ANALYSIS OF POLAR CAP ABSORPTION EVENTS
II. TIME RELATION OF MAJOR FLARES AND RF EMISSIONS AT CENTIMETER WAVELENGTHS

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TABLES

1.0 RESULTS AND CONCLUSIONS

This study has been devoted to the analysis of 142 flares that were observed during the years 1954 through 1963, and assigned an importance of 3 or 3+ in the McMath-Hulbert Working List. We have studied the relationship of these flares to all known radio frequency emissions at 1500, 2000, 2800, 2980, 3000, and 3750 Mc/s, that occurred at the time of the flare. The area and magnetic classification of the sunspot groups on flare day, and the age of the associated plage region in solar rotations have been considered.

1.1 TIME RELATION OF FLARES AND RF EMISSIONS

We find that for flares followed by an important PCA event the time of RF peak intensity coincided with or followed the time of the flare maximum intensity ($\Delta t \geq 0$) in 76.5% of the cases; while $\Delta t < 0$ for 92% of the flares not followed by a PCA event.

1.2 FLARES AND RF PEAK EMISSION

The RF peak intensity exceeded 500×10^{-22} W $(m^2 c/s)^{-1}$ for 87% of the flares that were followed by a PCA event while the flux was less than 500×10^{-22} W $(m^2 c/s)^{-1}$ for 76% of the flares not followed by a PCA event (including cases where the flare occurred during the normal observing time of at least one observatory and no flux was reported).

1.3 FLARES AND SUNSPOT AREAS ON FLARE DAY

Of the major flares during 1954 through 1959, 71.8% occurred in sunspot groups that on flare day had an area $\geq$ 500 millionths

of the solar hemisphere while 92% of the flares that were followed by a PCA event had areas greater than 500 millionths.

1.4 FLARES AND SUNSPOT MAGNETIC CLASS ON FLARE DAY

The magnetic classification of the associated sunspot group is not known on flare day for 21 spot groups. Ten of these flares occurred at either the east or west limb of the sun. Forty-seven per cent of the flares that occurred on days when the sunspot magnetic classification was known were classified as either γ or $\beta\gamma$. Only 39% of the γ or $\beta\gamma$ sunspots were followed by a PCA event. On the other hand, the flare-day magnetic classification is known for 32 of the PCA-flares and 69% occurred in either γ or $\beta\gamma$ spots.

1.5 PERCENTAGE OF THE FLARES IN EACH CLASSIFICATION

The results of this analysis may be expressed as follows:

79% of all cases where $\Delta t \geq 0$ were followed by a PCA

90% of all cases where $\Delta t < 0$ were not followed by a PCA event

76.5% of the PCA flare $\Delta t \geq 0$

92% of non PCA flares $\Delta t < 0$

87% of PCA flares the RF peak $> 500 \times 10^{-22}$ W$(m^2c/s)^{-1}$

76% of non PCA flares, the RF peak $< 500 \times 10^{-22}$W$(m^2c/s)^{-1}$

72% of the flare-sunspots had an area $\geq$ 500 millionths of the solar hemisphere on flare day

92% of the PCA flare sunspots had an area $\geq$ 500 millionths of the solar hemisphere on flare day

47% of the flare sunspots had a γ or $\beta\gamma$ classification on flare day

69% of the PCA flare sunspots had a γ or $\beta\gamma$ classification on flare day

NOTE: This study was based on a suggestion by Dr. Helen Dodson-Prince during a meeting of the Joint MSC-GSFC Working Group on Space Radiation. Dr. Prince suggested that the time difference between the maximum of the RF emissions and the optical H-alpha maximum should be investigated.

2.0 CLASSIFICATION OF IMPORTANCE 3 AND 3+ FLARES

The 142 flares with importance 3 or 3+ in the McMath-Hulbert working list of flares (Table 1) were placed in three groups:

(1) Flares followed by an important PCA event (Table 2).

(2) Flares followed by a small or very small PCA event (Table 3).

(3) Flares not followed by a known PCA event (Table 4).

2.1 ALL FLARES OF IMPORTANCE 3 AND 3+

Table 1 lists all flares of importance 3 or 3+ that occurred during the years 1954 through 1963.

We have included the McMath Plage Number and plage age in rotations, the Mt. Wilson sunspot number, the Mt. Wilson magnetic classification, the sunspot area based on the Royal Greenwich Observatory photoheliographic results, and the Zurich classification are given for flare day when the values are available.

2.2 IMPORTANCE 3 AND 3+ FLARES FOLLOWED BY A PCA EVENT

Table 2 lists all flares of importance 3 or 3+ that were followed by an important PCA event (from Table A-1). This table includes the flare, PCA, and short wave fade data. It also includes all known spectral emissions of Type II and IV associated with the flare, and single frequency data for frequencies 1500, 2000, 2800, 2980, 3000, and 3750 Mc/s. We have also included the value of the RF burst energy above 10% of the peak flux in units of 10^{-18} joules $(m^2c/s)^{-1}$ for 2800

and 3750 Mc/s when a value is given in the NASA Program Apollo working paper No. 1193 (January 28, 1966). The time difference in minutes Δt is the time of the RF burst peak minus the time of flare maximum intensity.

2.3 IMPORTANCE 3 AND 3+ FLARES FOLLOWED BY VERY SMALL PCA EVENTS

Table 3 lists the reported small PCA events that were not included in Table 2 and those that were derived by Gregory based on the use of high sensitivity vertical incidence back scatter sounding of the lower ionosphere at a frequency of 2.3 Mc/s.

2.4 IMPORTANCE 3 AND 3+ FLARES NOT FOLLOWED BY A KNOWN PCA EVENT

Finally Table 4 lists all importance 3 and 3+ flares that were not followed by a known PCA event. This table gives all of the reported radio emissions in the frequency range from 1500 to 3750 Mc/s range as well as short wave radio fadeouts and reported spectral emssions of Type II and Type IV.

The number of importance 3 and 3+ flares for each year and the number followed by PCA events is summarized in Table 1.1. This shows that approximately 27% of the flares were followed by a PCA event if the PCA's reported by Gregory only are not included.

For the purpose of our analysis of the difference (Δt) between the time of RF emission peak flux and the time of the flares maximum intensity we have grouped the small PCA events with the flares not followed by PCA's.

	No. of Flares Imp. 3, 3+	With PCA	Small PCA	PCA Gregory Only
1955	4	0	0	
1956	21	2	0	
1957	32	11	1	
1958	20	6	0	
1959	32	6	1	
1960	19	7	1	7
1961	10	5	0	
1962	2	0	0	
1963	2	1	0	
TOTAL	142	38	3	7

TABLE 1.1 Number of Importance 3 and 3+ Flares and Associated PCA Events

3.0 RELATIONSHIP OF FLARE MAXIMUM INTENSITY AND PEAK RADIO FLUX INTENSITY

3.1 FLARES FOLLOWED BY IMPORTANT PCA EVENTS

This list contains 38 PCA events, that with one exception, are included in one or more of the catalogues by Bailey, Modisette, Malitson, and Warwick and Haurwitz (Table A-2). Four of the events (Numbers 12, 17, 18, and 55, Table A-2, Flares Numbers 43, 47, 49, and 156, Table 1) were reported with a weak absorption and their inclusion in Table 2 rather than Table 3 is quite arbitrary.

All of the flares in this group were followed by a short wave radio fadeout and radio emissions at one or more of the frequencies between 1500 and 3750 Mc/s. The time of the maximum intensity of both the flare and the RF emission are reported for 34 of the events.

The time of the RF maximum occurred simultaneiously with or after the flare maximum ($\Delta t \geq 0$, where Δt = time of RF maximum minus the time of the flare maximum) for 26 of the events (76.5%) (Table 2.1). The eight cases where $\Delta t < 0$ will be discussed in detail later when other factors will be considered.

Δt / abs. db.	Unknown	Positive	Zero	Negative	Total
≤ 3	0	6	2	2	10
>3 to ≤ 6	3	6	0	3	12
>6 to ≤ 10	0	2	0	1	3
>10	1	9	1	2	13
TOTAL	4	23	3	8	38

TABLE 2.1 Relation Between the Intensity of the PCA Events and the Algebraic Sign of Δt

This table does not indicate any good correlation between the intensity of the PCA and algebraic sign of Δt.

On the other hand Table 2.2 shows that the peak RF flux exceeds 500 x 10^{-22} $W(m^2c/s)^{-1}$ for 86% of the PCA flares, and the $\Delta t \geq 0$ for 80%.

Flux \ Δt	Unknown	Positive	Zero	Negative	Total
≤ 250	1	0	0	1	2
>250 to ≤ 500	1	1	0	1	3
>500 to ≤ 1000	0	4	1	2	7
>1000 to ≥ 5000	1	13	1	3	18
>5000	1	5	1	1	8
TOTAL	4	23	3	8	38

TABLE 2.2 Relation Between the Peak Intensity of the RF Flux and the Sign of Δt

Flux / abs.db.	≤ 250	>250 to ≤ 500	>500 to ≤ 1000	>1000 to ≤ 5000	>5000	Total
≤ 3	1	2	3	4	0	10
>3 to ≤ 6	1	1	3	7	0	12
>6 to ≤10	0	0	0	3	0	3
> 10	0	0	1	4	8	13
TOTAL	2	3	7	18	8	38

TABLE 2.3 Relation Between the Intensity of the PCA Events and Peak Intensity of RF Emissions

Table 2.3 does not indicate any good correlation between the intensity of the PCA absorption and the peak flux of the RF emission.

3.2 FLARES FOLLOWED BY VERY SMALL PCA EVENTS

We have ten events in this group of small or very small PCA events including seven events derived by Gregory based on the use of high sensitivity vertical incidence back scatter sounding of the lower ionosphere at a frequency of 2.3 Mc/s.

The times of both flare maximum and RF peak flux at one or more of the frequencies in the range from 1500 to 3750 Mc/s are known for nine of the events. In this case we find only two events where the RF maximum follows the flare maximum ($\Delta t \geq 0$) while major RF bursts were reported (flux $\geq 500 \times 10^{-22}$ W $m^{-2}(c/s)^{-1}$) for three of the cases where Δt was negative.

Flux \ Δt	Unknown	Positive	Zero	Negative	Total
< 500	1	0	0	4	5
≥ 500 to < 1000	0	1	0	2	3
≥ 1000	0	1	0	1	2
TOTAL	1	2	0	7	10

TABLE 3.1
Δ t for Flares Followed by Small PCA Events

Because of the probable very low absorption during these events we will combine these flares with those not followed by PCA events.

3.3 FLARES OF IMPORTANCE 3 AND 3+ NOT FOLLOWED BY PCA EVENTS

Thirty-eight of the flares of importance 3 or 3+ were followed by important PCA events and ten more have been assoicated with very small events. In addition three of the PCA events occurred within three hours of the associated PCA flare and may have contributed to the intensity of the PCA event (flares 95, 100, and 137) although in two cases (95 and 100), the start of the flare followed the reported start time of the PCA. This leaves 91 importance 3 and 3+ flares that were not followed by a known PCA event (Table 4).

We find that eleven flares occurred during the normal observing times of two or more RF frequencies and eight during the normal observing time of at least one RF frequency with no increase in flux reported.

There was no known RF observations at the times of five flares (numbers 7, 11, 26, 28, and 32).

The times of flare maximum and/or RF peak intensity is not reported for 13 flares. The values of Δt for the 54 flares for which the times of flare maximum and RF peak intensity is negative for 49 of the flares. If we assume that at least one observatory was observing at the time of the 11 flares that occurred during the observing times of two or more frequencies, we have 60 (and possible 68) cases where Δt was negative or no RF flux was emitted as shown in Table 4.1. We see that for the importance 3 and 3+ flares that were not followed by a PCA event there was probably no RF emission from eleven (and possibly 19), and the RF emission was less than 500 x 10^{-22} W $(m^2c/s)^{-1}$ for 47 of the flares.

Peak Flux \ Δt	No Flux	Unknown	Positive	Zero	Negative	Total
No known cm obs.		5				5
No flux reported	19					19
$\leq$ 500		10	4	1	32	47
$>$ 500 to $<$ 1000		2	0	0	5	7
$\geq$ 1000		1	0	0	12	13
TOTAL	19	18	4	1	49	91

TABLE 4.1
Relation Between the Intensity of the RF Flux and Δt

We also find that Δt was negative (the time of the RF flux maximum preceded the time of flare maximum) in 92% of the cases where the times of both maxima were known.

The four cases (Flares 34, 48, 54, 58) where $\Delta t > 0$ and the one case of $\Delta t = 0$ will be examined in detail later.

If we include the nine cases where (Table 3 and 3.1) very small or doubtful PCA events were reported with the 65 cases from Table 4 and 4.1, we find that in 90% of the cases the time of RF emission peak precedes the time of flare maximum.

3.4 PROBABILITY THAT AN IMPORTANCE 3 OR 3+ FLARE WILL OR WILL NOT BE FOLLOWED BY A PCA EVENT

Table 1.2 shows that if we include all cases where $\Delta t \geq 0$, the flare was followed by a PCA event in 79% of the cases. Similarly, when $\Delta t < 0$, or no flux is reported when the flare occurs during the normal operating time of two or more frequencies (11 flares), the flare was not followed by a PCA event in 90% of the cases.

