FURTHER STUDIES OF COSMIC RAY BURSTS WITH SOLAR ACTIVITY

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Among the upper air observations of cosmic ray intensity, Pomerantz after a preliminary choice selected nine instances to relate them to solar flares, giving corresponding radio data and reproducing the cosmic ray records. As these were events described in some detail, it was considered desirable to examine them with reference to the evolution of corresponding solar active regions. As evolution of the region was considered, the use of available solar magnetic data previous and subsequent to the actual flares would be unobjectionable. Solar magnetic data were also available for one of the five very large solar flares connected with cosmic ray bursts and allowed good comparision. The examination has not indicated any modification of the conclusions drawn earlier.

The five recorded very big cosmic ray bursts at the time of solar flares were shown to have occurred when a particularly long-lived and continuously active solar region showed intense eruptions either at the time of its central meridian passage or at the time of its disappearance at the western limb of the sun [1]. The high-energy particles from these active solar regions would belong to a much heavier element than normally and be positively charged.

Pomerantz in 1956 [2] examined from among the high altitude observations from balloons of cosmic ray increases and solar disturbances nine instances and concluded that on four occasions cosmic rays increased at high altitudes and that it was normal on five occasions when "r/f radio disturbances and/or visually observed solar flares occurred". While in the very big five events, the high-energy particles had definite sectors of emission, it cannot be excluded a priori that smaller events cannot occur under different conditions. Particles of lighter elements may be emitted with less over-all energy which might affect the cosmic ray reception at the surface of the earth or change the geomagnetic field. It appeared desirable to re-examine Pomerantz's instances by the method used earlier.

The big cosmic ray bursts depend on the evolution and nature of the associated solar active regions. On many occasions it has not been possible to obtain these data for epochs of cosmic ray bursts. Since evolution of the active region was considered apart from the instantaneous situation, cognate data for days just preceding and days just following the events could also be utilized for confirmatory evidence. The data on the nature of the active region and the distribution of the magnetic field and the photographs in it are from

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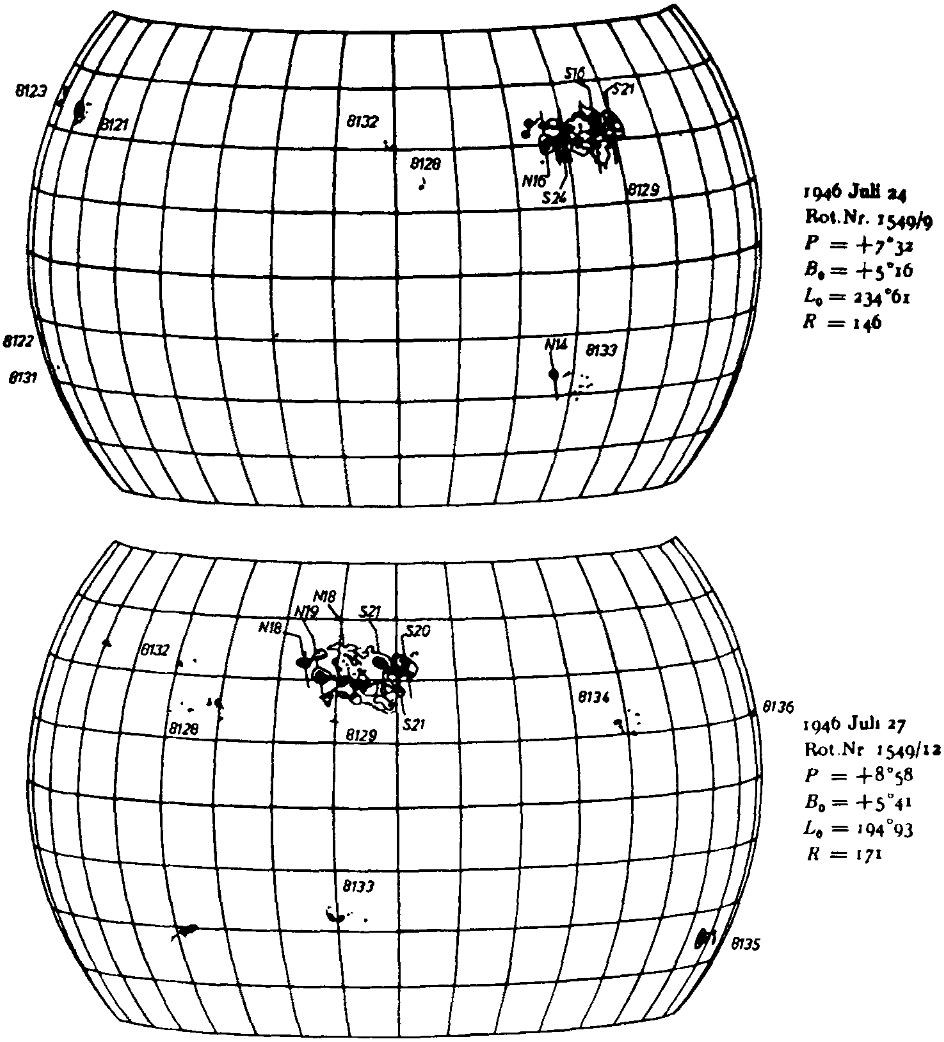

Fig. 1. Magnetic field strengths in solar active regions (from Potsdam Obsy. Publn.)

Potsdam [3]*. The classification of sun-spot groups after Quart. Bull. Solar Activity [4] saves detailed description. As a sort of comparision the events of July 25, 1946 — one of the historically recorded major events — has also been considered here.

