situ measurement by artificial satellites. It is appropriate to perform long-term monitoring observations under a uniform condition for determining the mass influx rate of such meteoroids.

An automatic all-sky camera has been operated at the Kiso Observatory since 1977. Although the main purpose of this camera is to monitor the weather condition during the automatic airglow observation by photoelectric zenith photometer (Tanabe et al. 1992; Atlas of Zenith Airglow, National Astr. Obs.,1989), this camera system can be used to monitor fireballs and bright meteors. The aim of this paper is to present all the data of detected fireballs, which could not be included in the paper presented in 1993 (Miyashita et al. 1993), during our operation period (1977-1990) as an archive for future investigations, along with the results of the basic statistics of the fireballs detected by this all-sky camera at Kiso Observatory.

2. Observation and Data Reduction

The all-sky camera was installed in 1977 at the Kiso Observatory, Institute of Astronomy, University of Tokyo. The location is λ=137°37'39" (9h10m30.8s), ψ=+35°47'38.7", and 1130m above sea level. Figure 1 shows the schematic diagram of the camera system, which is operated automatically every night. The camera was set in the observation building to protect from rain. The monitoring observation is performed through the protecting glass, which was coated by transparent conducting of the In_2O_3 in order to warm it up electrically. This device protects the glass (Miyashita et al.1979), and is useful for avoiding dew. The cover upon the glass is operated by a daylight switch. The system consists of 35mm camera (type Nikon F) with a fish-eye lens (type Nikkor F/8) with a focal length f=16 mm between 1977 and 1980. After March 1980, another type of fish-eye lens with a focal length f=8mm (F/2.8) was used. The Fuji SSS (Neopan ASA-400) film with 100 feet length, which provides 750 frames, is used along with the motor drive system. The film is developed by Fuji Pandol at the temperature 20°C with 15min. This camera is set to take one-hour exposure per frame. The maximum period of the automatic monitoring is about one month, which is limited by the length of the photographic film.

We checked all the frames taken by all-sky camera by

eye-inspection, and recorded the positions and the maximum apparent brightness of the meteor trails. The apparent magnitudes were estimated by comparing the trails to known stars. The positions of the beginning and ending points were measured by overlaying the transparent measure for the alt-azimuth coordinates diagram. We inspected the star trails on each frame to determine if the frame can be used for the monitoring observation. All frames were divided into three classes (weight 1, 0.5, 0) according to the observational conditions. The clear condition (weight 1) is calculated in100%, the cirrus or partly cloudy (weight 0.5) is in 50% and cloudy (weight 0) is in 0%. Adding the weight, we can roughly estimate the total observation time in unit of hour.

During 1977-1990, we obtained 32254 frames in total, and 8900 frames of them could be used to monitor fireballs. Total number of fireballs observed was 742 during the effective observation time of 8900 hours.

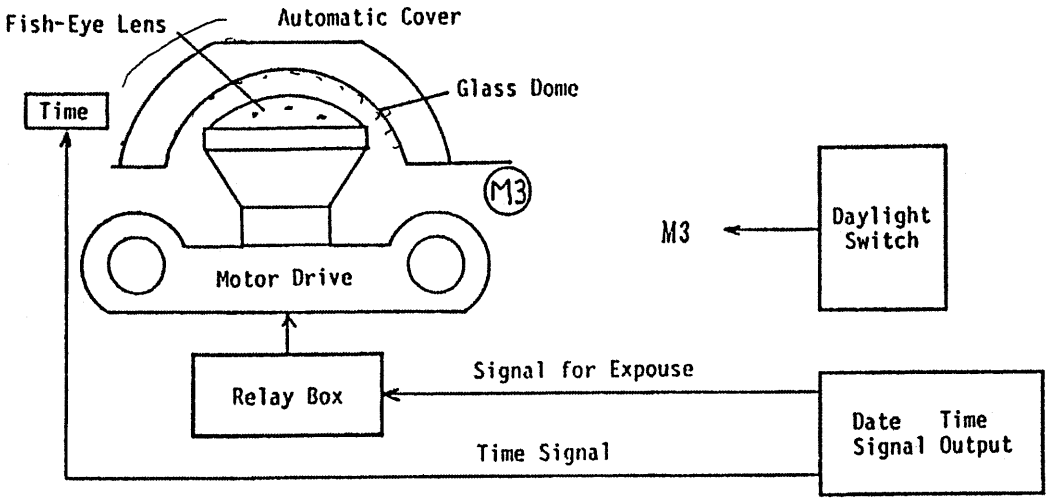

Figure 1. Schematic diagram of the all-sky camera system at the Kiso Observatory

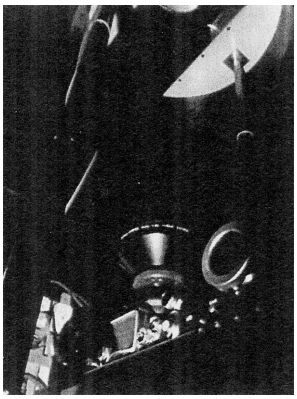

Figure 2. Camera with fish-eye lens

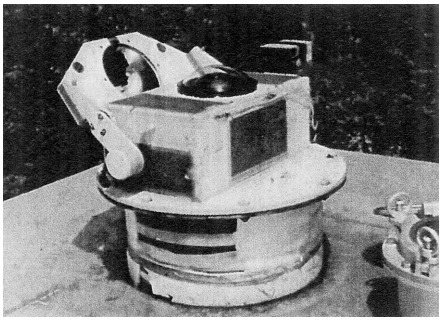

Figure 3. Cover operated automatic

Figure 4. Glass cover coated of the In_2O_3

3. Magnitude Calibration

There is a systematic difference between the apparent magnitude of fireballs and the estimated their true magnitude, because of the rapid angular speed and the reciprocal-low failure in emulsion. In order to estimate this difference quantitatively, we performed an experiment. The camera was set horizontally on a turn table, and was exposed in the rotation with an appropriate angular speed (22.5°/sec). Such frame contains many trails of bright planets, of which magnitudes are known. Comparing such experimental trail images with the apparent trails in a sidereal speed on the nor-

mal frames, we obtained approximate value of the systematic magnitudes difference as -7.0. This magnitude difference is for the G-type stars, and needs adjustments for color difference. Because we used the panchromatic emulsion for this observation, the color index derived by Ceplecha (1959) was used in this study. Because of the lack of the information, we assumed the constant index of -2.0 for the fireballs of which photographic magnitude is brighter than +2. This assumption may be supported by the result of Davis's photoelectric study (1959). The applied index correction is shown in table 1. Because the limiting apparent magnitude of stars in this camera is about 5, the average threshold of sensitivity of this monitoring observation is approximately +1 in the visual magnitude.

4. Results

All data obtained for each fireball is listed in table 2. It contains date and time, exposure time, the altitude and azimuth information of both starting and ending points of each fireball trail. The direction of the trail was judged from the brightness variation of the trail. It also contains the length of the trails and the apparent magnitude together with the estimated magnitude in the basis of table 1. Using the direction of each trail, we also judged if it belonged to known meteor showers or not. Special comments were also added if they were appropriate. The images of the fireballs are mainly processed for appropriate trimming in order to show them clearly. We did not list the images of faint fireballs in this image archive.

Using the corrected magnitude data, we can obtain the population index r, which indicates the increase of number of fireballs from a magnitude class m to m+1 as $N(m+1) = r\,N(m)$. Figure 5 shows the cumulative distribution of the magnitude of fireballs detected in our system. The population index of 1.4 ± 0.3 is derived from the fireballs of which magnitude ranges between 2 and -4. This value is comparable with the value of 1.2 to 1.9 derived by Sanchez and Gonzalez (2004). The overall feature of the seasonal variation is consistent with the result obtained by Sanchez and Gonzalez (2004).

Figure 6 shows the seasonal variation of the number of the detected fireballs. The effect of the rainy season in Japan around June and July is clearly shown, and corresponding to this period the actual number of fireballs recorded is small in the figure, while the estimated number after the weather factor correction is not small. The local maxima both in August and November are clearly shown, possibly due to the Perseids and Taurids, respectively.

Inspecting the detected fireballs, we noticed the five cases of the enhancement of fireballs, which may be related to the possible unusual activities of the meteor showers; Lyrids on April 22 in 1980, Ursides on December 22 in 1981, Virginids on April 15 in 1982, Taurids on November in 1988, and Geminids on 14 December in 1988. There are two possibilities for the cases. One is the enhancements of only bright or fireball-class meteors such like the Leonids storm in 1998(Asher et al. 1999). Another is the enhancements occurred over the wide mass range of meteoroids. We do not have enough information to discriminate these two cases for our detected activities. It is definitely the evidence that such all-sky camera is valuable for monitoring the activities of meteor showers, and the detailed investigation can be done by using our archive in the future.

We are grateful to all the staff in the Kiso Observatory for their cooperative efforts to maintain the automatic observation system.

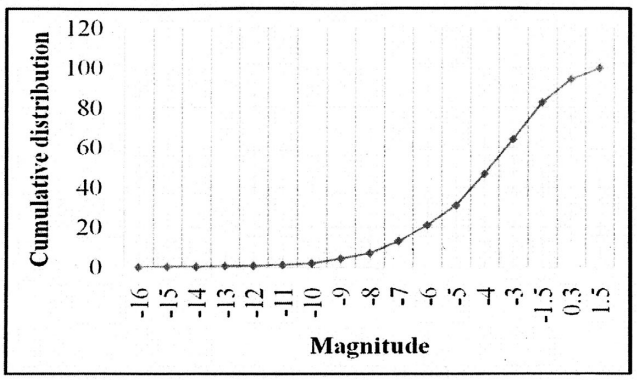

Figure 5. Cumulative distrbution of the visual magnitude

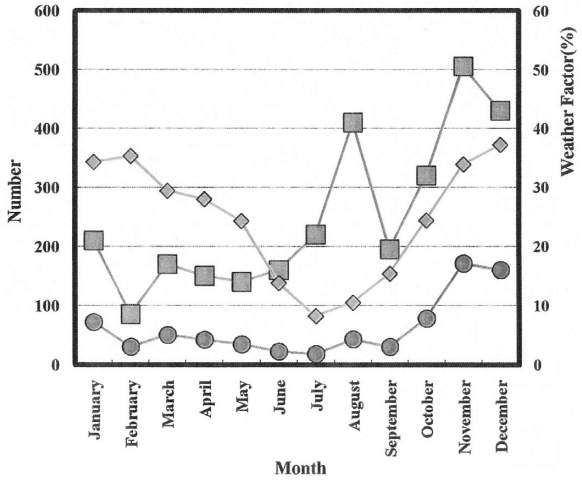

Figure 6. Seasonal variation of the ovserved fireballs. The marks of circle are number of Observed fireballs. The marks of square are corrected number by the weather factor. The marks of lozenge are weather factor (%)

Table 1. Correction between photographic and visual magnitude

Photographic Magnitude	Correction		Deduced Visual Magnitude
	Angular Velocity	Color Index	
5.0	-7.0	-3.5	1.5
4.0	-7.0	-3.3	0.3
3.0	-7.0	-2.5	-1.5
2.0	-7.0	-2.0	-3.0
1.0	-7.0	-2.0	-4.0
0.0	-7.0	-2.0	-5.0
-1.0	-7.0	-2.0	-6.0
-2.0	-7.0	-2.0	-7.0
-3.0	-7.0	-2.0	-8.0
-4.0	-7.0	-2.0	-9.0

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Table 2. List of fireballs detected in our monitor

No.	yyyy	mm	dd	Exposure Time(h-h)		Appearance Az	Appearance Al	Disappearance Az	Disappearance Al	Length of trail	Magnitude Photo.	Magnitude Deduced	Meteor group	Note
K-1	1977	4	22	2	3	1	29	4	22	7.5	0	-5	Lyrids	
K-2	1977	4	27	1	2	103	45	95	39	8.4	1	-4		
K-3	1977	11	3	1	2	193	31	198	23	9.2	1	-4		
K-4	1977	12	1	21	22	262	17	268	11	8.4	1	-4		
K-5	1977	12	3	22	23	253	49	249	40	9.4	0	-5		
K-6	1977	12	5	2	3	116	10	115	7	3.2	1	-4		to behind mountain
K-7	1977	12	13	1	2	138	20	143	8	12.9	-1	-6		
K-8	1977	12	14	21	22	94	55	87	42	13.8	2	-3		
K-9	1977	12	19	0	1	58	29	51	16	14.5	0	-5		
K-10	1978	3	2	3	4	124	18	133	15	9.1	-2	-7		
K-11	1978	3	8	1	2	132	31	136	20	11.6	0	-5		
K-12	1978	3	15	19	20	295	54	300	53	3.1	1	-4		
K-13	1978	3	25	0	1	22	50	18	35	15.3	1	-4		
K-14	1978	3	27	0	1	45	55	69	52	14.5	1	-4		
K-15	1978	3	29	23	24	46	43	49	37	6.4	0	-5		
K-16	1978	4	13	22	23	179	28	172	21	9.5	0	-5		
K-17	1978	10	21	21	22	88	31	88	12	19.0	-1	-6		
K-18	1978	10	30	23	24	345	19	347	17	2.8	0	-5		
K-19	1978	10	31	20	21	83	16	84	10	6.1	0	-5		
K-20	1978	10	31	23	24	320	32	319	28	4.1	1	-4	Taurids	
K-21	1978	10	31	23	24	314	23	313	18	5.1	2	-3	Taurids	
K-22	1978	11	1	0	1	85	59	103	34	27.7	-2	-7	Taurids	
K-23	1978	11	5	20	21	140	60	160	49	15.9	1	-4		
K-24	1978	11	6	2	3	22	24	18	19	6.2	0	-5	Taurids	
K-25	1978	11	7	0	1	161	51	163	40	11.1	2	-3	Taurids	
K-26	1978	11	7	0	1	337	15	337	13	2.0	2	-3	Taurids	
K-27	1978	11	7	3	4	72	34	71	30	4.1	2	-3	Taurids	
K-28	1978	11	9	21	22	80	30	81	17	13.0	2	-3		
K-29	1978	11	9	22	23	170	19	168	15	4.4	0	-5	Taurids	
K-30	1978	12	31	0	1	167	72	188	61	13.7	0	-5		
K-31	1979	1	4	5	6	198	26	194	19	7.9	-2	-7	Quadrantids	
K-32	1979	1	17	2	3	47	23	45	21	2.7	1	-4		
K-33	1979	1	19	18	19	71	47	75	44	4.1	2	-3		
K-34	1979	1	22	3	4	215	33	219	17	16.4	1	-4		
K-35	1979	1	25	5	6	200	27	203	25	3.4	1	-4		
K-36	1979	2	16	2	3	123	10	124	6	4.1	-2	-7		to bihind Mt. Ontake
K-37	1979	3	1	20	21	331	19	333	13	6.3	1	-4		
K-38	1979	3	1	21	22	294	22	296	16	6.3	3	-1.5		
K-39	1979	3	8	19	20	147	57	151	55	3.0	3	-1.5		
K-40	1979	4	19	1	2	303	48	263	19	43.4	-5	-10	Virginids	bright, no conparative star
K-41	1979	5	19	22	23	268	21	297	28	27.2	1	-4		
K-42	1979	5	20	2	3	343	28	307	15	35.8	-3	-8		bright, no conparative star
K-43	1979	6	17	21	22	262	10	253	6	9.8	-2	-7		
K-44	1979	7	31	2	3	201	30	216	15	20.4	-2	-7		2:37 am S.Kurusu：-6 mag
K-45	1979	8	1	20	21	325	58	335	63	7.0	0	-5		
K-46	1979	10	26	22	23	324	40	327	37	3.8	-3	-8	Taurids	
K-47	1979	11	2	2	3	125	82	163	67	17.4	0	-5		
K-48	1979	11	11	18	19	170	38	169	34	4.1	3	-1.5		
K-49	1979	11	11	19	20	237	58	241	25	33.1	0	-5		
K-50	1980	4	21	22	23	271	24	275	22	4.2	2	-3	Lyrids	
K-51	1980	4	22	0	1	181	31	177	28	4.6	2	-3	Lyrids	
K-52	1980	4	22	0	1	265	23	265	23	0.0	2	-3	Lyrids	
K-53	1980	4	22	2	3	119	37	118	31	6.1	4	0.3	Lyrids	
K-54	1980	4	22	2	3	197	43	195	40	3.4	3	-1.5	Lyrids	
K-55	1980	4	22	2	3	262	48	261	44	4.1	-1	-6	Lyrids	
K-56	1980	7	21	0	1	131	51	140	28	24.0	-10	-15		0:10:20, no conparative star
K-57	1980	9	9	22	23	300	76	9	71	19.0	1	-4		
K-58	1980	10	2	23	24	322	24	326	17	7.9	-2	-7		
K-59	1980	11	1	19	20	166	64	172	58	6.7	2	-3		
K-60	1980	11	3	23	24	307	27	307	18	9.0	-4	-9	Taurids	
K-61	1980	11	14	4	5	119	11	118	8	3.2	-2	-7		
K-62	1980	11	18	4	5	274	17	276	16	2.2	2	-3		
K-63	1980	12	2	2	3	314	23	311	16	7.5	1	-4		
K-64	1980	12	6	18	19	120	60	130	46	15.2	5	1.5		
K-65	1980	12	9	18	19	105	78	125	73	7.0	2	-3		
K-66	1980	12	15	3	4	359	13	357	8	5.4	2	-3	Geminids	
K-67	1980	12	15	3	4	0	73	10	75	3.4	4	0.3	Geminids	
K-68	1980	12	25	19	20	58	27	68	9	20.3	-1	-6		

No.	yyyy	mm	dd	Exposure Time(h-h)		Appearance		Disappearance		Length	Magnitude		Meteor	Note
						Az	Al	Az	Al	of trail	Photo.	Deduced	group	
K-69	1981	1	1	1	2	156	20	158	15	5.4	2	-3		
K-70	1981	1	30	22	23	184	56	177	39	17.6	2	-3		
K-71	1981	3	6	21	22	208	27	201	12	16.4	1	-4		
K-72	1981	3	29	2	3	125	38	146	19	26.4	2	-3	Virginids	
K-73	1981	4	7	2	3	18	50	28	14	36.9	-7	-12		bright, no conparative star
K-74	1981	4	10	22	23	14	20	20	10	11.6	-3	-8		
K-75	1981	4	22	23	24	285	45	299	45	9.9	-3	-8	Lyrids	
K-76	1981	7	8	1	2	245	31	241	31	3.4	2	-3		
K-77	1981	10	19	22	23	207	25	195	13	16.5	1	-4		
K-78	1981	10	31	20	21	306	35	302	36	3.4	-1	-6		
K-79	1981	11	1	0	1	133	24	134	17	7.1	-4	-9	Taurids	
K-80	1981	11	8	1	2	49	61	49	61	0.0	2	-3	Taurids	
K-81	1981	11	8	2	3	66	35	67	30	5.1	-2	-7	Taurids	
K-82	1981	11	8	2	3	114	34	120	30	6.5	-1	-6	Taurids	
K-83	1981	11	8	3	4	298	25	293	15	11.0	-2	-7	Taurids	
K-84	1981	11	8	4	5	310	74	301	73	2.7	2	-3		
K-85	1981	11	10	4	5	29	13	23	9	7.1	-1	-6	Taurids	
K-86	1981	11	17	22	23	131	19	130	15	4.1	-1	-6	Taurids	
K-87	1981	11	22	21	22	357	17	357	14	3.0	2	-3		
K-88	1981	11	22	23	24	351	12	351	11	1.0	2	-3	Taurids	
K-89	1981	11	23	0	1	325	82	290	80	5.7	0	-5	Taurids	
K-90	1981	12	14	21	22	117	40	103	21	22.4	-1	-6		
K-91	1981	12	14	23	24	75	28	77	11	17.1	-4	-9	Geminids	
K-92	1981	12	15	20	21	45	13	47	11	2.8	2	-3		
K-93	1981	12	18	0	1	295	69	270	68	9.2	1	-4		
K-94	1981	12	18	5	6	106	32	107	28	4.1	1	-4		
K-95	1981	12	21	5	6	284	60	280	53	7.3	2	-3		
K-96	1981	12	22	20	21	355	35	357	24	11.1	3	-1.5	Ursids	
K-97	1981	12	22	21	22	285	59	250	60	17.6	4	0.3	Ursids	
K-98	1981	12	22	21	22	10	80	12	52	28.0	5	1.5	Ursids	
K-99	1981	12	22	23	24	96	49	80	43	12.6	2	-3	Ursids	
K-100	1981	12	22	23	24	114	20	118	17	4.8	3	-1.5	Ursids	
K-101	1981	12	24	21	22	285	21	287	14	7.3	-2	-7		
K-102	1981	12	24	21	22	301	25	296	17	9.3	1	-4		
K-103	1981	12	28	21	22	23	57	63	24	43.8	-6	-11		bright, no conparative star
K-104	1982	1	28	0	1	212	29	208	22	7.9	-4	-9		
K-105	1982	1	29	20	21	282	50	325	42	30.5	-8	-13		conparative moon
K-106	1982	3	3	2	3	311	21	314	17	4.9	-1	-6		
K-107	1982	3	21	21	22	250	50	288	53	23.6	3	-1.5		
K-108	1982	3	27	20	21	266	37	277	25	15.2	4	0.3		
K-109	1982	3	29	3	4	308	34	298	17	19.2	3	-1.5		
K-110	1982	4	15	22	23	316	24	310	23	5.6	-1	-6	Virginids	
K-111	1982	4	15	23	24	11	32	13	20	12.1	-3	-8	Virginids	
K-112	1982	4	16	0	1	315	45	336	51	15.2	3	-1.5	Virginids	
K-113	1982	5	29	1	2	97	53	95	47	6.1	3	-1.5		
K-114	1982	6	21	22	23	313	29	312	21	8.1	3	-1.5		
K-115	1982	6	28	23	24	33	29	32	23	6.1	0	-5		
K-116	1982	10	23	3	4	258	41	255	37	4.6	-1	-6		
K-117	1982	11	13	4	5	296	60	285	39	22.1	2	-3	Taurids	
K-118	1982	11	20	20	21	73	42	76	27	15.2	-3	-8	Taurids	
K-119	1982	11	28	3	4	191	24	194	20	4.9	1	-4		
K-120	1982	12	4	18	19	312	12	299	11	12.8	1	-4		
K-121	1982	12	12	23	24	62	44	67	21	23.4	0	-5	Geminids	
K-122	1983	3	19	22	23	37	33	39	13	20.1	-8	-13		
K-123	1983	4	3	1	2	95	61	95	60	1.0	-2	-7		
K-124	1983	4	12	20	21	328	28	331	25	4.0	0	-5		
K-125	1983	4	14	3	4	97	66	110	65	5.5	-1	-6		
K-126	1983	5	7	22	23	216	58	220	50	8.3	3	-1.5		
K-127	1983	5	12	21	22	239	25	237	22	3.5	2	-3		
K-128	1983	5	14	21	22	227	25	227	20	5.0	1	-4		
K-129	1983	5	19	1	2	134	50	122	37	15.6	3	-1.5		
K-130	1983	6	1	21	22	110	54	99	56	6.6	4	0.3		
K-131	1983	6	1	21	22	210	71	240	76	9.7	3	-1.5		
K-132	1983	6	10	0	1	242	34	243	32	2.2	3	-1.5		
K-133	1983	7	4	0	1	340	67	323	69	6.6	-1	-6		
K-134	1983	8	9	2	3	219	56	216	57	1.9	-1	-6	Perseids	
K-135	1983	8	13	23	24	134	41	123	36	9.9	4	0.3	Perseids	
K-136	1983	8	14	0	1	317	35	329	26	13.7	-1	-6	Perseids	

No.	yyyy	mm	dd	Exposure Time(h-h)		Appearance		Disappearance		Length	Magnitude		Meteor	Note
						Az	Al	Az	Al	of trail	Photo.	Deduced	group	
K-137	1983	8	14	0	1	198	24	195	22	3.4	3	-1.5	Perseids	
K-138	1983	8	14	2	3	27	25	28	20	5.1	3	-1.5	Perseids	
K-139	1983	8	14	3	4	310	56	300	45	12.7	2	-3		
K-140	1983	9	19	21	22	315	75	200	63	35.8	-5	-10		
K-141	1983	10	3	0	1	93	17	101	9	11.2	1	-4		
K-142	1983	10	6	20	21	356	70	318	66	14.5	2	-3		
K-143	1983	10	21	19	20	168	31	197	24	26.6	-1	-6		
K-144	1983	10	27	19	20	311	36	312	34	2.2	3	-1.5		
K-145	1983	11	7	0	1	296	32	294	28	4.4	2	-3	Taurids	
K-146	1983	11	7	2	3	61	63	61	60	3.0	4	0.3	Taurids	
K-147	1983	11	9	0	1	19	41	20	37	4.1	3	-1.5	Taurids	
K-148	1983	11	9	3	4	193	38	178	26	17.4	4	0.3		
K-149	1983	11	9	3	4	25	33	17	26	9.9	-1	-6	Taurids	
K-150	1983	11	10	0	1	10	70	6	68	2.5	4	0.3	Taurids	
K-151	1983	11	12	0	1	273	69	210	75	19.3	3	-1.5		
K-152	1983	11	29	23	24	284	55	281	50	5.3	-2	-7	Taurids	
K-153	1983	12	4	18	19	15	22	13	14	8.2	-3	-8		
K-154	1983	12	6	23	24	285	71	340	45	36.8	3	-1.5		
K-155	1983	12	7	1	2	336	45	334	43	2.5	3	-1.5		
K-156	1983	12	8	4	5	140	48	150	41	10.0	0	-5		
K-157	1983	12	13	1	2	330	45	3	37	26.0	4	0.3		
K-158	1983	12	15	2	3	0	40	356	24	16.4	1	-4	Geminids	
K-159	1983	12	15	2	3	283	20	283	15	5.0	0	-5	Geminids	
K-160	1983	12	15	3	4	155	55	164	40	16.2	2	-3	Geminids	
K-161	1983	12	15	3	4	169	55	182	40	17.3	-1	-6	Geminids	
K-162	1983	12	15	4	5	345	53	334	40	15.0	5	1.5	Geminids	
K-163	1983	12	31	1	2	37	14	40	12	3.5	3	-1.5		
K-164	1984	1	6	2	3	90	17	85	14	5.7	1	-4		
K-165	1984	1	8	1	2	178	45	182	36	9.5	3	-1.5		
K-166	1984	1	8	3	4	146	22	143	20	3.4	4	0.3		
K-167	1984	1	9	0	1	322	15	321	12	3.2	-2	-7		
K-168	1984	1	23	23	24	340	37	347	25	13.4	1	-4		
K-169	1984	1	29	4	5	280	49	278	41	8.1	3	-1.5		
K-170	1984	1	29	23	24	54	55	47	42	13.8	2	-3		
K-171	1984	2	7	22	23	293	40	290	21	19.2	-1	-6		
K-172	1984	2	16	3	4	25	80	240	70	28.7	-2	-7		
K-173	1984	8	31	2	3	223	64	220	56	8.1	3	-1.5		
K-174	1984	8	31	23	24	293	38	300	24	15.2	1	-4		
K-175	1984	9	30	23	24	27	18	29	12	6.3	2	-3		
K-176	1984	10	22	0	1	308	23	313	21	5.0	2	-3	Orionids	
K-177	1984	10	22	4	5	149	31	149	31	0.0	3	-1.5		
K-178	1984	10	23	2	3	343	8	344	6	2.2	2	-3		to behind mountain
K-179	1984	10	23	23	24	60	13	62	7	6.3	-2	-7	Taurids	
K-180	1984	10	26	3	4	130	59	134	52	7.4	2	-3		
K-181	1984	10	30	2	3	229	64	223	60	4.9	4	0.3		
K-182	1984	10	30	3	4	16	13	17	10	3.2	2	-3		
K-183	1984	11	5	23	24	323	21	323	18	3.0	0	-5		
K-184	1984	11	6	1	2	132	43	137	35	8.9	-1	-6		
K-185	1984	11	14	2	3	145	15	143	13	2.8	2	-3		
K-186	1984	11	17	21	22	196	18	201	15	5.7	1	-4		
K-187	1984	11	20	21	22	115	17	113	11	6.3	-1	-6		
K-188	1984	11	20	23	24	70	50	70	43	7.0	5	1.5		
K-189	1984	11	21	3	4	238	61	280	64	19.3	5	1.5		
K-190	1984	11	21	3	4	230	58	199	52	18.6	5	1.5		
K-191	1984	11	21	4	5	42	8	42	7	1.0	1	-4		
K-192	1984	11	22	22	23	123	22	123	17	5.0	1	-4	Taurids	
K-193	1984	11	23	1	2	75	16	75	12	4.0	1	-4	Taurids	
K-194	1984	11	23	3	4	237	50	232	46	5.2	4	0.3	Taurids	
K-195	1984	11	23	3	4	18	64	1	62	7.9	4	0.3	Taurids	
K-196	1984	11	23	4	5	60	79	70	77	2.9	4	0.3	Taurids	
K-197	1984	11	25	20	21	244	36	249	26	10.9	1	-4		
K-198	1984	11	26	21	22	269	39	270	38	1.3	2	-3		
K-199	1984	11	28	1	2	5	23	4	22	1.4	-1	-6		
K-200	1984	11	28	21	22	295	22	297	14	8.2	-10	-15	Taurids	
K-201	1984	11	31	2	3	68	17	68	13	4.0	3	-1.5	Taurids	
K-202	1984	12	4	2	3	168	40	171	39	2.5	5	1.5		
K-203	1984	12	5	4	5	90	85	79	74	11.1	4	0.3		
K-204	1984	12	13	4	5	321	18	317	15	4.9	-2	-7		

No.	yyyy	mm	dd	Exposure Time(h-h)		Appearance Az	Al	Disappearance Az	Al	Length of trail	Magnitude Photo.	Deduced	Meteor group	Note
K-205	1984	12	15	20	21	320	21	320	18	3.0	-1	-6		
K-206	1984	12	19	0	1	130	71	170	55	23.4	-1	-6		
K-207	1984	12	19	4	5	80	31	80	28	3.0	2	-3		
K-208	1984	12	25	4	5	296	35	292	36	3.4	4	0.3		
K-209	1984	12	25	5	6	298	32	303	29	5.2	-1	-6		
K-210	1984	12	26	19	20	0	46	355	29	17.4	2	-3		
K-211	1984	12	26	22	23	25	48	37	36	14.9	3	-1.5		
K-212	1985	1	4	4	5	70	55	66	42	13.3	2	-3	Quadrantids	
K-213	1985	1	9	18	19	311	39	321	42	8.2	2	-3		
K-214	1985	1	10	18	19	277	31	281	28	4.6	2	-3		
K-215	1985	1	10	19	20	1	73	356	74	1.7	3	-1.5		
K-216	1985	1	15	4	5	167	25	193	17	25.5	-1	-6		
K-217	1985	1	16	19	20	20	62	17	62	1.4	4	0.3		
K-218	1985	1	17	2	3	17	34	25	20	15.7	3	-1.5		
K-219	1985	1	17	5	6	7	48	8	47	1.2	4	0.3		
K-220	1985	1	19	18	19	350	48	340	45	7.5	2	-3		
K-221	1985	1	21	2	3	272	28	280	26	7.4	-1	-6		
K-222	1985	1	21	21	22	191	55	203	30	26.4	0	-5		
K-223	1985	1	22	2	3	180	64	174	51	13.4	1	-4		
K-224	1985	1	25	2	3	289	61	312	40	25.3	3	-1.5		
K-225	1985	1	25	21	22	157	21	156	20	1.4	2	-3		
K-226	1985	2	14	19	20	161	38	158	27	11.3	2	-3		
K-227	1985	2	18	4	5	296	48	292	39	9.5	0	-5		
K-228	1985	2	24	0	1	173	18	176	14	4.9	0	-5		to behind forest
K-229	1985	3	23	3	4	349	53	347	48	5.2	2	-3		
K-230	1985	3	27	0	1	32	67	33	63	4.0	1	-4		
K-231	1985	4	24	0	1	278	37	281	35	3.1	4	0.3		
K-232	1985	5	18	2	3	122	37	114	38	6.4	5	1.5		
K-233	1985	7	16	2	3	204	35	202	32	3.4	4	0.3		
K-234	1985	8	2	21	22	87	60	86	59	1.1	0	-5		
K-235	1985	8	7	20	21	30	20	30	19	1.0	0	-5		
K-236	1985	8	8	2	3	122	17	119	14	4.2	-2	-7		
K-237	1985	8	9	23	24	125	60	125	54	6.0	2	-3	Perseids	
K-238	1985	8	16	0	1	274	45	276	42	3.3	4	0.3		
K-239	1985	8	16	1	2	101	58	95	59	3.3	4	0.3	Kappa-Cygnids	
K-240	1985	8	16	21	22	310	34	307	35	2.7	3	-1.5		
K-241	1985	8	16	23	24	60	35	53	23	13.5	-3	-8	Kappa-Cygnids	
K-242	1985	8	17	22	23	298	22	300	15	7.3	-2	-7	Kappa-Cygnids	
K-243	1985	9	6	3	4	196	51	185	49	7.3	-1	-6		
K-244	1985	9	7	23	24	283	18	289	12	8.3	2	-3		
K-245	1985	9	8	21	22	8	60	12	55	5.4	3	-1.5		
K-246	1985	9	12	2	3	96	58	92	39	19.2	-2	-7		
K-247	1985	9	12	23	24	264	29	266	27	2.7	2	-3		
K-248	1985	10	8	19	20	358	24	356	19	5.3	-3	-8		fall of the Soviet satellite in frame
K-249	1985	10	21	3	4	26	19	21	15	6.2	-2	-7	Taurids	
K-250	1985	10	21	3	4	316	66	292	42	27.4	0	-5	Taurids	
K-251	1985	10	23	2	3	328	56	316	46	12.5	3	-1.5	Taurids	
K-252	1985	10	23	2	3	346	42	338	35	9.4	2	-3	Taurids	
K-253	1985	11	3	19	20	228	43	219	36	9.8	2	-3		
K-254	1985	11	4	22	23	306	51	310	42	9.4	1	-4	Taurids	
K-255	1985	11	9	0	1	306	30	302	23	7.9	3	-1.5	Taurids	
K-256	1985	11	9	0	1	327	10	326	9	1.4	3	-1.5	Taurids	
K-257	1985	11	9	0	1	70	11	72	8	3.6	-4	-9	Taurids	
K-258	1985	11	10	0	1	342	82	327	83	2.2	4	0.3	Taurids	
K-259	1985	11	10	22	23	338	16	339	14	2.2	3	-1.5	Taurids	
K-260	1985	11	10	22	23	324	12	324	11	1.0	1	-4	Taurids	
K-261	1985	11	11	4	5	47	63	333	60	33.5	4	0.3	Taurids	
K-262	1985	11	15	2	3	298	39	294	32	7.7	5	1.5	Taurids	
K-263	1985	11	16	23	24	349	49	355	42	8.2	4	0.3	Taurids	
K-264	1985	11	17	1	2	316	39	327	34	10.1	5	1.5		
K-265	1985	11	17	1	2	228	40	235	39	5.5	3	-1.5		
K-266	1985	11	18	3	4	355	55	1	53	4.1	3	-1.5		
K-267	1985	11	20	3	4	27	31	20	25	8.6	1	-4	Taurids	
K-268	1985	11	20	19	20	183	64	175	63	3.7	1	-4		
K-269	1985	11	21	18	19	103	48	97	47	4.2	3	-1.5		
K-270	1985	12	2	20	21	79	24	85	9	16.1	-5	-10		
K-271	1985	12	4	4	5	247	15	250	10	5.8	1	-4		
K-272	1985	12	4	5	6	6	70	326	64	16.4	1	-4		