Flare Type \ Δt	Total Number	Unknown	Positive	Zero	Negative	No Flux Reported	
Non-PCA Flares	91	18	4	1	49	11	8
Very Small PCA	10	1	2	0	7	0	
Important PCA	38	4	23	3	8	0	
Others	3*						
TOTAL	142	23	29	4	64	11	8
ACCURACY PROBABILITY			79%		90%		

* Three of the PCA events may have been influenced by two major flares.

TABLE 1.2 Classification of all Importance 3 and 3+ Flares in Terms of the Algebraic Sign of Δt

4.0 SUNSPOT GROUP AREA AND MAGNETIC CLASSIFICATION ON FLARE DAY

4.1 SUNSPOT AREA ON FLARE DAY

The 142 flares of importance 3 or 3+ were observed in 101 different sunspot groups. Of the 109 flares reported during 1955 through 1959, 74 occurred in sunspot groups that on flare day had an area equal to or greater than 500 millionths of the solar hemisphere. The distribution with sunspot area is shown in Table 1.3.

Twenty-three of the 25 major flares that were followed by a PCA event occurred in a sunspot with an area greater than 500 millionths.

Sunspot Area	< 500	500 to <1000	1000 to <1500	1500 to <2000	≥ 2000	Unknown EL, WL or Not Observed
Number of Flares	30	33	22	14	5	5
PCA Flares	2	12	7	3	1	0

TABLE 1.3
Distribution of Sunspot Areas for All Importance 3 and 3+ Flares and Those Followed by a PCA Event

During this period 23 of the sunspot groups were the source of two or more major flares. In eleven cases at least one of the flares was followed by a PCA event.

We have limited the correlation of flares to sunspot area to the period through 1959 for which we have Greenwich Observatory daily sunspot area data.

Year	< 500	500 to <1000	1000 to <1500	1500 to <2000	≥ 2000	Unknown
1955	0	3	1	0	0	0
1956	6	5	4	5	0	1
1957	11*	10	4	2	3	2
1958	4	9	3	4	0	0
1959	9	6	10	3	2	2
1960**						
1961***	2	1	1	1	0	6
1962***	1	0	1	0	0	0
1963***	0	1	0	0	0	1
TOTAL	33*	35	24	15	5	12
PCA	3	14	8	4	1	1

* One flare (No. 57, Table 1) occurred in a region with no known sunspot groups.

** Flare day sunspot area data not available for 1960.

*** Flare day sunspot area data after July 1, 1961, taken from U. S. Naval Observatory daily reports.

TABLE 1.4
Distribution by Years of Importance 3 and 3+ Flares
with the Area of the Sunspot Group on Flare Day

If we use the U. S. Naval Observatory area data for the years 1961 through 1963, we find that 79 of the 112 flares (approximately

71%) for which the sunspot area is known on flare day have an area $\geq$ 500 millionths of the solar hemisphere. The distribution of the importance 3 and 3+ flares that were followed by a PCA event is given in Table 1.5.

Year	<500	500 to <1000	1000 to <1500	1500 to <2000	≥ 2000
1955	No PCA Events				
1956	0	2	0	0	0
1957	2	6	1	1	1
1958	0	3	1	2	0
1959	0	1	4	1	0
1960*					
1961**	1	1	1	1	0
1962	No PCA Events				
1963	0	1	0	0	0
TOTAL	3	14	7	5	1

* Daily sunspot areas not available.

** Flare day sunspot area data after July 1, 1961, is taken from U.S. Naval Observatory daily reports.

TABLE 1.5
Distribution of Importance 3 and 3+ Flares Followed by a PCA Event with the Area of the Sunspot Group on Flare Day

4.2 SUNSPOT GROUP MAGNETIC CLASSIFICATION ON FLARE DAY

The magnetic classification on flare day of the sunspot groups associated with the importance 3 and 3+ flares is known for 121 of the 142 flares as shown in Table 1.6.

Twenty-seven of the 30 PCA flare sunspot groups for which an area on flare day is known had an area greater than 500 millionths of the solar hemisphere. Both the sunspot magnetic classification and the sunspot area are known for 27 of the PCA flares. Nineteen of these had an area greater than 500 millionths and a γ or $\beta\gamma$ magnetic classification.

Both the flare day magnetic classification and area are known for 93 of the importance 3 and 3+ flares. Forty-three of these had a γ or $\beta\gamma$ magnetic classification and an area greater than 500 millionths. Only 44 per cent of the importance 3 and 3+ flares from large and magnetically complex sunspot groups were followed by PCA events.

	γ	$\beta\gamma$	β	α	Unknown		
					WL	EL	Not Rep.
1955	1	0	3	0	0	0	0
1956	5	2	10	2	2	0	0
1957	2	11	6	3	2	1	7*
1958	1	4	14	1	0	0	0
1959	11	7	8	1	0	2	3
1960	5	3	4	5	1	0	1
1961	0	3	3	2	2	0	0
1962	0	1	1	0	0	0	0
1963	0	1	1	0	0	0	0
TOTAL	25	32	50	14	7	3	11

* One flare (No. 57, Table 1) occurred in a region with no known sunspot group.

TABLE 1.6
Distribution of Importance 3 and 3+ Flares
with Sunspot Magnetic Classification on Flare Day

	γ	$\beta\gamma$	β	α	WL	EL	Not Reported
1955		None					
1956	1	0	0	0	0	0	1
1957	2	5	1	1	0	0	2
1958	0	2	4	0	0	0	0
1959	4	1	1	0	0	0	0
1960	2	1	1	1	1	0	1
1961	0	3	1	0	1	0	0
1962	None						
1963	0	1	0	0	0	0	0
TOTAL	9	13	8	2	2	0	3
TOTAL, All Major Flares	25	32	50	14	7	3	11
Percent with PCA	36	41	16	14	28	0	27
Small PCA (Table 3)	2	3	2	2	0	0	1
All PCA	11	16	10	4	2	0	4

TABLE 1.7
Distribution of Importance 3 and 3+ Flares
Followed by an Important PCA Event with Sunspot Magnetic Class

The sunspot magnetic classification on flare day is known for 121 of the importance 3 and 3+ flares. Fifty-seven (47%) were associated with sunspots that on flare day had a γ or $\beta\gamma$ magnetic classification. Only 22 (39%) were followed by a PCA event.

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Warwick, C. S., and M. W. Haurwitz, "A Study of Solar Activity Associated with Polar-Cap Absorption," J. Geophys. Res., 67(4) (1962), 1317-1332.

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2. Daily sunspot areas for the years 1954 through 1959 were obtained from the Royal Greenwich Observatory Bulletins - Photoheliographic Results

1955 - Published in 1958
1956 - Bulletin No. 14
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1958 - Bulletin No. 60
1959 - Bulletin No. 103

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2 Year 1957, LTV Report 00.538
3 Year 1958, LTV Report 00.503
4 Year 1959, LTV Report 00.650
5 Years 1960-1963, LTV Report 00.654

TABLE 1

MASTER LIST OF ALL IMPORTANCE 3 AND 3+ FLARES, 1954-1963

Serial No.	Date	Flare Start	With PCA Table 2	With PCA Table 3	No Known PCA Table 4	Plage No.	Plage Age	Sunspot MTW No.	Sunspot Magnetic Class	Sunspot Area	Sunspot Zurich Class
	1955										
1	1/16	2130			X	3065	2	11218	(γ)	526	E
2	6/18	1218			X	3182	1	11259	βp	639	E
3	11/12	1116			X	3326	1	11367	(βp)	1411	F
4	12/03	1058			X	3342	2	11388	(βp)	548	E
	1956										
5	1/19	0532			X	3379	1	11440	(γ)	1597	E
6	2/14	0538			X				γ	1563	E
7	2/17	1100			X	3400	2	11462	γ	1393	F
8	2/23	0334	1						-	793	F
9	2/29	2020			X	3413	1	11482	β	31	B
10	3/02	1220			X	3412	5	11495	α	285	C
11	4/09	0940			X	3457	4	11553	$\beta\gamma$	654	E
12	5/17	2230			X	3497	3	11622	($\alpha\rho$)	346	H
13	8/29	0937			X	3629	2, 5	11763	βp	1387	E
14	8/31	1226	3			3643	3	11777	(γ)	837	E
15	9/05	1445			X	3658	2	11797	(α)	755	-
16	9/14	0813			X	3666	2	11815	$\beta\gamma$	10	A
17	10/01	0755			X	3691	1	11868	βp	261	D
18	10/07	0400			X	3694	1	11878	βp	1176	F
19	10/11	0955			X				$\beta\gamma$	1581	F
20 *	11/07	1109			X	3751	1	11949	βp	929	H
21	11/14	1037			X				α	390	H
22	11/20	1002			X	3755	1	11963	γ	1906	E
23	12/06	1405			X	3785	5	12009	(βp)	1597	E
24	12/17	1535			X	3788	2	12016	(β)	1401	E
25	12/22	0955			X	3804	1	12046	West Limb		-
	1957										
26	1/06	1038			X	3813	3	12068	βp	508	H
27	1/20	1100	5			3820	6	12085	-	557	H
28 *	1/23	2310			X	3823	3	12089	-	820	H
29	1/24	1225			X				-	344	H
30	1/25	0520			X	3820	6	12085	$\alpha\rho$	276	-
31	1/31	0358			X	3830	2	12114	(α)	182	C
32	2/08	0832			X	3843	1	12122	-	194	C
33 *	2/21	1605		83		3856	4	12140	-	182	
34	2/28	0005			X	3863	3	12154	-	455	E
35	4/02	1002			X	3899	1	12216	(αf)	WL	D
36	4/03	0825	6			3907	6	12235	(β)	582	E
37	4/16	1040			X	3941	2	12285	East Limb		-
38	4/17	1006			X				-	1000	E
39 *	7/03	0712	9			4039	2	12434	γ	500	H
40	7/04	1134			X	4048	1	12456	$\beta\gamma$	268	D
41	7/22	0953			X	4075	3	12503	$\beta\delta$	1256	E
42	7/24	1712	10			4070	3	12496	$\beta\delta$	504	E
43	8/28	0810 0913	12			4125	3	12579	δ	774	E

Serial No.	Date	Flare Start	With PCA Table 2	With PCA Table 3	No Known PCA Table 4	Plage No.	Plage Age	Sunspot MTW No.	Sunspot Magnetic Class	Sunspot Area	Sunspot Zurich Class
44	8/31	1257	15			4124	3,2	12580	$\beta\delta$	1317	E
45	9/03	1412			X				$\beta\gamma$	1207	F
46	9/10	0223			X	4134	2	12596	($\beta\delta$)	872	E
47	9/11	0236	17						$\beta\gamma$	664	E
48	9/18	1026			X				$\beta\delta$	1998	F
49 *	9/18	1658	18			4151	5	12622	$\beta\delta$	1998	F
50	9/19	0350			X				($\beta\gamma$)	2122	F
51	9/21	1310	19			4152	2	12634	$\beta\delta$	491	E
52	9/26	1907	20			4159	4,3	12636	$\alpha\rho$	232	C
53	9/30	1657			X				$\alpha\rho$	213	C
54	10/16	0152			X	4189	2	12689	$\beta\delta$	2480	F
55 *	10/20	1617	21						-	2373	F
56	11/24	0848			X	4263	4	12788	($\alpha\rho$)	368	G
57 *	11/29	0945			X	4282	2	None			-
	1958										
58	1/25	0915			X	4372	4,6	12975	($\beta\gamma$)	677	E
59	3/01	0905			X	4436	1	13052	(β)	442	E
60	3/03	1005			X	4445	3,4	13063	β	1740	F
61	3/05	0500			X				βp	1684	F
62 *	3/23	0947	23			4476	2	13103	(βp)	1374	E
63	4/07	1010			X	4493	2	13130	-	512	D
64	5/01	2115			X	4530	1	13197	($\beta\gamma$)	1857	F
65	5/05	0356			X				($\beta\delta$)	1319	F
66	6/19	0940			X	4607	3	13311	βp	799	E
67 *	7/07	0020	26			4634	2	13346	$\beta\gamma$	686	E
68	7/29	0250	27			4659	3	13388	βp	1608	F
69	8/04	0402			X	4667	2	13404	(βp)	294	G
70	8/07	1427			X	4686	2	13434	βp	686	E
71 *	8/16	0432	28						$\beta\gamma$	935	G
72	8/22	1417	30			4708	3	13494	$\beta\delta$	1192	E
73	8/26	0005	31						(βp)	776	E
74	9/18	0728			X	4750	2	13524	$\beta\gamma$	197	D
75	11/14	0036			X	4877	3	13646	$\alpha\rho$	11	B
76	11/24	1607			X	4883	1	13718	$\beta\gamma$	645	E
77	12/31	1656			X	4934	4	13803	δ	872	E
	1959										
78	1/21	1700			X	4976	5,1	13883	$\alpha\rho$	1808	H
79	1/26	0842		S16		4969	3	13878	($\beta\delta$)	920	E
80	1/26	1027									E
81	2/01	0352			X	4997	3	13913	(β)	590	D
82	2/02	1015			X	4983	2	13897	(α)	---	-
83	2/02	1816			X	4997	3	13913	(βp)	361	D
84	2/12	2301	33			5009	4,1	13930	(βp)	906	E
85	2/18	1005			X	5023	3	13940	-	240	J
86	2/18	1142			X						J
87	2/19	2032			X	5016	2	13931	$\beta\gamma$	167	J
88	3/24	0558			X	5054	5	13994	(α)	1257	(F)
89	3/28	2113			X	5061	4	14004	β	317	H

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TABLE 1 (cont.)