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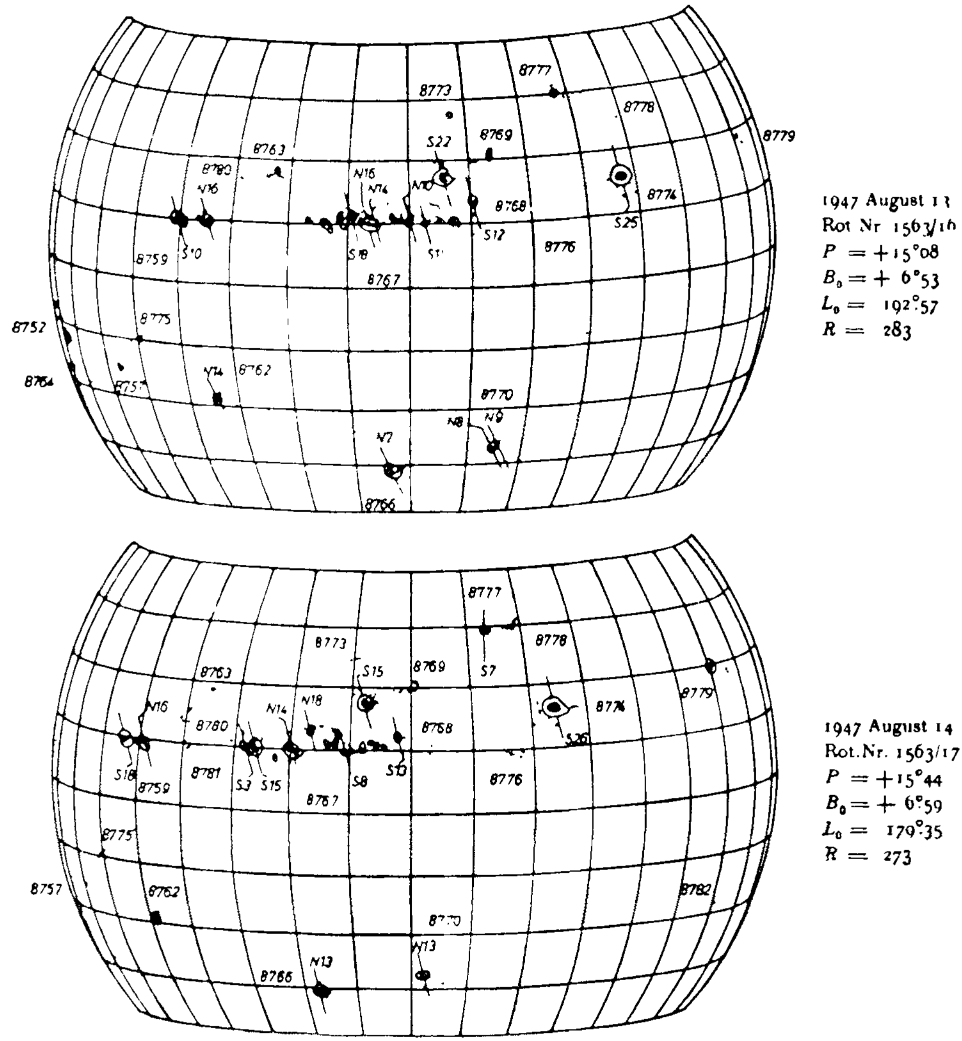

Fig. 2. Magnetic field strengths in solar active regions (from Potsdam Obsy. Publn.)