No.	yyyy	mm	dd	Exposure Time(h-h)		Appearance		Disappearance		Length	Magnitude		Meteor	Note
						Az	Al	Az	Al	of trail	Photo.	Deduced	group	
K-273	1985	12	5	19	20	29	64	27	62	2.2	4	0.3		
K-274	1985	12	5	22	23	343	18	342	15	3.1	2	-3		
K-275	1985	12	6	1	2	4	59	19	58	7.9	3	-1.5		
K-276	1985	12	11	1	2	222	30	220	20	10.2	1	-4	Geminids	
K-277	1985	12	12	3	4	342	37	349	28	10.8	4	0.3		
K-278	1985	12	12	3	4	103	50	105	41	9.1	2	-3	Geminids	
K-279	1985	12	12	22	23	36	18	40	14	5.5	-1	-6		
K-280	1985	12	13	23	24	340	42	358	25	22.6	-1	-6	Geminids	
K-281	1985	12	15	2	3	162	80	177	71	9.7	0	-5	Geminids	
K-282	1985	12	15	3	4	228	55	234	35	20.4	-1	-6	Geminids	
K-283	1985	12	26	5	6	227	44	222	37	8.0	-1	-6		
K-284	1986	1	7	5	6	4	82	15	82	1.5	3	-1.5		
K-285	1986	1	11	5	6	306	30	305	24	6.1	1	-4		
K-286	1986	1	12	2	3	19	17	21	16	2.2	2	-3		
K-287	1986	1	12	22	23	173	22	170	14	8.5	1	-4		to behind forest
K-288	1986	2	2	0	1	123	17	123	10	7.0	0	-5		
K-289	1986	2	6	21	22	306	20	298	15	9.1	3	-1.5		
K-290	1986	2	8	19	20	225	43	222	40	3.7	5	1.5		
K-291	1986	2	8	20	21	247	43	227	38	16.0	3	-1.5		
K-292	1986	2	12	4	5	11	39	18	35	6.9	1	-4		
K-293	1986	2	13	3	4	228	44	220	40	7.2	0	-5		
K-294	1986	3	2	20	21	359	9	3	7	4.4	0	-5		to behind mountain
K-295	1986	3	4	0	1	211	20	209	18	2.8	2	-3		
K-296	1986	3	4	0	1	172	18	173	13	5.1	0	-5		to behind mountain
K-297	1986	3	5	0	1	354	31	359	18	13.8	-4	-9		
K-298	1986	3	12	21	22	222	45	191	38	24.1	3	-1.5		
K-299	1986	3	15	23	24	350	53	3	51	8.2	3	-1.5		
K-300	1986	3	16	0	1	16	19	13	24	5.7	4	0.3		
K-301	1986	3	17	1	2	45	65	43	64	1.3	4	0.3		
K-302	1986	4	1	21	22	235	48	264	30	28.5	3	-1.5		
K-303	1986	4	1	23	24	313	45	302	42	8.5	4	0.3		
K-304	1986	4	6	3	4	220	32	218	32	1.7	3	-1.5		
K-305	1986	4	12	1	2	292	32	270	18	24.3	-1	-6		
K-306	1986	5	8	20	21	275	76	300	72	7.9	3	-1.5		
K-307	1986	5	10	21	22	351	25	357	15	11.5	-2	-7		
K-308	1986	5	12	23.5	24.5	133	15	135	14	2.2	1	-4		
K-309	1986	5	15	21.5	22.5	275	32	268	30	6.3	-1	-6		
K-310	1986	5	16	23.5	24.5	45	47	46	47	0.7	0	-5		
K-311	1986	5	26	20	21	269	57	274	56	2.9	4	0.3		
K-312	1986	6	4	2.5	3.5	171	76	172	74	2.0	2	-3		
K-313	1986	6	11	1.5	2.5	223	62	307	62	36.6	1	-4		
K-314	1986	7	2	0	1	320	43	327	34	10.5	3	-1.5		
K-315	1986	8	5	1	2	261	19	263	17	2.8	1	-4	Perseids	
K-316	1986	8	5	2	3	202	51	201	47	4.1	4	0.3		
K-317	1986	8	5	23	24	127	58	105	51	14.5	3	-1.5		
K-318	1986	8	12	1	2	20	17	22	12	5.4	0	-5	Perseids	
K-319	1986	8	13	1	2	233	45	236	44	2.4	3	-1.5	Perseids	
K-320	1986	8	14	2	3	278	20	280	18	2.8	2	-3	Perseids	
K-321	1986	9	4	19	20	240	11	240	9	2.0	1	-4		
K-322	1986	9	6	0	1	10	18	9	18	1.0	3	-1.5		
K-323	1986	9	11	3	4	264	18	267	17	3.0	0	-5		
K-324	1986	9	29	23	24	325	20	325	19	1.0	2	-3		
K-325	1986	9	30	0	1	264	23	271	11	13.7	0	-5		
K-326	1986	9	30	19	20	157	55	160	50	5.3	4	0.3		
K-327	1986	10	1	1	2	0	69	234	74	32.9	1	-4		
K-328	1986	10	6	1	2	82	23	76	19	6.9	3	-1.5		
K-329	1986	10	8	21	22	68	59	39	58	15.1	4	0.3		
K-330	1986	10	8	21	22	232	14	231	13	1.4	0	-5		
K-331	1986	10	14	3	4	311	32	315	27	6.1	5	1.5		
K-332	1986	10	14	21	22	229	62	230	62	0.5	0	-5		
K-333	1986	10	15	3	4	166	24	191	17	24.4	1	-4		
K-334	1986	10	23	20	21	358	31	357	29	2.2	3	-1.5		
K-335	1986	10	27	18	19	153	69	156	68	1.5	4	0.3		
K-336	1986	10	30	23	24	72	34	76	24	10.6	-3	-8	Taurids	
K-337	1986	10	31	4	5	325	78	328	77	1.2	4	0.3		
K-338	1986	10	31	4	5	3	19	7	16	4.9	1	-4		
K-339	1986	11	1	0	1	288	19	286	16	3.6	-2	-7		
K-340	1986	11	3	1	2	265	58	259	30	28.3	-2	-7		

No.	yyyy	mm	dd	Exposure Time(h-h)		Appearance Az	Appearance Al	Disappearance Az	Disappearance Al	Length of trail	Magnitude Photo.	Magnitude Deduced	Meteor group	Note
K-341	1986	11	3	2	3	224	26	220	22	5.4	1	-4		
K-342	1986	11	5	18	19	79	19	78	19	0.9	2	-3		
K-343	1986	11	8	2	3	88	56	92	55	2.5	4	0.3	Taurids	
K-344	1986	11	8	22	23	288	22	288	21	1.0	0	-5	Taurids	
K-345	1986	11	10	3	4	47	27	41	23	6.7	-1	-6	Taurids	
K-346	1986	11	11	20	21	146	46	147	44	2.1	1	-4		
K-347	1986	11	12	4	5	359	64	1	59	5.1	5	1.5		
K-348	1986	11	18	20	21	8	58	2	60	3.7	0	-5		
K-349	1986	11	20	2	3	293	44	296	43	2.4	2	-3		
K-350	1986	11	20	23	24	103	40	105	41	1.8	1	-4	Taurids	
K-351	1986	11	21	18	19	77	8	67	7	10.0	1	-4		
K-352	1986	11	27	0	1	170	23	171	21	2.2	2	-3	Taurids	
K-353	1986	11	27	2	3	316	30	320	28	4.0	1	-4		
K-354	1986	11	29	22	23	108	8	108	7	1.0	1	-4		
K-355	1986	11	30	2	3	238	59	245	41	18.5	-1	-6	Taurids	
K-356	1986	12	5	4	5	247	37	248	34	3.1	2	-3	Taurids	
K-357	1986	12	6	4	5	49	12	48	10	2.2	2	-3		
K-358	1986	12	30	5	6	301	48	227	42	50.6	-4	-9		
K-359	1987	1	1	3	4	142	77	141	75	2.0	3	-1.5		
K-360	1987	1	2	3	4	291	53	290	49	4.0	0	-5		
K-361	1987	1	4	0	1	81	14	81	12	2.0	2	-3		
K-362	1987	1	4	3	4	248	24	249	21	3.1	4	0.3	Quadrantids	
K-363	1987	1	4	3	4	337	29	341	26	4.6	3	-1.5	Quadrantids	
K-364	1987	1	4	5	6	115	67	122	62	5.8	5	1.5		
K-365	1987	1	4	5	6	275	29	275	29	0.0	3	-1.5		
K-366	1987	1	20	19	20	14	18	11	14	4.9	0	-5		
K-367	1987	1	24	19	20	292	27	276	24	14.7	3	-1.5		
K-368	1987	1	26	22	23	200	50	198	46	4.2	3	-1.5		
K-369	1987	1	28	2	3	334	41	334	38	3.0	4	0.3		
K-370	1987	2	7	2	3	65	44	91	33	23.0	0	-5		
K-371	1987	3	1	20	21	78	18	79	17	1.4	0	-5		
K-372	1987	3	7	3	4	226	79	235	74	5.4	3	-1.5		
K-373	1987	3	25	4	5	342	19	345	18	3.0	2	-3		
K-374	1987	3	27	3	4	332	61	337	63	3.1	5	1.5		
K-375	1987	3	30	0	1	172	41	173	33	8.0	4	0.3		
K-376	1987	3	30	2	3	82	8	82	8	0.0	1	-4		
K-377	1987	4	3	23	24	315	70	321	70	2.1	5	1.5		
K-378	1987	4	27	23	24	5	23	8	18	5.7	3	-1.5		
K-379	1987	5	4	22	23	275	39	271	37	3.7	2	-3		
K-380	1987	5	7	2	3	199	32	184	28	13.6	2	-3		
K-381	1987	5	7	3	4	170	87	114	60	28.4	0	-5		
K-382	1987	5	19	23	24	0	35	3	31	4.7	4	0.3		
K-383	1987	5	24	23	24	215	67	220	67	2.0	3	-1.5		
K-384	1987	5	29	0	1	24	32	13	26	11.3	-5	-10		
K-385	1987	5	31	21	22	34	77	44	74	3.9	2	-3		
K-386	1987	6	1	21	22	82	49	83	50	1.2	1	-4		
K-387	1987	6	4	1	2	237	60	240	60	1.5	2	-3		
K-388	1987	6	5	1	2	96	43	117	36	17.6	3	-1.5		
K-389	1987	6	17	1	2	75	82	165	78	14.4	-2	-7		
K-390	1987	6	21	23	24	152	56	170	31	28.0	-2	-7		
K-391	1987	6	27	2	3	246	65	242	64	2.0	3	-1.5		
K-392	1987	7	20	23	24	66	77	117	67	17.8	-1	-6		
K-393	1987	7	27	1	2	198	62	226	48	21.0	1	-4		
K-394	1987	7	27	23	24	266	61	252	57	8.2	-4	-9	Alpha-Capricornids	
K-395	1987	7	28	22	23	210	17	210	17	0.0	-1	-6		
K-396	1987	8	2	1	2	23	60	24	57	3.0	5	1.5		
K-397	1987	8	10	21	22	37	34	35	30	4.3	1	-4		
K-398	1987	8	27	23	24	37	13	34	11	3.6	1	-4		
K-399	1987	8	29	3	4	25	79	62	68	14.7	2	-3		
K-400	1987	8	29	22	23	1	44	4	39	5.5	3	-1.5		
K-401	1987	9	20	1	2	147	58	154	52	7.2	3	-1.5		
K-402	1987	9	21	0	1	11	12	11	9	3.0	3	-1.5		
K-403	1987	9	22	21	22	188	41	190	41	1.5	4	0.3		
K-404	1987	10	4	3	4	240	48	233	48	4.7	3	-1.5		
K-405	1987	10	13	3	4	135	19	135	18	1.0	-2	-7		
K-406	1987	10	13	20	21	185	59	178	55	5.5	-1	-6		
K-407	1987	10	20	4	5	179	25	176	22	4.1	1	-4		
K-408	1987	10	21	20	21	152	37	135	22	21.0	-2	-7		

No.	yyyy	mm	dd	Exposure Time(h-h)		Appearance		Disappearance		Length	Magnitude		Meteor	Note
						Az	Al	Az	Al	of trail	Photo.	Deduced	group	
K-409	1987	10	27	22	23	279	17	284	14	5.7	0	-5		
K-410	1987	10	27	22	23	323	27	320	25	3.4	3	-1.5		
K-411	1987	10	28	2	3	71	35	72	26	9.0	-2	-7	Taurids	
K-412	1987	10	28	2	3	31	73	42	69	5.4	5	1.5	Taurids	
K-413	1987	10	28	4	5	343	36	349	33	5.8	3	-1.5		
K-414	1987	10	28	20	21	172	16	168	13	4.9	2	-3		
K-415	1987	11	9	20	21	40	45	41	43	2.1	2	-3		
K-416	1987	11	18	3	4	173	57	175	53	4.2	2	-3		
K-417	1987	11	18	3	4	104	55	109	57	3.4	2	-3	Taurids	
K-418	1987	11	20	18	19	340	80	77	79	15.7	5	1.5		
K-419	1987	11	21	4	5	226	19	225	18	1.4	1	-4		
K-420	1987	11	21	23	24	236	27	237	22	5.1	1	-4		
K-421	1987	11	24	0	1	285	42	274	34	11.8	3	-1.5		
K-422	1987	11	24	18	19	94	64	101	62	3.8	5	1.5		
K-423	1987	11	24	21	22	244	52	231	48	9.2	3	-1.5	Taurids	
K-424	1987	11	25	18	19	146	59	146	59	0.0	3	-1.5		
K-425	1987	11	25	23	24	56	15	57	14	1.4	3	-1.5		
K-426	1987	11	26	4	5	285	71	282	58	13.1	5	1.5		
K-427	1987	11	29	18	19	186	44	195	31	14.8	3	-1.5		
K-428	1987	12	3	3	4	262	47	256	41	7.4	-4	-9		
K-429	1987	12	8	0	1	205	44	201	23	21.3	-4	-9		
K-430	1987	12	13	21	22	273	48	280	50	5.0	3	-1.5	Geminids	
K-431	1987	12	13	22	23	245	57	240	59	3.3	4	0.3	Geminids	
K-432	1987	12	13	22	23	102	12	99	6	6.7	0	-5		to behind forest
K-433	1987	12	13	23	24	115	45	117	37	8.1	-4	-9	Geminids	
K-434	1987	12	14	3	4	37	9	36	7	2.2	0	-5		
K-435	1987	12	14	4	5	15	64	345	50	21.2	2	-3	Geminids	
K-436	1987	12	14	21	22	21	37	33	23	17.4	0	-5	Geminids	
K-437	1987	12	14	21	22	287	21	294	15	9.0	-3	-8	Geminids	
K-438	1987	12	15	4	5	106	10	107	7	3.2	-3	-8	Geminids	
K-439	1987	12	15	5	6	61	38	48	30	13.4	1	-4	Geminids	
K-440	1987	12	16	23	24	308	26	307	23	3.1	1	-4		
K-441	1987	12	17	4	5	355	27	354	26	1.3	2	-3		
K-442	1987	12	17	4	5	119	22	119	14	8.0	-5	-10		
K-443	1987	12	17	19	20	206	27	206	23	4.0	0	-5		
K-444	1987	12	18	2	3	44	15	47	12	4.2	3	-1.5		
K-445	1987	12	19	2	3	125	15	126	13	2.2	2	-3		
K-446	1987	12	19	3	4	32	43	34	36	7.2	1	-4		
K-447	1987	12	20	2	3	5	64	16	57	8.8	0	-5		
K-448	1987	12	20	4	5	62	67	59	66	1.6	4	0.3		
K-449	1987	12	22	1	2	306	38	301	39	4.0	4	0.3		
K-450	1987	12	24	0	1	295	68	292	67	1.5	-1	-6		
K-451	1987	12	24	22	23	147	42	148	35	7.0	-2	-7		
K-452	1987	12	25	5	6	285	57	307	49	15.4	2	-3		
K-453	1987	12	26	4	5	229	22	227	19	3.5	0	-5		
K-454	1987	12	26	5	6	278	35	285	32	6.6	2	-3		
K-455	1987	12	27	1	2	105	49	106	48	1.2	4	0.3		
K-456	1987	12	28	1	2	299	20	296	14	6.6	4	0.3		
K-457	1987	12	29	2	3	342	22	339	16	6.6	-2	-7		
K-458	1988	1	1	3	4	260	20	260	20	0.0	1	-4		
K-459	1988	1	4	4	5	0	13	359	8	5.1	0	-5		
K-460	1988	1	10	21	22	114	23	114	23	0.0	3	-1.5		
K-461	1988	1	11	4	5	204	22	203	21	1.4	2	-3		
K-462	1988	1	14	5	6	308	71	318	67	5.4	2	-3		
K-463	1988	1	16	23	24	305	79	350	74	11.2	3	-1.5		
K-464	1988	1	17	4	5	205	52	198	51	4.5	4	0.3		
K-465	1988	1	20	20	21	277	35	277	37	2.0	3	-1.5		
K-466	1988	2	14	1	2	58	26	57	25	1.3	4	0.3		
K-467	1988	2	14	3	4	319	29	322	28	2.8	3	-1.5		
K-468	1988	2	19	20	21	333	42	334	43	1.2	4	0.3		
K-469	1988	3	8	20	21	50	38	48	37	1.9	3	-1.5		
K-470	1988	3	10	23	24	316	14	318	10	4.5	3	-1.5		
K-471	1988	3	20	4	5	172	72	172	70	2.0	3	-1.5		
K-472	1988	3	23	19	20	292	43	302	40	8.1	2	-3		
K-473	1988	3	24	4	5	174	76	174	74	2.0	4	0.3		
K-474	1988	4	10	21	22	132	15	134	14	2.2	3	-1.5		
K-475	1988	4	11	1	2	240	33	240	35	2.0	4	0.3		
K-476	1988	4	15	1	2	111	59	109	58	1.4	5	1.5		

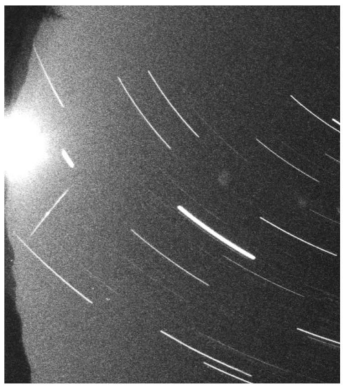
No.	yyyy	mm	dd	Exposure Time(h-h)		Appearance		Disappearance		Length	Magnitude		Meteor	Note
						Az	Al	Az	Al	of trail	Photo.	Deduced	group	
K-477	1988	4	16	0	1	101	56	100	55	1.1	5	1.5		
K-478	1988	4	16	0	1	53	46	52	45	1.2	4	0.3		
K-479	1988	4	21	1	2	52	18	47	15	5.7	1	-4		
K-480	1988	4	23	2	3	122	52	121	45	7.0	0	-5	Lyrids	
K-481	1988	4	24	1	2	67	75	39	73	7.9	3	-1.5		
K-482	1988	5	8	21	22	37	13	37	12	1.0	1	-4		
K-483	1988	5	9	0	1	233	23	226	17	8.9	1	-4		
K-484	1988	5	12	21	22	167	72	167	69	3.0	2	-3		
K-485	1988	5	13	21	22	180	24	179	23	1.4	2	-3		
K-486	1988	5	16	21	22	222	61	231	66	6.4	2	-3		
K-487	1988	5	19	0	1	174	62	172	52	10.1	4	0.3		
K-488	1988	5	20	2	3	221	66	221	65	1.0	1	-4		
K-489	1988	5	24	1	2	63	13	65	12	2.2	3	-1.5		
K-490	1988	5	29	0	1	264	14	269	12	5.3	-3	-8		
K-491	1988	6	4	22	23	343	71	345	69	2.1	5	1.5		
K-492	1988	6	5	21	22	280	57	291	54	6.9	1	-4		
K-493	1988	6	13	22	23	140	73	135	74	1.7	5	1.5		
K-494	1988	7	1	21	22	231	73	217	65	9.4	1	-4		
K-495	1988	7	2	21	22	235	73	203	64	14.5	5	1.5		
K-496	1988	7	27	2	3	149	31	150	30	1.3	-1	-6		
K-497	1988	8	3	0	1	23	16	23	13	3.0	1	-4		
K-498	1988	8	3	2	3	188	21	187	19	2.2	2	-3		
K-499	1988	8	12	0	1	117	34	105	26	13.1	0	-5	Perseids	
K-500	1988	8	12	0	1	104	27	100	23	5.4	3	-1.5	Perseids	
K-501	1988	9	9	20	21	132	60	123	47	14.0	2	-3		
K-502	1988	9	9	21	22	304	52	293	56	7.6	2	-3		
K-503	1988	9	14	21	22	53	13	52	13	1.0	2	-3		
K-504	1988	9	15	0	1	228	63	219	64	4.1	3	-1.5		
K-505	1988	9	15	1	2	213	57	215	66	9.0	4	0.3		
K-506	1988	9	18	19	20	178	29	174	19	10.6	1	-4		
K-507	1988	9	20	1	2	242	38	247	35	5.0	1	-4		
K-508	1988	10	3	19	20	213	54	197	44	14.4	4	0.3		
K-509	1988	10	6	19	20	20	56	24	55	2.5	3	-1.5		
K-510	1988	10	7	1	2	331	33	327	27	6.9	4	0.3		
K-511	1988	10	9	2	3	13	33	9	29	5.3	1	-4		
K-512	1988	10	9	19	20	90	22	90	21	1.0	2	-3		
K-513	1988	10	9	21	22	196	67	195	67	0.4	3	-1.5		
K-514	1988	10	10	19	20	82	50	82	47	3.0	5	1.5		
K-515	1988	10	11	2	3	270	88	239	72	16.3	-1	-6		
K-516	1988	10	11	4	5	274	47	275	46	1.2	-1	-6		
K-517	1988	10	13	23	24	198	18	197	15	3.1	0	-5		
K-518	1988	10	14	1	2	324	11	324	10	1.0	2	-3		
K-519	1988	10	14	22	23	167	34	167	29	5.0	3	-1.5		
K-520	1988	10	19	19	20	227	37	228	33	4.1	5	1.5		
K-521	1988	10	27	19	20	70	23	74	16	7.9	-2	-7		
K-522	1988	10	31	21	22	293	18	296	19	3.0	3	-1.5		
K-523	1988	10	31	22	23	286	35	284	30	5.3	2	-3	Taurids	
K-524	1988	10	31	22	23	349	27	352	23	4.8	3	-1.5	Taurids	
K-525	1988	11	1	18	19	329	63	323	60	4.1	4	0.3		
K-526	1988	11	2	18	19	337	59	338	57	2.1	4	0.3		
K-527	1988	11	3	3	4	145	70	119	58	16.3	0	-5		
K-528	1988	11	3	21	22	324	55	330	55	3.4	4	0.3	Taurids	
K-529	1988	11	3	23	24	117	28	118	26	2.2	0	-5	Taurids	
K-530	1988	11	4	0	1	118	20	119	16	4.1	1	-4	Taurids	
K-531	1988	11	4	1	2	195	88	45	85	6.8	5	1.5	Taurids	
K-532	1988	11	4	2	3	238	37	238	24	13.0	1	-4	Taurids	
K-533	1988	11	4	3	4	35	14	32	12	3.5	3	-1.5		
K-534	1988	11	4	3	4	220	51	230	36	16.6	-1	-6	Taurids	
K-535	1988	11	4	3	4	256	31	256	27	4.0	3	-1.5	Taurids	
K-536	1988	11	5	19	20	271	23	272	23	0.9	0	-5	Taurids	
K-537	1988	11	6	0	1	247	11	247	9	2.0	1	-4	Taurids	
K-538	1988	11	6	0	1	264	81	246	64	17.6	1	-4	Taurids	
K-539	1988	11	6	0	1	352	15	351	12	3.2	-2	-7	Taurids	
K-540	1988	11	6	1	2	315	24	318	23	2.9	5	1.5		
K-541	1988	11	6	22	23	290	27	290	23	4.0	-3	-8	Taurids	
K-542	1988	11	6	22	23	354	20	357	16	4.9	-5	-10	Taurids	
K-543	1988	11	6	23	24	35	47	38	44	3.7	5	1.5		
K-544	1988	11	7	0	1	227	55	225	48	7.1	5	1.5	Taurids	

No.	yyyy	mm	dd	Exposure Time(h-h)		Appearance		Disappearance		Length	Magnitude		Meteor	Note
						Az	Al	Az	Al	of trail	Photo.	Deduced	group	
K-545	1988	11	7	2	3	267	25	261	21	6.8	3	-1.5	Taurids	
K-546	1988	11	7	22	23	93	21	93	21	0.0	1	-4	Taurids	
K-547	1988	11	7	23	24	302	16	300	12	4.4	1	-4	Taurids	
K-548	1988	11	8	0	1	57	23	58	20	3.1	2	-3	Taurids	
K-549	1988	11	8	18	19	46	52	45	52	0.6	2	-3		
K-550	1988	11	8	21	22	258	80	275	74	7.1	4	0.3	Taurids	
K-551	1988	11	8	21	22	293	26	294	24	2.2	2	-3	Taurids	
K-552	1988	11	8	21	22	2	18	4	16	2.8	1	-4	Taurids	
K-553	1988	11	8	22	23	8	27	12	24	4.7	1	-4	Taurids	
K-554	1988	11	9	0	1	292	77	258	70	11.7	2	-3	Taurids	
K-555	1988	11	9	1	2	204	28	200	24	5.4	0	-5	Taurids	
K-556	1988	11	9	2	3	307	56	292	40	18.8	2	-3	Taurids	
K-557	1988	11	9	2	3	321	18	317	13	6.3	-3	-8	Taurids	
K-558	1988	11	9	3	4	238	45	242	40	5.8	3	-1.5		
K-559	1988	11	9	19	20	207	23	184	17	22.4	1	-4	Taurids	
K-560	1988	11	9	21	22	181	21	177	17	5.5	3	-1.5	Taurids	
K-561	1988	11	10	3	4	190	10	192	8	2.8	2	-3		
K-562	1988	11	10	20	21	95	30	95	30	0.0	1	-4		
K-563	1988	11	10	20	21	276	17	276	16	1.0	0	-5	Taurids	
K-564	1988	11	10	22	23	252	64	222	58	15.5	-2	-7	Taurids	
K-565	1988	11	11	1	2	174	61	183	44	17.8	2	-3	Taurids	
K-566	1988	11	11	2	3	64	15	64	12	3.0	-2	-7	Taurids	
K-567	1988	11	11	22	23	50	59	59	49	11.3	2	-3	Taurids	
K-568	1988	11	11	23	24	276	71	249	62	13.8	1	-4	Taurids	
K-569	1988	11	12	3	4	179	24	176	20	4.9	-3	-8		
K-570	1988	11	12	4	5	234	32	230	27	6.1	-1	-6		
K-571	1988	11	13	19	20	123	40	124	39	1.3	2	-3		
K-572	1988	11	14	22	23	348	21	350	17	4.4	-1	-6	Taurids	
K-573	1988	11	14	23	24	353	39	352	35	4.1	5	1.5	Taurids	
K-574	1988	11	15	22	23	259	36	265	35	5.0	3	-1.5		
K-575	1988	11	15	23	24	341	65	357	64	6.9	0	-5	Taurids	
K-576	1988	11	17	0	1	199	43	198	35	8.0	-1	-6	Taurids	
K-577	1988	11	17	5	6	79	18	80	18	1.0	-2	-7		
K-578	1988	11	17	3	4	240	35	240	35	0.0	2	-3		
K-579	1988	11	28	21	22	181	55	178	53	2.7	1	-4		
K-580	1988	11	29	22	23	43	55	44	52	3.1	4	0.3		
K-581	1988	11	29	5	6	101	41	103	43	2.5	1	-4		
K-582	1988	11	30	18	19	333	64	333	62	2.0	4	0.3		
K-583	1988	11	30	19	20	8	50	7	48	2.1	4	0.3		
K-584	1988	12	1	19	20	71	32	72	31	1.3	1	-4		
K-585	1988	12	2	18	19	292	52	290	50	2.4	3	-1.5		
K-586	1988	12	3	3	4	264	56	249	41	17.9	-2	-7		
K-587	1988	12	6	3	4	277	39	275	37	2.5	3	-1.5		
K-588	1988	12	6	19	20	87	37	88	27	10.0	-4	-9		
K-589	1988	12	6	2	3	274	55	276	67	12.0	4	0.3		
K-590	1988	12	8	3	4	1	25	358	21	4.9	1	-4		
K-591	1988	12	10	5	6	319	52	323	53	2.6	-3	-8		
K-592	1988	12	11	3	4	13	18	8	15	5.7	-3	-8		
K-593	1988	12	12	0	1	213	50	208	42	8.7	3	-1.5		
K-594	1988	12	12	0	1	233	21	232	13	8.1	2	-3	Geminids	
K-595	1988	12	12	1	2	321	64	328	50	14.5	-2	-7	Geminids	
K-596	1988	12	12	21	22	210	32	213	35	3.9	4	0.3		
K-597	1988	12	13	0	1	10	41	7	31	10.3	2	-3		
K-598	1988	12	13	1	2	199	23	198	15	8.1	0	-5	Geminids	
K-599	1988	12	13	22	23	162	45	154	39	8.4	3	-1.5		
K-600	1988	12	13	23	24	282	70	288	72	2.8	5	1.5	Geminids	
K-601	1988	12	13	23	24	281	31	282	28	3.1	5	1.5	Geminids	
K-602	1988	12	14	0	1	332	70	345	70	4.4	3	-1.5	Geminids	
K-603	1988	12	14	0	1	249	42	248	34	8.0	2	-3	Geminids	
K-604	1988	12	14	0	1	249	31	247	18	13.1	-4	-9	Geminids	
K-605	1988	12	14	0	1	214	28	212	22	6.3	4	0.3	Geminids	
K-606	1988	12	14	2	3	41	73	35	64	9.3	-2	-7	Geminids	
K-607	1988	12	14	3	4	73	41	73	36	5.0	4	0.3	Geminids	
K-608	1988	12	14	4	5	5	21	4	18	3.1	1	-4	Geminids	
K-609	1988	12	14	4	5	32	33	30	31	2.6	5	1.5	Geminids	
K-610	1988	12	14	4	5	39	40	32	36	6.8	4	0.3	Geminids	
K-611	1988	12	14	4	5	230	46	235	38	8.8	4	0.3	Geminids	
K-612	1988	12	14	4	5	250	21	251	16	5.1	5	1.5	Geminids	