Serial No.	Date	Flare Start	With PCA Table 2	With PCA Table 3	No Known PCA Table 4	Plage No.	Plage Age	Sunspot MW No.	Sunspot Magnetic Class	Sunspot Area	Zurich Class
90*	4/05	2316			X	5071	5	14020	β	42	B
91	4/08	0903			X	5093	4,6	14050	γ	--	(H)
92	4/13	0823			X				(γ)	880	H
93	5/09	0123			X	5148	5	14121	($\beta\delta$)	1047	E
94*	5/10	2055	34						($\beta\delta$)	1326	E
95	5/10	2315							($\beta\gamma$)	1326	E
96	5/11	2006			X				$\beta\delta$	466	E
97	6/16	0618			X	5204	4	14211	(γ)	1005	G
98*	6/18	1134			X				(γ)	775	G
99*	7/10	0806	35			5265	2,5	14284	(γ)	1053	H
100	7/10	0539							(γ)	1053	H
101	7/13	0855			X				(γ)	1306	H
102*	7/14	0325	36						(γ)	1314	H
103	7/14	1400			X	5273	2	14290	-	15	B
104	7/16	1525			X	5265	2,5	14284	(γ)	1775	H
105*	7/16	2114	37						(γ)	1775	H
106	7/27	2050			X	5291	1	14314	($\beta\rho$)	353	G
107	8/18	1014	38			5323	4	14356	(γ)	1119	E
108	11/28	2006			X	5476	4	14579	$\beta\rho$	2319	F
109	11/30	1720			X				($\beta\delta$)	2402	F
	1960										
110	1/11	2040		S19		5527	2	14660	$\alpha\rho$		H
111	2/22	1352			X	5581	4	14732	δ		D
112	4/01	0843	41			5615	2	14778	γ		F
113	4/28	0130	43			5645	2	14815	$\beta\rho$		D
114	5/04	1000	45			5642	3	14814	West Limb		-
115*	5/06	1404	46			5653	2	14823	$\alpha\rho$		G
116	5/09	0704		G16		5657	3	14831	α		J
117	5/13	0519	47			5654	1	14825	γ		F
118*	6/01	0824		G20		5680	2	14867	β		D
119	6/25	1131		G22		5713	1	14908	γ		C
120	6/26	0428			X				$\beta\rho$		C
121	6/26	2358			X	5719	4	14915	$\alpha\rho$		D
122	6/27	2140		G23		5713	1	14908	γ		H
123	10/29	1026		G30		5909	1	15099	$\beta\rho$		D
124	11/06	1752			X	5921	2	15110	$\alpha\rho$		J
125	11/10	1009		G31					$\beta\delta$		F
126*	11/12	1315	49			5925	3	15114	-		F
127	11/15	0207	50						$\beta\delta$		F
128*	12/05	1825		G38		5959	4	15151	$\beta\delta$		C
	1961										
129	3/26	1009			X	6060	1	15250	$\alpha\rho$		D
130	4/26	1040			X	6088	3	15280	$\beta\rho$		H
131	5/04	2145			X				α		J
132	7/11	1612	52			6171	3	15353	$\beta\delta$	1529	E
133	7/12	0050	53						($\beta\delta$)	1274	E

Serial No.	Date	Flare Start	With PCA Table 2	With PCA Table 3	No Known PCA Table 4	Plage No.	Plage Age	Sunspot MW No.	Sunspot Magnetic Class	Sunspot Area	Zurich Class
134	7/15	1433			X	6172	2,3	15355	$\beta\rho$	254	G
135*	7/18	0920	54						$\beta\delta$	921	E
**	7/20	1524	55			6171	3	15353	West Limb		-
136	7/20	≤1633			X				West Limb		-
137	7/20	1828			X				West Limb		-
138	9/28	2202	57			6235	3	15435	$\beta\gamma$	133	C
	1962										
139	3/22	2220			X	6373	3	15532	($\beta\gamma$)	1212	E
140	4/18	1734				6393	4	15542 15543	$\alpha\rho$ ($\beta\delta$)	485	J
	1963										
141	9/16	0325				6964	3	15768	$\beta\gamma$		-
142	9/26	0638	59						$\beta\delta$	921	-

** The flare on 7/20/61 at 1524 UT, Importance 2, is considered by Leinbach to be the source of PCA 55 although the importance 3 flares at 1633 and 1828 may have contributed to the proton stream.

* Flares with Importance 3+.

1959 Sunspot area on flare day, from Royal Observatory Bulletin No. 103 (1965). The 1961-1963 sunspot data, from U.S. Naval Observatory daily reports.

TABLE 2

IMPORTANCE 3 AND 3+ FLARES FOLLOWED BY IMPORTANT PCA EVENTS

Flare Serial No.	Date	Start UT	Duration Min.	Max. UT	Position	No. Reg.	No. Max. Imp.	PCA Serial No.	PCA Start	PCA Duration Hrs.	PCA Abs. db	SWF Onset	SWF Duration Min.	SWF Imp.	Spectral Type Start UT Dur./Imp. II	Spectral Type Start UT Dur./Imp. IV	Sudden Frequency Deviation Bursts f	Sudden Frequency Deviation Bursts Type	Sudden Frequency Deviation Bursts Onset UT	Sudden Frequency Deviation Bursts Max. UT	Sudden Frequency Deviation Bursts Duration Min.	Sudden Frequency Deviation Bursts Peak Int.	Sudden Frequency Deviation Bursts Energy	Sudden Frequency Deviation Bursts Δ t	Remarks and Discussion
	1956																								
8	2/23	0134	96	--	N23 W80	3/2		1	0400	123	13.0	0330	160	3+		(0335)	3000 3750	CD CD	0333 0334	--- 0336	50 15.5	4700 18000	448		$M_{1,2}$ M_1	Also a very great burst at 200 Mc/s, > 2:000 peak.
14	8/31	1226	244	1246	N15 E15	11/1		3	1430	69	4.9	1239	81	3		(1231)	1500 2800	CD BD	1230 1234	--- ---	85.0 39.0	(4920) (>340)			M_2	Also a very great burst at 200 Mc/s, 22500 peak.
	1957																								
27	1/20	1000	197	1119	S30 W18	10/1		5	1500	86	4.1	1113	13	1+			2980	--	1100	---	24.0	184			$M_{1,2}$	No observations at other cm. wavelengths.
36	4/03	0825	121	0835	S14 W60	4/2		6	1330	65	3.9	0833	35	2		(0828)	1500	CD	0829	---	38.0	(383)			M_2	Also 9400 Mc/s start 0828 lasting 277 min. 632 smooth flux. Observed increase, not reported in IAU at 2980.
39*	7/03	0712	274	0740	N14 W40	17/4		9	1000	58	9.2	0729 0830	61 44	2+ 3		(0838) 0849 25/3	1500 2000 2980 3000 3750	CD-BCD BCD CD CD CD CD	0726 0831 0726.5 0733 0727 0832	0809.5 0839.6 --- --- 0742 0843.1	50.0 20.0 31.0 30.0 69.0 29.0	(1690) 928 965 285 (337) (763)	32		+89.5 +59.6 M_2 $M_{1,2}$ +63.1	Also bursts at 9500, 9400, 9375, and 1000 Mc/s and at all meter wavelengths.
42	7/24	1712	193	1737	S24 W27	4/2		10	2015	27	2.0	1727 1759	113 81	3 3-		1802 73/3	1500 2800 2980 3000 3750	BD CD CD	1730 1759 1733 1801.5	1737 1838	19.0 --- 9.0 89.0	(155) 1100 358 1275	94		0 +61	
43	8/28	0810	354	0925	S31 E33	11/2		12	1300	--	Weak	0917	38	3		(0928) 0950 -/3	1500 2000 2980 3000	CD CD CD	0900 0910 0943	1001 0947 ---	280.0 244.0 40.0	(698) --- 1192			+ 36 + 22 M_2	This small PCA was included in the basic list. It was observed by Anderson at balloon altitudes and by most of the observers of the ionospheric scatter technique.
44	8/31	1257	180	1312	N25 W08	8/1		13	1415	46	4.9	1303	184	3+		1301 179/3	1500 2000 2800 2980 3000	CD BD	1258 1301	1325 1315.5	122 65	(3900)	350		+13 +3.5	
47	9/11	0836	286	0300	N13 W08	5/2		17 Sept. 12	0200	57	0.5	0244	100	3		0305 257/3	2000 3000 3750	CA CA CA	0243 0244 0243	0304 0301 0304	70 75 90	(564) 110 (373)	27		+4 +1 +4	The flare associated with this small PCA reported by many observers occurred in the same region as the flare 46, Table 3.
49*	9/18	1658 1818	282	1740 1840	N23 E08	6/4		18	2000	--	--	1730	43	3+		1810 378/3	1500 2000 2800 2980 3000	CD CD	1805 1821	-- 1825	100 40	(>2) (275)	47		M_2 +45	No flux increase reported at any wavelength associated with the flare max. at 1740. [illegible] PCA. The Δt = -15 if associated with the flare max. at 1840 UT.
51	9/21	1330	100	1335	N10 W06	11/3		19	1700	63	5.1	1330	60	3-		1330 15/3	1500 2000 2800 2980 3000	CD CD	1330 1330	1336 1337	31 14.5	(432) (785)	19		+1 +2	Major bursts at all meter wavelengths. Also 9400 Mc/s with Δt = +1. NRI observed increase (not reported IAU).
52	9/26	1307	278	1952	N22 E16	6/4		20	2100	31	2.0	1925	100	2+		1957 48/3	2800	CD	1926	1939	60	(67)	25		-13	Ott. was the only observatory at cm wavelength observing at the time of the flare. Large bursts at meter wavelengths reached peak intensity with Δt = +36, and +120.
55	10/20	1617	97	1642	S26 W45	2/1		21	2100	64	7.8	1639	156	3+	1650.9 7/3+	1651 202/3	1500 2800 3000	CD	1644	1651	51	(4000)	209		+9	
	1958																								
62*	3/23	0947	280	1005	S24 E78	17/8		23	1500	53	3.2	0953	196	3		(1003)	1500 2980 3000	CA BCD	0953 0958	-- 1002	110 10	> 1340 > 1190			-3	Major bursts at all meter wavelengths with Δt ranging from 0 to +7.0. This flare was followed only 20 minutes after flare maximum by one of the largest PCA's so far recorded. The RF bursts at all frequencies showed two distinct phases. It is felt that the short duration bursts at both cm. and meter wave lengths starting at 0027UT with peak intensities at 0028UT are associated with the importance 2+ flare (1+ in the Weekth working list) at 0026UT, [illegible] lasting 51 minutes, maximum [illegible] at 0033UT.
67*	7/07	0020	230	0110	N25 W08	5/4		26	0130	96	23.7	0025	125	3	0032.5 15.5/- 0101 163/	0058 55/3 0149 35/-	3000 CD BD 3000 CA 3750 BCD CD	BCD CD BD BCD CA BCD CD	0027 0055 0026.5 0026.6 0050.2 0027 0028 0102.5	0028 0111.5 0027.5 >0027.8 0111.3 0028 0111.4	10 38 >8.5 12 100 10 30	(550) (1300) (875) >708 3770 (990) (1700)	Sunset 196		+1.5 +1.3 +1	
68	7/29	0259	69	0304	S14 W44	2/2		27	0400	30	1.5	0240	120	3+	0304 15/-	0321 99/-	2000 3000 3750	CD CD CD	0300 <0303 0258	0304 0304 0304	21 >25 21	(830) >2100 (2000)	15		0 0 0	Also 9400, 1000, and 1420 Mc/s.
71*	8/16	0432	239	0440	S14 W50	9/2		28	0600	71	>15.0	0433	168	3+		(0448)	2000 3000 3750	CD CD CD	0434 0434 0434	0440 0439	60 70 60	(2900) 5030 (5800)	300		0 0 -1	Also major bursts at 9400, 9500, 1420, and 1000 Mc/s all with Δt = 0, or +2. A great burst at 200 Mc/s.
72	8/22	1417	180	1450	N18 W10	5/3		30	1530	84	10.6	1435	170	3+		1500 617/2	1500 2800 2980 3000	CD SA	1427 1430	1509 1506	128 120	443 (1500)	192		+19 +16	Also 9400 with Δt = +1. Major bursts at meter wavelength. Red NRI Data not published in IAU.
73	8/26	0005	79	0027	N20 W54	1/1		31	0100	89	16.6	0018	240	3+	0021 24/3	0030 240/3	2000 3750	CD CD	0005 0005	0042 0041	57 50	(2100) (5050)	550		+15 +14	Also 1420 Mc/s, flux 288 Δt = +15, and 9400, 9500, and 1000 Mc/s.