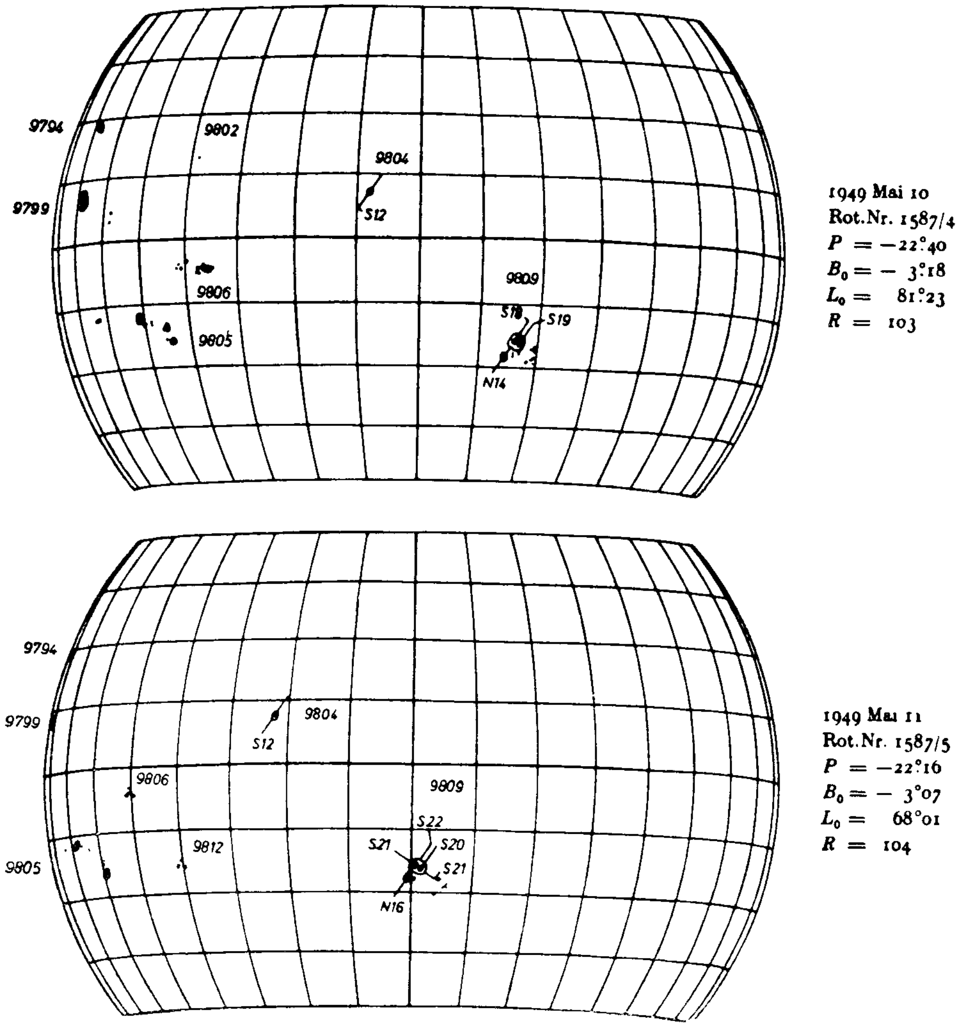

Fig. 3. Magnetic field strengths in solar active regions (from Potsdam Obsy. Publn.)

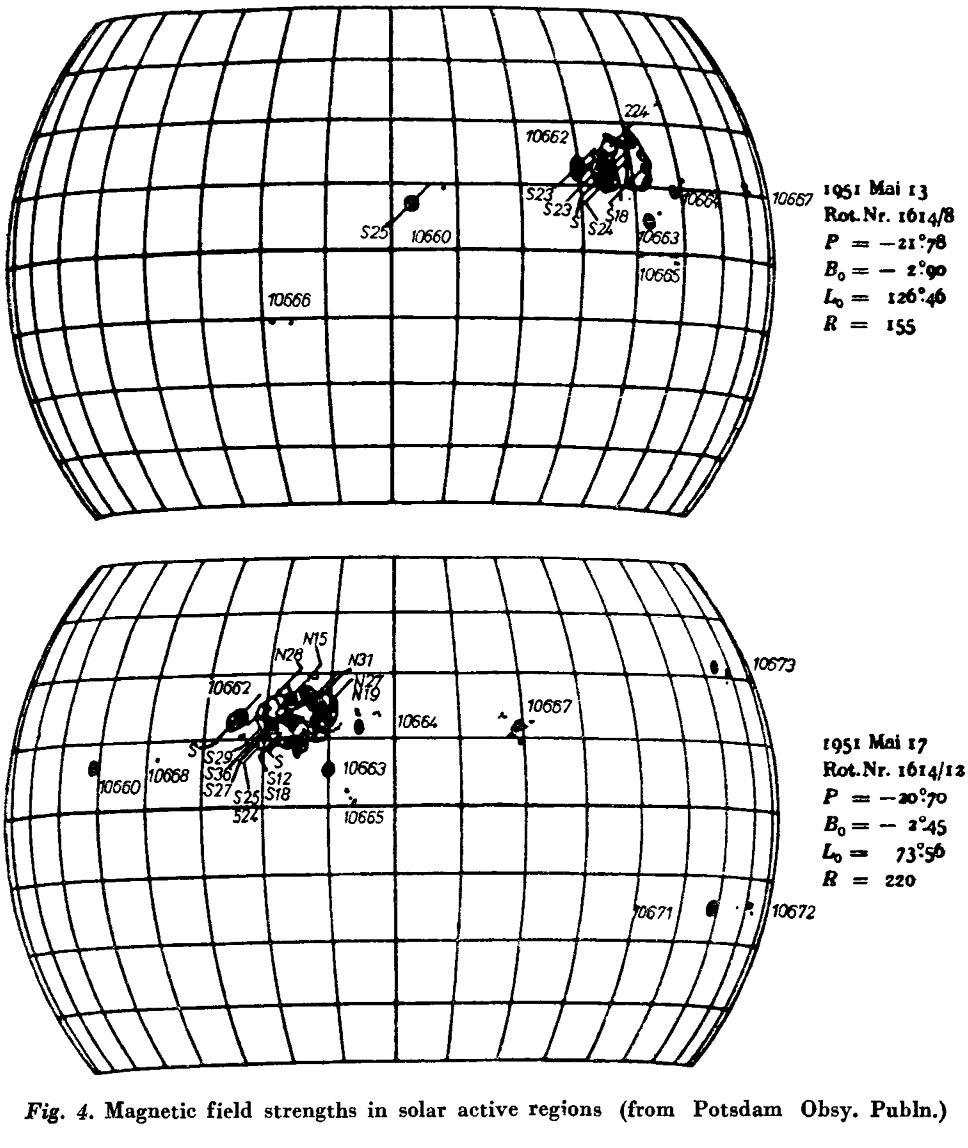

Fig. 4. Magnetic field strengths in solar active regions (from Potsdam Obsy. Publn.)