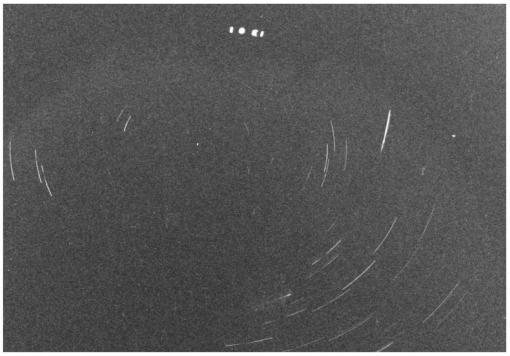
No.	yyyy	mm	dd	Exposure Time(h-h)		Appearance Az	Appearance Al	Disappearance Az	Disappearance Al	Length of trail	Magnitude Photo.	Magnitude Deduced	Meteor group	Note
K-613	1988	12	14	21	22	30	43	37	36	8.8	4	0.3	Geminids	
K-614	1988	12	18	1	2	52	29	50	26	3.5	-2	-7		
K-615	1988	12	21	1	2	64	12	63	7	5.1	-2	-7		
K-616	1988	12	28	0	1	102	74	108	68	6.3	3	-1.5		
K-617	1988	12	31	3	4	13	28	15	27	2.0	0	-5		
K-618	1988	12	31	3	4	227	27	228	27	0.9	3	-1.5		
K-619	1989	1	2	4	5	163	71	163	70	1.0	3	-1.5		
K-620	1989	1	4	5	6	273	65	278	65	2.1	3	-1.5	Quadrantids	
K-621	1989	1	12	21	22	322	30	323	19	11.0	1	-4		
K-622	1989	1	12	23	24	356	16	356	15	1.0	3	-1.5		
K-623	1989	1	13	21	22	96	21	97	13	8.1	-1	-6		
K-624	1989	1	15	4	5	196	29	202	21	9.7	3	-1.5		
K-625	1989	1	17	0	1	282	29	282	28	1.0	2	-3		
K-626	1989	1	27	20	21	82	17	82	17	0.0	0	-5		
K-627	1989	1	30	5	6	181	73	178	71	2.2	3	-1.5		
K-628	1989	1	31	2	3	230	55	238	58	5.3	3	-1.5		
K-629	1989	2	2	5	6	190	72	185	68	4.3	2	-3		
K-630	1989	2	4	23	24	32	62	33	61	1.1	4	0.3		
K-631	1989	2	5	2	3	41	15	40	14	1.4	2	-3		
K-632	1989	2	10	23	24	7	10	7	7	3.0	1	-4		
K-633	1989	2	11	2	3	126	21	107	12	20.3	0	-5		
K-634	1989	2	11	4	5	334	38	334	37	1.0	3	-1.5		
K-635	1989	2	14	2	3	199	40	214	61	22.9	2	-3		
K-636	1989	2	26	20	21	300	15	308	10	9.3	2	-3		to behind mountain
K-637	1989	3	9	4	5	112	24	111	21	3.1	1	-4		
K-638	1989	3	10	20	21	7	33	43	11	39.6	-4	-9		
K-639	1989	3	11	22	23	301	44	297	40	5.0	3	-1.5		
K-640	1989	3	12	4	5	78	64	94	63	7.2	4	0.3		
K-641	1989	3	16	4	5	162	34	156	30	6.5	4	0.3		
K-642	1989	3	29	20	21	357	17	352	12	7.0	2	-3		
K-643	1989	4	2	3	4	27	47	28	43	4.1	2	-3		
K-644	1989	4	5	23	24	258	68	299	64	16.8	3	-1.5	Virginids	
K-645	1989	4	13	3	4	61	20	60	19	1.4	3	-1.5		
K-646	1989	4	14	2	3	63	52	64	50	2.1	4	0.3		
K-647	1989	4	22	3	4	195	64	216	67	9.2	1	-4		
K-648	1989	4	25	20	21	226	67	254	73	11.1	4	0.3		
K-649	1989	4	26	1	2	114	20	121	14	9.0	-1	-6		
K-650	1989	4	26	20	21	113	61	124	55	8.3	2	-3		
K-651	1989	4	26	23	24	48	12	49	11	1.4	3	-1.5		
K-652	1989	5	9	21	22	50	58	60	53	7.5	1	-4		
K-653	1989	5	29	21	22	78	52	83	52	3.1	4	0.3		
K-654	1989	5	30	20	21	25	64	19	60	4.9	2	-3		
K-655	1989	6	1	21	22	15	83	359	73	10.4	3	-1.5		
K-656	1989	6	1	23	24	229	58	234	56	3.4	4	0.3		
K-657	1989	6	2	23	24	40	81	154	44	50.2	-6	-11		
K-658	1989	7	1	1	2	257	25	256	24	1.4	-1	-6		
K-659	1989	7	5	21	22	112	65	105	67	3.5	2	-3		
K-660	1989	7	27	3	4	65	66	48	64	7.4	1	-4		
K-661	1989	7	28	21	22	137	45	140	42	3.7	3	-1.5		
K-662	1989	7	28	23	24	223	19	222	17	2.2	-1	-6		
K-663	1989	7	30	22	23	97	23	98	22	1.4	0	-5		
K-664	1989	8	4	1	2	351	24	347	21	4.8	-3	-8		
K-665	1989	8	4	22	23	46	21	48	18	3.5	-1	-6		
K-666	1989	8	8	20	21	85	51	77	56	6.9	1	-4		
K-667	1989	8	9	0	1	265	56	289	58	13.2	0	-5	Perseids	
K-668	1989	8	10	3	4	8	40	5	41	2.5	1	-4		
K-669	1989	8	11	0	1	45	49	78	15	43.4	1	-4		
K-670	1989	8	11	1	2	297	45	301	42	4.2	-2	-7	Perseids	
K-671	1989	8	13	2	3	46	42	44	32	10.1	-3	-8	Perseids	
K-672	1989	8	14	2	3	325	52	334	44	10.0	2	-3	Perseids	
K-673	1989	9	12	21	22	100	60	106	45	15.4	-4	-9		
K-674	1989	10	1	1	2	132	25	131	22	3.1	1	-4		
K-675	1989	10	1	18	19	45	67	61	66	6.4	2	-3		
K-676	1989	10	8	20	21	222	18	223	17	1.4	0	-5		
K-677	1989	10	9	4	5	287	30	293	12	18.8	-4	-9		
K-678	1989	10	18	0	1	245	55	239	50	6.2	-2	-7		
K-679	1989	10	20	23	24	357	47	356	46	1.2	3	-1.5		
K-680	1989	10	21	3	4	215	36	214	35	1.3	1	-4		

No.	yyyy	mm	dd	Exposure Time(h-h)		Appearance		Disappearance		Length of trail	Magnitude		Meteor group	Note
						Az	Al	Az	Al		Photo.	Deduced		
K-681	1989	10	27	19	20	36	40	37	40	0.8	2	-3		
K-682	1989	10	27	20	21	341	39	350	27	14.2	3	-1.5		
K-683	1989	10	29	22	23	5	15	8	8	7.6	4	0.3		
K-684	1989	11	2	2	3	146	75	181	68	12.8	3	-1.5		
K-685	1989	11	2	3	4	287	41	290	39	3.0	3	-1.5		
K-686	1989	11	2	18	19	230	24	231	24	0.9	3	-1.5		
K-687	1989	11	3	19	20	258	15	258	15	0.0	1	-4		
K-688	1989	11	11	1	2	84	44	79	38	7.1	0	-5		
K-689	1989	11	20	21	22	266	68	280	60	10.0	2	-3	Taurids	
K-690	1989	11	20	22	23	318	53	320	46	7.1	4	0.3	Taurids	
K-691	1989	11	21	0	1	57	10	57	9	1.0	1	-4	Taurids	
K-692	1989	11	21	2	3	39	32	41	29	3.5	4	0.3		
K-693	1989	11	21	3	4	3	32	357	21	12.2	-4	-9		
K-694	1989	11	21	3	4	158	25	157	24	1.4	2	-3		
K-695	1989	11	21	18	19	160	16	154	14	6.1	2	-3		to behind forest
K-696	1989	11	22	18	19	316	18	325	15	9.1	1	-4		
K-697	1989	11	24	1	2	7	45	8	44	1.2	3	-1.5		
K-698	1989	11	24	18	19	200	60	199	59	1.1	5	1.5		
K-699	1989	12	2	1	2	323	28	323	26	2.0	2	-3		
K-700	1989	12	2	1	2	342	28	346	24	5.4	-1	-6		
K-701	1989	12	2	23	24	324	12	325	11	1.4	2	-3		
K-702	1989	12	3	2	3	314	10	313	8	2.2	0	-5		to behind mountain
K-703	1989	12	3	18	19	123	20	139	16	15.7	0	-5		
K-704	1989	12	4	3	4	183	84	183	80	4.0	4	0.3		
K-705	1989	12	5	2	3	79	43	80	38	5.1	-1	-6		
K-706	1989	12	6	3	4	181	62	155	66	12.0	-2	-7		
K-707	1989	12	9	21	22	355	35	356	25	10.0	-2	-7		
K-708	1989	12	11	0	1	329	46	329	44	2.0	1	-4		
K-709	1989	12	17	23	24	78	36	74	30	6.9	-2	-7		
K-710	1989	12	18	20	21	299	13	291	12	7.9	3	-1.5		
K-711	1989	12	19	1	2	335	62	35	49	34.9	3	-1.5		
K-712	1989	12	21	0	1	137	24	137	24	0.0	2	-3		
K-713	1989	12	21	1	2	200	64	198	54	10.1	5	1.5		
K-714	1989	12	21	22	23	46	42	48	39	3.4	4	0.3		
K-715	1989	12	22	21	22	211	34	212	34	0.8	3	-1.5		
K-716	1989	12	23	18	19	63	73	66	71	2.2	1	-4		
K-717	1989	12	23	22	23	270	66	255	73	8.7	3	-1.5		
K-718	1989	12	24	22	23	256	55	256	55	0.0	-3	-8		
K-719	1989	12	27	23	24	237	26	241	18	8.8	4	0.3		
K-720	1989	12	27	23	24	143	37	140	30	7.4	3	-1.5		
K-721	1989	12	28	3	4	298	41	290	36	8.0	1	-4		
K-722	1990	1	3	5	6	316	71	314	69	2.1	3	-1.5		
K-723	1990	1	4	0	1	247	22	249	22	1.9	4	0.3	Quadrantids	
K-724	1990	1	4	3	4	331	21	335	18	4.8	5	1.5	Quadrantids	
K-725	1990	1	11	23	24	354	54	9	30	26.3	-6	-11		
K-726	1990	1	20	20	21	150	30	156	28	5.6	-1	-6		
K-727	1990	1	21	5	6	212	23	209	22	2.9	1	-4		
K-728	1990	1	21	19	20	171	10	168	9	3.1	2	-3		to behind mountain
K-729	1990	1	22	2	3	237	18	236	17	1.4	3	-1.5		
K-730	1990	1	27	1	2	128	40	120	36	7.5	3	-1.5		
K-731	1990	1	27	22	23	130	23	139	12	13.9	-4	-9		to behind forest
K-732	1990	2	1	22	23	312	13	313	9	4.1	-1	-6		to behind mountain
K-733	1990	2	2	23	24	3	29	3	28	1.0	1	-4		
K-734	1990	2	13	19	20	125	38	141	19	23.6	-1	-6		
K-735	1990	2	21	19	20	282	50	256	37	22.7	-1	-6		
K-736	1990	2	21	21	22	339	15	341	13	2.8	0	-5		
K-737	1990	3	17	3	4	167	40	185	27	19.8	1	-4		
K-738	1990	3	19	21	22	300	37	299	35	2.2	2	-3		
K-739	1990	3	21	0	1	299	47	297	45	2.4	4	0.3		
K-740	1990	3	26	19	20	150	49	151	47	2.1	2	-3		
K-741	1990	3	26	22	23	299	22	298	21	1.4	3	-1.5		
K-742	1990	3	27	0	1	116	17	107	13	9.6	1	-4		

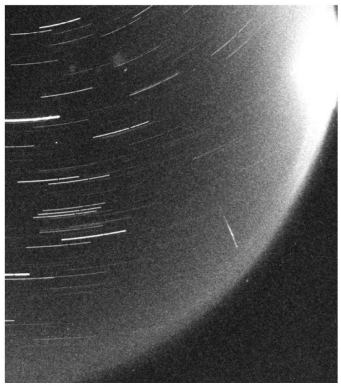
K-2
Time (JST) : 1977-4-27 01:00-02:00



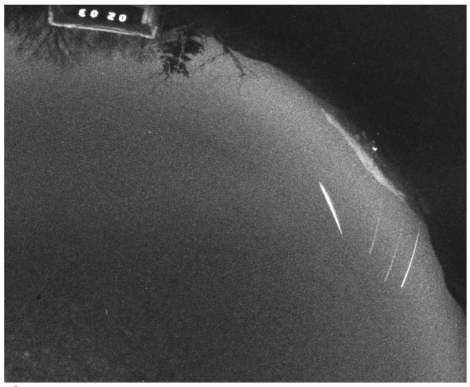
K-4
Time (JST) : 1977-12-1 21:00-22:00



K-7
Time (JST) : 1977-12-13 01:00-02:00

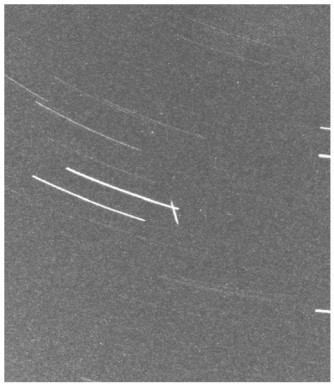


K-8
Time (JST) : 1977-12-14 21:00-22:00



K-9
Time (JST) : 1977-12-19 00:00-01:00

K-11
Time (JST) : 1978-3-8 01:00-02:00



K-12
Time (JST) : 1978-3-15 19:00-20:00

K-15
Time (JST) : 1978-3-29 23:00-24:00

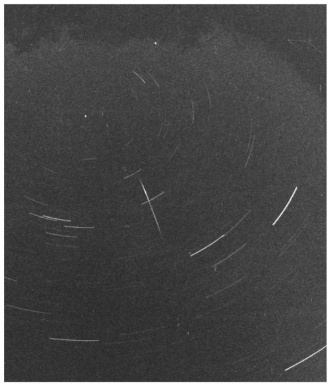
Figure 7. Fireball Images [#1]

K-16
Time (JST) : 1978-4-13 22:00-23:00

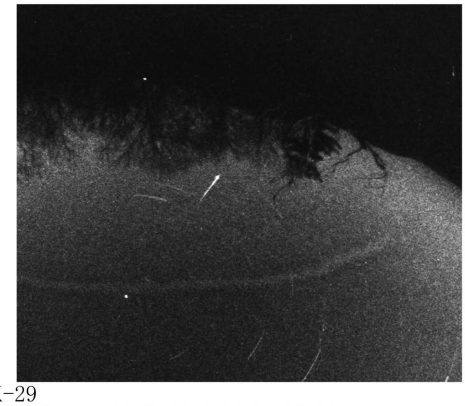
K-17
Time (JST) : 1978-10-21 21:00-22:00

K-19
Time (JST) : 1978-10-31 20:00-21:00

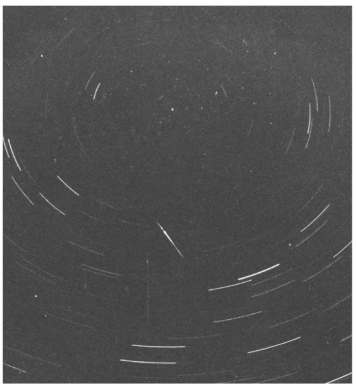
K-22
Time (JST) : 1978-11-1 00:00-01:00



K-23
Time (JST) : 1978-11-5 20:00-21:00



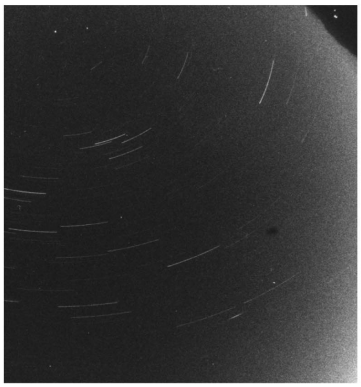
K-29
Time (JST) : 1978-11-9 22:00-23:00



K-30
Time (JST) : 1978-12-31 00:00-01:00

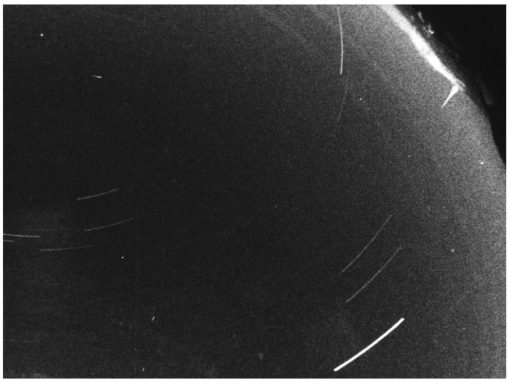
K-31
Time (JST) : 1979-1-4 05:00-06:00

Figure 8. Fireball Images [#2]



K-33
Time (JST) : 1979-1-19 18:00-19:00

K-34
Time (JST) : 1979-1-22 03:00-04:00

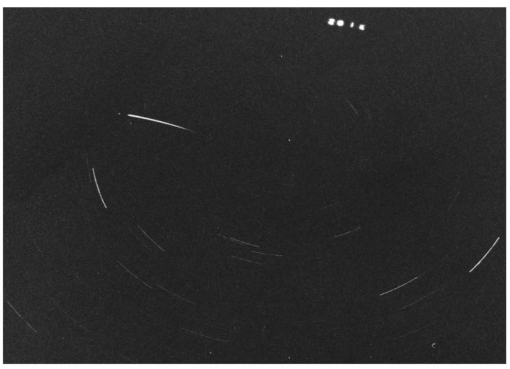


K-36
Time (JST) : 1979-2-16 02:00-03:00

K-40
Time (JST) : 1979-4-19 01:00-02:00

K-41
Time (JST) : 1979-5-19 22:00-23:00

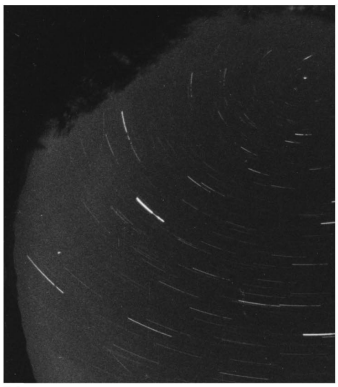
K-42
Time (JST) : 1979-5-20 02:00-03:00



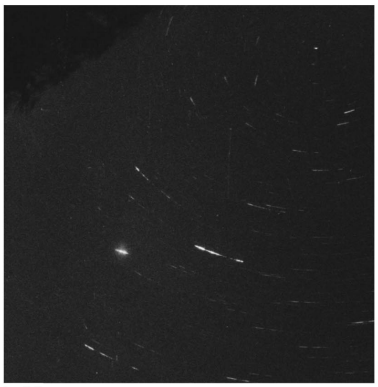
K-44
Time (JST) : 1979-7-31 02:00-03:00

K-49
Time (JST) : 1979-11-11 19:00-20:00

Figure 9. Fireball Images [#3]



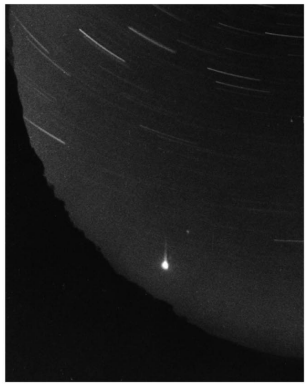
K-51,K-52
Time (JST) : 1980-4-22 00:00-01:00



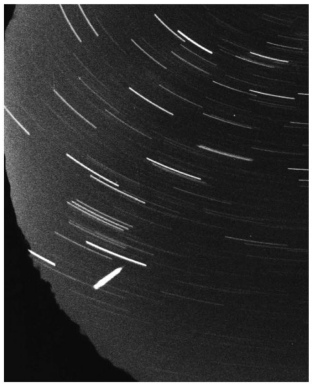
K-54,K-55
Time (JST) : 1980-4-22 02:00-03:00

K-56
Time (JST) : 1980-7-21 00:00-01:00

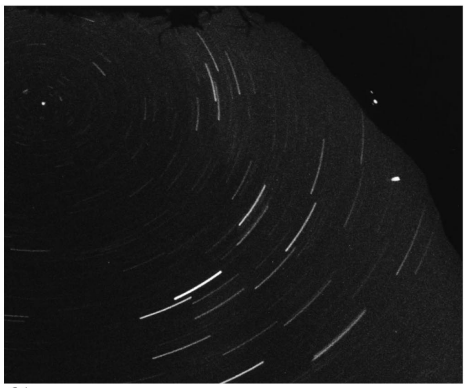
K-57
Time (JST) : 1980-9-9 22:00-23:00



K-58
Time (JST) : 1980-10-2 23:00-24:00



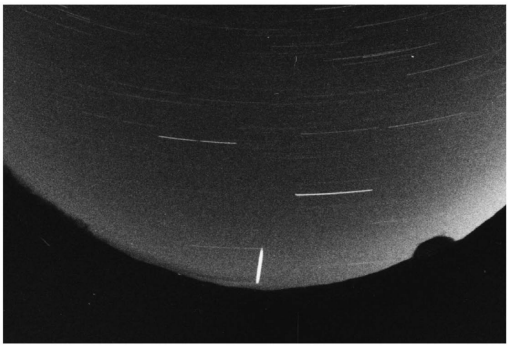
K-60
Time (JST) : 1980-11-3 23:00-24:00



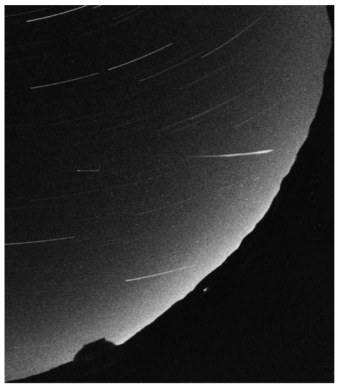
K-61
Time (JST) : 1980-11-14 04:00-05:00

K-63
Time (JST) : 1980-12-2 02:00-03:00

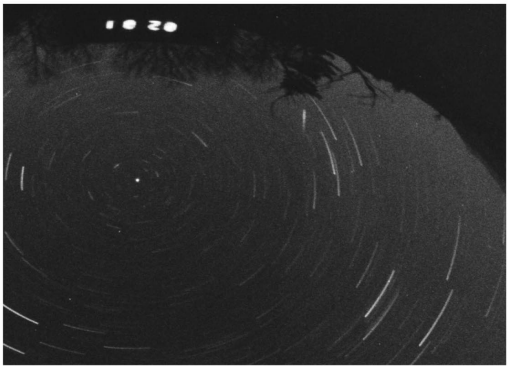
Figure 10. Fireball Images [#4]



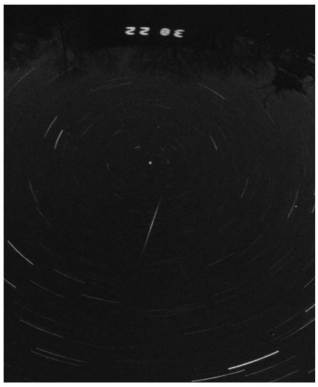
K-64
Time (JST) : 1980-12-6 18:00-19:00



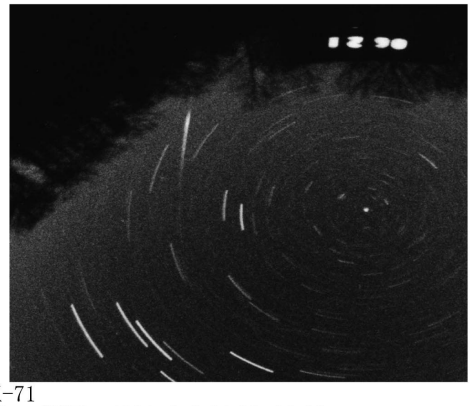
K-68
Time (JST) : 1980-12-25 19:00-20:00



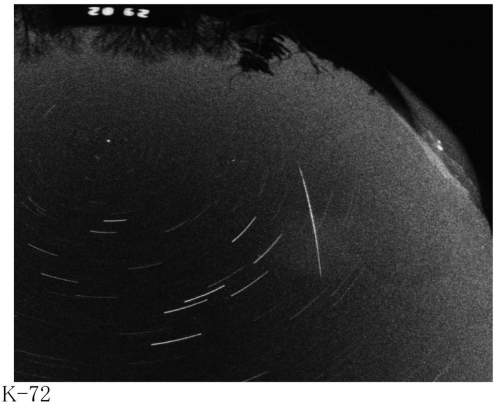
K-69
Time (JST) : 1981-1-1 01:00-02:00



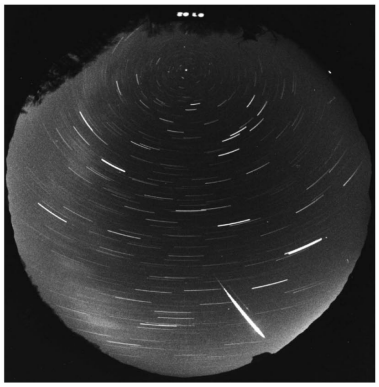
K-70
Time (JST) : 1981-1-30 22:00-23:00



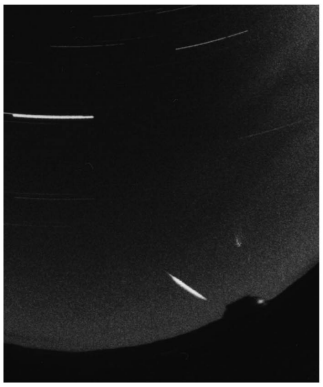
K-71
Time (JST) : 1981-3-6 21:00-22:00



K-72
Time (JST) : 1981-3-29 02:00-03:00



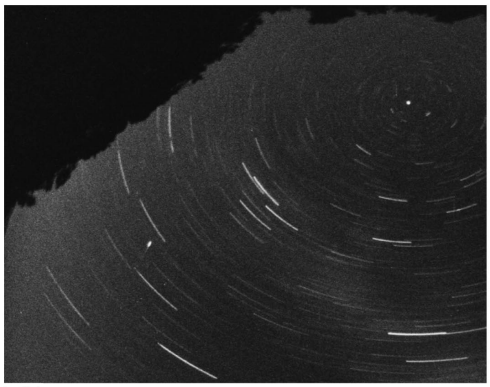
K-73
Time (JST) : 1981-4-7 02:00-03:00



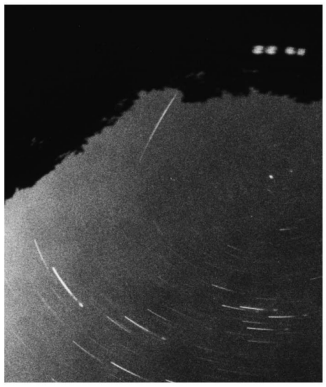
K-74
Time (JST) : 1981-4-10 22:00-23:00

Figure 11. Fireball Images [#5]

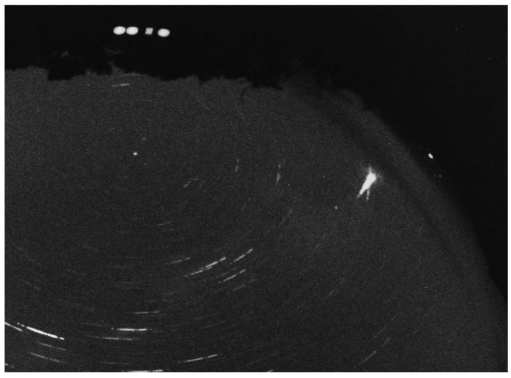
K-75
Time (JST) : 1981-4-22 23:00-24:00



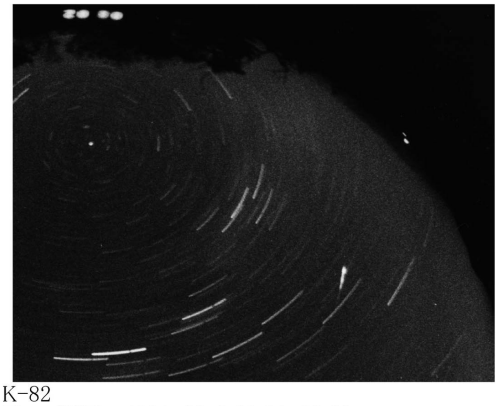
K-76
Time (JST) : 1981-7-8 01:00-02:00



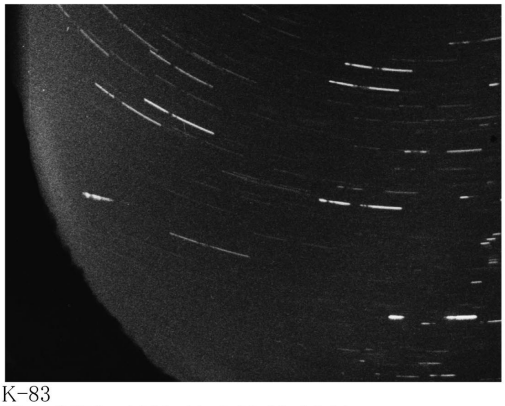
K-77
Time (JST) : 1981-10-19 22:00-23:00



K-79
Time (JST) : 1981-11-1 00:00-01:00

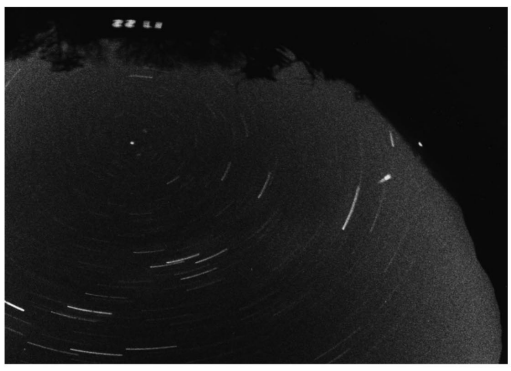


K-82
Time (JST) : 1981-11-8 02:00-03:00



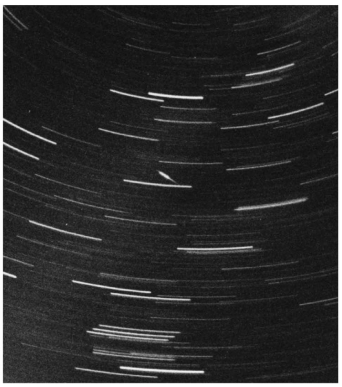
K-83
Time (JST) : 1981-11-8 03:00-04:00

K-85
Time (JST) : 1981-11-10 04:00-05:00



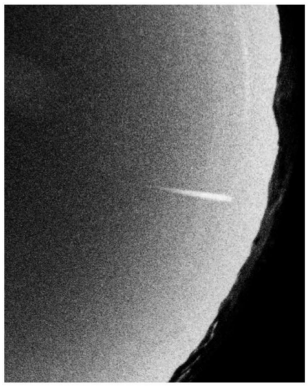
K-86
Time (JST) : 1981-11-17 22:00-23:00

Figure 12. Fireball Images [#6]



K-89
Time (JST) : 1981-11-23 00:00-01:00

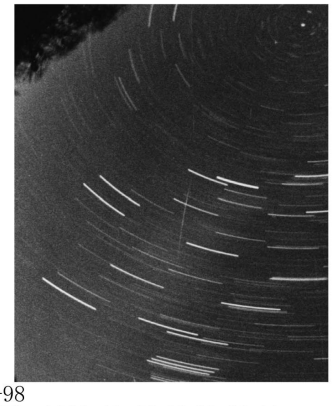
K-90
Time (JST) : 1981-12-14 21:00-22:00



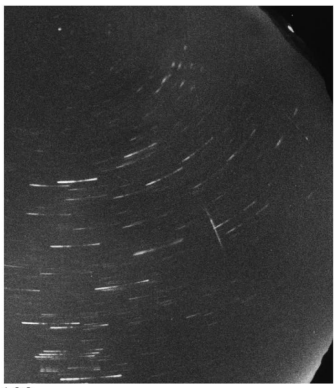
K-91
Time (JST) : 1981-12-14 23:00-24:00

K-93
Time (JST) : 1981-12-18 00:00-01:00

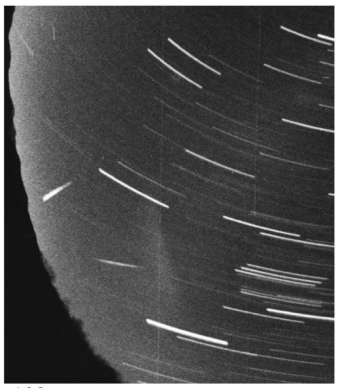
K-95
Time (JST) : 1981-12-21 05:00-06:00



K-97,K-98
Time (JST) : 1981-12-22 21:00-22:00

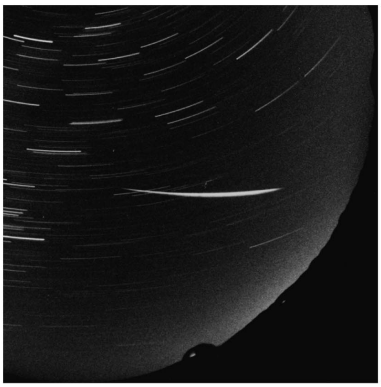


K-99,K-100
Time (JST) : 1981-12-22 23:00-24:00



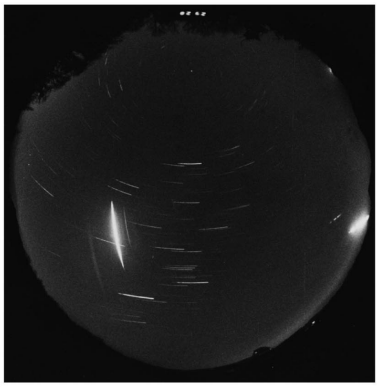
K-101,K-102
Time (JST) : 1981-12-24 21:00-22:00

Figure 13. Fireball Images [#7]



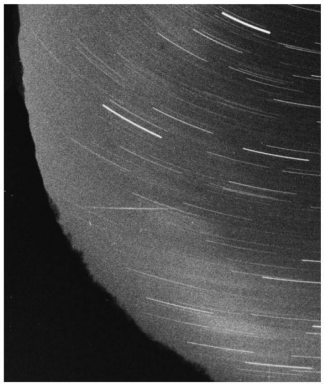
K-103
Time (JST) : 1981-12-28 21:00-22:00

K-104
Time (JST) : 1982-1-28 00:00-01:00

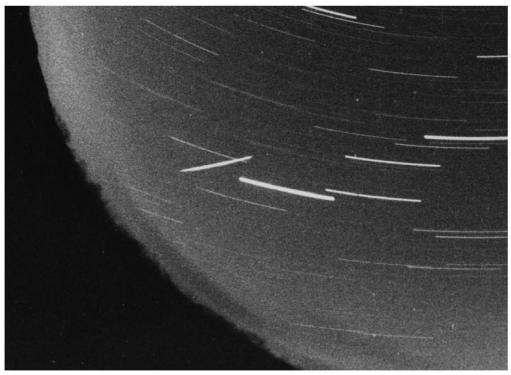


K-105
Time (JST) : 1982-1-29 20:00-21:00

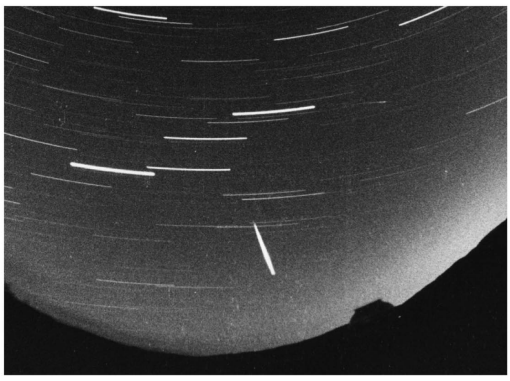
K-107
Time (JST) : 1982-3-21 21:00-22:00