TABLE 2 (cont.)

Flare Serial No.	FLARE DATA: Date	Start UT	Duration Min.	Max. UT	Position	No. Reg.	No. Max. Imp.	POLAR CAP ABSORPTION: Serial No.	Start	Duration Hrs.	Abs. db	SHORT WAVE FADE: Onset	Duration Min.	Imp.	SPECTRAL TYPE Start UT Dur./Imp. Min/ II	IV	SINGLE FREQUENCIES CENTIMETER BURSTS: f	Type	Onset UT	Max. UT	Duration Min.	Peak Int.	Energy	Δt	NOTES AND DISCUSSION
	1959																								
84	2/12	2301	134	2325	N13 E48	2/1		33	0800	74	2.6	2308	40	2		2303 66/3	2000	CD	2250	2314	55	(335)		-11	This small PCA had a delay time ~8 hours.
																	3750	CD	2250	2313	70	(440)	30	-12	Also 9400 and 1000 Mc/s.
94*	5/10	2055	313	2140	N19 E47	5/3		34	2300	170	22.0	2110	560	3+	2123	2116	2000	CD	<2200	2213	>100	(1300)		+33	Sunrise at Mag. Also 9400, 9500 and 1000 Mc/s.
95*		2315	125	--	N19 E51	2/2									8/3+	16A/3	2800	CD	2100	2149	>160	(2500)	811	+9	Flare 95 may have contributed to the intensity and duration of this PCA. No RF and no second peaks reported at the time of Flare 95. McMath considers these two flares as a single event.
99*	7/10	0206	212	0230	N20 E63	4/4		35	0400	360	20.0	0200	190	3+	0222	(02238)	2000	CD	<0211	0224	>90	(3000)		-6	Also very great burst at 9430 Mc/s (Δt = -6) and a great burst at 1000 Mc/s (Δt = -7). The flare
															44/-		3000	SD	0206	0224	35	>1300		-6	100 at 0539 is considered to be a continuation of
																	3750	CD	<0209	0224	>38	(6300)	515	-6	99 in the McMath list. That flare probably con-
																	2000	SD	0514	0515.7	6	(23)			tributed to the intensity and duration of the PCA.
100*	7/10	0539	261	--	N19 E58	5/3											3750	SD	0514	0516	20	(26)			The RF bursts starting at 0514 were very weak.
102*	7/14	0325	476	0349	N17 E04	20/7		36	0445	72	23.7	0328	180	3+	0338	0401	2000	CD	0331	0420	125	(8450)		+31	Also 1420, 9400, and 9500.
															34/3	129/1-3	3000	CD	0331	0359	40	>1300		+10	Also very great bursts of long duration at 200 and
																(0330B)	3750	CD	0330	0356	100	(6000)	400	+7	545 Mc/s.
105*	7/16	2114	196	2128	N16 W30	3/1		37	< 2250	168	21.2	2118	177	3+		2121 262/3	2000	N	< 2201	2210	> 65	(2350)		+42	Flares 99, 100, 102, 105 and the non-PCA flares 101
																	2800	CD	2118	2154	>180	(6500)	732	+26	and 104 all come from the same solar region. Also
																	3750	CD	< 2201	2201	> 60	(1500)		+33	RF at 1420 Mc/s.
107	8/18	1014	237	1030	N12 W33	17/2		38	1100	60	3.0	1025	120	3		(10258)	1500	CA	1025	1030	63	745		0	Also 9375, 9400, and 19000 Mc/s.
																	2980	CD	1025	--	23	989		M_2	
																	3000	BCD	1026	1030	106	621		O^2	Also Ger. 3000 Mc/s.
	1960																								
112	4/01	0843	312	0859	N12 W11	10/4		41	1000	73	3.6	0850	97	3		(0818)	1500	C+	0816	0928	224	> 950		+29	Has 12 peaks.
																	2980								
																	3000	C+	0848	--	> 250	>1000		M_2	Also major burst at 9100 Mc/s.
113	4/28	0130	15	0137	S05 E34	1/1		43	0230	30	3.5	0120	100	3+	0120	0145	2000	C	0115	0129.7	30	285		+7.3	Also 1000 Mc/s, flux 265 Δt = +2.9, and 9500 Mc/s.
															26/2	45/-	3000	BCD	0124.5	0130	15	512		-7	This flare reported by Honolulu only.
																	3750	C	0116	0129.5	40	260	17	-7.5	
114	5/04	1000	120	1016	N13 W90	3/1		45	1030	8	3.4	1015	35	3		(1015)	1500	C+	1011.4	1042.4	107.6	504		+29.4	Also 9100 and 9400 Mc/s.
																	2980	C+	1015	1039	62	2650		+23	
																	3000								NKI recorded, not reported IAU
115*	5/06	1404	376	1440	S09 E01	10/1		46	1600	103	16.0	1427	151	3	1438	1414	1500	C+	1408	1435.4	213	520		-4.6	
															7/3	116/3	2800	C+	1408.5	1434.5	90	695	69	-5.5	
																	2980	C	1428	--	28	>620			
																	3000								NKI recorded, not reported IAU.
117	5/13	0519	136	0532	N29 W67	6/1		47	0620	65	4.5	0512	221	3+	0523	0930	2000	C+	0517	0557.8	122	1440		+29.8	Very great burst at 9400 Mc/s, lasting for 105 minutes
															15/3	>39/1	3000	CA	0519	0531.6	101	2065		--	with a peak flux equal to 18300.
																	3750	C+	0517	0532	105	[illegible]0	500	0	
126*	11/12	1315	367	1330	N27 W40	8/5		49	1400	73	21.2	1326	154	3+		<1345 255/3	1500	C+	1323		> 90	770			
																	2800	C+	1320	1346	340	5500	606	+15.5	
																	2980								
																	3000								
127	11/15	0207	140	0821	N26 W35	2/1		50	0430	79	20.0	0217	27	3	0221	0221	2000	C+	0220	0222.6	75	4950		+1.6	Also great burst at 9400 Mc/s.
															227/-	227/-	3000								Tok not observing.
																	3750	CS+	0219	0222	80	11600	780	+1	
	1961																								
132	7/11	1615	265	1659	S07 E31	4/2		52	2200	--	1.3	1648	245	3+	1702	1655	1500								
															16/3	110/3	2500	C+	1650	1745	115	1500	138	+46	The series of PCA events between 11 and 20 July has
133	7/12	0950	190	1025	S07 E22	19/4		53	1900	72	17.0	1023	97	3			1500	C+	1010	1023.5	240	1140		-1.5	been studied in considerable detail by Leinbach (1962).
																				1042.5		1820		+17.5	During this period Flare 6171 was the source of 77 flares
																				1113		1250		+48	reported in the IAU Bulletin with importance ≥1. The
																	2800		< 1100	1114	>45	1212	88	+49	first flare occurred on 10th 0605 UT importance 1.
																	2980	C+	1018	1042	87	4100		+17.0	The first major flare occurred on the 11th. 1615 UT
135*	7/18	0920	210	1005	S07 W59	19/8		54	1130	55	10.0	1000	113	3			1500	C+	0938.5	0951.2	232	> 590		-13.8	at E32, the probable source of PCA No.52 at 2200 UT.
																				0959		~1300		-7	This PCA increased at an unusually slow rate of about
																	2980	C+	0938		65	2400			0.06 db/hr during the next 16 hours. PCA 53 has been
																									associated with the importance 3 flare at 0950 UT
																									on the 12th, while the earlier PCA was still in progress
																									The absorption showed little change until 1900 UT when
																									a rapid increase of approximately 0.8 db/hr indicated
136	7/20	1524	46	1530	S07 W90			55	2200		Weak	1550	370	3+	1554	1552	1500	C+	1552.0	1621.5	>170	412		+51.5	the start of a new PCA. The start of PCA 54 is ob -
		< 1633	> 62	1653	S05 W90										2/3	132/3	2800	C+	1552.0	1621.3	42	1800	94	+51.3	secured by strong auroral absorption and the night time
															1557			C	1634	1725.5	222	250			recovery. Maximum absorption occurred between 18 and
															28/3										20h on the 18th. The final event of this series PCA 55
137	7/20	1828	79	1847	S07 W90																				started at about 2200 UT following an importance 2 flare
																									at 1524 and two importance 3 flares <1633 and 1828 UT.
																									An examination of other data indicates that this weak
																									PCA resulted from the importance 2 flare at 1524 rather
																									than other flares 136 or 137. A small ground level
																									increase in the Deep River Neutron Monitor starting
																									at 1620 UT tends to confirm the earlier flare; it also
																									indicates the PCA actually started some time before
																									the tabulated time of 2200 UT. The type IV RF covered
																									the range from 3900 to 10 Mc/s.
138	9/28	2202	208	2223	N13 E29	3/2		57	2245	~144	3.3	2218	62	2	2217	2212	2000	C+	2211	2220.2	40	1000		-2.8	Also 9400 Mc/s, peak flux 1600, Δt = -3.7.
															32/3+	37/3	2800	C+	2211	2218	>30	800	36	-5.0	9500 Mc/s peak flux 1580, Δt = -6.5.
																	3750	C+	2212	2217.3	40	1690	48	-5.7	Protons >23 Mev observed Explorer XII by
																									2245 UT integrated flux 530/cm² sec. Also at
																									balloon altitude, and Inyun 1.
	1963																								
142	9/26	0638	186	0717	N13 W78			59	0745	89	4.6	0709	102	3+			1500	C	0637	0723.5	300	287		+6.5	
																	2000	C+	0705	0723.0	27	495		+6.0	
																		C+	0732	0749.4	23	115		+32.4	
																	2980	C+	0705	0716	60	1008		+1.0	
																	3750	C+	0705	0716.2	35	1850		+0.8	
																		C	0740	0749.3	15	200		+32.0	

TABLE 3

IMPORTANCE 3 AND 3+ FLARES WITH REPORTED SMALL PCA EVENTS

Flare Serial No.	FLARE DATA: Date	Start UT	Duration Min.	Max. UT	Position	No. Rep. / Max. Imp.	POLAR CAP ABSORPTION: Serial No.	Start UT	Duration Hrs.	Intensity	SHORTWAVE FADE: Onset	Dur. Min.	Imp.	SPECTRAL: Start Dur/Imp. II	Start IV	SINGLE FREQUENCIES: f	Type	Onset UT	Max. UT	Dur. Min.	Flux	Energy	Δt	NOTES AND REMARKS
	1957																							
33*	2/4	1605	360	1930	N20 W30	1/1	S3	18XX	96	S				1605 2008 3/2		2800	SD	1750	1915	240.0	(19)		-15	The flare reported by Sac Peak only, assigned importance 3+ by McMath. This small PCA reported by Be, DLF, JC, JP and S, based on ionospheric f_{min} data. The RF burst is a small but long enduring rise and fall in flux.
	1959																							
79	1/26	0842	108	0900	N16 W61	9/1	S16	15XX	--	S	0855	20	2	--	--	1500 2980 3000	CD CD M	0855 0855 0852	0858.5 -- 1036	5.0 12.5 189.0	344 386 964		-1.5	Also at 9400 Mc/s, flux = 663, Δt = -4. PCA reported by JC and JP only. Also max at 0859. Another imp 3 flare (No. 80, Table 3) in the same region starts at 1027.
	1960																							
110	1/11	2040	195	2126	N22 E03	2/2	S19	22XX	96	VS	2100	24	2-	2103.3 14.7/3	2105 170/3	2800	S	2056	2108	>35	220	13	-18	PCA reported by B_1, G, with start times 11/2200 and 12/0700 respectively, and by JC and S with 13/1600 and 13/2000 start times respectively. Only four flares all of importance 1 reported between 11/2040 and 13/1201. None with important radio bursts.
116	5/09	0704	197	0734	S11 E52	7/1	G16	08XX	>72	VS	0700	98	2	--	--	2000 3750	S S	0700 0710	-- --	>70 >60	>20 >40		M_2 M_2	This very small PCA reported by Gregory only. No spectral observations at the time of the flare.
118*	6/01	0824	456	0900	N29 E46	18/10	G20	14XX	144	VS	0837	75	3	--	(0837)	1500 2980 3000	C+ C+	0822.4 0831.	0846.5 0848.	~800 60	700 3100		-13.5 -12.0	Also a major burst at 9100 Mc/s, lasting 63 minutes, peak flux >3400. Very small PCA reported by Gregory only. No spectral observations at the time of the flare.
119	6/25	1131	239	1215	N21 E06	8/4	G22	17XX	> 48	VS	1203	67	2	--	1215 165/3	1500 2800 2980 3000	C+ C+	1148.5 1148	1207.0 1209	241 88	610 425	46	-8.0 -6.0	Small PCA reported by Gregory only. HHI observing no report in IAU Bulletin.
122	6/27	2140	125	2156	N21 W27	4/2	G23	23XX	> 24	VS	2141	138	2+	2157 15/3	2150 44/3	2800 3750	S	2140	2158	38	140	17	-2.0	Small PCA reported by Gregory only. Mag. observing. No report. The type II reported by Warwick frequency 33 to 15 Mc/s, reported unclassified by Ft. Davis and Michigan "resembling type II." Michigan and Warwick continue the Type IV for 119 minutes. This was the third importance 3 flare (flares 119, 120 & 122) from this region. Flare 120 (Table 4) did not produce a PCA event. The radio bursts were moderate at cm wavelength and strong at meter wavelength, starting almost simultaneously with the flare but of short duration and negative Δt.
123	10/29	1026	185	1030	N22 E26	4/2	G30	12XX	192	VS	1029	80	3		See Note	1500 2980 3000	C+ S C+	1026.5 1036 1026.0	1055.2 1049 ~1045.0	273.5 50 >235	583 1000 >800		+25.6 +19.0 +15.0	Small PCA reported by Gregory. No spectral observations at the time of the flare. A probable Type IV based on the large bursts at all frequencies from 23 to 9400 Mc/s.
125	11/10	1009	231	1023	N28 E29	9/1	G31	18XX	>24	VS	1022	90	2			1500 2980 3000	C+ C C+	1016.4 1016 1009.6	1020.6 1120.6 1135.8 1021.7 1022 1121 1136	~200 12 >100	365 760 400 360		-2.4 +62.4 +77.6 -1.3	This burst had 3 major peaks. Also major bursts at 9400 Mc/s and 9100 Mc/s. No spectral observations at the time of the flare. This is the first of a series of major solar events from Plage 5925 which was the source of three major PCA events (Numbers 49, 50 and 51) and four small events reported by Gregory only (G31, G32, G34, and G36), between 11/10 and 11/21 when the region was about 20 degrees beyond the west limb.
128*	12/05	1825	325	1838	N26 E74	4/3	G38	05XX	144	VS	1830	100	3	1834 16/3	1833.5 16.5/3	2800	C	1828 1855	1837.5	27 >120	330 45	23	-0.5	This small PCA reported by Gregory only is in a region which is a return of the very active region 5925.