Date	Station	Time (U. T.)	Co-ordinates		Imp.
			ø	C. M. Dist.	
1947					
Aug. 8.	Canberra	*0607—0625*	12 N	71 E	1
	Zürich	1547—1555	10 N	70 E	2
	McMath	1610—1625	10 N	70 E	1
	,,	1705	5 N	55 E	1
9.	Wendelstein	*0540—0550*	8 N	63 E?	1
	,,	*0605*—0800	15 N	61 E	1—2
	Schauinsland	0735—*0750*	18 N	58 E	1
	Wendelstein	*1055—1115*	8 N	63 E	1—2
	,,	*1237—1310*	8 N	48 E	1
	,,	*1425—1640*	15 N	61 E	1—2
	,,	*1620—1635*	8 N	48 E	1
10.	Wendelstein	0630—*0750*	11 N	46 E	1
	,,	0630—*0730*	20 N	50 E	2
	,,	*0810—0830*	12 N	51 E	2
	,,	*0926—0944*	11 N	46 E	1
	,,	*0959—1010*	12 N	51 E	1
	,,	*1213—1315*	10 N	37 E	2
	,,	*1515*—1630	11 N	46 E	1
	,,	*1604*—1630	12 N	51 E	1—2
	McMath	1635—1715	15 N	50 E	2
11.	Sherborne	0954—1010	13 N	40 E	1
	Schauinsland	1215—*1222*	8 N	12 E	1
	McMath	1705	10 N	10 E	1
	,,	2018	10 N	30 E	1
12.	Zürich	0700—*0740*	11 N	11 E	1
	Schauinsland	0710—*0836*	10 N	4 E	2
	Wendelstein	0710—*0836*	10 N	4 E	2
	Zürich	0834—*0839*	13 N	2 W	1
	Sherborne	*1154*—1213 (Max. 1157)	9 N	0	1
	Zürich	1204—*1215*	9 N	4 E	1
	Greenwich	*1400—1501* (Max. 1409)	13 N	24 E	3
	McMath	1403	10 N	15 E	2
	Schauinsland	1437—1530	11 N	21 E	2
	McMath	1605	10 N	15 E	1
	Sherborne	1730—1740	13 N	10 E	1
	McMath	1830	10 N	5 E	1
	,,	2000	10 N	15 E	1
13.	Canberra	*0100*—0110	9 N	5 W	1
	Schauinsland	0602—0645	13 N	16 E	2
	Wendelstein	0602—0645	13 N	16 E	2
	Zürich	0623—0635	11 N	12 E	2
	Muswell Hill	0640—0700 (Max. 0645)	3 N	15 E	1
	,, ,,	*0700*	10 N	0	2
	Greenwich	1034—1100	9 N	7 W	2
	Muswell Hill	*1045*—1100	10 N	7 W	2
	Meudon	1048—*1055*	10 N	10 W	1
	Arcetri	1053—1058	10 N	6 W	2
	Schauinsland	*1155—1200*	9 N	2 W	1
14.	Schauinsland	*1233—1240*	9 N	19 W	2
	Wendelstein	*1440—1450*	11 N	35 W	1
	McMath	1443	13 N	30 W	1
	McMath	1640	15 N	30 W	1

Date	Station	Time (U. T.)	Co-ordinates		Imp.
			⌀	C. M. Dist.	
Aug. 14.	Wendelstein	1740—*1815*	11 N	34 W	1—2
	Mt. Wilson	*1740*—1745	10 N	34 W	1
	McMath	1745	15 N	30 W	2
	Meudon	1750—1756	11 N	30 W	2
15.	Schauinsland	0540—*0553*	14 N	31 W	1
	,,	*0545—0620*	9 N	40 W	2
	Wendelstein	*0545—0620*	9 N	40 W	2
	Muswell Hill	*1100—1200* (Max. 1145)	10 N	50 W	1
16.	Wendelstein	*0705—0738*	11 N	56 W	1
	,,	*0807—0815*	10 N	49 W	1
	Schauinsland	0852	7 N	45 W	1
	Greenwich	1005—*1015*	9 N	57 W	1
	Wendelstein	1008—1016	10 N	50 W	2
	,,	*1342—1350*	9 N	43 W	1
	,,	*1705—1725*	9 N	38 W	1—2
17.	Mt. Wilson	1630—1642	10 N	70 W	1
	McMath	1650	15 N	60 W	1
	Wendelstein	1740—1755	12 N	62 W	1
	Zürich	1747—1800	11 N	64 W	3
18.	Zürich	0618—*0705*	10 N	61 W	2
	Schauinsland	0627—0740	9 N	63 W	1
	Arcetri	0943—0948	13 N	90 W	1
	,,	0943—0948	10 N	60 W	1
19.	Arcetri	1338—1543	10 N	90 W	1
1949					
May 5.	Ondrejov	1300	17 S	75 E	1+
6.	,,	0725—0748	18 S	62 E	1
	,,	*0833—0910* (Max. 0838)	15 S	71 E	1
	Edinburgh	0855—*0920*	15 S	75 E	1
	Kodaikanal	0900	17 S	70 E	1
	Mt. Wilson	1735—*1750* (Max. 1745)	17 S	70 E	1
7.	McMath	2045	23 S	55 E	2
	Mitaka	2219—2300	18 S	45 E	1
8.	Mt. Wilson	*1524—1716* (Max. 1556)	16 S	40 E	2+
	McMath	*1528*—1720	24 S	37 E	3—
	Schauinsland	1529—*1645* (Max. 1531)	13 S	46 E	2
	Huancayo	1545—1648	18 S	31 E	1
	Kanzelhöhe	1646—1735	18 S	37 E	1
	Meudon	1715—1804	17 S	40 E	2
	Mt.Wilson	*1951—2006* (Max. 1953)	17 S	39 E	2
	McMath	*1958—*	24 S	37 E	2
9.	Mitaka	0000—*0015*	20 S	27 E	1
	,,	*0353—0428*	18 S	28 E	1
	Kanzelhöhe	*0635—0647*	17 S	27 E	1
	Mt. Wilson	*1508—1518* (Max. 1514)	17 S	25 E	1
10.	Kodaikanal	0330—0430 (Max. 0345)	17 S	20 E	2
	Canberra	*0330—0350*	18 S	18 E	2