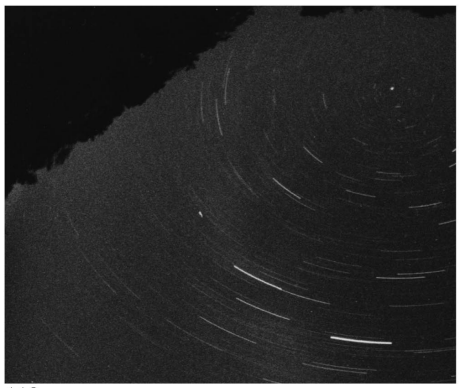
K-109
Time (JST) : 1982-3-29 03:00-04:00



K-110
Time (JST) : 1982-4-15 22:00-23:00



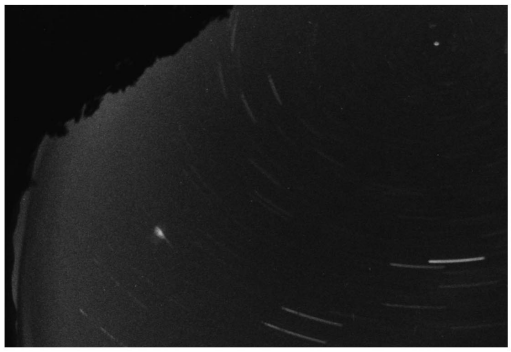
K-111
Time (JST) : 1982-4-15 23:00-24:00



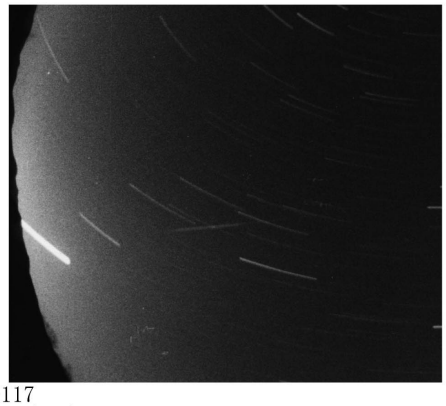
K-113
Time (JST) : 1982-5-29 01:00-02:00

Figure 14. Fireball Images [#8]

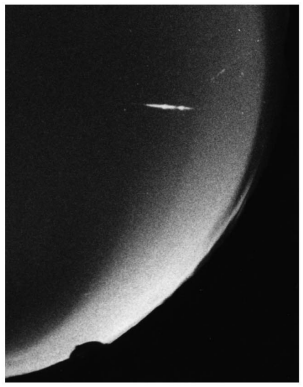
K-115
Time (JST) : 1982-6-28 23:00-24:00



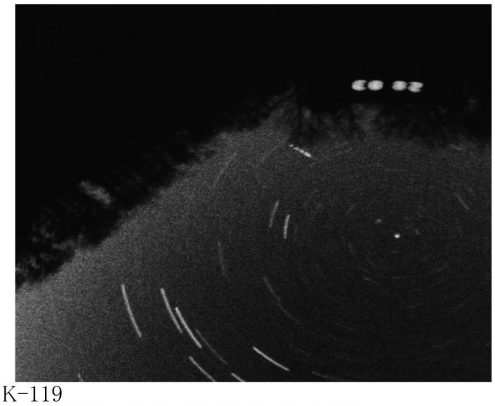
K-116
Time (JST) : 1982-10-23 03:00-04:00



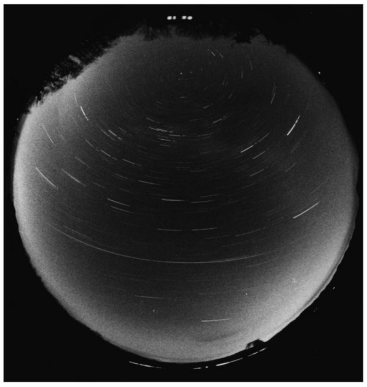
K-117
Time (JST) : 1982-11-13 04:00-05:00



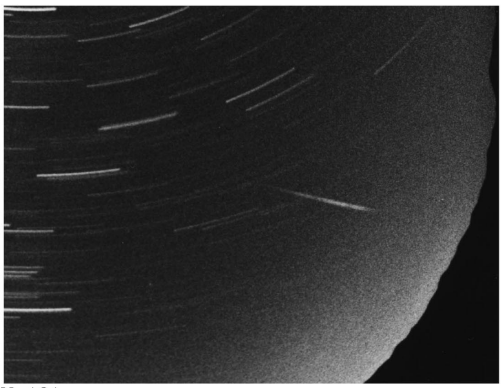
K-118
Time (JST) : 1982-11-20 20:00-21:00



K-119
Time (JST) : 1982-11-28 03:00-04:00



K-120
Time (JST) : 1982-12-4 18:00-19:00

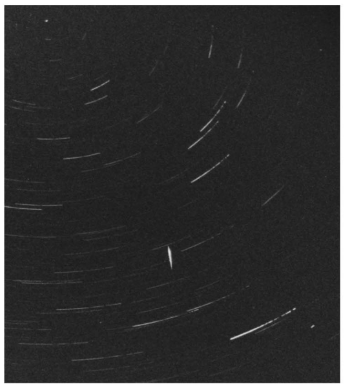


K-121
Time (JST) : 1982-12-12 23:00-24:00

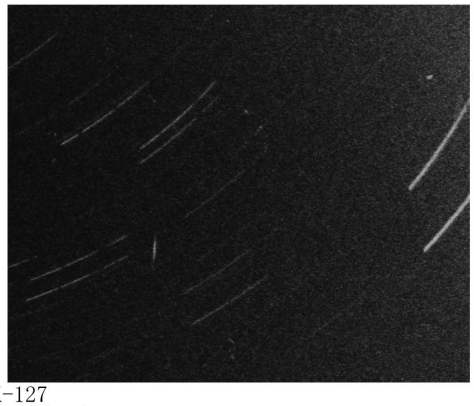
K-122
Time (JST) : 1983-3-19 22:00-23:00

Figure 15. Fireball Images [#9]

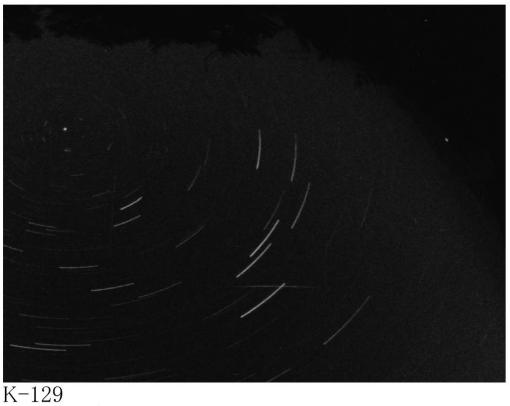
K-123
Time (JST) : 1983-4-3 01:00-02:00



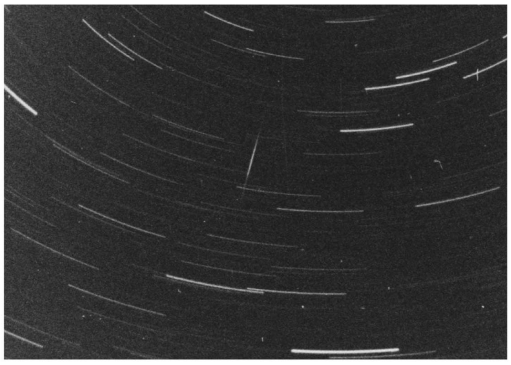
K-125
Time (JST) : 1983-4-14 03:00-04:00



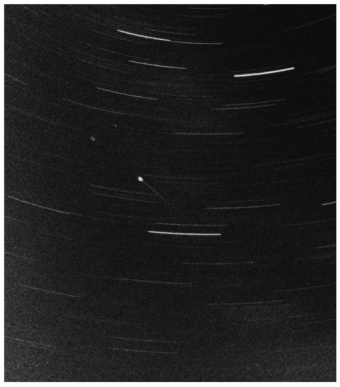
K-127
Time (JST) : 1983-5-12 21:00-22:00



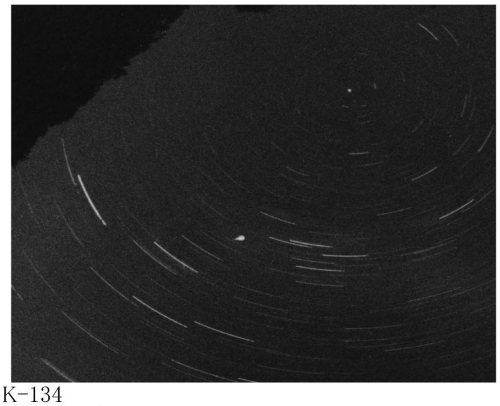
K-129
Time (JST) : 1983-5-19 01:00-02:00



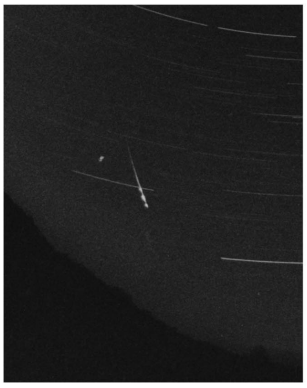
K-131
Time (JST) : 1983-6-1 21:00-22:00



K-133
Time (JST) : 1983-7-4 00:00-01:00



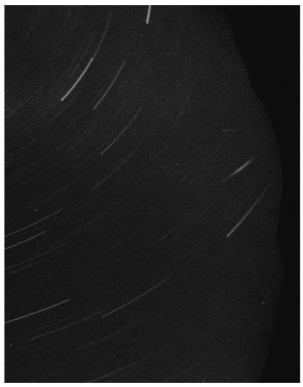
K-134
Time (JST) : 1983-8-9 02:00-03:00



K-136
Time (JST) : 1983-8-14 00:00-01:00

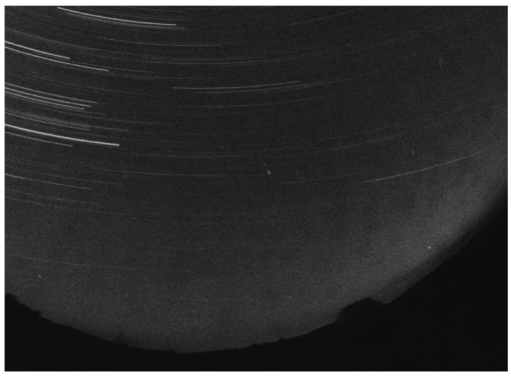
Figure 16. Fireball Images [#10]

K-140
Time (JST) : 1983-9-19 21:00-22:00



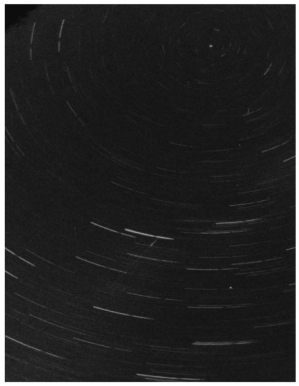
K-141
Time (JST) : 1983-10-3 00:00-01:00

K-143
Time (JST) : 1983-10-21 19:00-20:00

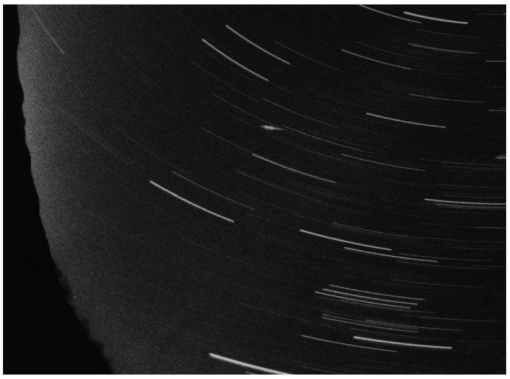


K-147
Time (JST) : 1983-11-9 00:00-01:00

K-149
Time (JST) : 1983-11-9 03:00-04:00



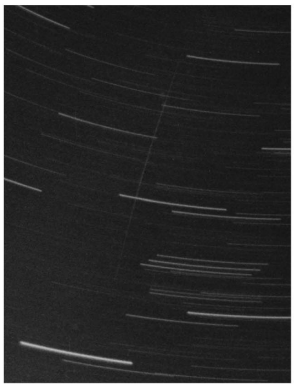
K-151
Time (JST) : 1983-11-12 00:00-01:00



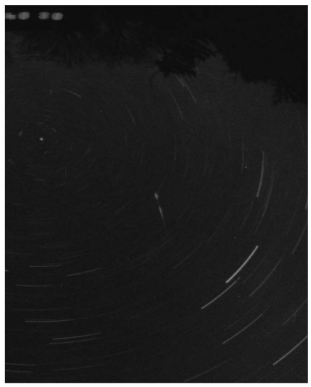
K-152
Time (JST) : 1983-11-29 23:00-24:00

K-153
Time (JST) : 1983-12-4 18:00-19:00

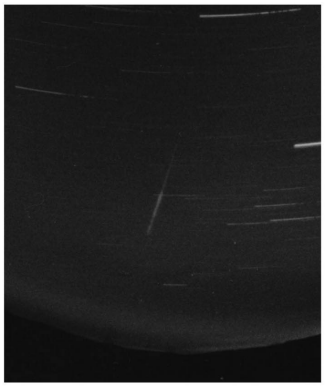
Figure 17. Fireball Images [#11]



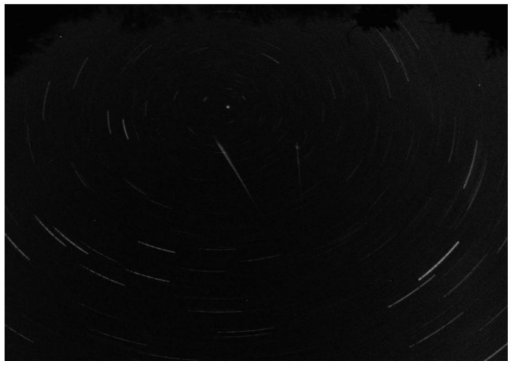
K-154
Time (JST) : 1983-12-6 23:00-24:00



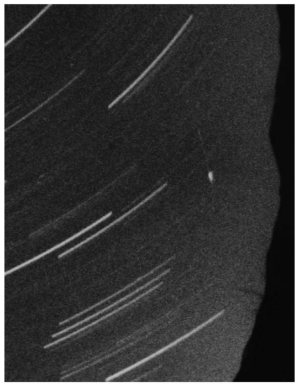
K-156
Time (JST) : 1983-12-8 04:00-05:00



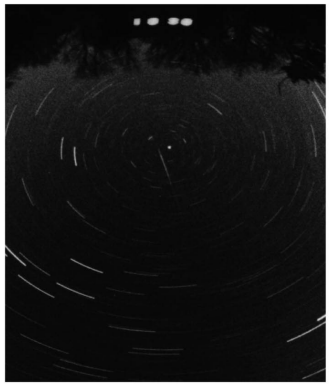
K-158
Time (JST) : 1983-12-15 02:00-03:00



K-160,K-161
Time (JST) : 1983-12-15 03:00-04:00

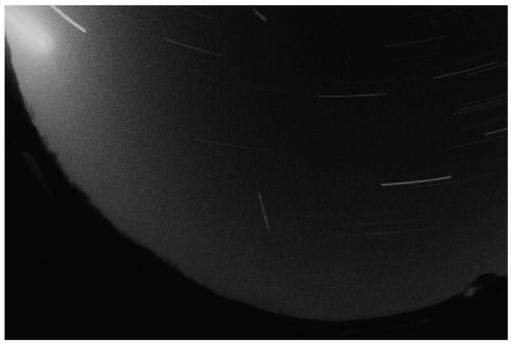


K-164
Time (JST) : 1984-1-6 02:00-03:00



K-165
Time (JST) : 1984-1-8 01:00-02:00

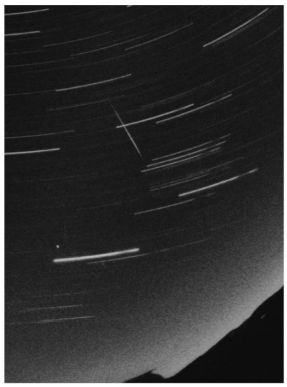
K-167
Time (JST) : 1984-1-9 00:00-01:00



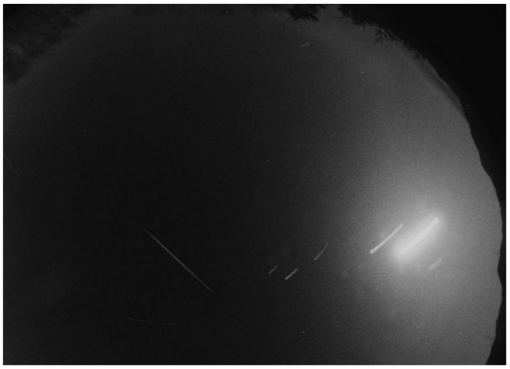
K-168
Time (JST) : 1984-1-23 23:00-24:00

Figure 18. Fireball Images [#12]

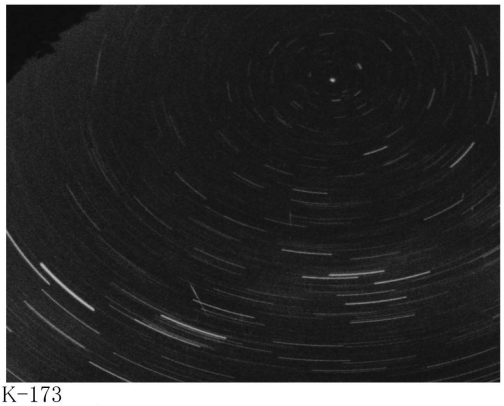
K-169
Time (JST) : 1984-1-29 04:00-05:00



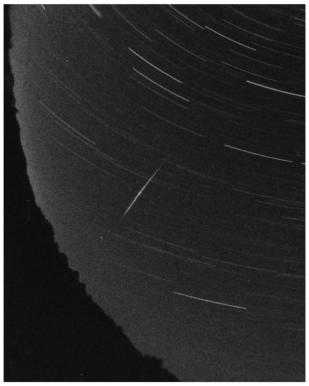
K-170
Time (JST) : 1984-1-29 23:00-24:00



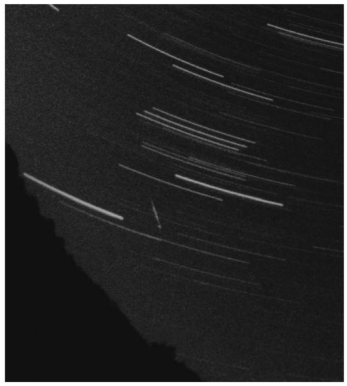
K-172
Time (JST) : 1984-2-16 03:00-04:00



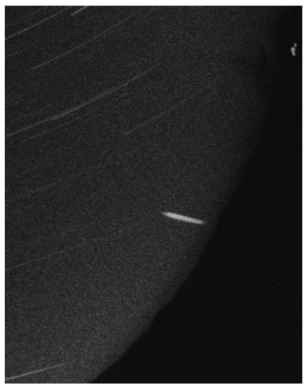
K-173
Time (JST) : 1984-8-31 02:00-03:00



K-174
Time (JST) : 1984-8-31 23:00-24:00



K-176
Time (JST) : 1984-10-22 00:00-01:00



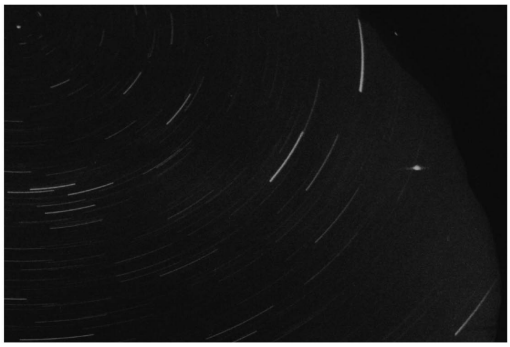
K-179
Time (JST) : 1984-10-23 23:00-24:00

K-182
Time (JST) : 1984-10-30 03:00-04:00

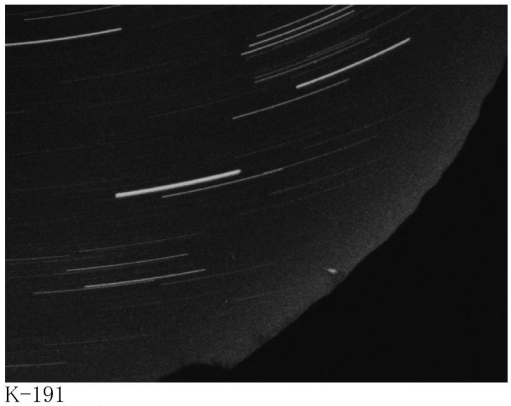
Figure 19. Fireball Images [#13]

K-183
Time (JST) : 1984-11-5 23:00-24:00

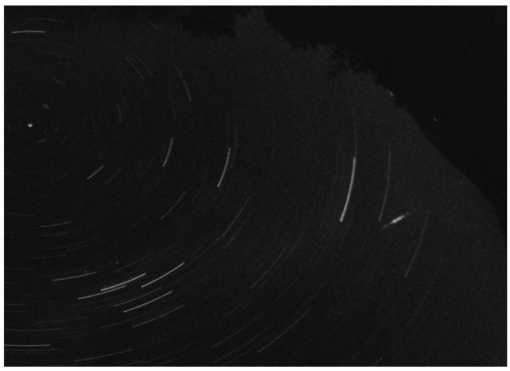
K-184
Time (JST) : 1984-11-6 01:00-02:00



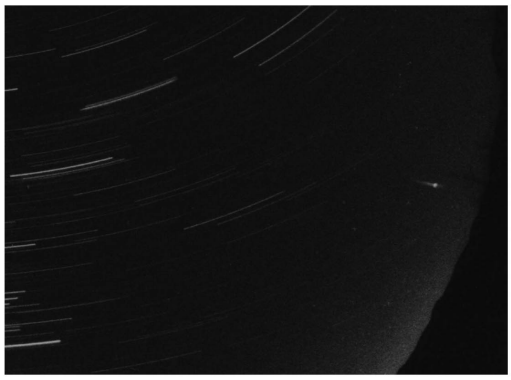
K-187
Time (JST) : 1984-11-20 21:00-22:00



K-191
Time (JST) : 1984-11-21 04:00-05:00

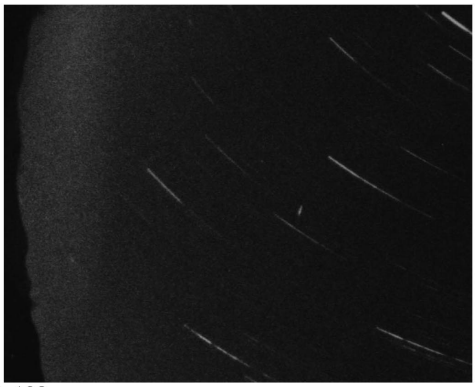


K-192
Time (JST) : 1984-11-22 22:00-23:00



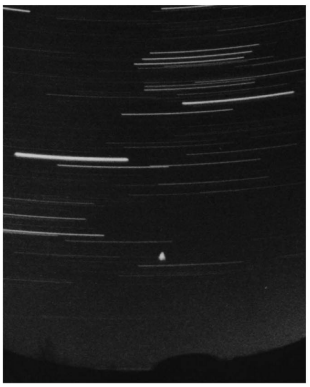
K-193
Time (JST) : 1984-11-23 01:00-02:00

K-197
Time (JST) : 1984-11-25 20:00-21:00

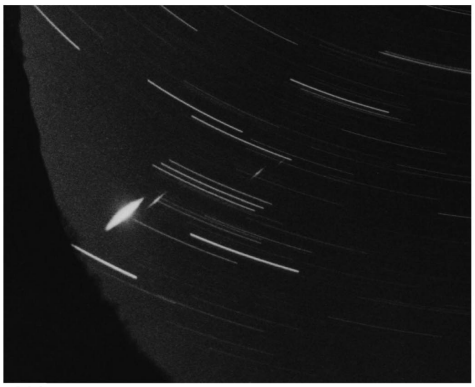


K-198
Time (JST) : 1984-11-26 21:00-22:00

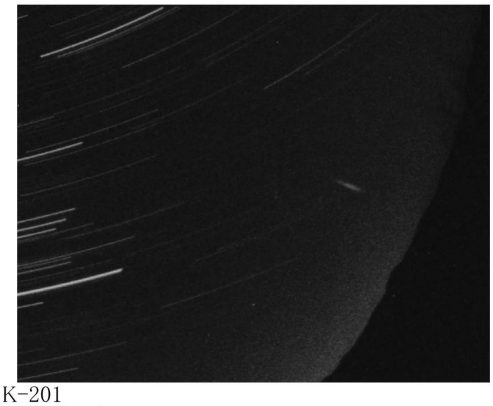
Figure 20. Fireball Images [#14]



K-199
Time (JST) : 1984-11-28 01:00-02:00

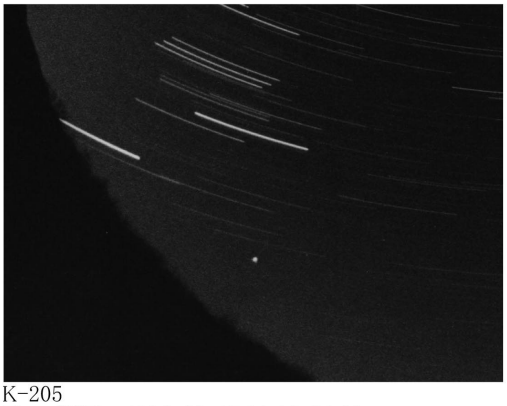


K-200
Time (JST) : 1984-11-28 21:00-22:00



K-201
Time (JST) : 1984-12-1 02:00-03:00

K-204
Time (JST) : 1984-12-13 04:00-05:00



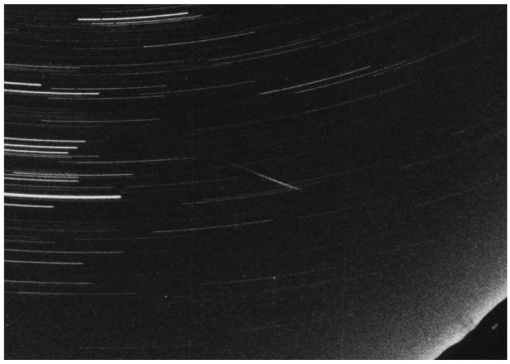
K-205
Time (JST) : 1984-12-15 20:00-21:00

K-206
Time (JST) : 1984-12-19 00:00-01:00

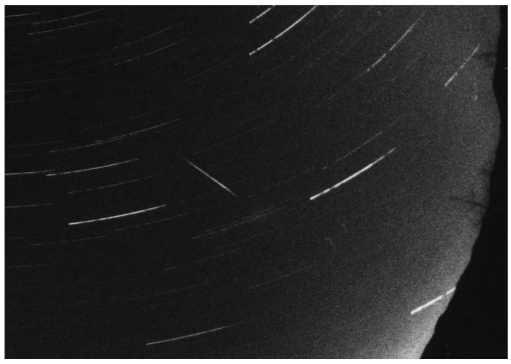
K-209
Time (JST) : 1984-12-25 05:00-06:00

K-210
Time (JST) : 1984-12-26 19:00-20:00

Figure 21. Fireball Images [#15]

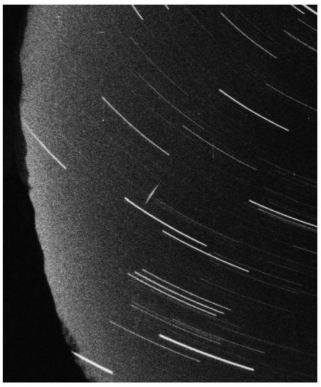


K-211
Time (JST) : 1984-12-26 22:00-23:00

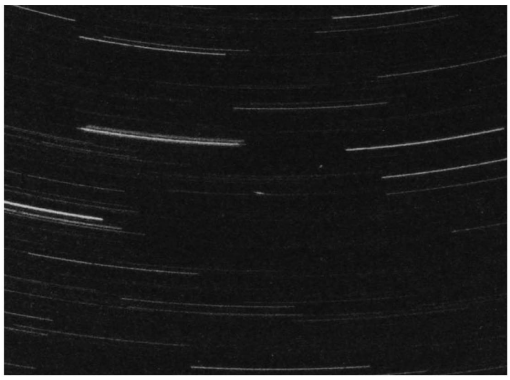


K-212
Time (JST) : 1985-1-4 04:00-05:00

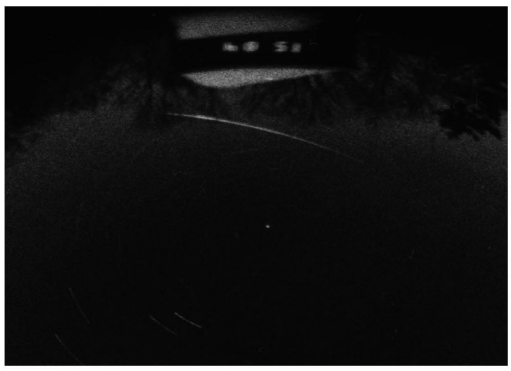
K-213
Time (JST) : 1985-1-9 18:00-19:00



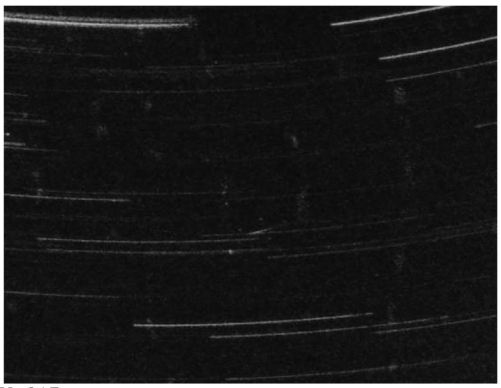
K-214
Time (JST) : 1985-1-10 18:00-19:00



K-215
Time (JST) : 1985-1-10 19:00-20:00



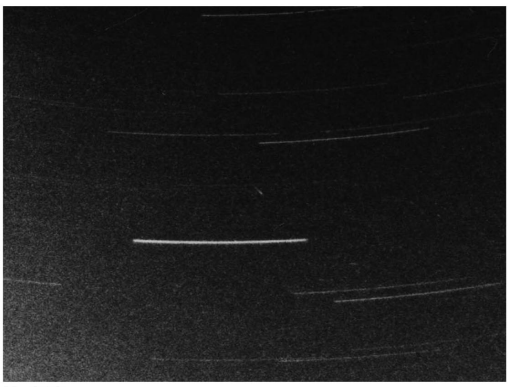
K-216
Time (JST) : 1985-1-15 04:00-05:00



K-217
Time (JST) : 1985-1-16 19:00-20:00

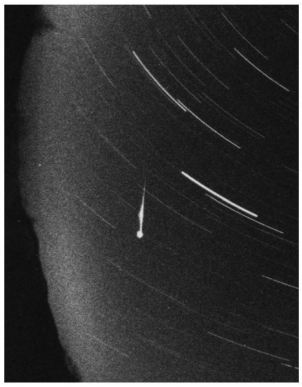
K-218
Time (JST) : 1985-1-17 02:00-03:00

Figure 22. Fireball Images [#16]

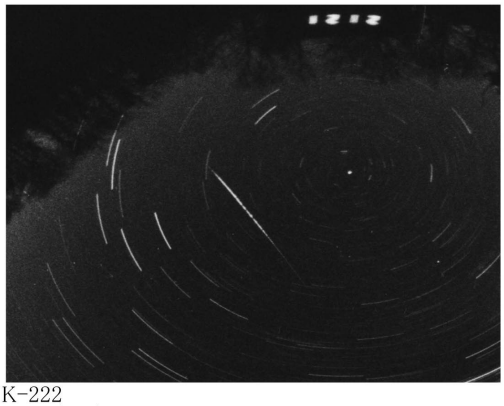


K-219
Time (JST) : 1985-1-17 05:00-06:00

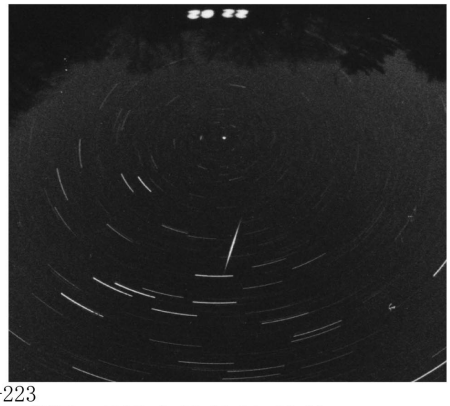
K-220
Time (JST) : 1985-1-19 18:00-19:00



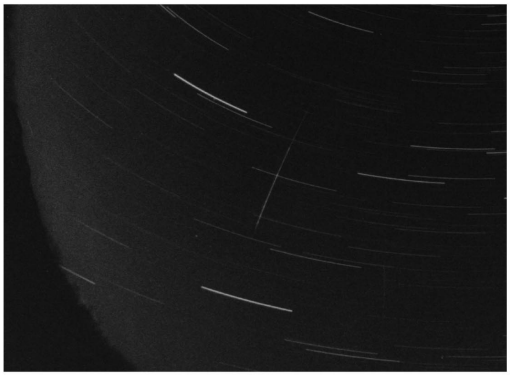
K-221
Time (JST) : 1985-1-21 02:00-03:00



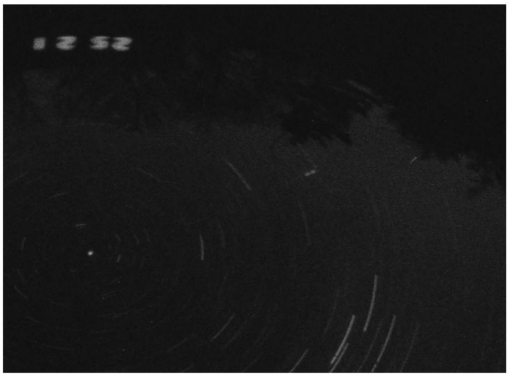
K-222
Time (JST) : 1985-1-21 21:00-22:00