TABLE 4

IMPORTANCE 3 AND 3+ FLARES

WITH NO KNOWN ASSOCIATED PCA EVENT

Flare Serial No.	Date	Start UT	Duration Min.	Max. UT	Position	No. Reg.	No. Max. Imp.	Onset	Dur. Min.	Imp.	Spectral Type Start UT Dur./Imp. Min /		f	Type	Onset UT	Max. UT	Dur. Min.	Peak Int.	Energy	Δt	Notes
	1955																				
1	1-16	2130	50	----	N33 W41	1/1							2800	CD	2105	--	30.0	(>133)			M_{12}
2	1-18	1218	57	1232	S23 W25	4/2		1227	48	1			2800	CD	1222	--	53.5	(> 84)			M_2
3	11-12	1116	43	1133	N27 E37	2/1		1127	23	2+			2800								Probably observing. Normal observing time 4th quarter 1955: 10-2400 UT
4	12-03	1058	93	1112	N22 E10	2/1		1105	20	3			2800								
	1956																				
5	1-19	0535	100	----	N22 E19	1/1		0558	32	1+			3750								Normal observing time 00-0600 UT
6	2-14	0538	112	0557	N21 E33	3/2		0532	116	3	0554		3000	CD	0541	--	80.0	1080			Time of peak flux not reported.
											26/-		3750	CD	0541	0553	75.0	2720	66	-4	Also 0538-0538.7, SD, Peak Flux (15)
7	2-17	1100	102	1120	N20 W04	8/3		1102	44	3											None observed at cm wave length.
9	2-29	2220	49	----	S30 W21	2/2		2228	72	3-			2800	SD	2217	----	23.0	(525)			M_{12} Times of flare max. & RF peak not reported.
10	3-02	1220	80	----	N21 W64	1/1		1158	34	2			2800								Normal observing time 1st quarter 1956 12-2300 UT
11	4-09	0940	70	1000	N22 E27	5/2		0945	70	2											None observing at cm wavelengths
12	5-17	2230	94	2305	S24 W18	1/1						(2234)	2800	SD	2230	2252	50.0	(35)		-13	
13	8-29	0937	76	0956	N30 W63	8/2		0938	80	2			1500								HRI may have observed.
													2800								Sunrise, normal observing time 10-2300 UT
15	9-05	1445	22	----	S25 E77	1/1							1500								No RF reported at cm wavelength.
													2800								
16	9-14	0813	54	----	S22 E29	3/1							1500								No RF reported at cm wavelengths.
17	10-01	0756	60		W45 W48	1/1							1500								No RF reported at any frequency.
18	10-07	0400	62		N24 E07	1/1							2800								Time of flare max. not reported.
													3000	CD	0411	0413.5	5.0	273		M_1	
														CD	0446	0447	6.0	363			
													3750	CD	0350	----	2.3	(32)		M_{12}	
19	10-11	0955	78	1026	N22 W56	5/2		1012	50	3-			1500								
20	11-07	1109	174	1135	S17 E32	6/2*		1127	153	3-		(1103)	1500	CD	1106	-----	113.0	(865)		M_2	Time of peak intensity not reported.
21	11-14	1037	230	1055	S20 W55	3/2		1037	78	2+		(1035)	1500	CD	1032	----	73.0	(820)		M_2	Also 9400 Mc/s starting 1035 UT lasting 115 mins., peak smoothed flux 1045.
22	11-20	1002	188	1020	S15 W56	6/2		1007	59	3-		(1009)	1500	CD	1010		215.0	(>1500)		M_2	Also 9400 Mc/s start 1000 UT lasting 208 mins., peak smoothed flux >5000. Major bursts at meter wavelength.
23	12-06	1405	9		S21 E41	1/1		1338	38	3-			2800	SD	1336	1339.5	6.0	127		M_1	
															1342		95.0	10			
24	12-17	1535	90	1551	S24 W52	1/1		1554	75	3			2800	SD	1538.5	1545.5	16.5	(335)		-5.5	
															1555		100.0	50			
25	12-22	0955	63		N32 E90	1/1							1500								No bursts reported at any wavelength Normal observing times 07-1400 UT at 1500 Mc/s
	1957																				
26	1-06	1038	205	1128	S21 [illegible]	6/1															No observations at cm wavelength.
28	1-23	2310	48	2314	N17 [illegible]	1/1*															No observations at cm wavelength.
29	1-24	1225	89	1241	N16 [illegible]	4/1		1235	35	2			2800	SD	<1235	----	>10.0	(>120)			Also moderate bursts at 200 & 536 Mc/s.
30	1-25	0520	17	0526	S22 [illegible]	1/1		0528	20	1			3000								Normal observing time 1st quarter 00-0600 UT at 3000 and 3750 Mc/s.
													3750								
31	1-31	0358	112	0436	N[illegible] E05	1/1*		0356	84	1	0407		3000	CD	0400	0435	>120.0	234		-1	
											17/3		3750								No flux reported.
32	2-08	0832	43	0836	S[illegible] E06	1/1															No observations at cm wavelength, small bursts at meter wavelength.
34	2-28	0005	255	0014	N[illegible] W35	1/1		0020	110	1+	0009	0029	3000	CD	0000	0045	>50.0	224		+31	Flare was reported by Mitaka only (IAU)
											17/3+	57/-									
35	4-02	1002	10		S[illegible] W90	1/1							1500	SD	1036	----	2.0	(129)			No report at 2980.
37	4-16	1040	140	1105	S[illegible] E85	10/2		1044	76	3			1500								HRI was observing at 1500 Mc/s
													2800	CD	1040	1046	54.0	(1650)	87	-19	but not included in IAU Bulletin
													2980	CD	1037		50.0	1600			
38	4-17	1006	72	1022	S[illegible] E76	6/2		1004	79	3			1500								Flare occurred during normal observing time at 1500, 2000, and 3000 Mc/s, no flux reported. Sunrise at 2800.
													2000								
													2980	CD	1006		4.0	---		-	
38a	4-17	2000	180	2116	S[illegible] E69	1/1*		1937	163	3+	2032	2011	2800	GB	2006	2042	79.0	6000	546	-34	This flare reported by Honolulu is not included in the IAU Bulletin
												44/2									

TABLE 4 (cont.)

Flare Serial No.	FLARE DATA: Date	Start UT	Duration Min.	Max. UT	Position	No. Rep.	No. Max. Rep.	SHORT WAVE FADE: Onset	Dur. Min.	Imp.	SPECTRAL TYPE: Start UT / Dur. Min. / Imp. IV	IV	RADIO FREQUENCIES CONVERTER HOURS: f	Type	Onset UT	Max. UT	Dur. Min.	Peak Int.	Energy	Δt	Notes
40	7-04	1134	20		N12 E39	1/1							1500 2000 2800 2980 3000								This flare reported by Moscow only, occurred during the normal 3rd quarter observing-time of at least five HF observatories. None reported a flux increase.
41	7-22	0953	117		N15 E51	1/1							1500 2000 2980 3000 3750								Flare reported by Moscow only. Many small bursts reported between 0946 and 1008 UT at meter wavelength. Flare occurred during the normal operating times of the listed frequencies, also at 2900, 9375, and 9400. No flux reported at any cm wavelength.
45	9-03	1412	195	1429	N23 W30	13/6		1420	103	3		(1417)	1500 2800 2980 3000	SD SD	1420 1417	1425 1424	80.0 25.0	(509) (1350)	51	-4 -5	A large burst was also recorded at 9400 Mc/s Δt =-6. Hed recorded an increase at 2980. Moderate to large bursts were reported at most meter wavelengths.
46	9-10	0223	37	0250	N14 E11	1/1							2000 3000 3750	CD SD CD	0222 0223 0222	0228 0228 0228	35.0 35.0 35.0	(15) 349 (38)		-22 -22 -22	This flare was reported by Sydney only.
48	9-18	1026	347	1045	N23 E30	12/3		1030	104	3			1500 2000 2800 2980 3000	CD Sunrise SD SD	1100 1102 1100	1103 --- 1102	7.0 2.5 6.0	(157) 308 ---		+18 +17	All of the HF Bursts associated with this flare started after the reported flare maximum at 1045 UT, even tho there was a major SWF starting a few minutes after the flare, all of the HF bursts were small and of short duration.
50	9-19	0350	125	0410	N23 E02	5/1		0359	54	3		0427 183/3	2000 3000 3750	CD CD CD	0402 0401 0359	0406 0406 0406	8.0 10.0 11.0	(254) 1410 (1080)	 12	-4 -4 -4	
53	9-30	1057	33	1706	N25 W37	5/3		1700	40	3			1500 2000 2800 2980 3000	 SD SD CD CD	 1658 1658 1700 1705.5	 1658.4 1710 1702 1706.3	 1.0 70.0 6.0 3.0	 (18) (30) (77) (120)		 -7.6 +4 -4 +0.3	The HF emissions were reported at 2800 Mc/s only and consist of several small bursts super posed on a rise and fall in flux. No bursts were reported at the other cm wavelength and none were reported at meter wavelength.
54	10-16	0152	10	0152	S25 E21	1/1		0150	20	2+			2000 3750	CD ECD	0151.9 0151.9	0152.8 0152.2	3.0 3.0	92 (165)		+0.8 +0.2	This flare was reported by Mitaka only. Small bursts were also reported at 9400 and 1000 Mc/s.
56	11-24	0848	194	0911	S14 E37	7/1		0901	32	3-		(0857)B	1500 2980 3000	CD CD CD	0857 0859 <0906.5	0904 0906.5	61.0 40.0 >19.0	(251) >998 ---		-7 M_2 -4.5	
57	11-29	0045	315	0213	S41 E63	1/1*					0059 4/2		2000 3000 3750								This flare was reported by Sydney only. No HF bursts were reported at the selected frequencies. A burst at 9500 Mc/s lasted for 120 minutes with a peak flux 488 and Δt= -5 was the only reported emission although Sydney reported a Type II which started before the flare max.
	1958																				
58	1-25	0915	112	1005	S24 W69	17/1		0938	74	3			1500 2980 3000	CD CD SD	0948 0932 0949	1015 1015	51.0 40.0 83.0	122 278 358		+10 M_2 +10	Also max at 1006, 1011 with Δt -1, +5, resp. Also max at 0957, 1002, 1005 with Δt: -8, -3, 0, resp.
59	3-01	0905	62	0917	S11 W46	5/1		0913	12	2+			1500 2980 3000	SD SD	0911 0913.5	0914	21.0 2.0	225 458		-3 M_2	HHI not reported in IAU
60	3-03	1005	165	1020	S16 E60	8/1		1010	95	3+		(1005)B	1500 2980 3000	SD	1005	--	28.0	1338 1015		M_2 -5	Great bursts at meter wavelengths. Max reported by Jod.
61	3-05	0500	92	0540	S12 E46	1/1							2000 3000 3750								This is a questionable importance 3 flare.
63	4-07	1010	125	1025	N15 E33	5/2		1016	69	2+			1500 2980 3000	CD SD	1013 1014	1016.5	36.0 8.0	564 736		-8.5 M_2	
64	5-01	2115	86	2130	S19 E15	4/1		2130	25	1+			2800	SD SA	2127.9 2127.9	2157 2128.5	>152.0 5.0	(25) (130)		+27 -1.5	This weak gradual rise and fall of long duration has the super-posed minor burst with a Δt =-1.5. The large burst at 9500 (peak >829) Also has a Δt = -1.5.
65	5-05	0356	61	0415	S18 W29	3/2		0407	53	3		(0412)	2000 3000 3750	CD CD CD	0412 0412 0412	0414.9 0414.8 0414.1	9.0 12.0 9.0	(470) 1200 (900)	 10	-0.1 -0.2 -0.9	Also max at 0414.8, 0419.6 with Δt: -0.2, +4.6 , resp.
66	6-19	0940	150	1010	N14 W21	14/5		1005	25	2			1500 2800 2980 3000	CD SD	0943 0942.8	0944.5 0944.2	107.0 5.0	116 (140)		-25.5 -25.8	Small bursts lasting from 30 to 200 minutes reported at all meter wavelengths. HHI and Hed. also observed increase, not reported.
69	8-04	0409	121	0435	N30 W31	3/1		0422	96	3	See Note		2980 3000 3750	CD CD CD	0427 0427 0428	0432 0431 0431	10.0 20.0 10.0	(96) 337 (130)		-3 -4 -4	Also bursts at 1000 and 0500. Sydney reports possible Type II 0439-0453.