Date	Station	Time (U. T.)	Co-ordinates		Imp.
			ø	C. M. Dist.	
May 10.	McMath	*2002—2220*	20 S	12 E	3+
		(Max. 2011)			
	Mitaka	*2108—2217*	18 S	5 E	1—2
16.	Ondrejov	0921—0935	21 S	64 W	1
Aug. 12.	Cambridge	0944—1004	12 N	90 E	1
15.	Mitaka	0450—0610	14 N	60 E	1
16.	Wendelstein	1657—1741	16 N	29 E	1—2
		(Max. 1712)			
	McMath	*1700—1830*	13 N	22 E	2?
		(Max. 1748)			
	Mt. Wilson	1709—1900	11 N	30 E	2
		(Max. 1759)			
18.	McMath	*1953—2020*	14 N	10 E	1
	Mt. Wilson	*2151—2204*	14 N	7 E	1
		(Max. 2153)			
19.	Kodaikanal	0250—0315	12 N	5 W	1
	Meudon	0722	14 N	2 E	1
	Mt. Wilson	*2105—2150*	16 N	9 W	2
		(Max. 2111)			
	McMath	*2105—2206*	13 N	10 W	3
		(Max. 2110)			
	Mt. Wilson	*2337—2341*	15 N	7 W	1
20.	McMath	1550—	12 N	10 W	1
	Mitaka	2350—*2355*	12 N	28 W	1
21.	Mitaka	*0050—0102*	12 N	28 W	1
	Mitaka	*0350—0415*	14 N	26 W	1
	Zürich	*1110—1118*	15 N	25 W	1
23.	Ondrejov	*1235—1250*	12 N	55 W	1
24.	Mitaka	0324—0334	9 N	68 W	1
25.	Kanzelhöhe	1430—1434	10 N	90 W	1
Oct. 1.	Kodaikanal	0418—0423	10 N	80 E	1
	Greenwich	1018—1026	9 N	85 E	?
	McMath	1415—	5 N	85 E	1+
	Mt. Wilson	*1705—1723*	8 N	76 E	1
		(Max. 1710)			
	Mitaka	*2154—2202*	9 N	69 E	1
2.	Mitaka	*0035—0119*	5 N	70 E	1
	,,	*0246—0309*	7 N	69 E	1
	,,	*0410—0437*	9 N	69 E	1
	Schauinsland	1345—*1437*	9 N	68 E	2
		(Max. 1405)			
	Mt. Wilson	*1822*—1836	7 N	64 E	1
		(Max. 1827)			
	,,	*2339—2357*	8 N	62 E	1
		(Max. 2349)			
	Mitaka	*2341—2349*	8 N	60 E	1
3.	Kodaikanal	0314—0530	8 N	50 E	3
		(Max. 0318)			
	Mitaka	0317—0336	7 N	50 E	2
	Carter. N. Z.	0339—0424	9 N	52 E	2
	Wendelstein	1053—*1104*	6 N	49 E	1—2
	Edinburgh	*1114—1226*	8 N	50 E	2
		(Max. 1156)			
	Wendelstein	*1144—1219*	5 N	50 E	2
		(Max. 1158)			
	Kanzelhöhe	1609—1614	8 N	47 E	1

Date	Station	Time (U. T.)	Co-ordinates		Imp.
			ø	C. M. Dist.	
Oct. 3.	Mt. Wilson	*1736—1842* (Max. 1756)	8 N	48 E	1
	Mt. Wilson	*2302*—2352 (Max. 2333)	8 N	44 E	1
4.	Kanzelhöhe	0555—*0635*	7 N	43 E	1
	,,	0741—*0755* (Max. 0747)	6 N	38 E	1+
	,,	0755—0810	11 N	39 E	1
	Arcetri	0800	8 N	47 E	1
	Wendelstein	*1309—1346* (Max. 1317)	11 N	35 E	2
	Zürich	*1310—1337* (Max. 1317)	10 N	37 E	1
	Kanzelhöhe	1320—1338 (Max. 1324)	10 N	35 E	1+
	Greenwich	1323—1342 (Max. 1324)	13 N	36 E	2+
	Mt. Wilson	1610—*1637* (Max. 1623)	14 N	30 E	2
	Kanzelhöhe	1618—1628	13 N	33 E	1
	Mt. Wilson	*1900—1917* (Max. 1908)	6 N	32 E	1
5.	Muswell Hill	*1105—1130*	5 N	30 E	1
	Wendelstein	*1111—1134* (Max. 1120)	5 N	31 E	1—2
	Greenwich	1114—*1126* (Max. 1119)	9 N	25 E	2
	Edinburgh	*1114—1135* (Max. 1120)	11 N	32 E	1
	Kanzelhöhe	1120—*1135*	8 N	31 E	1+
6.	Kodaikanal	0452	8 N	17 E	1
	Canberra	*0455—0505*	8 N	25 E	1
	Kanzelhöhe	*0920—0952* (Max. 0923)	10 N	11 E	1
	Ondrejov	*0920—0934* (Max. 0925)	13 N	10 E	1
	Wendelstein	1121—*1200* (Max. 1138)	11 N	10 E	1—2
	Kanzelhöhe	1130—*1210* (Max. 1142)	11 N	11 E	1
	Ondrejov	1134—1201 (Max. 1135)	15 N	8 E	1
	Greenwich	1136—1203 (Max. 1142)	11 N	11 E	2
	Kanzelhöhe	1230—*1234*	9 N	8 E	1
	Wendelstein	*1316—1336* (Max. 1324)	7 N	10 E	1
	Kanzelhöhe	1326—*1403*	6 N	10 E	1+
	Greenwich	1338—*1348*	6 N	9 E	2?
7.	Mitaka	*0232—0238*	11 N	4 E	1
10.	Ondrejov	*0950—1010* (Max. 0953)	17 N	58 W	1+
11.	,,	*0750—0805* (Max. 0753)	14 N	55 W	2
	Wendelstein	0757—*0811*	11 N	52 W	1
	Ondrejov	1422—1430	8 N	61 W	1