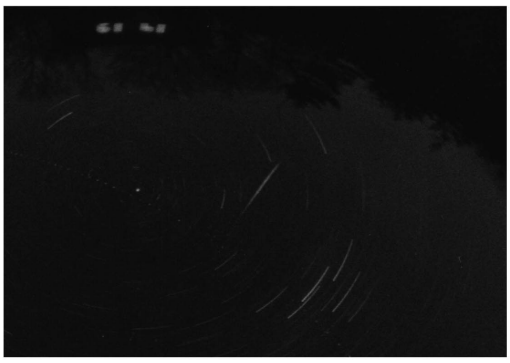
K-223
Time (JST) : 1985-1-22 02:00-03:00



K-224
Time (JST) : 1985-1-25 02:00-03:00

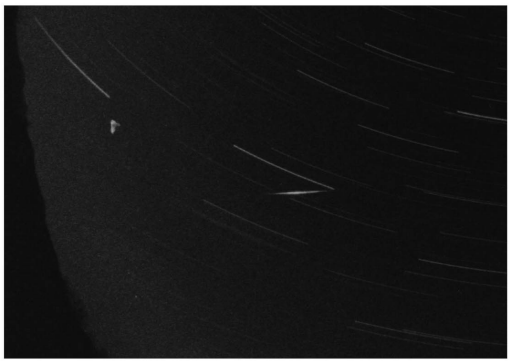


K-225
Time (JST) : 1985-1-25 21:00-22:00



K-226
Time (JST) : 1985-2-14 19:00-20:00

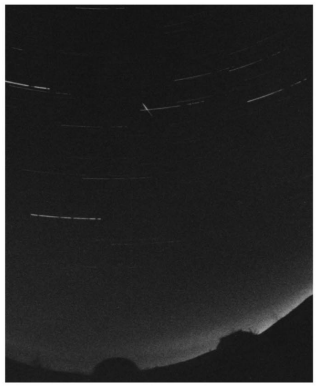
Figure 23. Fireball Images [#17]



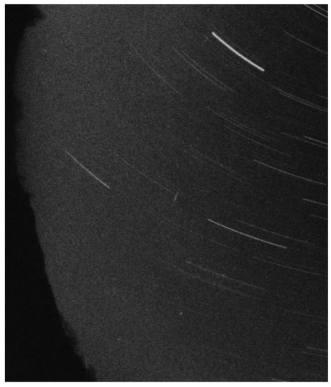
K-227
Time (JST) : 1985-2-18 04:00-05:00

K-228
Time (JST) : 1985-2-24 00:00-01:00

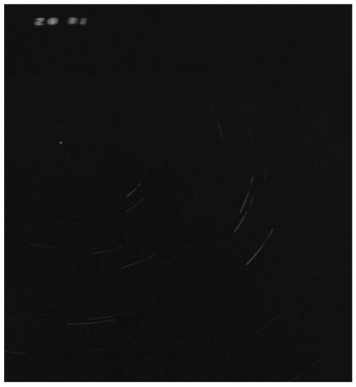
K-229
Time (JST) : 1985-3-23 03:00-04:00



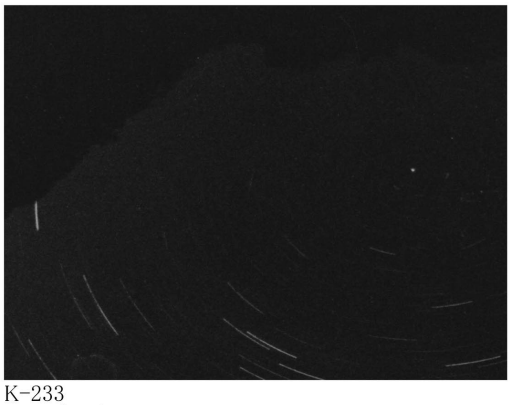
K-230
Time (JST) : 1985-3-27 00:00-01:00



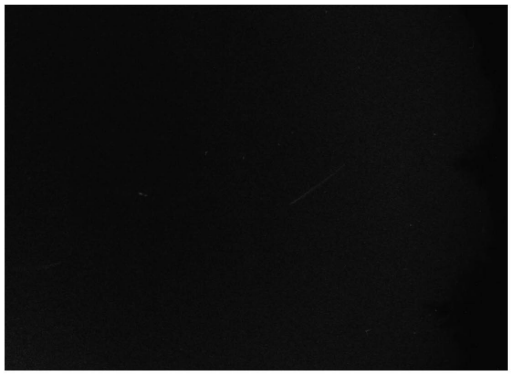
K-231
Time (JST) : 1985-4-24 00:00-01:00



K-232
Time (JST) : 1985-5-18 02:00-03:00



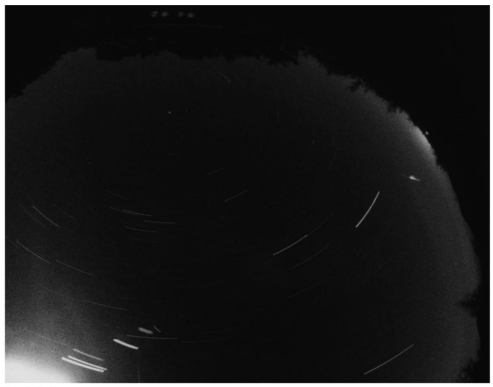
K-233
Time (JST) : 1985-7-16 02:00-03:00



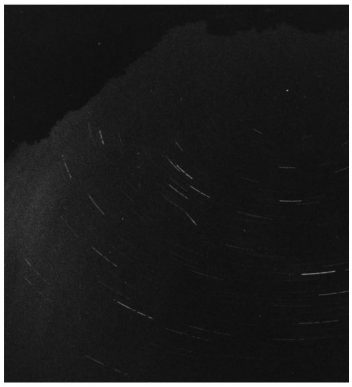
K-234
Time (JST) : 1985-8-2 21:00-22:00

Figure 24. Fireball Images [#18]

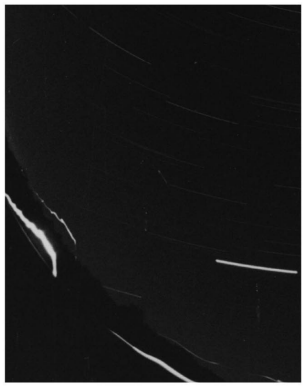
K-235
Time (JST) : 1985-8-7 20:00-21:00



K-236
Time (JST) : 1985-8-8 02:00-03:00

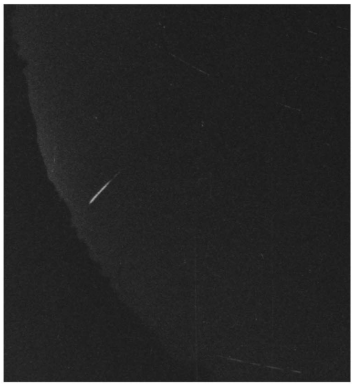


K-237
Time (JST) : 1985-8-9 23:00-24:00



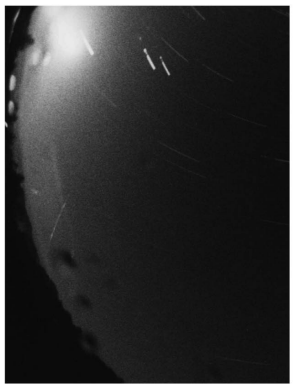
K-240
Time (JST) : 1985-8-16 21:00-22:00

K-241
Time (JST) : 1985-8-16 23:00-24:00



K-242
Time (JST) : 1985-8-17 22:00-23:00

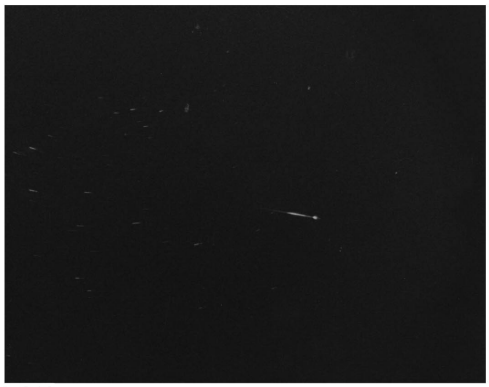
K-243
Time (JST) : 1985-9-6 03:00-04:00



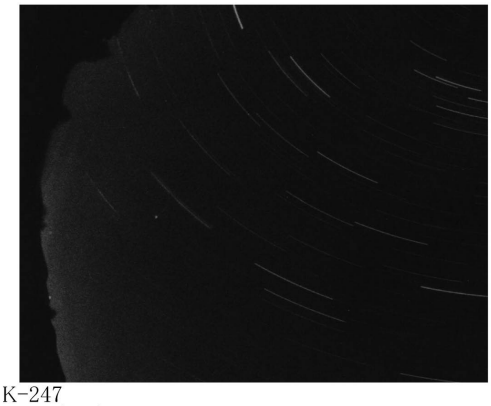
K-244
Time (JST) : 1985-9-7 23:00-24:00

Figure 25. Fireball Images [#19]

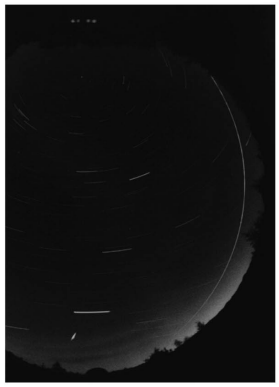
K-245
Time (JST) : 1985-9-8 21:00-22:00



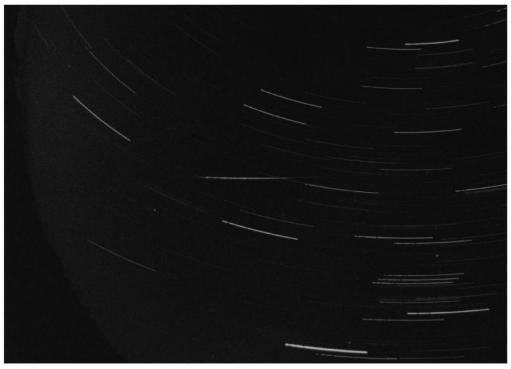
K-246
Time (JST) : 1985-9-12 02:00-03:00



K-247
Time (JST) : 1985-9-12 23:00-24:00

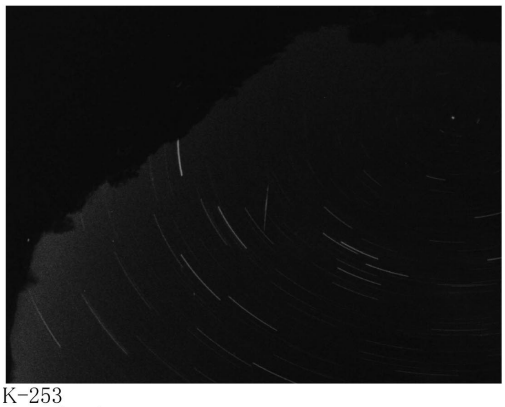


K-248
Time (JST) : 1985-10-8 19:00-20:00



K-250
Time (JST) : 1985-10-21 03:00-04:00

K-251,K-252
Time (JST) : 1985-10-23 02:00-03:00



K-253
Time (JST) : 1985-11-3 19:00-20:00

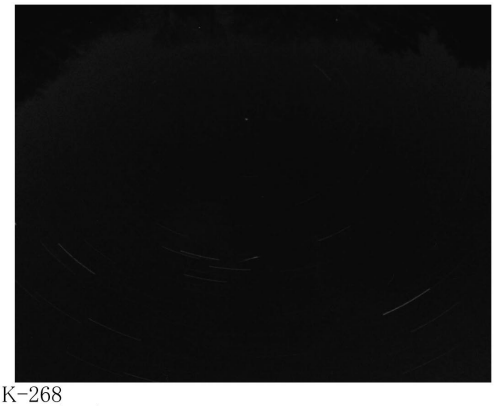
K-255,K-256,K-257
Time (JST) : 1985-11-9 00:00-01:00

Figure 26. Fireball Images [#20]

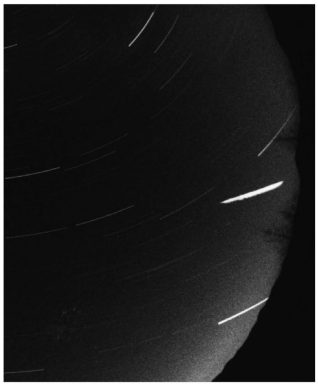
K-259,K-260
Time (JST) : 1985-11-10 22:00-23:00

K-261
Time (JST) : 1985-11-11 04:00-05:00

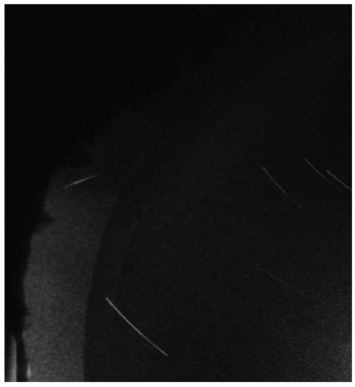
K-267
Time (JST) : 1985-11-20 03:00-04:00



K-268
Time (JST) : 1985-11-20 19:00-20:00

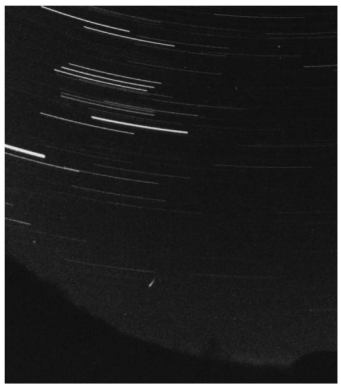


K-270
Time (JST) : 1985-12-2 20:00-21:00



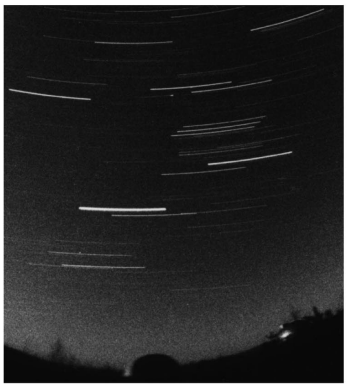
K-271
Time (JST) : 1985-12-4 04:00-05:00

K-272
Time (JST) : 1985-12-4 05:00-06:00

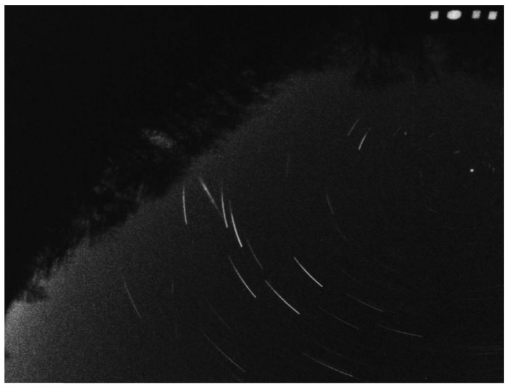


K-274
Time (JST) : 1985-12-5 22:00-23:00

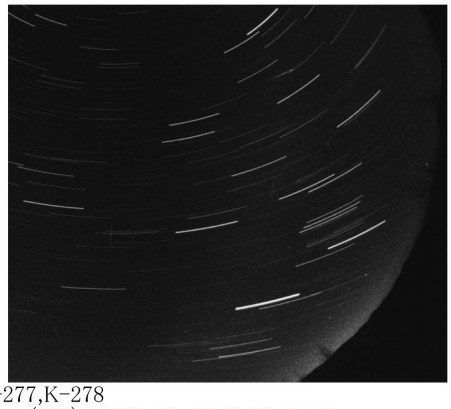
Figure 27. Fireball Images [#21]



K-275
Time (JST) : 1985-12-6 01:00-02:00



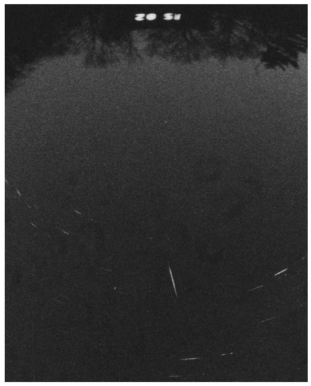
K-276
Time (JST) : 1985-12-11 01:00-02:00



K-277,K-278
Time (JST) : 1985-12-12 03:00-04:00

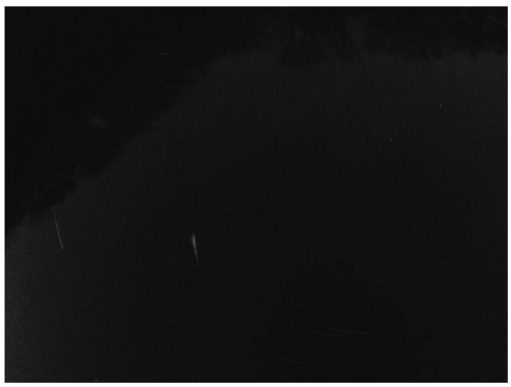
K-279
Time (JST) : 1985-12-12 22:00-23:00

K-280
Time (JST) : 1985-12-13 23:00-24:00



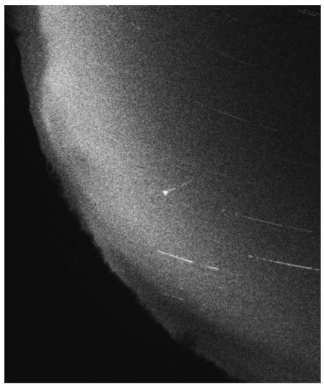
K-281
Time (JST) : 1985-12-15 02:00-03:00

K-282
Time (JST) : 1985-12-15 03:00-04:00

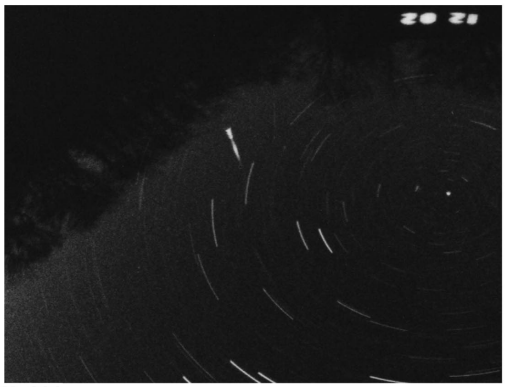


K-283
Time (JST) : 1985-12-26 05:00-06:00

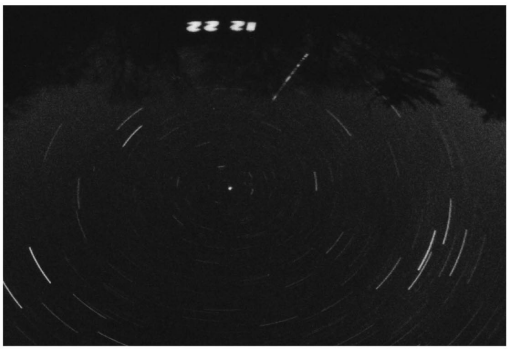
Figure 28. Fireball Images [#22]



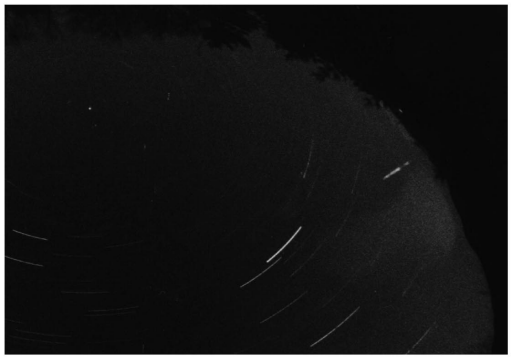
K-285
Time (JST) : 1986-1-11 05:00-06:00



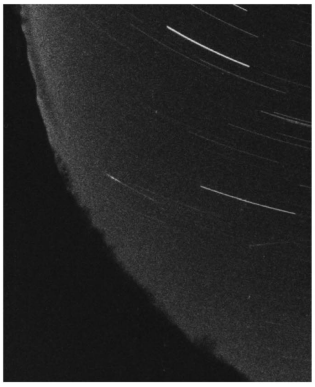
K-286
Time (JST) : 1986-1-12 02:00-03:00



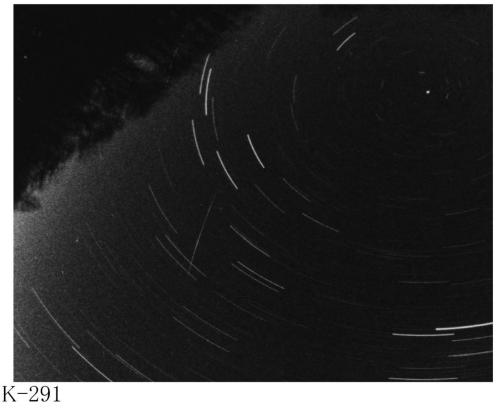
K-287
Time (JST) : 1986-1-12 22:00-23:00



K-288
Time (JST) : 1986-2-2 00:00-01:00

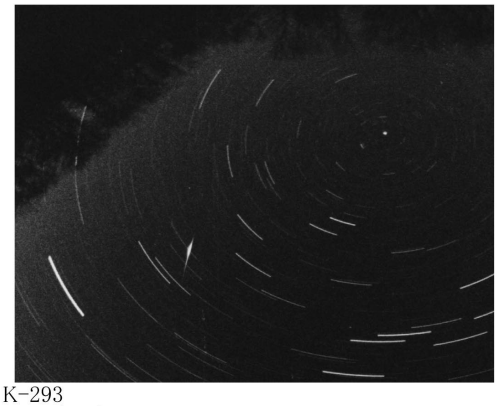


K-289
Time (JST) : 1986-2-6 21:00-22:00



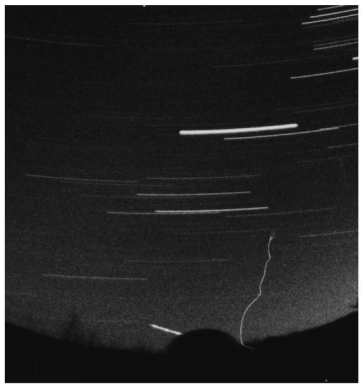
K-291
Time (JST) : 1986-2-8 20:00-21:00

K-292
Time (JST) : 1986-2-12 04:00-05:00

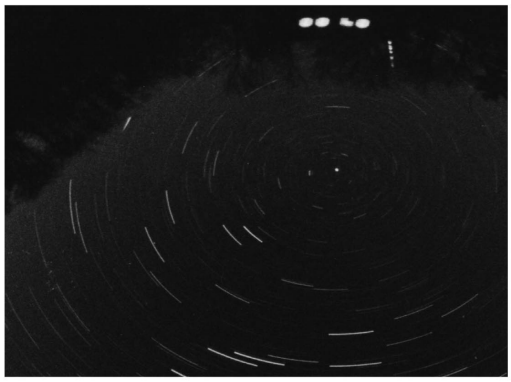


K-293
Time (JST) : 1986-2-13 03:00-04:00

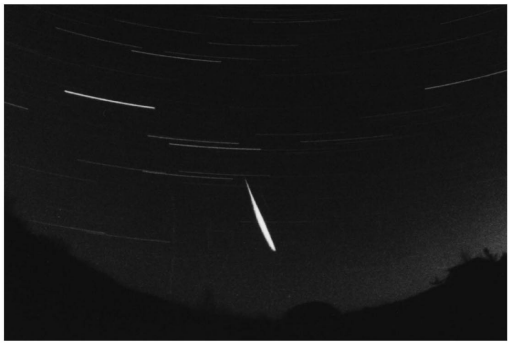
Figure 29. Fireball Images [#23]



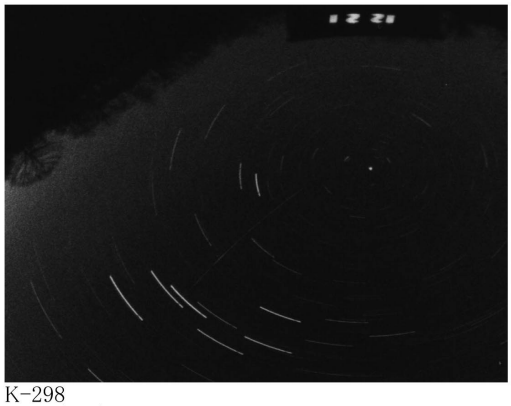
K-294
Time (JST) : 1986-3-2 20:00-21:00



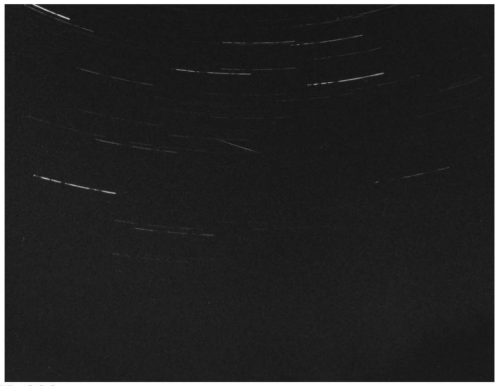
K-295,K-296
Time (JST) : 1986-3-4 00:00-01:00



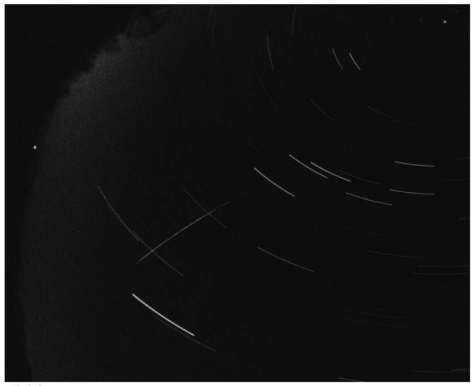
K-297
Time (JST) : 1986-3-5 00:00-01:00



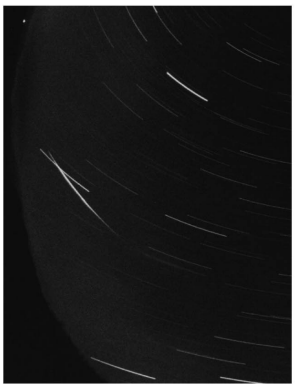
K-298
Time (JST) : 1986-3-12 21:00-22:00



K-299
Time (JST) : 1986-3-15 23:00-24:00



K-302
Time (JST) : 1986-4-1 21:00-22:00



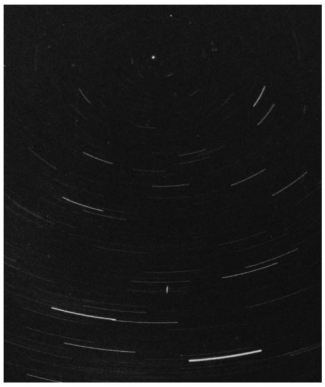
K-305
Time (JST) : 1986-4-12 01:00-02:00

K-307
Time (JST) : 1986-5-10 21:00-22:00

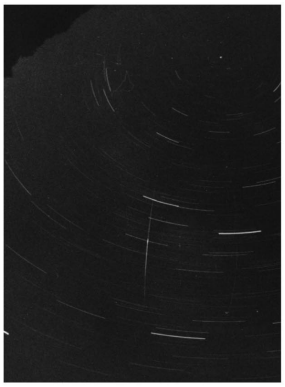
Figure 30. Fireball Images [#24]

K-309
Time (JST) : 1986-5-15 21:30-22:30

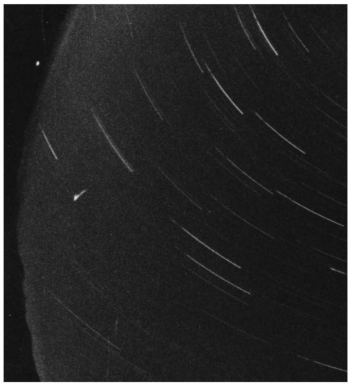
K-310
Time (JST) : 1986-5-16 23:30-00:30



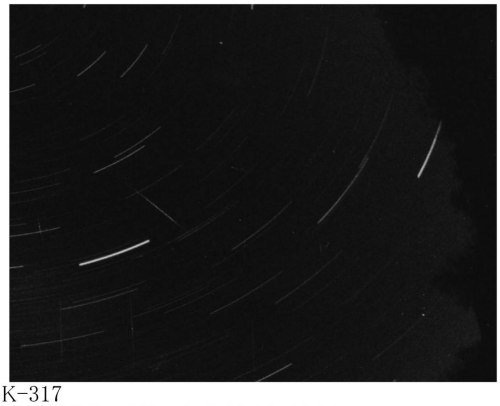
K-312
Time (JST) : 1986-6-4 02:30-03:30



K-313
Time (JST) : 1986-6-11 01:30-02:30

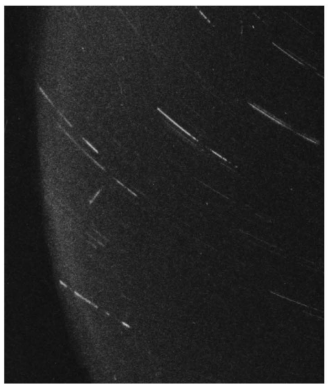


K-315
Time (JST) : 1986-8-5 01:00-02:00



K-317
Time (JST) : 1986-8-5 23:00-24:00

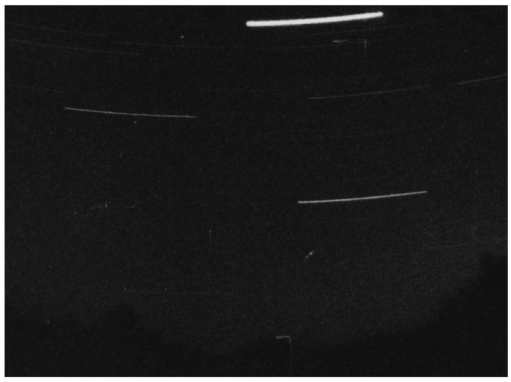
K-318
Time (JST) : 1986-8-12 01:00-02:00



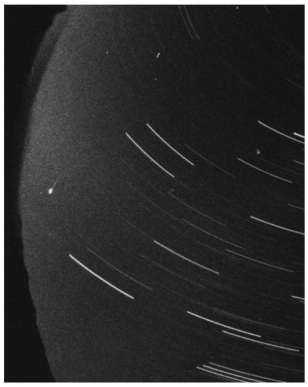
K-320
Time (JST) : 1986-8-14 02:00-03:00

Figure 31. Fireball Images [#25]

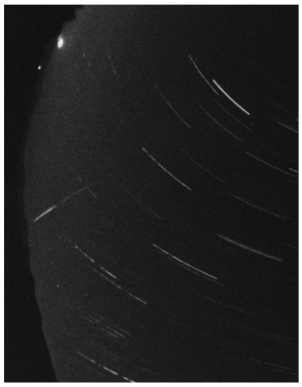
K-321
Time (JST) : 1986-9-4 19:00-20:00



K-322
Time (JST) : 1986-9-6 00:00-01:00

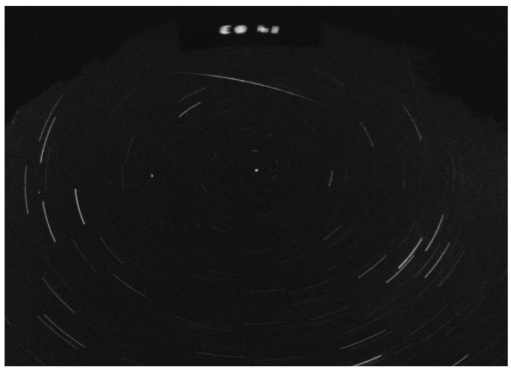


K-323
Time (JST) : 1986-9-11 03:00-04:00

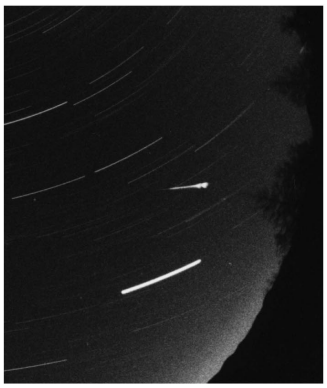


K-325
Time (JST) : 1986-9-30 00:00-01:00

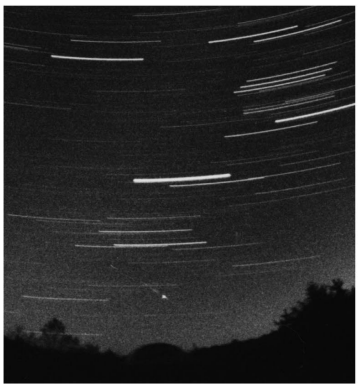
K-327
Time (JST) : 1986-10-1 01:00-02:00



K-333
Time (JST) : 1986-10-15 03:00-04:00

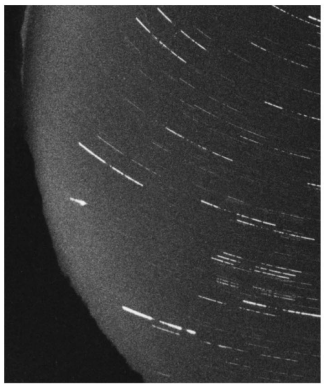


K-336
Time (JST) : 1986-10-30 23:00-24:00

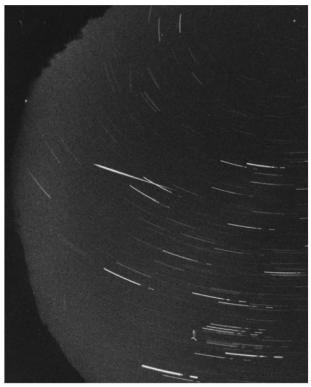


K-338
Time (JST) : 1986-10-31 04:00-05:00

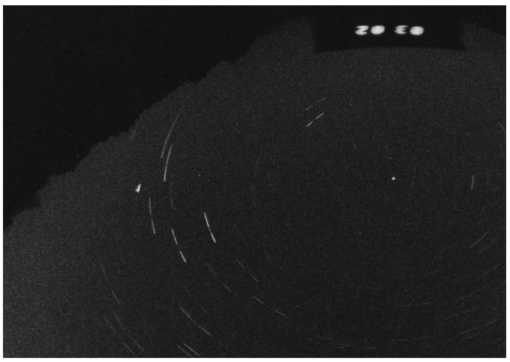
Figure 32. Fireball Images [#26]