TABLE 4 (cont.)

Flare Serial No.	FLARE DATA: Date	Start UT	Duration Min.	Max. UT	Position	No. Rep	No. Max. Imp.	SHORT WAVE FADE: Onset	Dur. Min.	Imp.	SPECTRAL TYPE: Start UT Dur./Imp. Min/ II	IV	SINGLE FREQUENCIES CENTIMETER BURSTS: f	Type	Onset UT	Max. UT	Dur. Min.	Peak Int.	Energy	Δt	Notes
70	8-07	1457	123	1508	S16 E71	10/4		1500	105	3+			1500	SD	1500	1503	57.3	136		-5	Flare in the same region as the PCA flare No. 28 on 8/16.
													2800	CA	1500	1503	15.5	(95)		-3	
														CA	1516	1522	12.5	(180)		+14	
													2980								MRI and Med observed increase of 1500 and 1516 UT
													3000								
74	9-18	0728	130	0830	S12 W53	8/3							1500	SD	0828	0829.5	5.0	222		-0.5	
													2980								
													3000	SD	0827	0830.0	11.3	261		0	Also max. at 0835 UT
75	11-14	0036	91	0046	S19 E51	2/1		0039	61	3			2000	CD	0033	0039	11.0	(32)		-7	Also small bursts at 1000 and 9400 Mc/s moderate burst at 9500 Mc/s.
													3000								
													3750	CD	0035	0040	65.0	(32)		-6	
76	11-24	1607	180	1621	S12 W08	3/2		1615	80	3-		1607 12/3	2800	SA	1613	1620	25.0	(285)		-1	Also at 1600 UT lasting > 30 minutes
													3000								
77	12-31	1656	67	1703	S18 W54	2/2		1700	36	2+	1705/ 36/2+	1700 12/2	2800	CD	1658	1702	18.0	(340)		+1	
													3000								Sunset at Jod.
	1959																				
78	1-21	1700	50	1709	N20 E48	2/1		1702	41	2+	1718 25/3		1500								
													2800	SD/ RCD	1702	1708	26.5	600	12	-7	
													3000								
80	1-26	1027	158	1050	N16 W61	8/2							1500	CD	1025	1037	13.5	765		-13	The small PCA (S16) was associated with the importance 3 flare at 0842 in the same region.
													2980	CD	1032		34.0	1099		M_2	
													3000								
81	2-01	0352	66	0423	N12 E83	1/1		0422	25	3-			2000	CD	0408	0422	16.0	(270)		-1	Also bursts at 1000, 9400 and 9500 Mc/s. Tok.not observing at 3000 Mc/s Feb. 01 through Feb. 06.
													3000								
													3750	CD	0408	0422	17.0	(550)	6	-1	
82	2-02	1015	132	1039	N22 W30	7/3		1032	18	1			1500								No RF activity reported between 0635 and 1817 UT.
													2800								
													3000								
83	2-02	1816	123	1824	N09 E60	2/2		1817	85	3	1853 10/3		2800	CD	1819	1821.2	9.0	115		-2.8	The RF emission consisted of complex bursts superposed on a long but small rise and fall in flux. Other 2800 Mc/s peaks at 1851.3 and 1910.3
															1817	---	65.0	30			
													3200		1819.7 1814.6	1822.2	9.5 70.0	122 39		-1.8	
85	2-18	1005	15	----	N21 E76	1/1							1500								It is doubtful if either flare 85 or 86 was importance 3. They are included in Table 1 but not in Table VIII, Solar Activity Cat. They are included in the McMath Working List. Both flares were reported by Kennelhohe.
86	2-18	1142	08	----	N21 E76	1/1							2800								
													3000								
87	2-19	2032	132	2037	N11 W10	3/1		2030	40	1+		(2030)	2800	SD	2030		80.0	(200)			The time of max. is indeterminate; however, times of peak flux at 3200 and 9530 Mc/s indicate a negative Δt
													3200		2030	2034.5	12.0	417		-2.5	
88	3-24	0956	207	1015	N29 W77	16/7		1002	107	3		(1003)	1500	CD	1005	1013	30.0	812		-2	MRI reports a max at 1012.
													2980	SD	1003		25.0	>1729			
													3000		1003	1012	57.0			-3	
89	3-28	2113	122	2126	N24 W33	5/3		2121	24	1+			2800	SD	2121	2124	7.0	(100)		-2	
90	4-09	2316	123	2327	N16 W67	4/2*		2317	93	3+			2000	CD	2320	2323	9.0	(580)		-4	Also major burst at 9500 Mc/s (peak flux 2960) and small burst at 1000 Mc/s (smooth peak 38)
													2800		sunset						
													3750	CD	2318	2323	> 8.0	(2300)	37	-4	
91	4-08	0903	97	0921	N27 E85	9/3		0913	32	2+			1500	SD	0915	0916	15.2	> 925		-5	
													2980	SD	0915		22.0	> 2150		M_2	
													3000	CD	0914	0916	18.5	1484		-5	Also observed by Gor. and Sim.
92	4-13	0823	73	0840	N27 E19	16/2		0835	25	2			1500	SD	0832	0840	12.0	232		0	
													2980	CD	0832		13.5	282		M_2	
													3000	SD	0830	0840	16.7	314		0	
93	5-09	0123	49	0150	N20 E78	1/1							2000		No centimeter bursts reported						Flares 93 and 96 occur in the same region as PCA (34) associated with flares 94 and 95 on May 10 that were also responsible for the sea level event on May 11 at 0030 UT. Flare 96 which has all of the characteristics of a PCA flare occurred while PCA 34 was still increasing. However, Leinbach found no evidence that this flare did contribute to the PCA.
													2980		although the flare occurred						
													3000		during the normal observing times						
													3750		for these frequencies.						
96	5-11	2002	104	2028	N10 E41	4/1		2015	67	3-	2020 19/3+	2028 18/3	2800	CA	2010	2022	200.0	(900)		-6	
97	5-10	0618	112	0628	N15 E15	9/5		0623	34	2		(0624)	1500								Also a major burst at 9400 Mc/s (smoothed peak 2300 durations very short). No bursts reported at the other cm wavelengths although the flare occurred during their normal observing times.
													2000	SD	0623	0625.9	5.0	(1150)		-2.1	
													2980								
													3000								
													3750	CD	0623	0625.6	6.0	(1100)	16	-2.4	
98	5-16	1134	86	1148	N16 W12	7/1		1138	22	2+		(1138)	1500	SD	1138	1142		1025		-6	Also major bursts at 9375 and 19000 Mc/s with Δt= -9
													2800	CD	1139	1140	180	(1225)	14	-8	
													2980								
													3000	CD	1139	1140	48.0			-8	Also Gor. and Sim.
101	7-13	0255	190	0410	N13 E18	1/1							2000	CD	0249	0254	12.0	(24)		-76	Flares 101 and 104 occurred in the same region as PCA's 35, 36, and 37, flares 99-100, 102, and 105.
													3000	SD	0249	0250	3.0	246		-80	
													3750	CD	0248.8	0249.5	3.0	(38)		-80.5	
103	7-14	1400	210	1452	S25 E37	14/1		1355	105	2+			1500	M	1443	1447	32.0	340		-5	
													2800	SD	1443	1446	30	(85)		-6	
													2980								Observed by Med, flux and time not reported
													3000								
104	7-16	1525	110	1616	N14 W27	8/1		1610	28	2-	1616 7/13		1500								Observed by MRI, flux and time not reported
													2800	SA	1613	1615	9.0	(350)		-1	
													2980								Observed by Med, flux and time not reported
													3000								

TABLE 4 (cont.)

Flare Serial No.	FLARE DATA: Date	Start UT	Duration Min.	Max. UT	Position	No. Reg.	No. Max. Imp.	SHORT WAVE FADE: Onset	Dur. Min.	Imp.	SPECTRAL TYPE: Start UT / Dur./Imp. Min. II	IV	SINGLE FREQUENCIES CENTIMETER BURSTS: f.	Type	Onset UT	Max. UT	Dur. Min.	Peak Int.	Energy	Δt	Notes
106	7-27	2050	120	2115	N27 E26	6/2		2105	23	1+	2118 8/2		2800	SD	2100	2126	110.0	(20)		+13	A burst superposed on a long rise and fall in flux neither of which is very strong.
														SA	2107	2111	10.0	(75)		-4	
108	11-28	2006	84	2018	N12 E31	3/2		2010	35	2	2017 28/3	(2027)	2800	SD	2010	--	15.0	>225	M_2		Flares 108 and 109 occurred in a region which during disk passage produced four importance 2+ flares and one importance 2 flare that were followed by Type II and/or Type IV spectral emissions. The importance 2+ flare at 0847 on the 30th was followed by Type II, Type IV spectral emissions, and strong bursts at centimeter wavelengths 9400 to 1000 Mc/s, followed by most burst decreases in flux lasting for two or more hours.
109	11-30	1720	106	1744	N07 E06	5/4		1735	47	3-	1741 29/3+	1739 351/3	2800	SD	1737.8 1745.8	--	18.0 60.0	(3475) 20	M_2		
	1960																				
111	2-22	1352	88	1400	N08 E41	4/1		1358	42	3-	1358 13/3	<1356 >4/2	1500	C	1351.4	1355.4	50.0	319		-4.6	Also 9400 Mc/s 1353.8 UT, 59.8 sfm. Peak flux 455, Δt = -1.4
													2800	C	1353.5	1359	28.0	340		-1.0	
120	6-26	0428	57	0436	N20 W08	2/2		0432	56	1+			2000	c	0428		10.0	92		-3.8	This flare occurs in the same region as the flares associated with the two very small PCA's reported by Gregory: G22 and G23, flares 119 and 122.
													3000	ECD	0430.8	0432.7	8.0	422		-3.8	
													3750	C	0428	0432.2	10.0	225		-3.8	
121	6-26	2358	59	2415	S08 E34	2/2		2403	67	2-	2404 4.5/3	2413 36/3	2000								Also Mag.
													2800	s	2402	--	>28.0	13	M_2		In sunset oscillation
													3750	c	2405	2412.5	50.0	50		-2.5	
124	11-06	<1752	158	1841	N13 E07	1/1		1708	67	1	1840 10/2		2800	s	1835	1838	25.0	28		-3	Flare reported by Honolulu only.
	1961																				
129	3/26	1009	101	1035	S15 E74	16/6		1019	41	3			1500	C+	1020	1028.7	110	200		-6.3	10 peaks on 1500 Mc/s
													2980	C	1026	--	14.0	460	M_2		
													3000								During normal observing time of HHI
130	4-26	1646	179	1710	S11 E54	2/1		1650	113	3			1500								During normal observing time of HHI
													2800	s	1640		237	32	M_2		
															1656.8	1702	8.0	18		-8	
131	5-04	2145	115	2213	S11 W56	4/2		2205	40	1+	2209 30.3/1	2249 72/1-	2000	c	2205	2208	8.0	110		-5	Also 9400 and 1000 Mc/s
													2800	s	2205	2208.8	9.0	95		-4.2	
													3750	c	2207	2209	6.0	80		-4	
134	7-15	1433	296	1556	N13 E15	8/1		1512	113	3		1533 50/3	1500	s	1428.4	1428.7	1.6	3		-92.7	Also <1435, max 1600.7, >240 min., flux 296, Δt +4.7
													2800	c	1432	1436.3	14.0	54		-79.7	Also 1432, max 1623, 458min.flux 54, Δt +4.5
													2980	c	1433	1436.5				-79.5	
	1962																				
139	3-22	2220	50	2241	N07 E36	1/1							2000	c	--	2231.4	>15.0	16		-9.8	Sunrise } flare reported by Sac peak only
													2800	-	2214	2230	>36.0	35		-11	Sunset } records incomplete
													3750	c	--	2231.2	>15.0	29		-9.8	Sunrise }
140	4-18	1734	235	1806	N09 E05	5/2		1752	108	3	1844.4 8.6/2	1839 63/2-3	2800	s	1734	1845	294.0	25			The gradual small rise which lasts for nearly six hours has the very small superposed burst with a Δt = -2.5. No other single frequency at either cm or meter wavelength are reported.
														s	1800	1803.5	11.0	20		-2.5	
141	1961 9-16	0325	172	0422	N11 E57	3/							2000	es	0419.5	0419.6	1.0	55		-2.4	Also 9400 Mc/s at 0419-0423, peak flux 120, Δt = -2.3.
													3750	es	0419.5	0419.6	1.0	35		-2.4	No observations b. Tok.at 3000 Mc/s.