Date	Station	Time (U. T.)	Co-ordinates		Imp.
			ø	C. M. Dist.	
Oct. 11.	Mt. Wilson	2116—*2437?* (Max. 2120)	8 N	60 W	1
8.	Kodaikanal	0452	18 N	71 E	2
	Ondrejov	1017—1028 (Max. 1021)	16 N	65 E	1
	Schauinsland	1310—1331	21 N	62 E	2
	Ondrejov	1312—*1335* (Max. 1316)	22 N	78 E	2
9.	Kanzelhöhe	0829—0843	19 N	47 E	1
	,,	0937—0950	18 N	54 E	1
10.	Mitaka	*0427—0437*	17 N	45 E	1
	,,	*0628—0638*	17 N	45 E	1
11.	,,	*0124—0135*	16 N	32 E	1
	Carter, N. Z.	0207—0228	18 N	27 E	2
	Canberra	—0235	22 N	53 E	1
	Kodaikanal	0235—0240	14 N	31 E	1
	Wendelstein	*1139—1323* (Max. 1150)	20 N	25 E	2
	Ondrejov	*1514—1540* (Max. 1523)	19 N	22 E	2
	Wendelstein	1516—1527	21 N	23 E	2
	Mt. Wilson	1539—*1654* (Max. 1551)	19 N	22 E	2
12.	Ondrejov	0722—*0729*	22 N	12 E	1
	Kanzelhöhe	1131—*1250*	19 N	12 E	1
	Greenwich	1140—*1220*	19 N	9 E	1+
13.	Ondrejov	1118—*1251* (Max. 1147)	21 N	4 W	2
	Kanzelhöhe	1130—1246 (Max. 1150)	19 N	1 E	2+
	Zürich	1225—*1252*	18 N	2 E	2
15.	Arcetri	0846	20 N	27 W	2
	Edinburgh	*1048—1151* (Max. 1058)	19 N	28 W	1
	Greenwich	*1055—1125* (Max. 1101)	19 N	27 W	2—
	Wendelstein	1058—1120 (Max. 1104)	21 N	25 W	1
	Ondrejov	*1242—1248* (Max. 1246)	21 N	35 W	1
	Kanzelhöhe	*1456—1542*	20 N	30 W	1
	Mt. Wilson	1536—*2000* (Max. 1640)	20 N	31 W	1+
	Huancayo	1630—1700 (Max. 1640)	25 N	38 W	2+
	Mt. Wilson	1630—1640 (Max. 1635)	21 N	42 W	1
16.	Mitaka	*0127—0135*	18 N	33 W	1
	Kodaikanal	0225	18 N	40 W	1
	Schauinsland	0736—*0805*	20 N	40 W	1
	Ondrejov	0746—*0807*	22 N	39 W	1
	Arcetri	0821	20 N	39 W	2
	Edinburgh	*1456—1516* (Max. 1500)	20 N	44 W	1
	Kanzelhöhe	1500—*1512*	21 N	44 W	1+
	Ondrejov	1502—1515	19 N	37 W	1+

Date	Station	Time (U. T.)	Co-ordinates		Imp.
			ø	C. M. Dist.	
Oct. 16.	Mt. Wilson	1716—*1840*	20 N	48 W	1
17.	Mt. Wilson	1724—1734	20 N	58 W	1+
18.	Zürich	*0940—0955*	19 N	65 W	1
1951		(Max. 0945)			
Nr. (5)					
Jan. 27.	Edinburgh	1204—*1245*	8 N	8 E	1
	,,	*1530*—1600	8 N	6 E	1
		(Max. 1534)			
28.	Mitaka	*2343—2354*	11 N	11 W	1
Feb. 2.	Mitaka	*0121—0124*	10 N	60 W	1
Nr. (6)					
Jan. 22.	Huancayo	1630—1700	10 S	90 E	1
27.	Edinburgh	*1515—1535*	12 S	17 E	1
		(Max. 1517)			
	Mt. Wilson	1956—2438	10 S	9 E	2
Nr. (7)					
Jan. 24.	Mitaka	0524—0544	8 N	76 E	1
25.	,,	0158—0203	10 N	60 E	1
	,,	*0302*—0308	8 N	62 E	1
	Meudon	1028	7 N	58 E	1+
	Schauinsland	1043—1118	8 N	62 E	1
	Mitaka	2330—2350	8 N	49 E	1
26.	Mitaka	0512—*0527*	7 N	40 E	1
27.	Mitaka	*0250—0255*	9 N	25 E	1
	,,	*0418—0435*	8 N	23 E	1
	Edinburgh	1048—*1120*	9 N	28 E	1
28.	Mitaka	2338—*2343*	14 N	0	1
29.	Herstmonceux	*0953—1005*	18 N	10 W	1
		(Max. 0956)			
	Herstmonceux	0149—0201	8 N	29 W	1
Feb. 1.	Mitaka	*0040—0052*	4 N	40 W	1
	,,	0149—0201	8 N	29 W	1
Nr. (13)					
May 8.	McMath	1505	10 N	90 E	2
	Mt. Wilson	*1506*—1514	12 N	90 E	1
		(1508)			
10.	Herstmonceux	1012—*1024*	12 N	73 E	2—
11.	Canberra	0120—0131	10 N	65 E	1
	,,	*0153*—0215	0	70 E	1
	,,	0610—0615	10 N	70 E	1
	Herstmonceux	1015—*1026*	17 N	59 E	1
		(Max. 1018)			
12.	Kodaikanal	0215—0240	15 N	55 E	1
	Arcetri	0933	15 N	45 E	1
	McMath	1255	12 N	50 E	1
	,,	1920	12 N	50 E	1
13.	Meudon	0705	10 N	40 E	1+
	Zürich	0943—1005	15 N	37 E	2
	Ondrejov	1254—*1316*	14 N	36 E	1
	McMath	1314	10 N	35 E	1+
14.	Kodaikanal	0240	12 N	35 E	1
	Kanzelhöhe	1146—1204	16 N	26 E	1
	Mt. Wilson	2245—2322	14 N	19 E	2
		(Max. 2253)			
15.	McMath	1315—1415	16 N	10 E	1+
		(Max. 1330)			