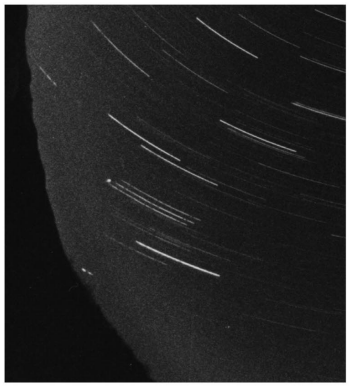
K-339
Time (JST) : 1986-11-1 00:00-01:00



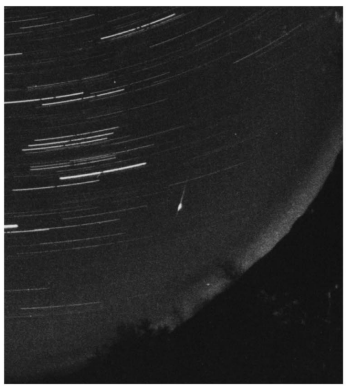
K-340
Time (JST) : 1986-11-3 01:00-02:00



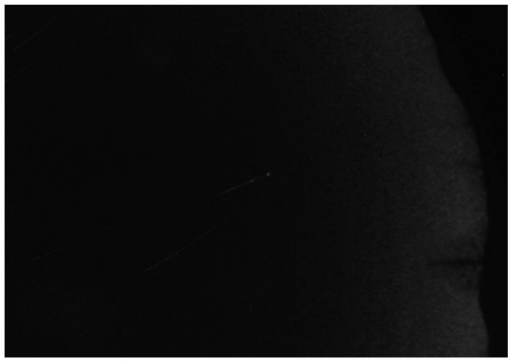
K-341
Time (JST) : 1986-11-3 02:00-03:00



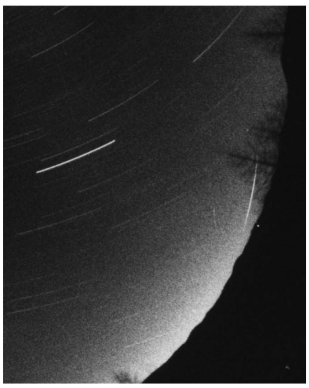
K-344
Time (JST) : 1986-11-8 22:00-23:00



K-345
Time (JST) : 1986-11-10 03:00-04:00



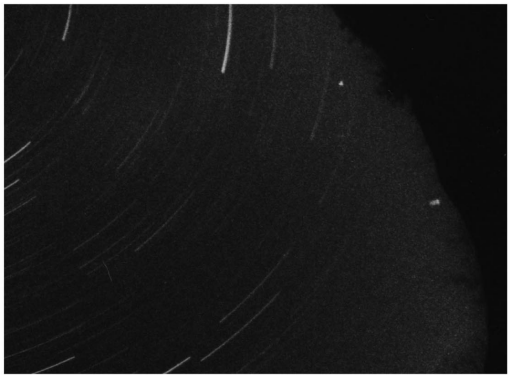
K-350
Time (JST) : 1986-11-20 23:00-24:00



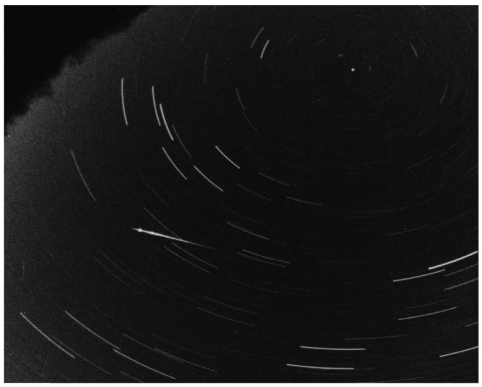
K-351
Time (JST) : 1986-11-21 18:00-19:00

K-353
Time (JST) : 1986-11-27 02:00-03:00

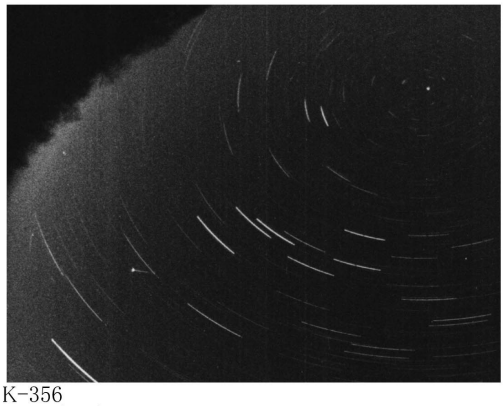
Figure 33. Fireball Images [#27]



K-354
Time (JST) : 1986-11-29 22:00-23:00

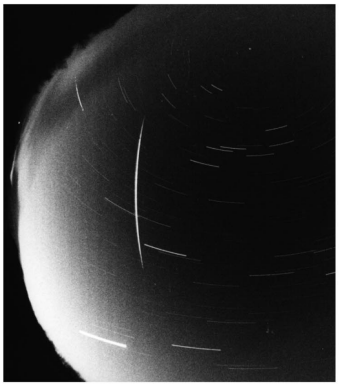


K-355
Time (JST) : 1986-11-30 02:00-03:00

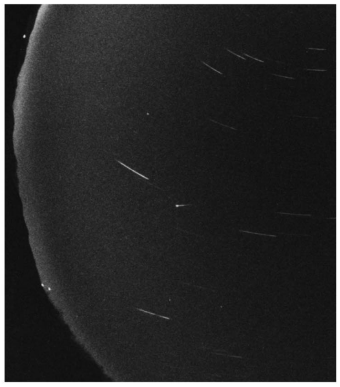


K-356
Time (JST) : 1986-12-5 04:00-05:00

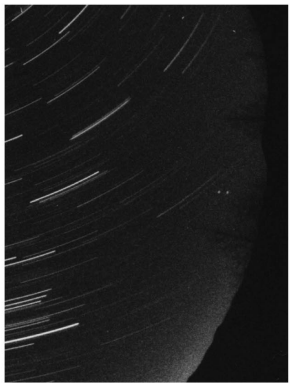
K-357
Time (JST) : 1986-12-6 04:00-05:00



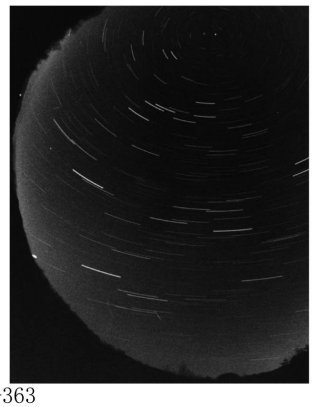
K-358
Time (JST) : 1986-12-30 05:00-06:00



K-360
Time (JST) : 1987-1-2 03:00-04:00



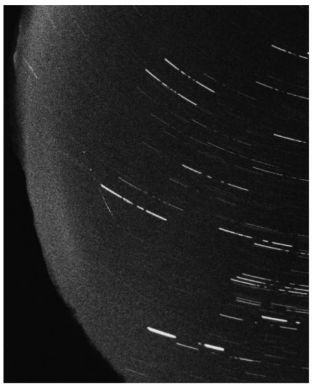
K-361
Time (JST) : 1987-1-4 00:00-01:00



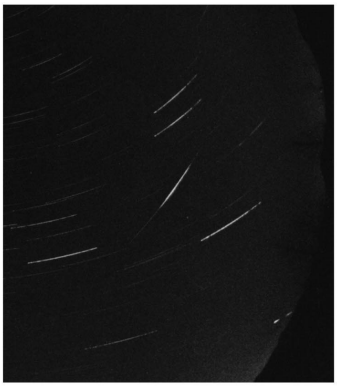
K-362,K-363
Time (JST) : 1987-1-4 03:00-04:00

Figure 34. Fireball Images [#28]

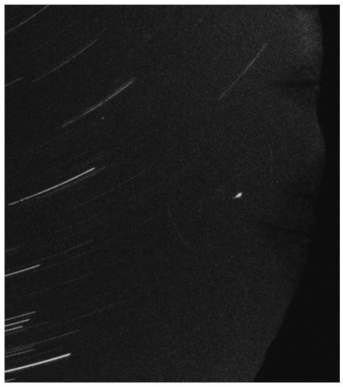
K-366
Time (JST) : 1987-1-20 19:00-20:00



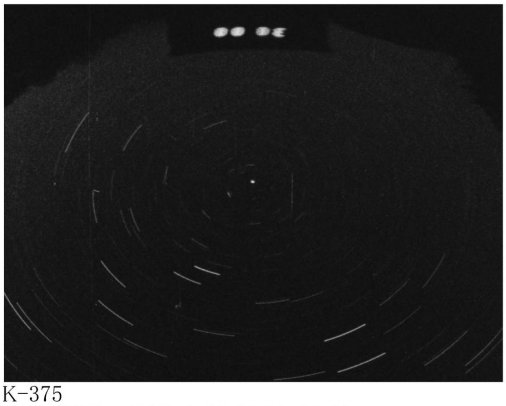
K-367
Time (JST) : 1987-1-24 19:00-20:00



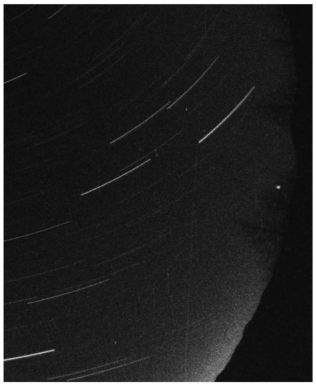
K-370
Time (JST) : 1987-2-7 02:00-03:00



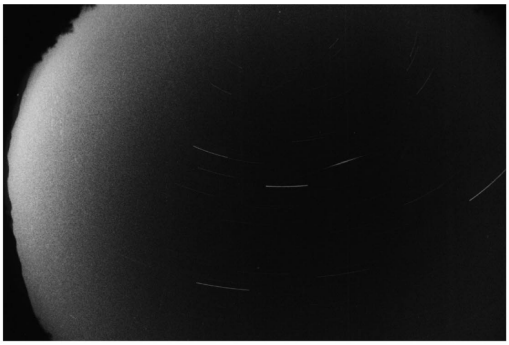
K-371
Time (JST) : 1987-3-1 20:00-21:00



K-375
Time (JST) : 1987-3-30 00:00-01:00



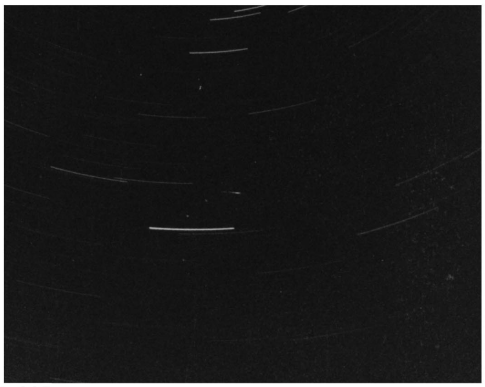
K-376
Time (JST) : 1987-3-30 02:00-03:00



K-381
Time (JST) : 1987-5-7 03:00-04:00

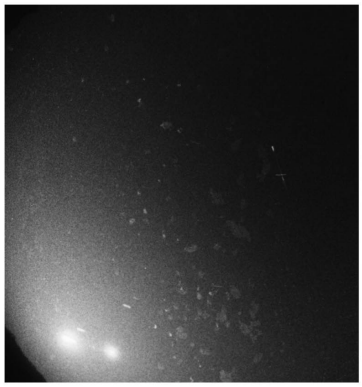
K-384
Time (JST) : 1987-5-29 00:00-01:00

Figure 35. Fireball Images [#29]

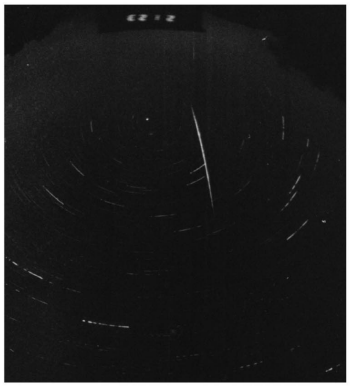


K-385
Time (JST) : 1987-5-31 21:00-22:00

K-386
Time (JST) : 1987-6-1 21:00-22:00

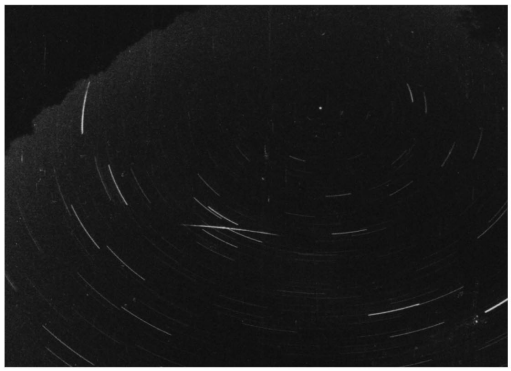


K-389
Time (JST) : 1987-6-17 01:00-02:00

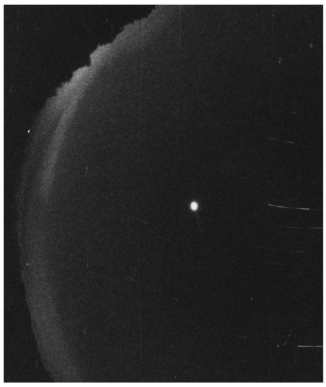


K-390
Time (JST) : 1987-6-21 23:00-24:00

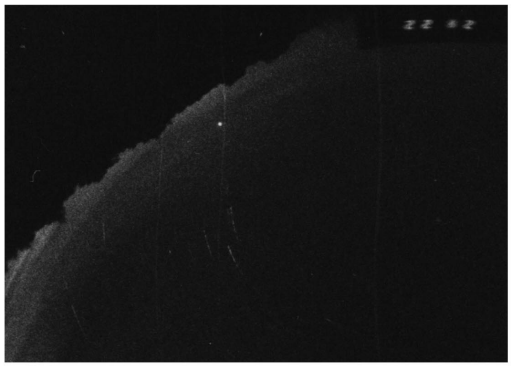
K-392
Time (JST) : 1987-7-20 23:00-24:00



K-393
Time (JST) : 1987-7-27 01:00-02:00

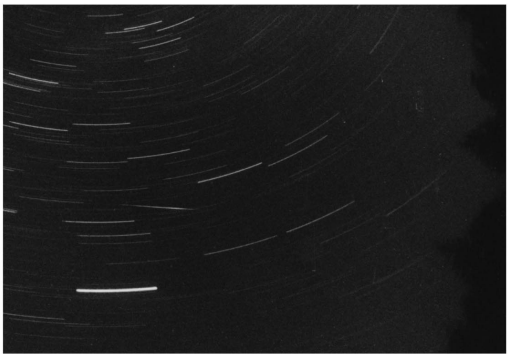


K-394
Time (JST) : 1987-7-27 23:00-24:00

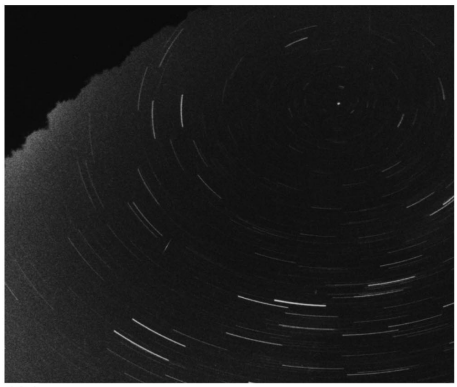


K-395
Time (JST) : 1987-7-28 22:00-23:00

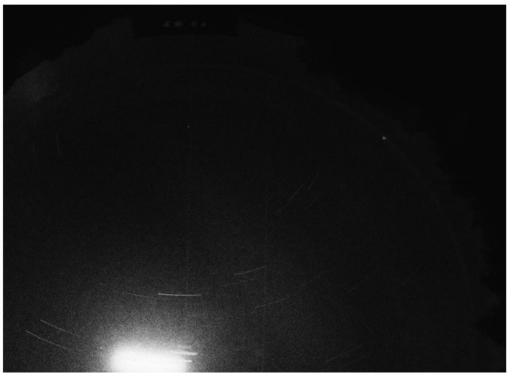
Figure 36. Fireball Images [#30]



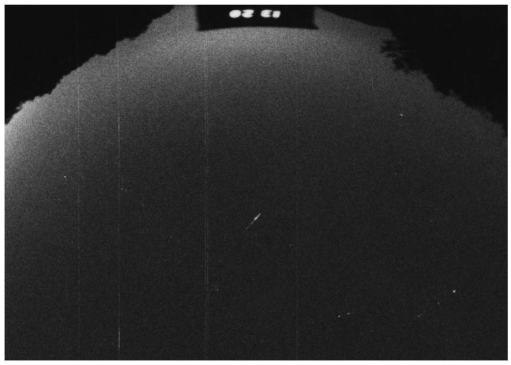
K-399
Time (JST) : 1987-8-29 03:00-04:00



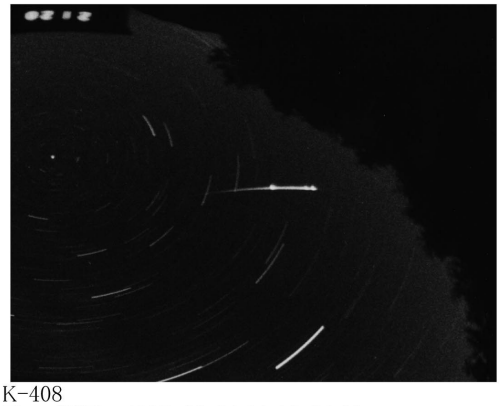
K-404
Time (JST) : 1987-10-4 03:00-04:00



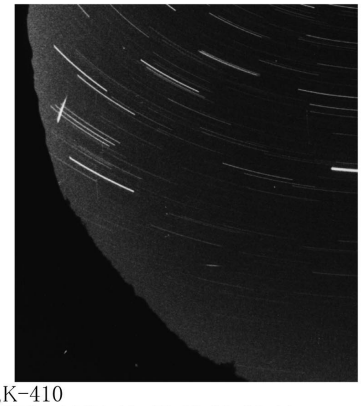
K-405
Time (JST) : 1987-10-13 03:00-04:00



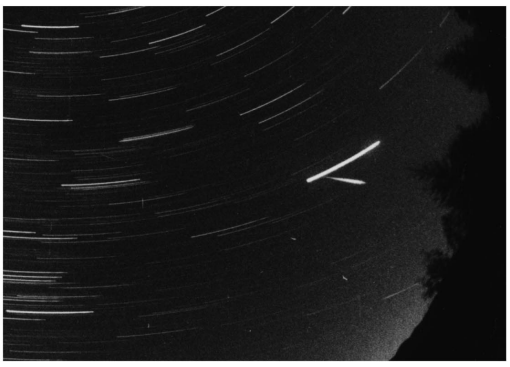
K-406
Time (JST) : 1987-10-13 20:00-21:00



K-408
Time (JST) : 1987-10-21 20:00-21:00



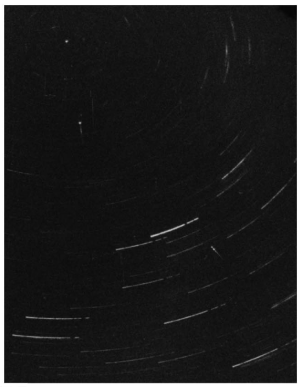
K-409,K-410
Time (JST) : 1987-10-27 22:00-23:00



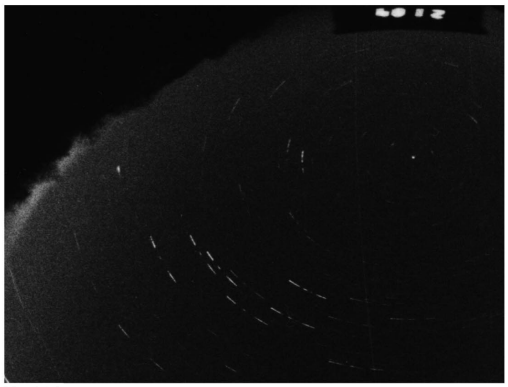
K-411,K-412
Time (JST) : 1987-10-28 02:00-03:00

K-414
Time (JST) : 1987-10-28 20:00-21:00

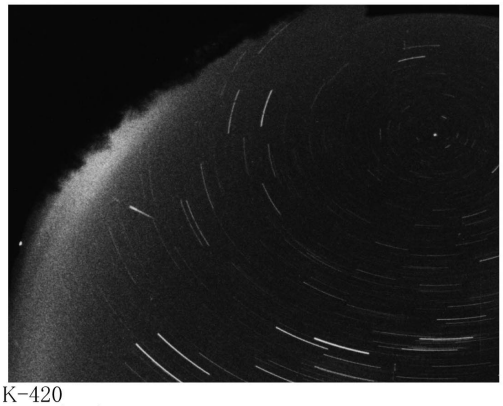
Figure 37. Fireball Images [#31]



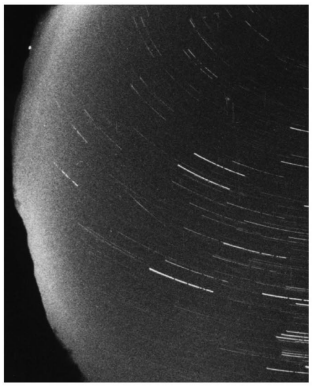
K-416,K-417
Time (JST) : 1987-11-18 03:00-04:00



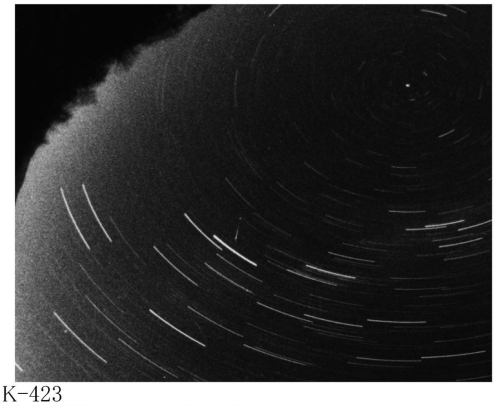
K-419
Time (JST) : 1987-11-21 04:00-05:00



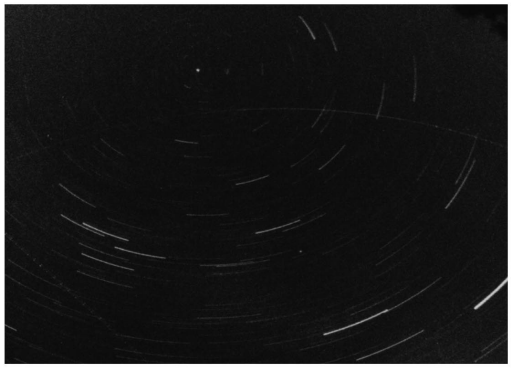
K-420
Time (JST) : 1987-11-21 23:00-24:00



K-421
Time (JST) : 1987-11-24 00:00-01:00

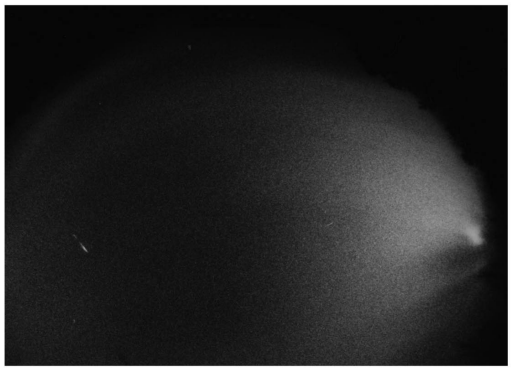


K-423
Time (JST) : 1987-11-24 21:00-22:00



K-424
Time (JST) : 1987-11-25 18:00-19:00

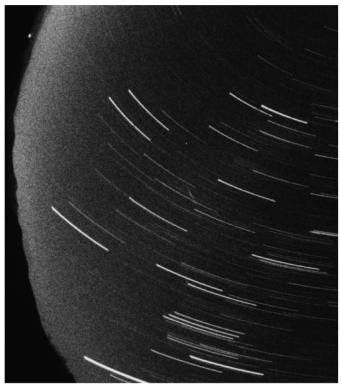
K-425
Time (JST) : 1987-11-25 23:00-24:00



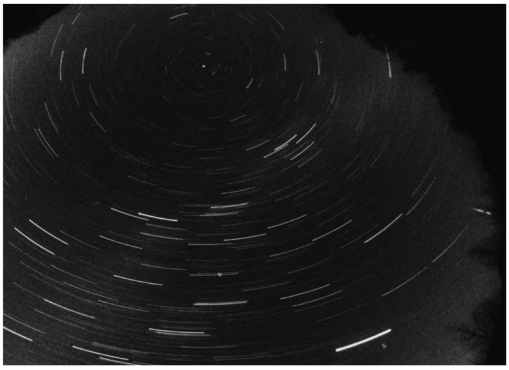
K-428
Time (JST) : 1987-12-3 03:00-04:00

Figure 38. Fireball Images [#32]

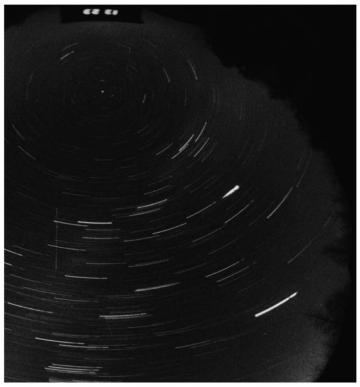
K-429
Time (JST) : 1987-12-8 00:00-01:00



K-430
Time (JST) : 1987-12-13 21:00-22:00



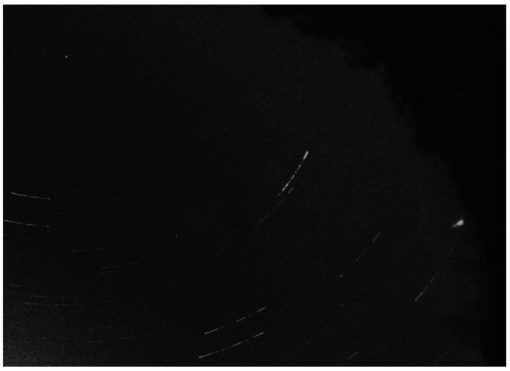
K-431,K-432
Time (JST) : 1987-12-13 22:00-23:00



K-433
Time (JST) : 1987-12-13 23:00-24:00

K-435
Time (JST) : 1987-12-14 04:00-05:00

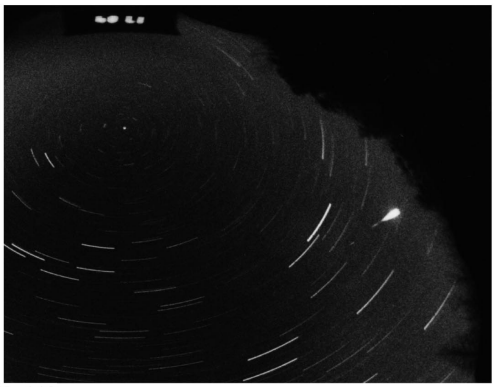
K-436,K-437
Time (JST) : 1987-12-14 21:00-22:00



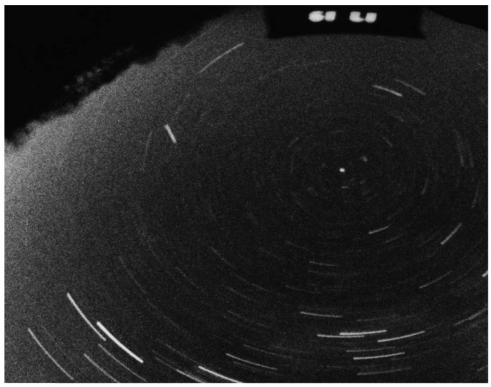
K-438
Time (JST) : 1987-12-15 04:00-05:00

K-439
Time (JST) : 1987-12-15 05:00-06:00

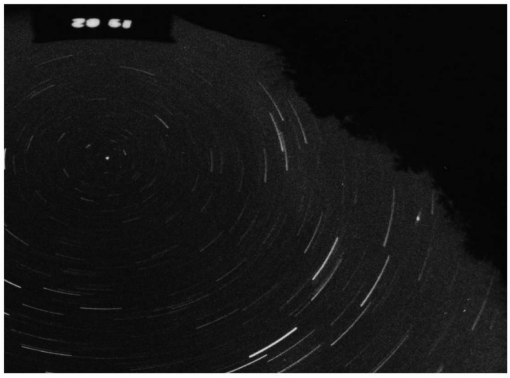
Figure 39. Fireball Images [#33]



K-442
Time (JST) : 1987-12-17 04:00-05:00



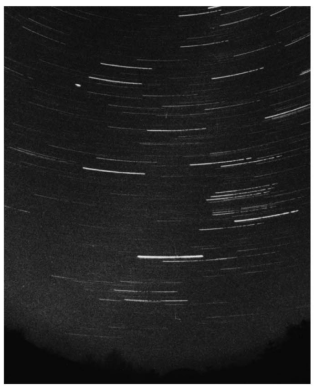
K-443
Time (JST) : 1987-12-17 19:00-20:00



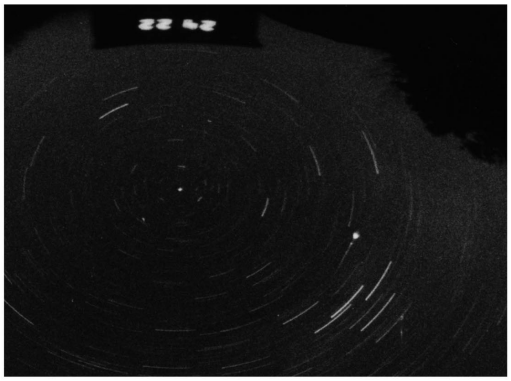
K-445
Time (JST) : 1987-12-19 02:00-03:00

K-446
Time (JST) : 1987-12-19 03:00-04:00

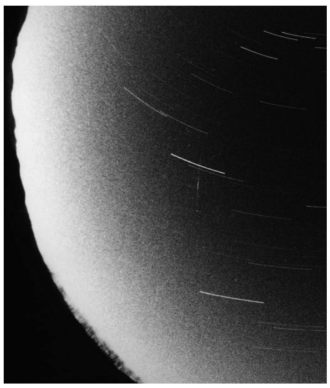
K-447
Time (JST) : 1987-12-20 02:00-03:00



K-450
Time (JST) : 1987-12-24 00:00-01:00

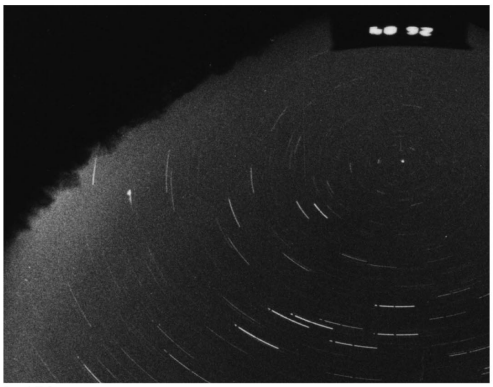


K-451
Time (JST) : 1987-12-24 22:00-23:00

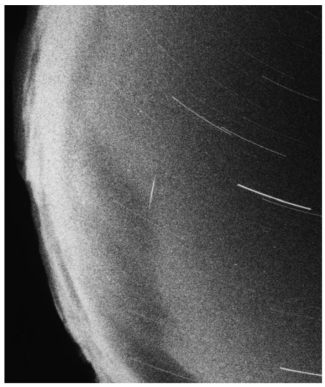


K-452
Time (JST) : 1987-12-25 05:00-06:00

Figure 40. Fireball Images [#34]

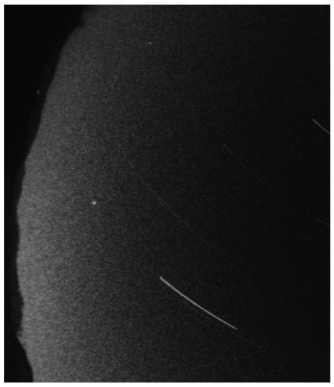


K-453
Time (JST) : 1987-12-26 04:00-05:00

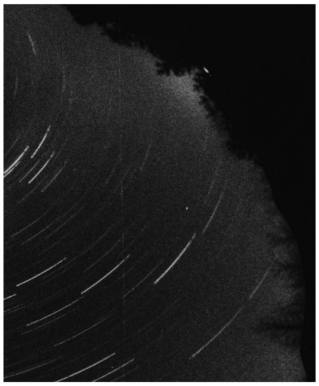


K-454
Time (JST) : 1987-12-26 05:00-06:00

K-457
Time (JST) : 1987-12-29 02:00-03:00

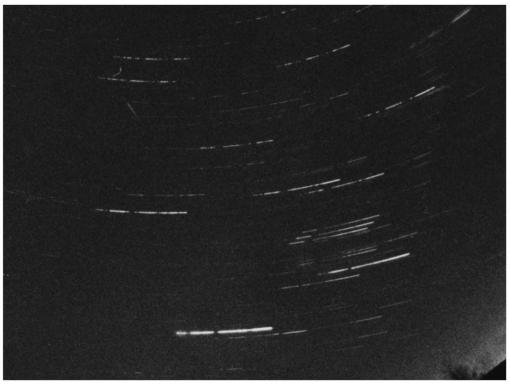


K-458
Time (JST) : 1988-1-1 03:00-04:00



K-460
Time (JST) : 1988-1-10 21:00-22:00

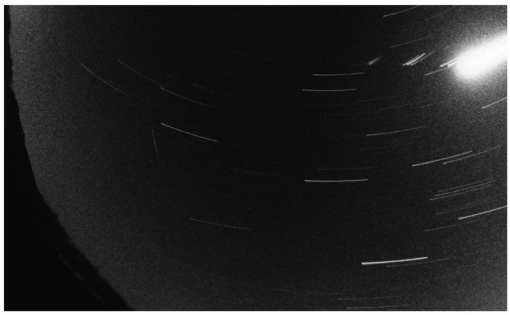
K-462
Time (JST) : 1988-1-14 05:00-06:00