APPENDIX A

For the sake of convenience we have included Tables 1, 2, 7, and 8 from Source 4, as Tables A-1, A-2, A-3, and A-4.

TABLE A-1

PCA'S WITH ASSOCIATED FLARES AND SOURCES

No.	Date	PCA Beg.	Rise Time, hrs.	Duration hrs.	Abs. db.	Flare Onset	Flare Max.	Imp.	Position	Δt	Range Start Times	Original Sources	Others
	1956												
1.	Feb. 23	0400	18	123	13.0	0334	--	3	N23 W80	0^h23^m	23/0400-23/0600	B_1, B_2, Be, CJM, JP, S	M, Mo, WH
2.	Mar. 10	0900	38	160	3.5	0515	--	2	N16 E88	3^h45^m	10/0900-11/1600	B_1, Be, CJM	M
3.	Aug. 31	1430	14	69	4.9	1226	1246	3+(3)	N15 E15	2^h04^m	31/1430-31/1800	B_1, B_2, Be, CJM, JP, S	M, Mo. WH
4.	Nov. 13	2000	27	63	5.4	1430	1501	2	N16 W10	5^h30^m	13/1400-14/1600	B_1, B_2, Be, CJM	M, Mo, WH
	1957												
5.	Jan. 20	1500	16	86	4.1	1100	1119	3	S30 W18	4^h00^m	20/1500-21/1500	B_1, B_2, Be, CJM, DLP, S	BO, M, Mo, WH
6.	Apr. 3	1330	14	65	3.9	0825	0835	3	S14 W60	5^h05^m	02/2300-04/1200	B_1, B_2, Be, CJM, JP	BO, M, Mo, WH
7.	June 19	2215			Weak	1609	1613	2+(2)	N20 E45	6^h06^m	19/2215-19/2300	Be, JP, S	BO
8.	June 22	0500	44	115	5.0	0236	--	2	N23 E12	2^h24^m	22/0500-22/1000	B_1, B_2, K, RL, S	BO, M, WH
9.	July 3	0900	12	52	9.2	0712 0830	0745 0840	3+ 3+	N14 W40 N10 W42	1^h42^m 0^h30^m	03/0815-03/1030	B_1, B_2, Be, Bo, DLP, HG, HNS, H, JP, K, OH, PS, RL, S	BO, M, Mo, WH
10.	July 24	2015		27	2.0	1712 1801	1737 1828	3	S24 W27	3^h03^m	24/1000-24/2400	B_2, Bo, H, HG, HNS, JP, K, OH, PS, RL, S	BO, M, Mo, WH
11.	Aug. 9	1600	10	50	3.1	0617	0629	2	S09 E76	9^h43^m	09/1500-09/2400	B_1, Be, H, JC, K, PS	BO, M
12.	Aug. 28	1300			Weak	0810	0955	3+(3)	S30 E35	4^h50^m	28/0400-28/2300	A, Be, Bo, DLP, H, PS	BO, Mo
13.	Aug. 29	0000	7	27	3.2	28/2010	2024	3(2+)	S28 E30	3^h50^m	29/0000-29/0500	A, B_1, B_2, HG, HNS, OH, PS, S	BO, M, Mo, WH
14.	Aug. 29	1300	12	58	8.2	1031	1052	3(2)	S25 E20	3^h29^m	29/1300-29/1500	A, B_1, B_2, DLP, HG, HNS, K, OH, RL, S	BO, M, WH
15.	Aug. 31	1415	12	46	4.9	1257	1313	3+(3)	N25 W02	1^h18^m	31/1415-31/1530	A, B_1, B_2, H, K, S	BO, M, Mo, WH
16.	Sept. 02	1700	9	46	7.2	1313		3(2+)	S34 W36	3^h47^m	02/1500-02/2100	B_1, B_2, Bo, HNS, H, K, OH, RL, S	BO, M, Mo, WH
17.	Sept. 12	0200	13	57	0.5	11/0236	0300	3	N13 W02	23^h24^m	12/0200-12/2315	B_2, Be, Bo, DLP, HG, HNS, H, JP, K, Kh, OH, PS, RL, S	BO, M, Mo, WH
18.	Sept. 18	2000				18 1658 1818	1740 1840	3+	N23 E08	$3^h 02^m$ $1^h 42^m$	18/2000-19/0400	Be, DLP, H, Kh, PS	BO
19.	Sept. 21	1700	18	63	5.1	1330	1335	3	N10 W06	$3^h 30^m$	21/1200-21/2115	B, B_2, CJM, HG, HNS, H, K, OH, PS, RL, S	BO, M, Mo, WH
20.	Sept. 26	2100		31	2.0	1907	1952	3	N22 E15	$1^h 53^m$	26/2100-26/2315	B_1, Be, Bo, HG, HNS, H, K, Kh, OH, PS, RL, S	BO, M, WH
21.	Oct. 20	2100	22	64	7.8	1637	1642	3+	S26 W45	$4^h 23^m$	20/1700-21/1400	B_1, Be, Bo, CJM, DLP, HG, HNS, H, JP, K, Kh, OH, PS, RL, S	BO, M, Mo, WH
	1958												
22.	Feb. 10	0600	14	37	3.2	9/2108	2142	2+	S12 W14	$8^h 52^m$	10/0500-10/2400	B_1, B_2, Be, Bo, CJM, DLP, HG, HNS, K, Kh, OH, PS, RL, S	BO, M, Mo, WH
23.	Mar. 23	1500	34	53	3.2	0947	1005	3+	S14 E78	$5^h 13^m$	23/1500-23/1830	B_1, B_2, Bo	BO, M, Mo, WH
24.	Mar. 25	1530	13	122	10.0	0557		2	S15 E50	$9^h 33^m$	25/0100-25/1545	B_1, B_2, Be, CJM, DLP, HG, HNS, K, Kh, L, OH, PS, RL, S	BO, M, Mo, WH
25.	June 06	0600			Weak	0436	0448	3(2)	N16 W78	$1^h 12^m$	04/2300-06/1345	Be, Bo, DLP, HG, HNS, Kh, OH, PS, S	BO, M, WH
26.	July 07	0130	22	96	23.7	0020	0110	3+	N25 W08	$0^h 20^m$	07/0100-07/600	B_1, B_2, Be, Bo, CJM, DLP, HG, HNS, JP, K, Kh, L, OH, PS, RL, S	BO, M, Mo, WH
27.	July 29	0400		30	1.5	0259	0304	3	S14 W44	$1^h 01^m$	29/0400-29/0500	B_2, Be, Bo, DLP, HG, HNS, JP, K, Kh, OH, RL, S	BO, M, Mo, WH
28.	Aug. 16	0600	16 (2 db/hr)	71	>15.0	0433	0440	3+	S14 W50	$1^h 28^m$	29/0600-16/1200	B_1, B_2, Be, Bo, CJM, DLP, HG, HNS, JP, K, Kh, L, OH, PS, RL, S, EIV	BO, M, Mo, WH
29.	Aug. 21	1400	0.2 db/hr	19	3.0	20/0042	0045	3(2+)	N16 E17	13^h18^m	21/1400-21/1730	B_1, Be, DLP, HNS, K, Kh, L, RL, S	BO, M, WH
30.	Aug. 22	1530	11	84	10.6	1417	1450	3	N18 W10	$1^h 23^m$	22/1500-22/1745	B_1, B_2, Bo, CJM, DLP, HG, HNS, K, Kh, L, OH, PS, RL, S	BO, M, Mo, WH
31.	Aug. 26	0100	1 db/hr	89	16.6	0005	0027	3	N20 W54	$0^h 55^m$	26/0100-26/0400	B_1, B_2, Bo, CJM, DLP, HG HNS, JP, K, Kh, L, OH, PS, RL, S	BO, M, Mo, WH
32.	Sept. 22	1400	22	80	5.0	0738	0750	2+(2)	S19 W42	$6^h 22^m$	22/0530-22/1730	B_1, B_2, Be, Bo, HG, HNS, JP, K, Kh, OH, PS, RL, S	BO, M, Mo, WH
	1959												
33.	Feb. 13	0800	12	74	2.6	12/2301	2325	3+(3)	N13 E48	$8^h 59^m$	13/0800-13/1400	B_1, Be, JC, JP	BO
34.	May 10	2300	3 db/hr	170	22.0	2055	2140	3+	N19 E47	$2^h 05^m$	10/2300-11/0300	B_1, B_2, Be, CJM, DH, DLP, EHO, JP, K, Kh, L, OH, RL, S, SL	BO, M, Mo, WH

PCA'S WITH ASSOCIATED FLARES AND SOURCES (cont.)

No.	Date	PCA Beg.	Rise Time, hrs.	Duration hrs.	Abs. db.	Flare Onset	Flare Max.	Imp.	Position	t	Range Start Times	Original Sources	Others
35.	July 10	0400	0.9 db/hr	360	20.0	0206	0230	3+	N20 E60	$1^h\ 54^m$	9/2000-10/1000	B_1, B_2, Be, CJM, DLP, EHO, K, Kh, L, OH, RL, S, SL	BO, M, Mo, WH
36.	July 14	0445	27	72	23.7	0325	0349 0527	3+	N17 E04	$1^h\ 20^m$	14/0445-14/0800	B_1, B_2, CJM, DLP, EHO, K, Kh, L, OH, RL, S, SL	BO, M, Mo, WH
37.	July 16	<2250	10	168	21.2	2114	2128	3+	N16 W30	$1^h\ 36^m$	16/2200-17/0600	B_1, B_2, CJM, DH, EHO, JP, K, Kh, L, OH, RL, S, SL	BO, Mo, WH
38.	Aug. 18	1100		60	3.0	1014	1030	3+(3)	N12 W33	$0^h\ 46^m$	18/1100-19/10xx	B_1, Be, DLP, JC, JP, K, S	BO
	1960												
39.	Mar. 29	0800	50	73	2.6	0640	0710	3(2+)	N13 E30	$1^h\ 20^m$	29/0800-29/1100	B_1, B_2, G	BO, Mo
40.	Mar. 30	2000		>36	5.0	1455	1540	3+(2)	N12 E13	$5^h\ 05^m$	30/1100-31/<0700	B_2, DH, EHO, GM, JP, K, L, S, Sat.	BO, M, Mo, WH
41.	Apr. 01	1000	6	73	3.6	0843	0859	3	N12 W11	$1^h\ 17^m$	01/0930-01/1000	B_1, B_2, G, GM, K, L, S, Sat	BO, M, Mo, WH
42.	Apr. 05	0400	>16	55	3.1	0215	0245	3(2)	N12 W62	$1^h\ 45^m$	05/0400-05/1400	B_1, B_2, EHO, G, GM, K, L, S, Sat.	BO, M, Mo, WH
43.	Apr. 28	0230	12	30	3.5	0130	0137	3	S05 E34	$1^h\ 0^m$	28/0200-28/1000	B_1, B_2, EHO, G, GM, JP, K, L, S, Sat	BO, M, Mo, WH
44.	Apr. 29	0400	0.4 db/hr	114	14.0	0107	0210 0359 0554	3(2+)	N14 W21	$2^h\ 53^m$	29/0200-29/700	B_1, B_2, EHO, G, GM, JP, K, L, S, Sat	BO, M, Mo, WH
45.	May 04	1030	3.2 db/hr	8	3.4	1000	1016	3	N13 W90	$0^h\ 30^m$	04/1030-04/1200	B_1, B_2, EHO, G, JP, K, L, S, Sat	BO, M, Mo, WH
46.	May 06	1600	0.15-0.33 db/hr	103	16.0	1404	1448	3+	S09 E07	$1^h 56^m$	06/1400-06/1800	B_1, B_2, EHO, G, JP, K, L, S	BO, M, Mo, WH
47.	May 13	0620	0.7 db/hr	65	4.5	0519	0532	3+(3)	N29 W67	$1^h\ 01^m$	13/0620-13/0800	B_1, B_2, EHO, G, JP, K, L, S, Sat	BO, M, Mo, WH
48.	Sept. 03	0500	31	89	2.7	0037	0108	3(2+)	N18 E88	$4^h\ 23^m$	03/0500-03/2300	B_1, B_2, EHO, G, JC, K, S	BO, M, Mo, WH
49.	Nov. 12	1400	16	73	21.2	1315	1330	3+	N27 W04	$0^h\ 45^m$	12/1400-12/1600	B_1, B_2, G, JP, K, S, Sat	BO, M, Mo, WH
50.	Nov. 15	0430	15	79	20.0	0207	0221	3+(3)	N26 W35	$2^h\ 23^m$	15/043-15/1200	B_1, B_2, G, JP, K, S, Sat.	BO, M, Mo, WH
51.	Nov. 21	0200	15	51	3.0	20/1955 20/2114	2020 2135	3(1) 3(2)	N25 W90 N28 W90	$6^h\ 05^m$ $4^h\ 46^m$	21/0000-21/1300	B_1, B_2, G, JP, S	BO, M, Mo, WH
	1961												
52.	July 11	2200	0.08 db/hr		1.3	1615	1659 1710	3	S07 E31	$5^h\ 45^m$	11/2200-11/2400	L, M, Sat	BO, M, Mo
53.	July 12	1900	0.8 db/hr	72	17.0	0950	1025	3+(3)	S07 E22	$9^h\ 10^m$	12/1300-12/2115	B_1, JP, L_2, Sat	BO, M, Mo, WH
54.	July 18	1130	8	55	10.0	0920	1005	3+	S07 W59	$2^h\ 10^m$	18/1130-18/1200	B_1, JP, L_2, Sat	BO, M, Mo, WH
55.	July 20	2200			Weak	1553 1633 1828	1600 1653 1847	3+(3)	S05 W90	$6^h\ 07^m$ $5^h\ 27^m$ $3^h\ 32^m$		L_2, Sat	BO, M, Mo, WH
56.	Sept. 10	2000	18	79	2.9	1555	1610	1	N10 W90	$4^h\ 05^m$	10/2000-10/2300	B_1, BO, Sat	M, Mo
57.	Sept. 28	2245	1.7 db/h pre-ssc 3.3 db/h post-ssc		3.3	2202	2223	3	N13 E29	$0^h\ 43^m$	10/2245-10/2335	B_1, L, L_2, Sat, Bal	BO, M, Mo, WH
	1963												
58.	Sept. 20	2400	15	54	3.1	2314	2403	2	N10 W09	$0^h\ 46^m$		B_1, BO,	
59.	Sept. 26	0745	8	89	4.6	0638	0717	3	N13 W78	$1^h\ 07^m$	26/0730-26/0745	B_1, BO	