Date	Station	Time (U. T.)	Co-ordinates		Imp.
			⌀	C. M. Dist.	
May 15.	Canberra	2332—2415	5 N	0	1
16.	Arcetri	0938	12 N	15 W	1
	Edinburgh	1016—1031 (Max. 1023)	15 N	2 W	1
	Herstmonceux	1025—*1032*	15 N	3 W	1
	McMath	*1659—1810*	15 N	5 W	2
17.	Canberra	*0108—0125*	15 N	10 W	1
	Meudon	1442—*1455*	12 N	20 W	1
	Herstmonceux	1447—*1525* (Max. 1451)	15 N	16 W	1
	Edinburgh	1504—1524	21 N	15 W	1
	,,	1527—*1601*	13 N	17 W	1
	Herstmonceux	*1533—1548* (Max. 1535)	15 N	16 W	1
	Huancayo	*1637—1643*	15 N	21 W	1
	Canberra	2333—*2358*	10 N	20 W	1
18.	Canberra	0145—0153	12 N	25 W	1
	,,	*0201—0227*	20 N	20 W	2
	Kodaikanal	0215—0315	16 N	22 W	1
	Canberra	0314—0325	16 N	30 W	1
	Kanzelhöhe	0725—0949	15 N	28 W	1
	Ondrejov	0739—0758 (Max. 0743)	15 N?	28 W?	1+
	Cambridge	1020—1225 (Max. 1050)	12 N	35 W	?
	Edinburgh	1021—1337 (Max. 1028)	16 N	30 W	3
	Kanzelhöhe	1022—1258 (Max. 1050)	15 N	29 W	2
	Ondrejov	1025—*1154*	12 N	26 W	2
	Zürich	1028—*1320*	15 N	29 W	3
	Herstmonceux	1043—1316 (Max. 1112)	13 N	29 W	3
	Saltsjobaden	1045	15 N	30 W	3
	McMath	1155—*1415*	11 N	30 W	2+
	Creteil	1300	18 N	35 E	3
	Meudon	1303—*1330*	15 N	33 W	2
	Kanzelhöhe	1621—1623	19 N	28 W	1
	McMath	*1956—2100* (Max. 2000)	17 N	35 W	2+
	Mt. Wilson	*1959—2050* (Max. 2010)	17 N	43 W	1
19.	Kanzelhöhe	0445—*0452*	14 N	46 W	1+
	Zürich	*0734—0745*	7 N	39 W	1
	,,	*0832—0845*	16 N	37 W	1
	,,	0858—*0937*	13 N	39 W	1
	Kanzelhöhe	0901—0930	16 N	41 W	1
	Ondrejov	*1345—1421* (Max. 1351)	18 N	45 W	1
	Schauinsland	1350—*1430*	18 N	38 W	2
	Edinburgh	1415—1425	20 N	45 W	1
	McMath	1949—2040 (Max. 1957)	12 N	43 W	3—
20.	Ondrejov	0431—0509 (Max. 0447)	6 N	69 W	1
	,,	0657—*0718* (Max. 0703)	13 N	55 W	1

Date	Station	Time (U. T.)	Co-ordinates		Imp.
			ø	C. M. Dist.	
May 20.	Kanzelhöhe	0817—0845	16 N	58 W	2
	Ondrejov	0819—0850 (Max. 0832)	12 N	65 W	1
	Meudon	0843	17 N	60 W	1+
	Mt. Wilson	1956—2014 (Max. 2000)	13 N	68 W	1
	McMath	1957	12 N	60 W	2—
21.	Kodaikanal	0218—0310	8 N	67 W	1
	Zürich	1255—*1303*	8 N	75 W	1
	Herstmonceux	*1308—1337* (Max. 1313)	11 N	75 W	1+
	Kanzelhöhe	1320—1323	4 N	68 W	1
	Arcetri	1336	6 N	72 W	2
	Herstmonceux	*1612—1623* (Max. 1615)	11 N	76 W	1
22.	Kanzelhöhe	0439—0442	11 N	85 W	1
	Ondrejov	0918	6 N	84 W	1
	Zürich	1540—1545	14 N	80 W	1
23.	McMath	1310	13 N	90 W	1
Nr. (16)					
May 15.	Ondrejov	1127—1145	13 N	18 E	2+
	McMath	1150	12 N	17 E	2
	Mt. Wilson	2307—2330 (Max. 2315)	10 N	18 E	1
16.	McMath	*1409—1529* (Max. 1418)	10 N	5 E	1
	,,	*1558—1647*	10 N	5 E	1
	,,	2047	10 N	5 E	1
17.	Herstmonceux	*1754*—1815 (Max. 1758)	11 N	10 W	2
	Edinburgh	*1759*—1845	12 N	9 W	2