K-463
Time (JST) : 1988-1-16 23:00-24:00

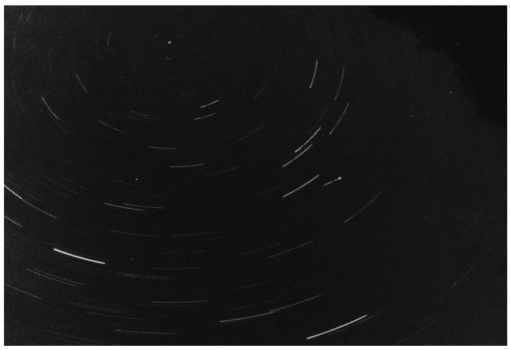
K-469
Time (JST) : 1988-3-8 20:00-21:00

Figure 41. Fireball Images [#35]

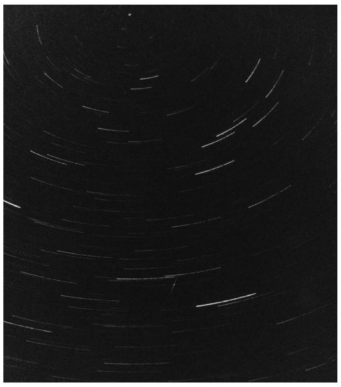


K-472
Time (JST) : 1988-3-23 19:00-20:00

K-479
Time (JST) : 1988-4-21 01:00-02:00

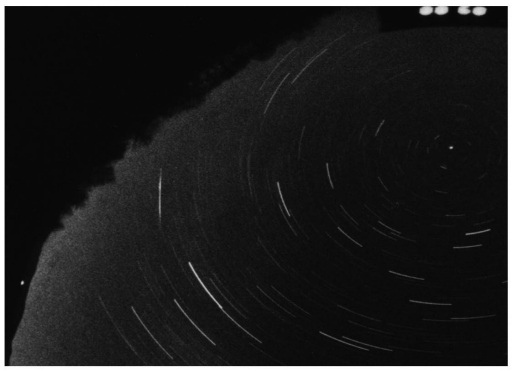


K-480
Time (JST) : 1988-4-23 02:00-03:00

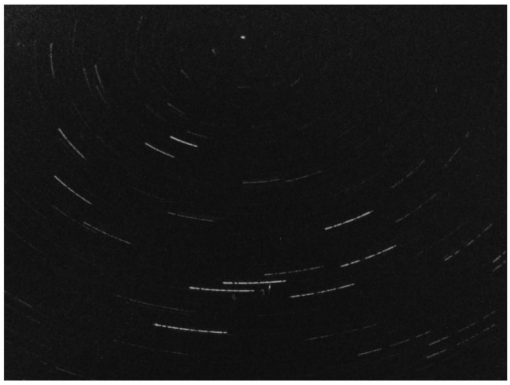


K-481
Time (JST) : 1988-4-24 01:00-02:00

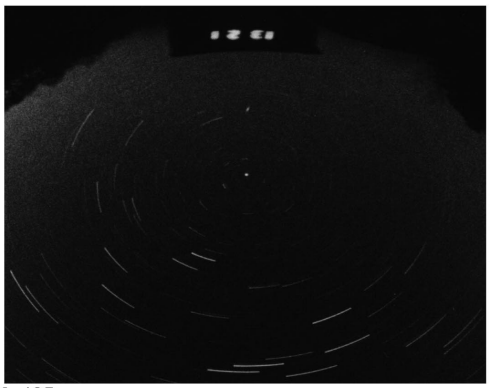
K-482
Time (JST) : 1988-5-8 21:00-22:00



K-483
Time (JST) : 1988-5-9 00:00-01:00

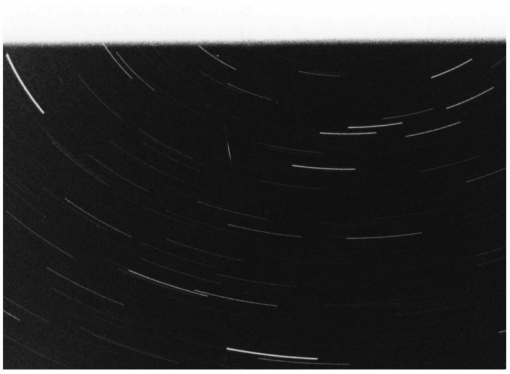


K-484
Time (JST) : 1988-5-12 21:00-22:00

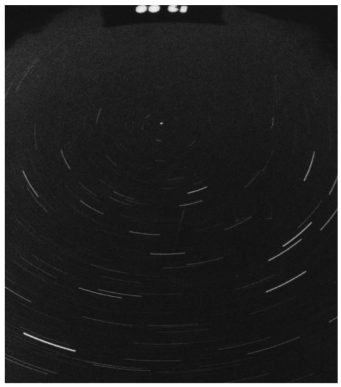


K-485
Time (JST) : 1988-5-13 21:00-22:00

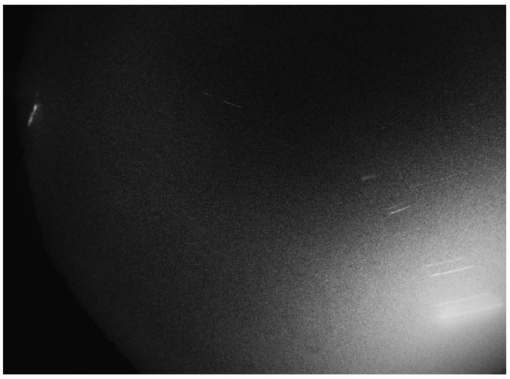
Figure 42. Fireball Images [#36]



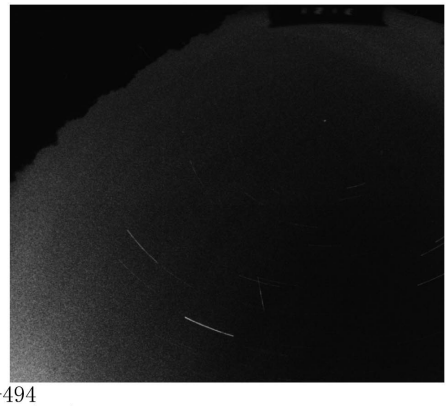
K-486
Time (JST) : 1988-5-16 21:00-22:00



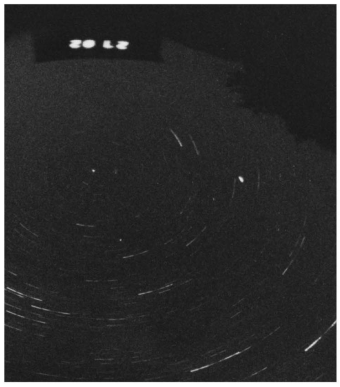
K-487
Time (JST) : 1988-5-19 00:00-01:00



K-490
Time (JST) : 1988-5-29 00:00-01:00

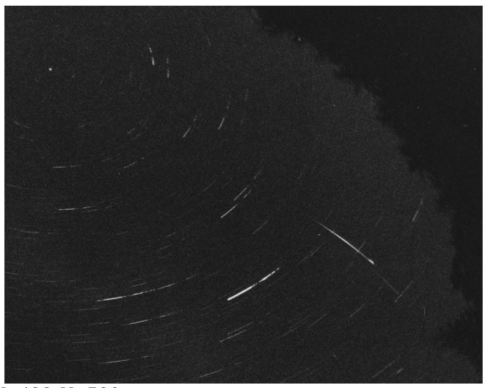


K-494
Time (JST) : 1988-7-1 21:00-22:00

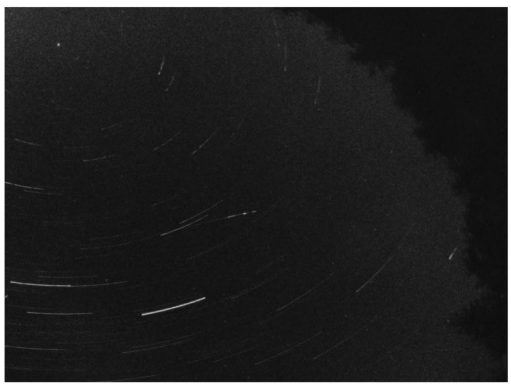


K-496
Time (JST) : 1988-7-27 02:00-03:00

K-497
Time (JST) : 1988-8-3 00:00-01:00

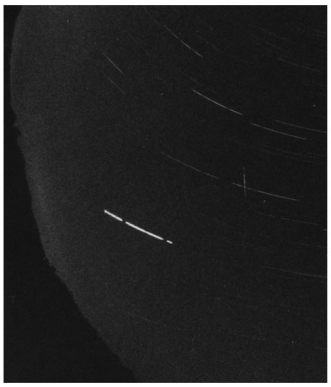


K-499,K-500
Time (JST) : 1988-8-12 00:00-01:00

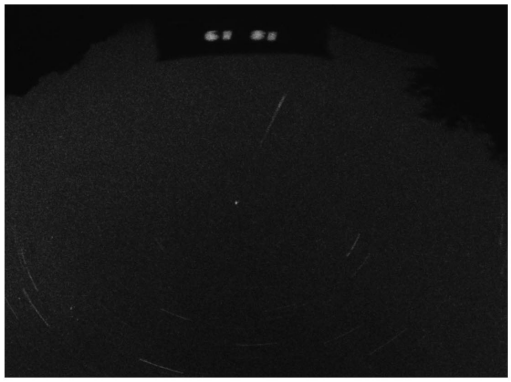


K-501
Time (JST) : 1988-9-9 20:00-21:00

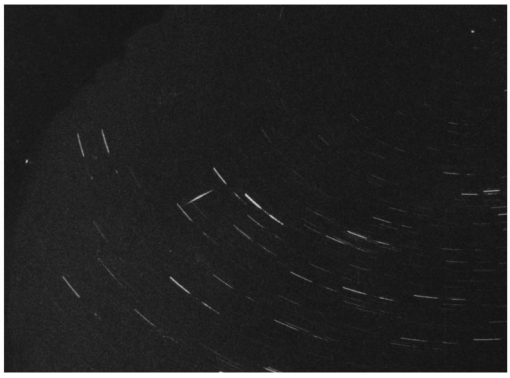
Figure 43. Fireball Images [#37]



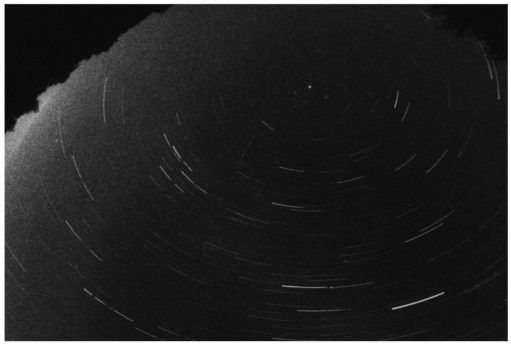
K-502
Time (JST) : 1988-9-9 21:00-22:00



K-506
Time (JST) : 1988-9-18 19:00-20:00

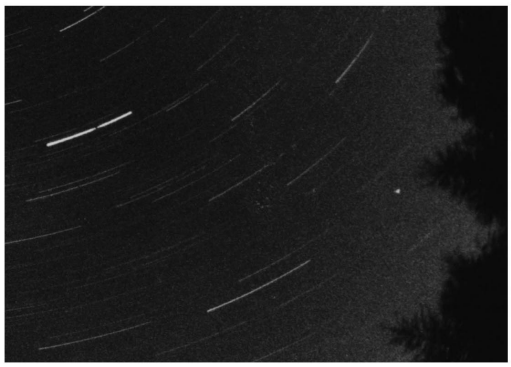


K-507
Time (JST) : 1988-9-20 01:00-02:00

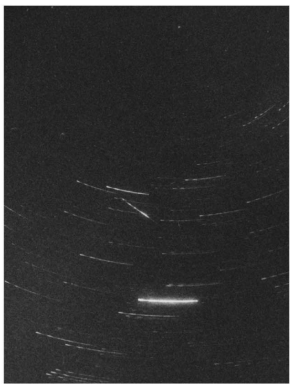


K-508
Time (JST) : 1988-10-3 19:00-20:00

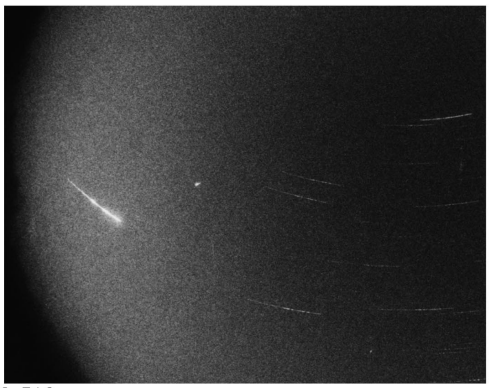
K-511
Time (JST) : 1988-10-9 02:00-03:00



K-512
Time (JST) : 1988-10-9 19:00-20:00

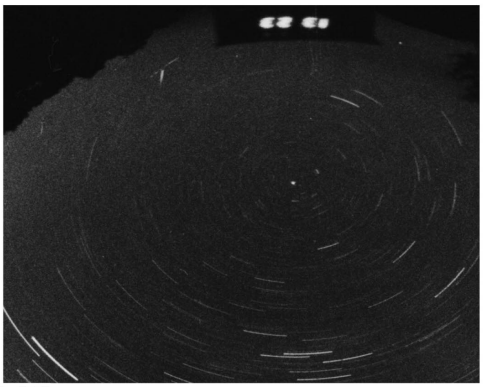


K-515
Time (JST) : 1988-10-11 02:00-03:00



K-516
Time (JST) : 1988-10-11 04:00-05:00

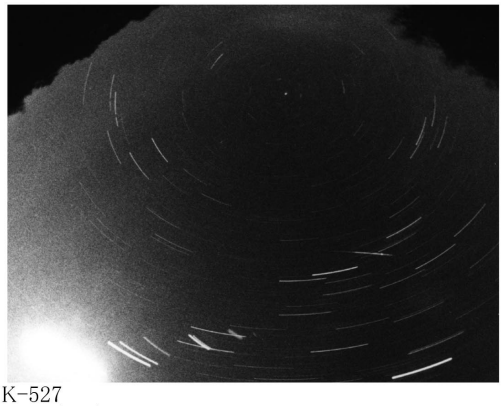
Figure 44. Fireball Images [#38]



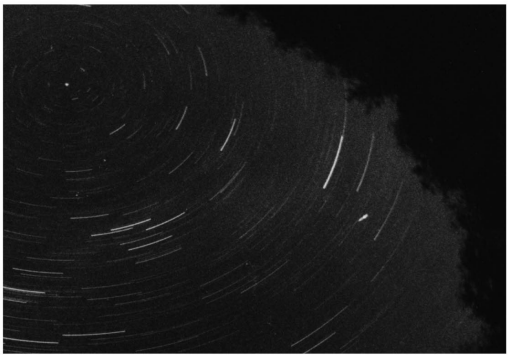
K-517
Time (JST) : 1988-10-13 23:00-24:00

K-521
Time (JST) : 1988-10-27 19:00-20:00

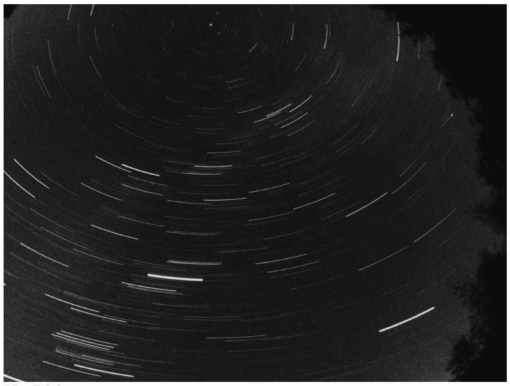
K-523,K-524
Time (JST) : 1988-10-31 22:00-23:00



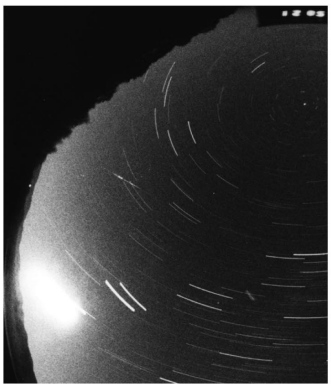
K-527
Time (JST) : 1988-11-3 03:00-04:00



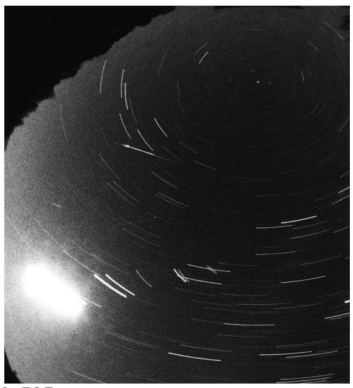
K-529
Time (JST) : 1988-11-3 23:00-24:00



K-530
Time (JST) : 1988-11-4 00:00-01:00

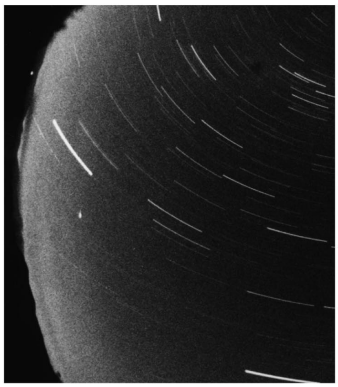


K-532
Time (JST) : 1988-11-4 02:00-03:00

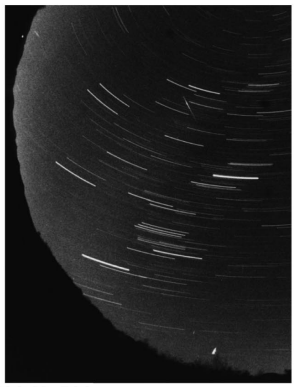


K-534,K-535
Time (JST) : 1988-11-4 03:00-04:00

Figure 45. Fireball Images [#39]

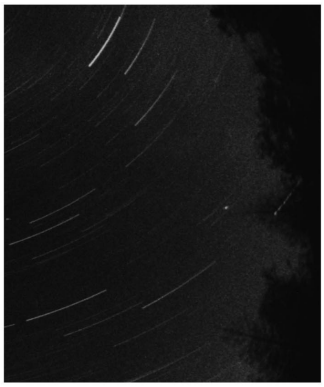


K-536
Time (JST) : 1988-11-5 19:00-20:00

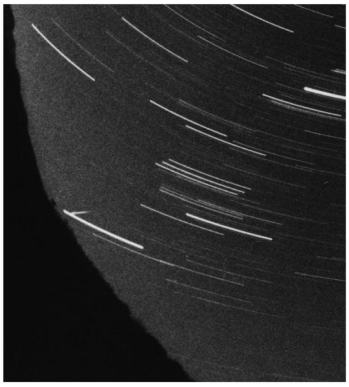


K-537,K-538,K-539
Time (JST) : 1988-11-6 00:00-01:00

K-541,K-542
Time (JST) : 1988-11-6 22:00-23:00

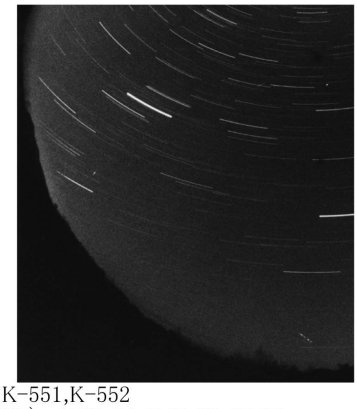


K-546
Time (JST) : 1988-11-7 22:00-23:00



K-547
Time (JST) : 1988-11-7 23:00-24:00

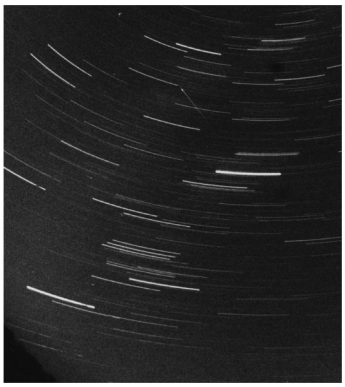
K-548
Time (JST) : 1988-11-8 00:00-01:00



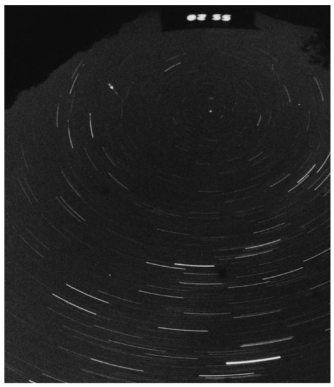
K-550,K-551,K-552
Time (JST) : 1988-11-8 21:00-22:00

K-553
Time (JST) : 1988-11-8 22:00-23:00

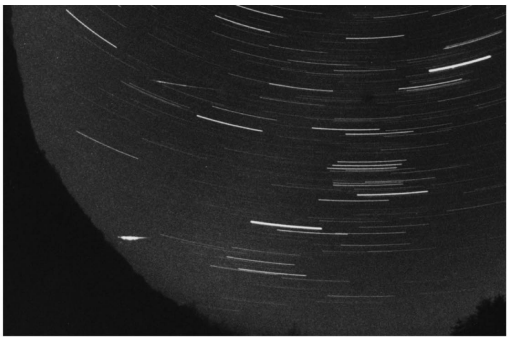
Figure 46. Fireball Images [#40]



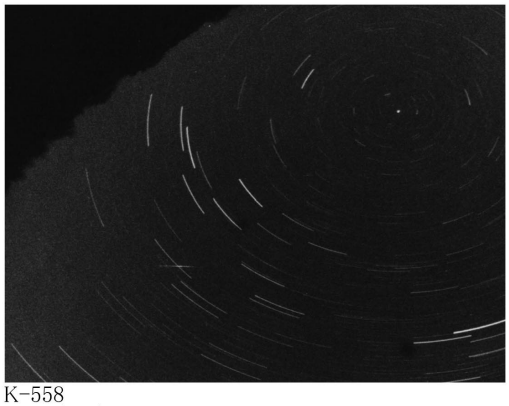
K-554
Time (JST) : 1988-11-9 00:00-01:00



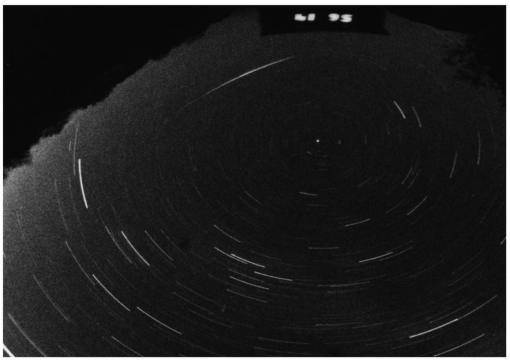
K-555
Time (JST) : 1988-11-9 01:00-02:00



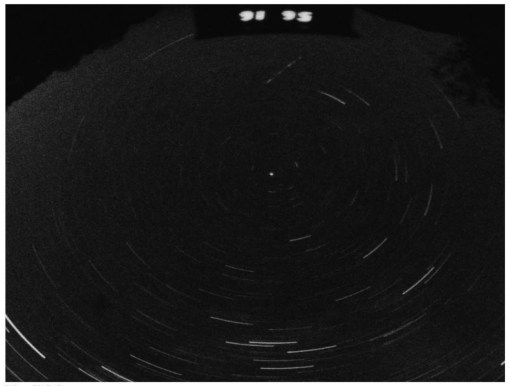
K-556,K-557
Time (JST) : 1988-11-9 02:00-03:00



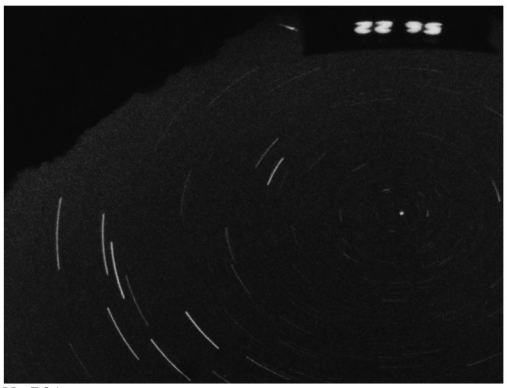
K-558
Time (JST) : 1988-11-9 03:00-04:00



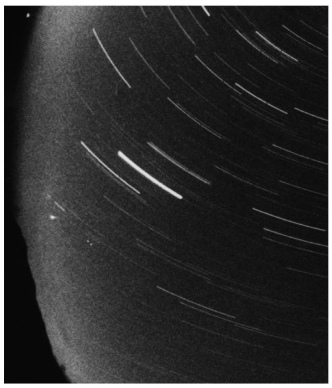
K-559
Time (JST) : 1988-11-9 19:00-20:00



K-560
Time (JST) : 1988-11-9 21:00-22:00

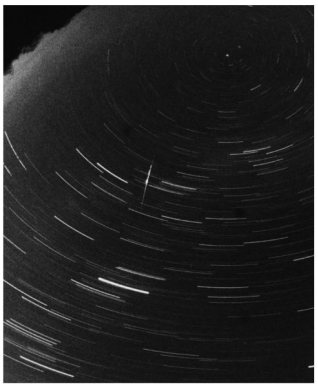


K-561
Time (JST) : 1988-11-10 03:00-04:00

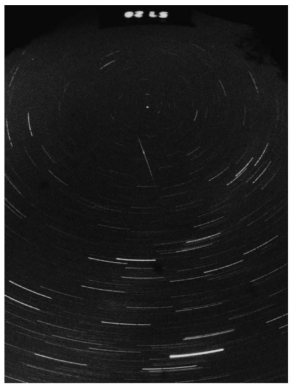


K-563
Time (JST) : 1988-11-10 20:00-21:00

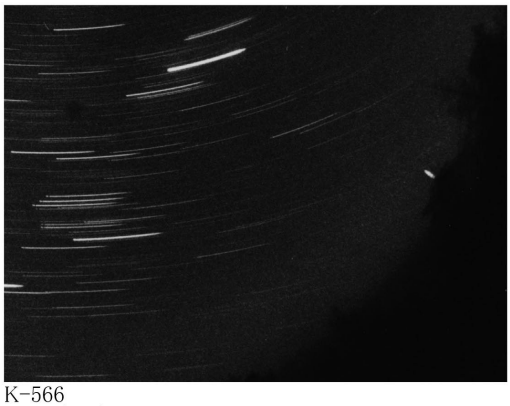
Figure 47. Fireball Images [#41]



K-564
Time (JST) : 1988-11-10 22:00-23:00

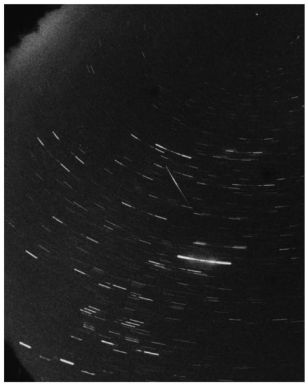


K-565
Time (JST) : 1988-11-11 01:00-02:00

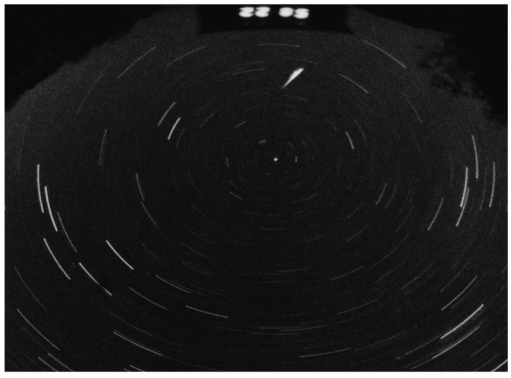


K-566
Time (JST) : 1988-11-11 02:00-03:00

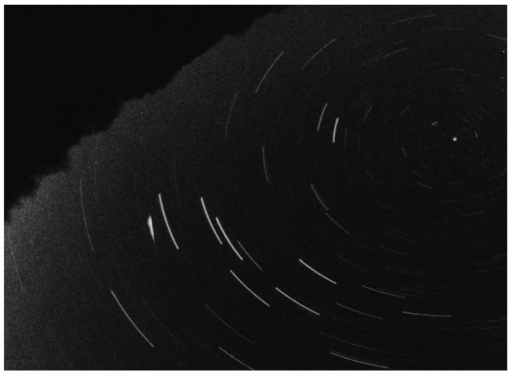
K-567
Time (JST) : 1988-11-11 22:00-23:00



K-568
Time (JST) : 1988-11-11 23:00-24:00



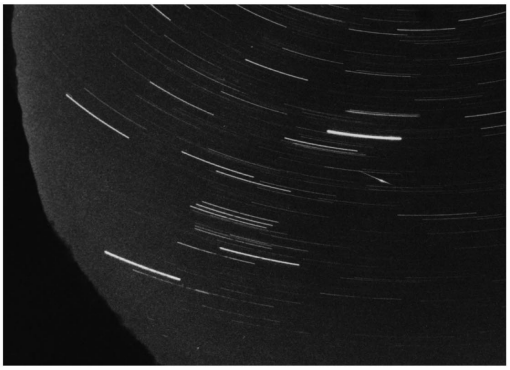
K-569
Time (JST) : 1988-11-12 03:00-04:00



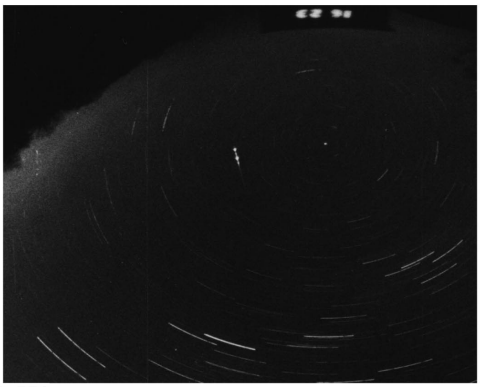
K-570
Time (JST) : 1988-11-12 04:00-05:00

K-572
Time (JST) : 1988-11-14 22:00-23:00

Figure 48. Fireball Images [#42]

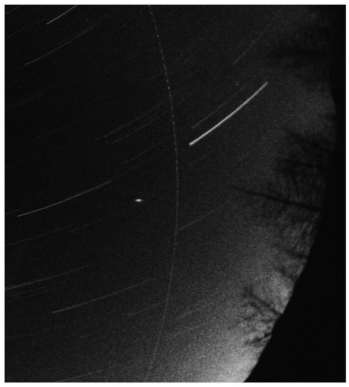


K-575
Time (JST) : 1988-11-15 23:00-24:00

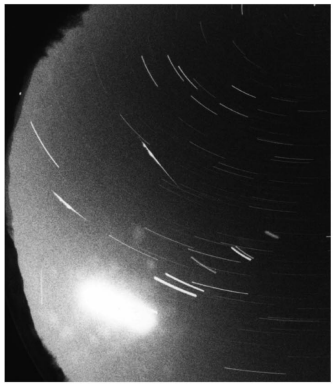


K-576
Time (JST) : 1988-11-17 00:00-01:00

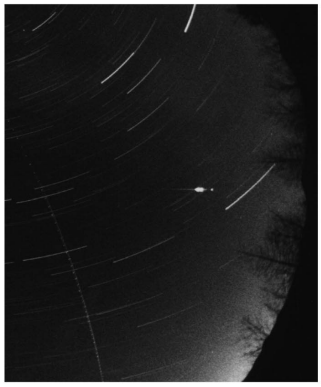
K-577
Time (JST) : 1988-11-17 05:00-06:00



K-584
Time (JST) : 1988-12-1 19:00-20:00

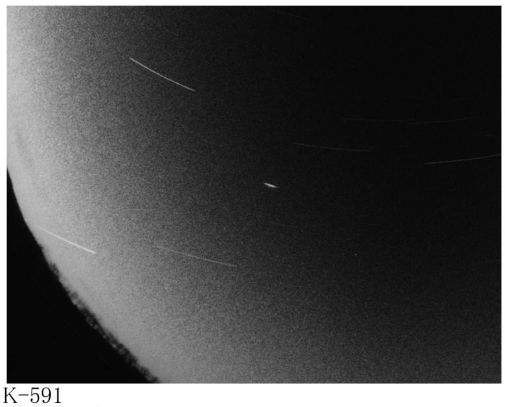


K-586
Time (JST) : 1988-12-3 03:00-04:00



K-588
Time (JST) : 1988-12-6 19:00-20:00

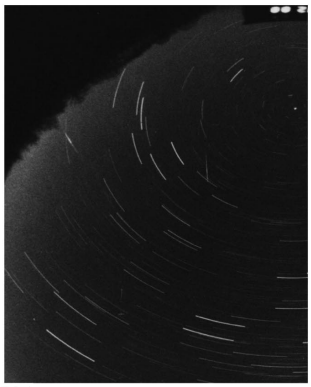
K-590
Time (JST) : 1988-12-8 03:00-04:00



K-591
Time (JST) : 1988-12-10 05:00-06:00

Figure 49. Fireball Images [#43]

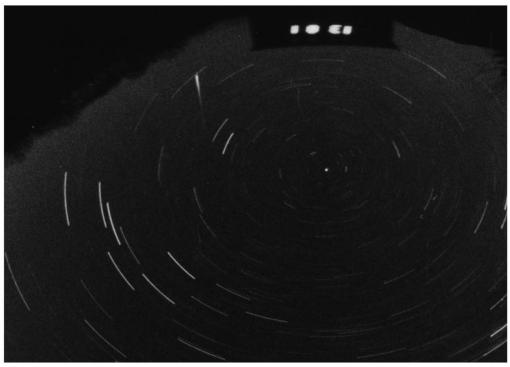
K-592
Time (JST) : 1988-12-11 03:00-04:00



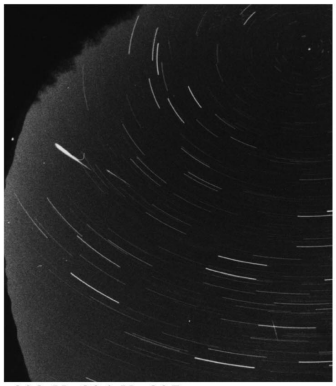
K-593,K-594
Time (JST) : 1988-12-12 00:00-01:00