TABLE A-2

SOURCES USED FOR POLAR CAP ABSORPTION DATA

A	Anderson	J. Geophys. Res.	69	1964	1743-1753
B_1	Bailey	Planet. Space Sci.	12	1964	495-541
B_2	Bailey	J. Phys. Soc. Japan	17 A-1	1962	106-112
Be	Besprozvannaya	J. Phys. Soc. Japan	17 A-1	1962	146-150
Bo	Bookin	J. Phys. Soc. Japan	17 A-1	1962	150-151
BO	Basler & Owren	U. Alaska Geophys. Inst.	R-152	1962	189 pp.
CJM	Collins, Jelly & Matthews	Can. J. Phys.	39	1961	35-52
DH	Dodson & Hedeman	Ark. Geofysik	3	1962	469-470
DLP	Dvoryashin, Levitskii & Pankratov	Soviet Astron. A.J.	5	1961	311-325
EHO	Egeland, Hultqvist & Ortner	Ark. Geofysik	3	1962	481-488
FW	Freier & Webber	J. Geophys. Res.	68	1963	1605-1620
Go	Gosling	J. Geophys. Res.	69	1964	1233-1238
G	Gregory	J. Geophys. Res.	68	1963	3097-3107
GM	Greenstadt & Moreton	J. Geophys. Res.	67	1962	3299-3316
H	Hill	J. Phys. Soc. Japan	17 A-1	1962	97-102
HG	Hakura & Goh	J. Radio Res. Lab. Japan	6	1959	635-650
HNS	Hakura, Nagai & Sano	Rep. Ionosph. Space Res. Japan	15	1961	14-30
JC	Jelly & Collins	Can. J. Phys.	40	1962	706-718
JP	Jenkins & Paghis	Can. J. Phys.	41	1963	1056-1073
K	Kahle	U. Alaska Geophys. Inst.	R-129	1962	76 pp.
Kh	Khocholava	Geomag. Aeronomy.	2	1962	90-96, 907-913
			3	1963	735-740
L_1	Leinbach	U. Alaska Geophys. Inst.	R-127	1962	230 pp.
L_2	Leinbach	U. Alaska Geophys. Inst.	R-126	1962	16 pp.
M	Malitson	NASA TR	R-169	1963	109-117
MW	Malitson & Webber	NASA TR	R-169	1963	1-17
Mo	Modisette	Manned Spacecraft Center Eng. Des. & Oper, Ed.Purser, et.al.		1964	97-104
OH	Obayashi & Hakura	J. Geophys. Res.	65	1960	3143-3148
PS	Piggott & Shapley	Antarctica Res. Geophys. Mon.	7	1962	111-120
RL	Reid & Leinbach	J. Geophys. Res.	64	1959	1801-1805
S	Sinno	J. Geomag. Geoelect.	13	1961	1-10
SL	Shapley & Lincoln	Ann. IGY	16	1962	289 pp.
WH	Warwick & Haurwitz	J. Geophys. Res.	67	1962	1317-1332

TABLE A-3

SMALL PCA'S REPORTED BY TWO OR MORE INDEPENDENT OBSERVERS

No.	Date	PCA Beg.	Rise Time, hrs.	Duration hrs.	Abs. db.	Flare Onset	Flare Max.	Flare Imp.	Flare Position	PCA Range Start Times	Original Sources	Plage	Sunspot	L	φ
	1955														
S1	1-16	1600		48	2	s,				16/1600-16/2230	B_2, Be, JC	3065	11218	61	N36
	1956														
S2	4-27	2000		48		1546		1+	S14 E14	27/2000-27/2200	Be, JC	3477	11596	324	S15
	1957														
S3	2-21	1800		72-96		1605	1930	3+	N20 W30	21/1800-22/1600	Be, DLP, JC JP, S	3856	12140	10	N15
S4	4-06	0800	12	66	3.2	05/1433		1	S15 W90		B_1	3907	12235	219	S15
S5	4-12	1700				11/1722	1738	3(2+)	S23 E04	11/1300-12/1700	Be, JC, JP	3923	12254 12258	43	S22
S6	7-01	1200				f				01/ 000-01/1200	CJM, H				
S7	7-28	1500		24	Weak	1340	1402	2	S24 W83	28/1500-28/2100	H, JC, PS	4070	12476	139	S23
S8	8-22	1000				0643		1+	N24 W32	22/1000-22/1200	H, PS	4151	12622	86	N23
						*0732	0750	2	N23 W38						
S9	11-05	0030	10	46	2.6	04/0058	0102	1	S20 W38	04/2300-05/0300	B_1, Be, DLP, H JC, PS	4207	12732	240	S24
						1058		1	S24 W30						
						1732	1740	1	S25 W45						
S10	12-17	1300			Weak	0734	0737	2	N20 E41	17/0300-17/1600	H, JP, PS	4314	12855	313	N18
S11	12-28	2300		30	Weak	2229	2230	2	N25 W10	28/2300-28/2400	H, JC, PS	4321	12874	263	N22
	1958														
S12	3-11	0400			Weak	0030	0042	1	N11 E02	11/0300-11/1000	Be, JC, PS, S	4449	13076	307	N11
S13	3-14	2200				1454	1507	2	S21 W84	14/1500-14/2200	Be, CJM, JP,PS,S	4445	13063	15	S18
S14	3-31	1600				*31/0005	0014	2	S17 W22	31/NTG -31/1600	JC, JP				
						30/2345	2349	1	S10 W31			4476	13103 13110	92	S13
						31/0038	0052	2	S08 W23				13110		
						31/0025	0031	2	N37 E59			4484	13118		
S15	4-10	0900	½	68	4.4	f					B_1, B_2, Be, CJM JP, K, L_1, PS, RL,S				
	1959														
S16	1-26	1500				0842	0900	3	N16 W61		JC, JP	4969	13878	106	N17
S17	6-13	1330			1.5	0357	0358	1	N17 E58	13/0800-13/1330	Be, JC, K	5204	14211	330	N17
S18	7-02	0400		48	Very small ~1.5	*1023	1038	2+	N12 E60		B_2, EHO, C	5354	14414	355	N12
						1648	1704	2+	S12 W52			5340			
						1947	1953	1+	N09 W15			5344			
						02/0310	0434	1+	N17 E21			5340			
	1960														
S19	1-11	2200		96	VS	2040	2124	3	N22 E03	11/2200-12/0700 13/1600-13/2000	B_1, G JC, S	5527	14660	101	N19
S20	9-26	0900		120	2 db	0525	0537	1+	S22 W64	25/2100-26/2300	G, JC, JP, K	5858	15043	353	S19
	1961														
S21	11-10	1500			2 db	1434	1444	1+	N19 W90	10/1500-10/1600	B_1, Ba, BO	6264	15461	5	N09
	1962														
S22	2-01	2030			1-2db	0901	0907	2	N10 W36		BO, Sat	6326	15507	298	N10
	1963														
S23	4-15	1200				1034	1125	2	S11 W06		BO, Ma	6766	15714	246	S12

* Most probable flare
f No reasonable flare or region association
s Sunspot and plage associations reasonable

TABLE A-4

PCA'S REPORTED BY GREGORY ONLY DURING 1960

	PCA			Flare						Solar Active Region					
No.	Date	UT Hrs	Duration Days	Beginning	Max	Importance	Position	Delay Hours	Source Station	Plage	Region	No.	L		Plage Age
***															
G2	1-15	03	1	1334		2	S20 W68	14	HLS	5525	1422-45	14657	121	S17	New
G3	2-7	07	4	*06/1340 06/1426	1344	1 2	S13 W81 S15 W03	17.5	Scott B.	5551	1423-3	14701	196	S13	4
G4	2-15	10	4	**											
G5	2-29	16	8	*1522 0140	1546	1 2	N22 E04 S32 W56	<1	Scott B.	5586	1424-21	14738	172	N24	2, 5
G6	3-10	18	2.5	1716	1720	1	N25 E08	1	HLS	5592	1424-39	14751	41	N25	3
G7	3-17	18	3	1616	1620	1	N05 W32	1	HLS	5597	1425-1		349	N06	5
****															
G11	4-15	10	4	*0717 0950	0719 0957	1 1	N12 W17 N23 E68	2.5	HLS	5627	1426-11	14796	313	N11	New
****															
G16	5-09	08	>3	0704	0734	3	S16 E55	1	HLS	5657	1427-11	14831	279	S09	3
****															
G18	5-17	15	2	*0418 1414	0425 1418	1+ 1-	S09 E33 N18 W08	11	HLS	5663	1427-28	14840	197	S12	3
G19	5-26	10	3	0818	0928	2+	N16 W15	2	HLS	5669	1427-40	14849	126	N13	4
G20	6-01	14	6	0824	0900	3+	N28 E39	6	HLS	5680	1428-02	14867	343	N30	2
G21	6-15	10	2	0635	0653	2	S09 E08	4	HLS	5695	1428-22	14888	199	S12	4
G22	6-25	17	>2	1131	1215	3	N19 E04	6	HLS						
G23	6-27	23	>1	2140	2156	3	N17 W23	1.5	HLS	5713	1428-39	14908	69	N20	New
G24	6-28	19	1.5	*1214 1815	1217 1825	1 1	N21 W37 N08 E68	7	HLS						
G25	8-11	24	5	1916	1929	2+	N22 E27	5	HLS	5794	1430-13	14981	143	N20	2
G26	8-26	10	5	0847	0852	1	N17 W90	1	HLS	5802	1430-23	14989	68	N17	3
****															
***															
G29	10-3	16	10	**					HLS						
G30	10-29	12	8	1026	1030	3	N14 E25	1.3	HLS	5909	1433-19	15099	185	N12	New
G31	11-10	18	>1	1009	1023	3	N28 E28	8							
G32	11-11	04	>1	0305	0340	2	N28 E12	1	HLS						
****															
G34	11-14	22	>1	2114	2120	1+	N35 W27	1	All	5925	1433-39	15114	28	N27	3
****															
G36	11-19	12	>2	1001	1059	1	N25 W90	2	Southern						
****															
G38	12-06	05	6	5/1825	1839	3+	N26 E68	11	HLS	5959	1434-38	15151	8	N25	4

* Preferred Flare
** No Reasonable Flare Association
PCA's Reported by Gregory and Others:
*** For: G1, 28
See Table 7: S19, 20
**** For: G-8, 9, 10, 12, 13, 14, 15, 17, 27, 33, 35, 37
See Tables
1- 5 : 39, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51