Summary Table

Year	No.	Co-ordinates ø	Co-ordinates L	Co-ordinates Date at	C. M. Passage Age at	No. of Distinct Obsd. Flares	Type of Active Region	Field in 100 Oersteds	Date Balloon Ascent	C. M. Dist.	Cosmic Ray Change	Geomagnetic Change Later	Dates of Solar Field
1946	7	21 N	198	Jul. 26. 8	>6	37	F. - A large classification	24	—	—	Flare enhanced even *ground*	a storm	July 24, 27
1947	32	10 N	190	Aug. 13. 2	>6	53	E. - Nowhere of much area line of spots	18	Aug. 12	—	normal	s. c. 12. 3	Aug. 13, 14
1949/2	30	17 S	60	May 11. 6	+7?	15	D or C, prob. fading after May 10th	22	May 11	—	enhanced	s. c. 11. 2 plus storm	May 10, 11
1949/3 1949	26	15 N	178	Aug. 19. 5	>6	17	D type following B type one. Not very active	—	Aug. 19	—	normal	nil	—
1949/4	7	9 N	254	Oct. 7. 3	>6	35	D type. Not very active	25	Oct. 4 (nearly three days before C. M. passage)		normal	s. c. 4. 2	
1949/4	8	20 N	172	Oct. 13. 5	5	27	C type becoming D and later degrading to B	—	Oct. 11 (two days before CM passage)		normal	s. c. 11. 4	
1951/1	5 6 7	9 N 10 S 8 N	68 66 52	Jan. 28. 2 Jan. 28. 4 Jan. 29. 5	+5? >6 >6	4) 3) 14)	No data		Jan. 27	—	enhanced	nil	
1951/2 1951/2	13 16	14 N 12 N	85 72	May 16. 1 May 17. 1	>6 >6	49 6	E type. No >2 Flare till 18th	36	May 17	—	enhanced	nil	May 13, 17
1952				No Data Reported					Jan. 17 1952	—	enhanced		

July 26, 1946.

This has been described earlier [1] as one of the five very large recorded solar flare periods when a cosmic ray burst occurred. The solar active region had a long history of great activity and the large flare near the C. M. passage of the sun gave rise to a cosmic ray burst followed by a cosmic ray related geomagnetic storm. From the photographs from Potsdam, the region was of very large type with a marked magnetic field.

Aug. 12, 1947.

The activity and the largest magnetic field of the related region was less than the previous one. The active region is a linear one with a relatively small breadth. The balloon ascent took place near about the time of the C. M. passage of the centre of the group of linear smaller regions. The geomagnetic storm occurred about the same time.

May 11, 1949.

The solar active region is a small one, though the largest magnetic field as measured on the sun is relatively large. After the big flares on 10th May, nearly a day before the C. M. passage, there has been only one recorded flare on the 16th. The region was apparently dissolving itself. Has a resemblance to those regions [1] when only geomagnetic storms were reported on the ground, without a cosmic ray burst at the time of a flare.

Aug. 19, 1949.

Though the active region was observed from limb to limb of the sun, the eruptions are not very marked and the region was of small type. It produced no ground effects and no upper air cosmic ray changes.

Oct. 4, 1949.

The solar active region observed from 80 E to 60 W. Though the highest observed magnetic field was quite marked the extent of the region is a small one. Balloon ascent nearly three days before the C. M. passage of the region which was decreasing in importance from 4th. After the C. M. passage flares observed towards end of its life.

Oct. 11, 1949.

Solar active region observed from 71 E to 65 W. C type region becoming D, degrading later to one of B. Balloon ascent two days before the C. M. passage. The activity of the region not marked.

Jan. 27, 1951.

Three minor solar active regions were approaching the C. M. of the sun. There are no solar magnetic data. Upper air cosmic ray *enhancement.*

May 17, 1951.

A large E type spot with a very marked magnetic field. Up to the day of balloon ascent the eruptions not very marked. Next day when the region had passed nearly 30 away from the C. M. the flares of importance 3 were observed twice *independently.* No geomagnetic storm followed. Upper air cosmic ray *enhanced.*

Jan. 17, 1952.

No solar active region reported and there was no geomagnetic disturbance. Radio disturbance has been quoted by POMERANTZ at the time of upper air cosmic ray *enhancement.*

In the instances given by POMERANTZ, none of the related solar active regions were markedly active over an extended period, compared with the five very big regions quoted earlier : except in the case of May, 1949 ; among the four occasions when cosmic ray increases were recorded no geomagnetic storm has been recorded at about the epoch. Whether *M* regions of Bartels are responsible for events of *Jan. 17, 1952* would be a difficult question to decide. The study of emission of particles which might have given rise to enhancement of upper air cosmic rays would be possible if more data than at present available could be collated. The facts presented here do not contradict or come in the way of the arguments used about the very large solar flares when cosmic bursts also occurred simultaneously. It would be necessary to examine all relevant data so as to obtain a picture of the geophysical and extra-terrestrial control of emission from the sun.

The cosmic ray enhancements have belonged to compact large area active regions in the sun with strong magnetic fields. A loosely distributed area of active region has produced little effect. This in an additional criterion to those already given [1]: of long life and of exceptional activity on the sun at the stage of C·M passage or near the western limb.

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ДАЛЬНЕЙШИЕ ИССЛЕДОВАНИЯ ЛИВНЕЙ КОСМИЧЕСКОГО ИЗЛУЧЕНИЯ, СВЯЗАННЫХ С СОЛНЕЧНОЙ АКТИВНОСТЬЮ

Ш. Л. МАЛУРКАР

Резюме

Из наблюдений интенсивности космического излучения в стратосфере Померанц выбрал после предварительной селекции девять случаев, связанных с солнечными вспышками, приводя соответствующие радио-данные и воспроизводя записи космического излучения. Так как они являются случаями, описанными детально, мы сочли желательным их исследование с учетом эволюции соответствующей активной солнечной области.

Так как была исследована эволюция области, солнечные магнитные данные до и после самой вспышки считались безупречными. Солнечные магнитные данные были доступны также в случае одной из пяти самых больших вспышек, связанных с ливнями космического излучения, и этот факт дал хорошую возможность для сравнения. Результаты исследования не потребовали внести изменение в наши предыдущие выводы.