K-595
Time (JST) : 1988-12-12 01:00-02:00

K-597
Time (JST) : 1988-12-13 00:00-01:00



K-598
Time (JST) : 1988-12-13 01:00-02:00



K-602,K-603,K-604,K-605
Time (JST) : 1988-12-14 00:00-01:00

K-606
Time (JST) : 1988-12-14 02:00-03:00

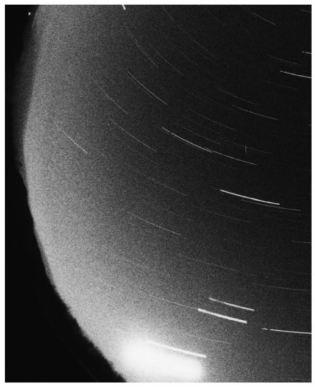
K-608,K-609,K-610
Time (JST) : 1988-12-14 04:00-05:00

Figure 50. Fireball Images [#44]

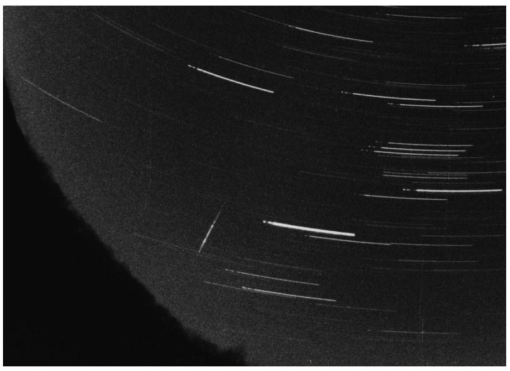
K-614
Time (JST) : 1988-12-18 01:00-02:00

K-615
Time (JST) : 1988-12-21 01:00-02:00

K-617
Time (JST) : 1988-12-31 03:00-04:00

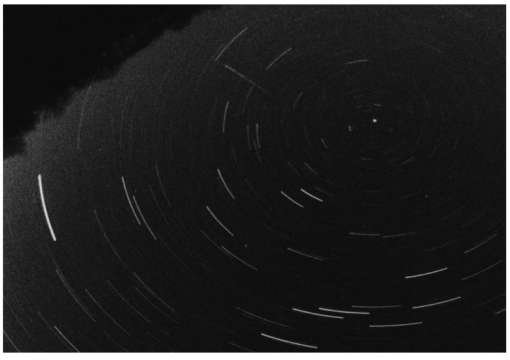


K-620
Time (JST) : 1989-1-4 05:00-06:00

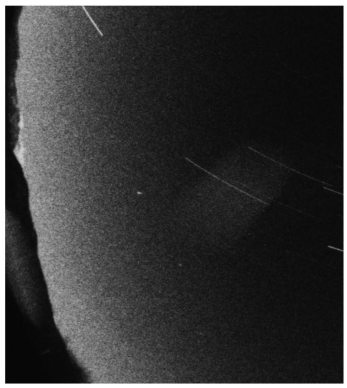


K-621
Time (JST) : 1989-1-12 21:00-22:00

K-623
Time (JST) : 1989-1-13 21:00-22:00



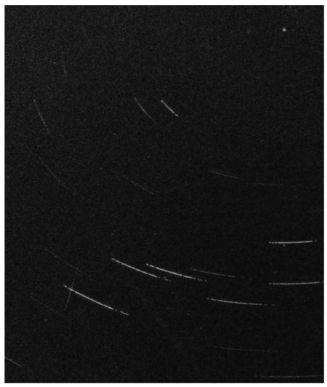
K-624
Time (JST) : 1989-1-15 04:00-05:00



K-625
Time (JST) : 1989-1-17 00:00-01:00

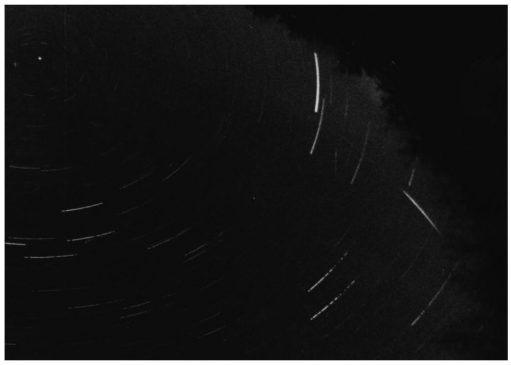
Figure 51. Fireball Images [#45]

K-626
Time (JST) : 1989-1-27 20:00-21:00

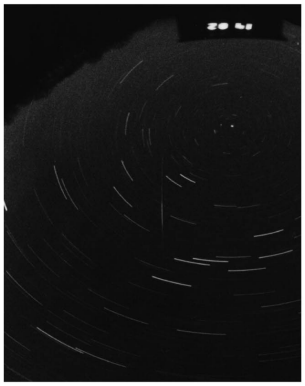


K-628
Time (JST) : 1989-1-31 02:00-03:00

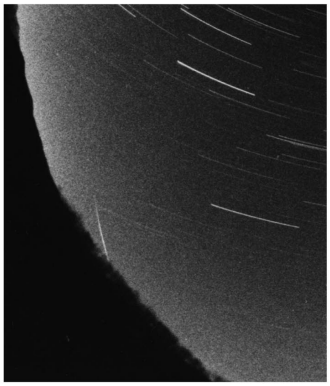
K-632
Time (JST) : 1989-2-10 23:00-24:00



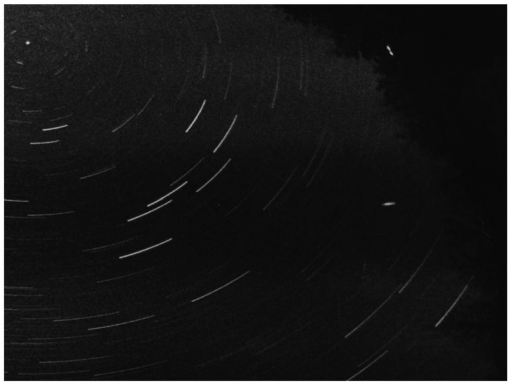
K-633
Time (JST) : 1989-2-11 02:00-03:00



K-635
Time (JST) : 1989-2-14 02:00-03:00



K-636
Time (JST) : 1989-2-26 20:00-21:00



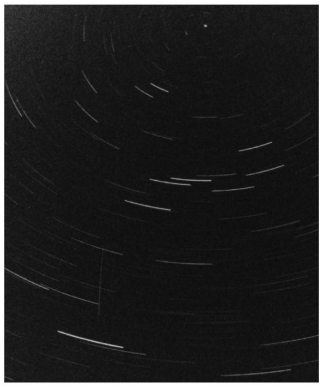
K-637
Time (JST) : 1989-3-9 04:00-05:00

K-638
Time (JST) : 1989-3-10 20:00-21:00

Figure 52. Fireball Images [#46]

K-642
Time (JST) : 1989-3-29 20:00-21:00

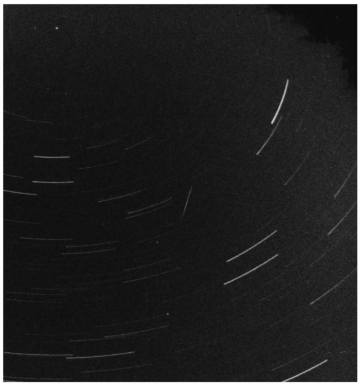
K-643
Time (JST) : 1989-4-2 03:00-04:00



K-644
Time (JST) : 1989-4-5 23:00-24:00

K-647
Time (JST) : 1989-4-22 03:00-04:00

K-649
Time (JST) : 1989-4-26 01:00-02:00

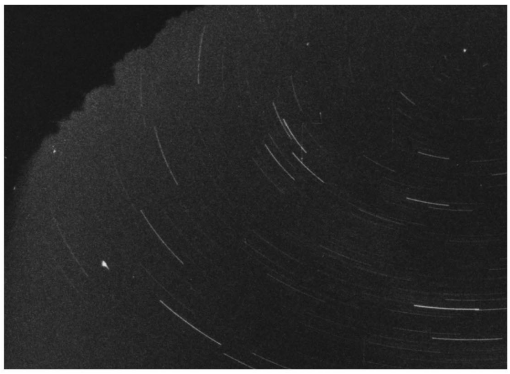


K-650
Time (JST) : 1989-4-26 20:00-21:00

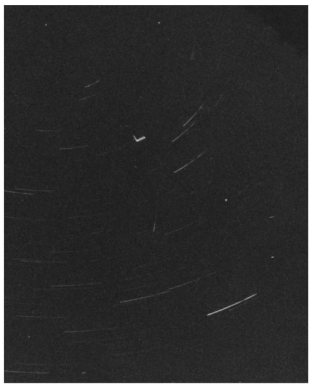
K-652
Time (JST) : 1989-5-9 21:00-22:00

K-657
Time (JST) : 1989-6-2 23:00-24:00

Figure 53. Fireball Images [#47]

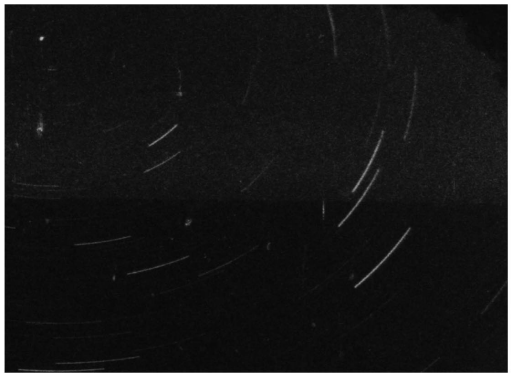


K-658
Time (JST) : 1989-7-1 01:00-02:00

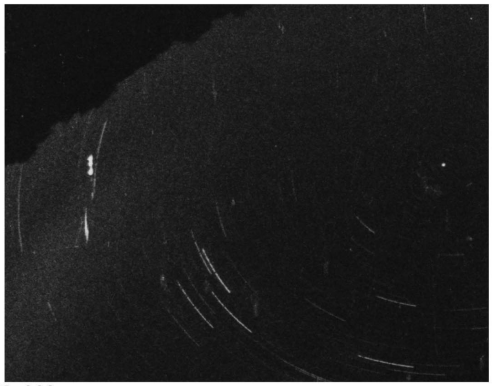


K-659
Time (JST) : 1989-7-5 21:00-22:00

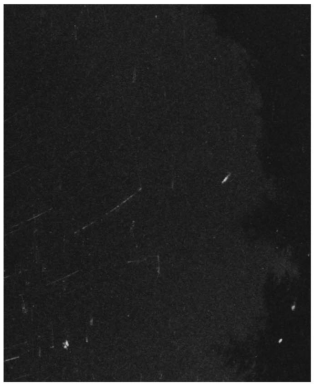
K-660
Time (JST) : 1989-7-27 03:00-04:00



K-661
Time (JST) : 1989-7-28 21:00-22:00



K-662
Time (JST) : 1989-7-28 23:00-24:00



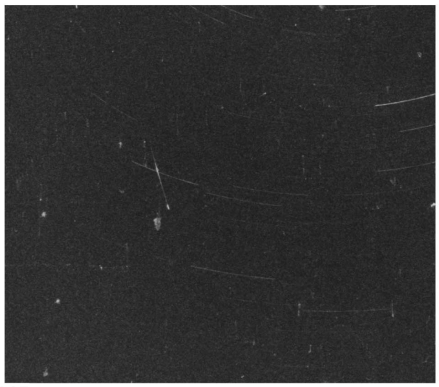
K-663
Time (JST) : 1989-7-30 22:00-23:00

K-664
Time (JST) : 1989-8-4 01:00-02:00

K-665
Time (JST) : 1989-8-4 22:00-23:00

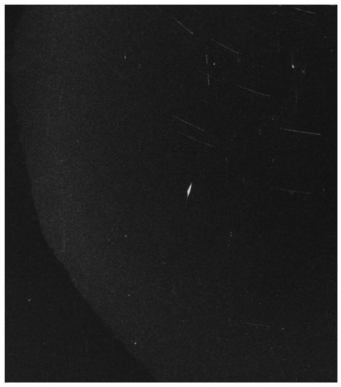
Figure 54. Fireball Images [#48]

K-666
Time (JST) : 1989-8-8 20:00-21:00



K-667
Time (JST) : 1989-8-9 00:00-01:00

K-669
Time (JST) : 1989-8-11 00:00-01:00

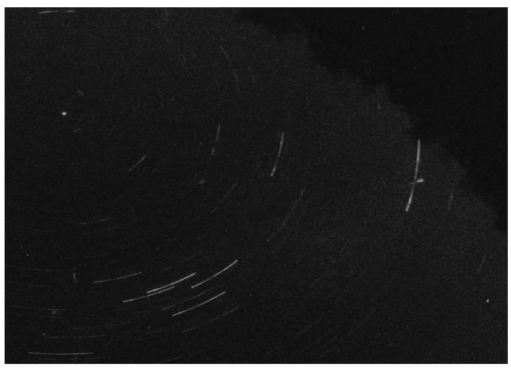


K-670
Time (JST) : 1989-8-11 01:00-02:00

K-671
Time (JST) : 1989-8-13 02:00-03:00

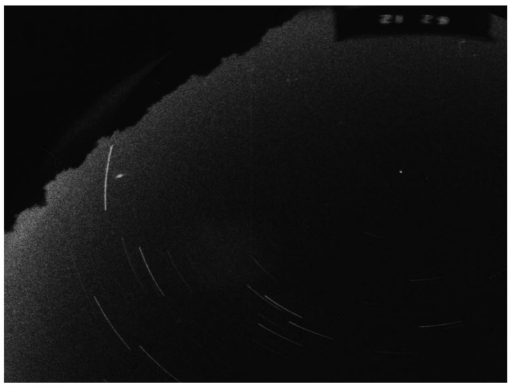
K-672
Time (JST) : 1989-8-14 02:00-03:00

K-673
Time (JST) : 1989-9-12 21:00-22:00

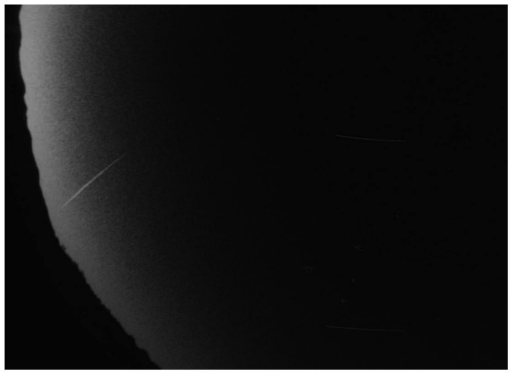


K-674
Time (JST) : 1989-10-1 01:00-02:00

Figure 55. Fireball Images [#49]

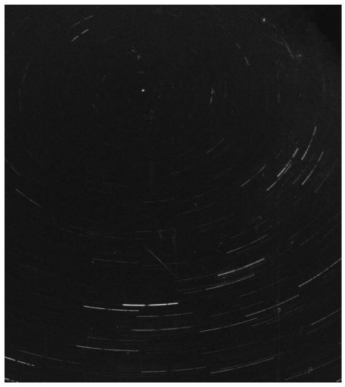


K-676
Time (JST) : 1989-10-8 20:00-21:00

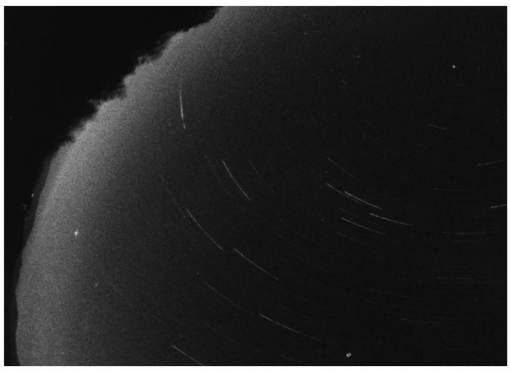


K-677
Time (JST) : 1989-10-9 04:00-05:00

K-678
Time (JST) : 1989-10-18 00:00-01:00

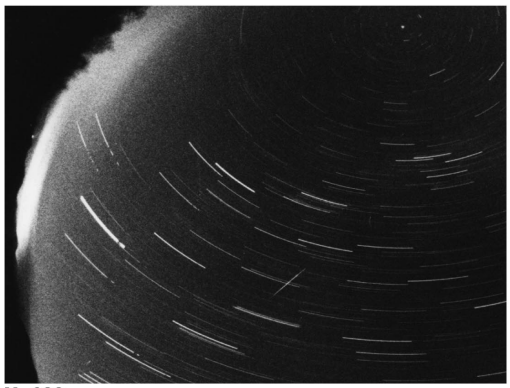


K-684
Time (JST) : 1989-11-2 02:00-03:00



K-687
Time (JST) : 1989-11-3 19:00-20:00

K-688
Time (JST) : 1989-11-11 01:00-02:00



K-689
Time (JST) : 1989-11-20 21:00-22:00

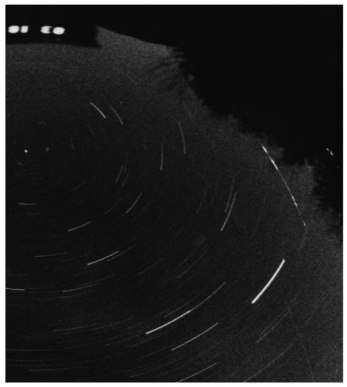
K-693
Time (JST) : 1989-11-21 03:00-04:00

Figure 56. Fireball Images [#50]

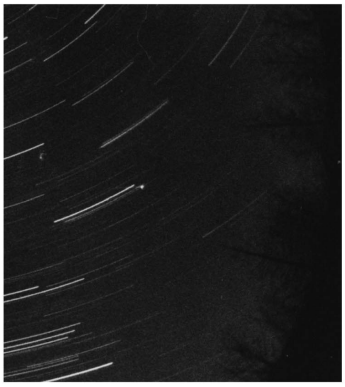
K-696
Time (JST) : 1989-11-22 18:00-19:00

K-697
Time (JST) : 1989-11-24 01:00-02:00

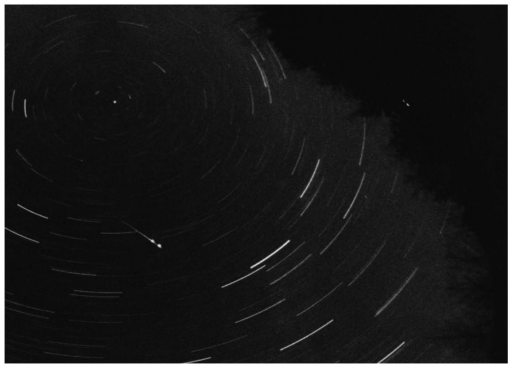
K-699,K-700
Time (JST) : 1989-12-2 01:00-02:00



K-703
Time (JST) : 1989-12-3 18:00-19:00

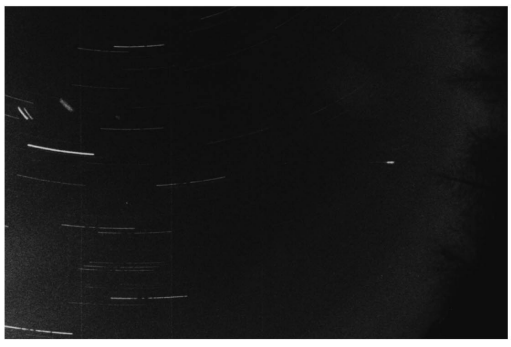


K-705
Time (JST) : 1989-12-5 02:00-03:00



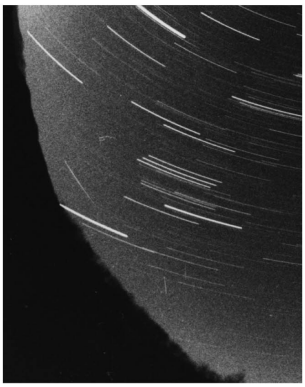
K-706
Time (JST) : 1989-12-6 03:00-04:00

K-707
Time (JST) : 1989-12-9 21:00-22:00



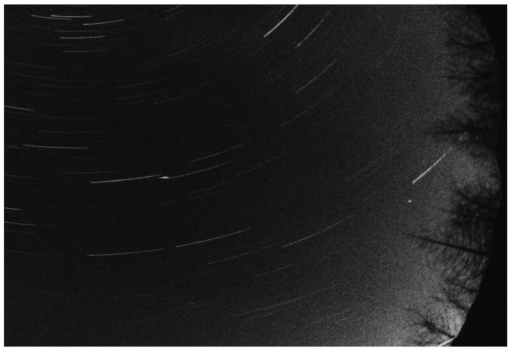
K-709
Time (JST) : 1989-12-17 23:00-24:00

Figure 57. Fireball Images [#51]

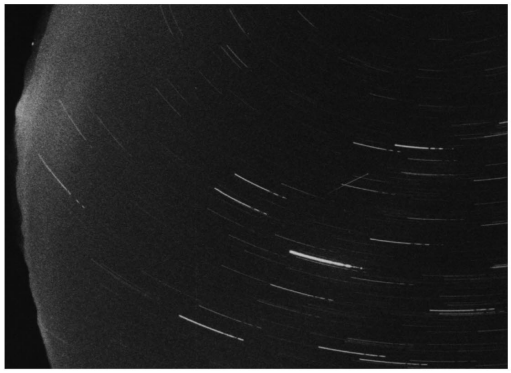


K-710
Time (JST) : 1989-12-18 20:00-21:00

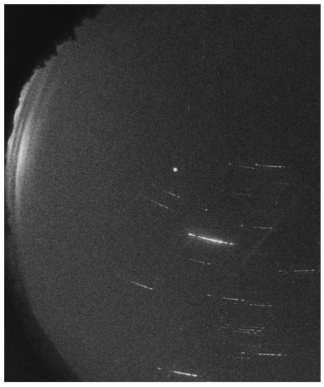
K-711
Time (JST) : 1989-12-19 01:00-02:00



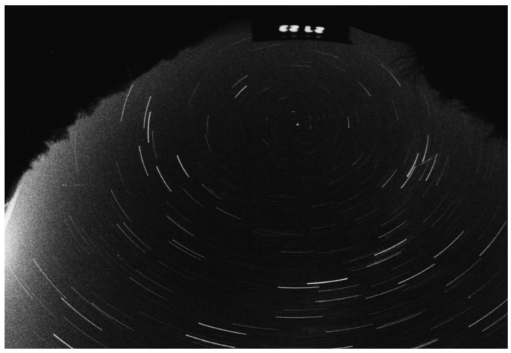
K-716
Time (JST) : 1989-12-23 18:00-19:00



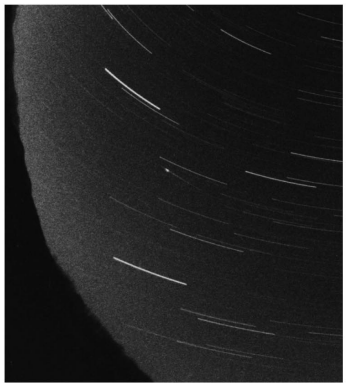
K-717
Time (JST) : 1989-12-23 22:00-23:00



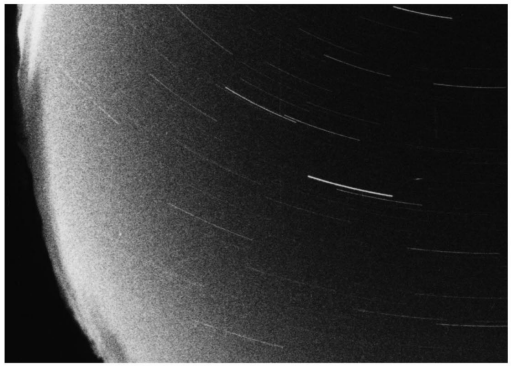
K-718
Time (JST) : 1989-12-24 22:00-23:00



K-719,K-720
Time (JST) : 1989-12-27 23:00-24:00

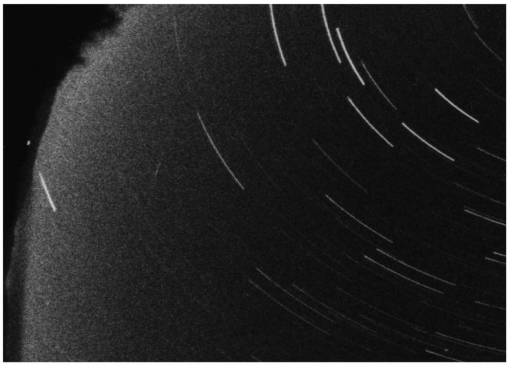


K-721
Time (JST) : 1989-12-28 03:00-04:00



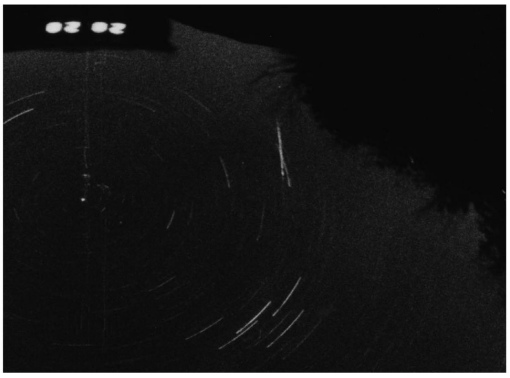
K-722
Time (JST) : 1990-1-3 05:00-06:00

Figure 58. Fireball Images [#52]

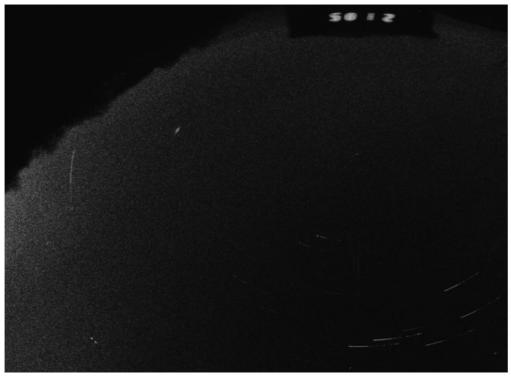


K-723
Time (JST) : 1990-1-4 00:00-01:00

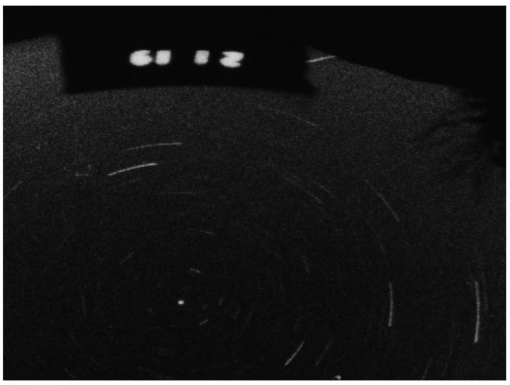
K-725
Time (JST) : 1990-1-11 23:00-24:00



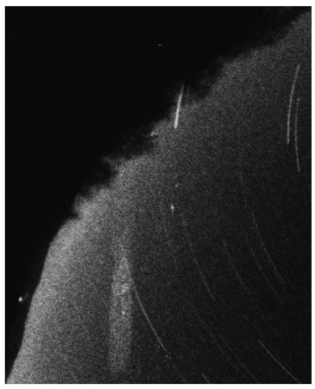
K-726
Time (JST) : 1990-1-20 20:00-21:00



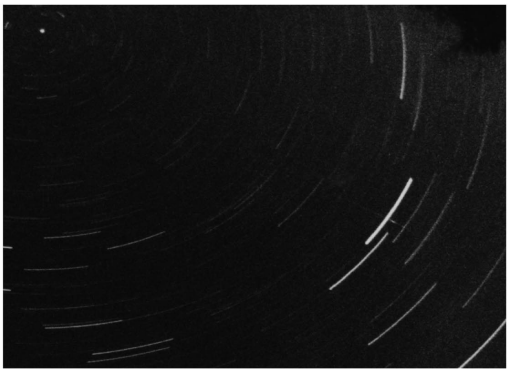
K-727
Time (JST) : 1990-1-21 05:00-06:00



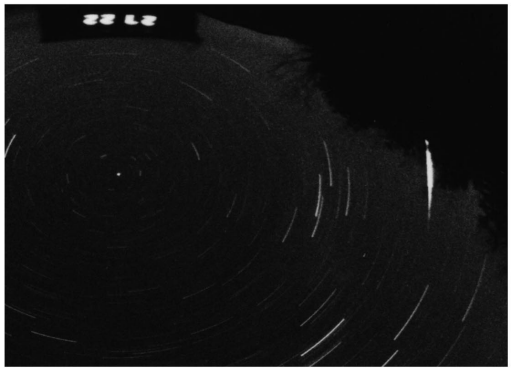
K-728
Time (JST) : 1990-1-21 19:00-20:00



K-729
Time (JST) : 1990-1-22 02:00-03:00

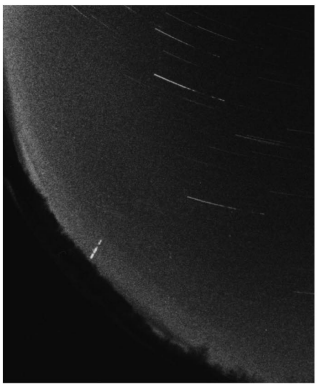


K-730
Time (JST) : 1990-1-27 01:00-02:00



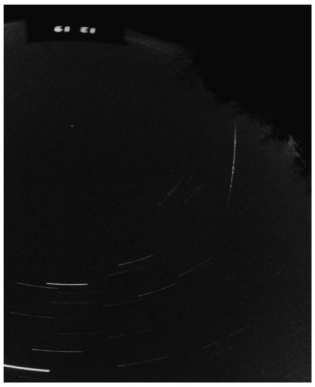
K-731
Time (JST) : 1990-1-27 22:00-23:00

Figure 59. Fireball Images [#53]

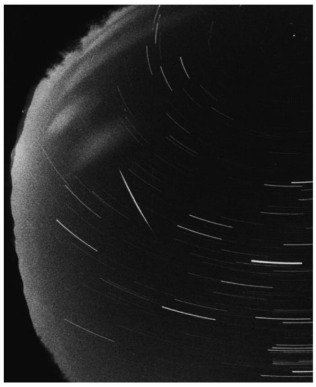


K-732
Time (JST) : 1990-2-1 22:00-23:00

K-733
Time (JST) : 1990-2-2 23:00-24:00

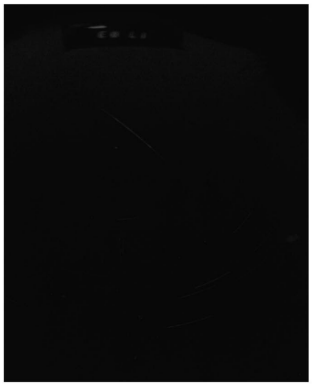


K-734
Time (JST) : 1990-2-13 19:00-20:00

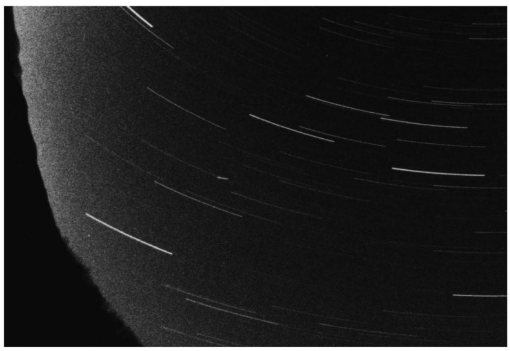


K-735
Time (JST) : 1990-2-21 19:00-20:00

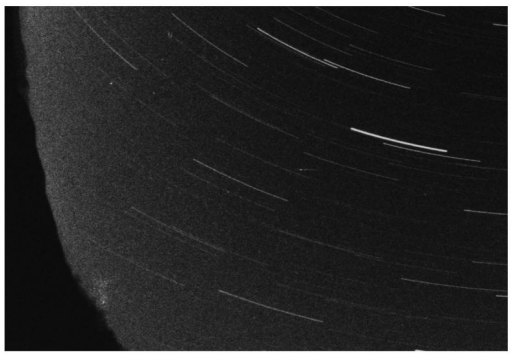
K-736
Time (JST) : 1990-2-21 21:00-22:00



K-737
Time (JST) : 1990-3-17 03:00-04:00

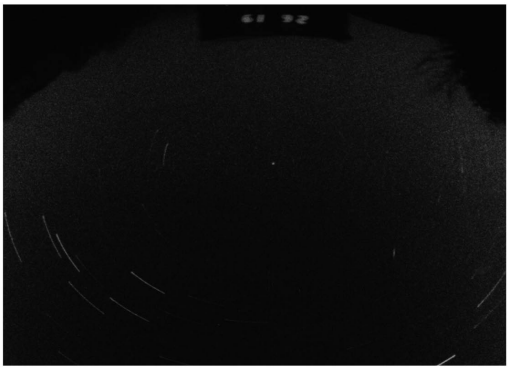


K-738
Time (JST) : 1990-3-19 21:00-22:00

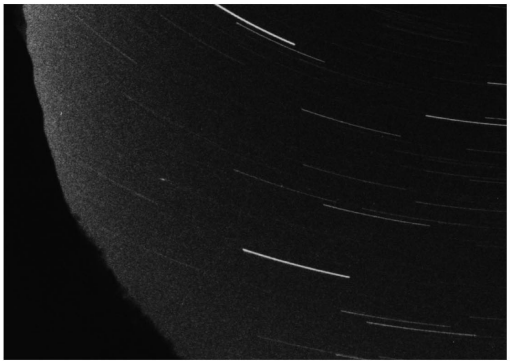


K-739
Time (JST) : 1990-3-21 00:00-01:00

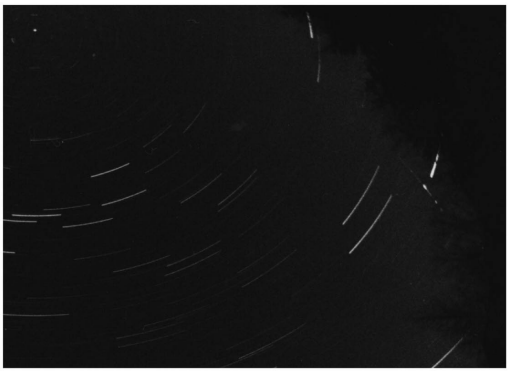
Figure 60. Fireball Images [#54]



K-740
Time (JST) : 1990-3-26 19:00-20:00



K-741
Time (JST) : 1990-3-26 22:00-23:00



K-742
Time (JST) : 1990-3-27 00:00-01:00

Figure 61. Fireball Images [#55]