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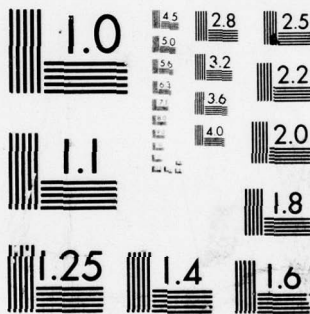
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**SOLAR AND GEOPHYSICAL ASSOCIATIONS WITH THE PRINCIPAL
ENERGETIC PARTICLE EVENTS IN 1971 AND 1972**

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27 relatively high energy (19-80 or >60 MEV or PCA) proton enhancements. An additional 17 high energy increases were observed, but assured solar or geomagnetic associations could not be established. Tabulations have been prepared of solar and geomagnetic circumstances prior to all events with assured flare or geomagnetic associations and/or high energy proton detection. The tabulations of this report provide solar and geomagnetic data for approximately 50% of the identified energetic particle events in 1971 and 1972. The remaining events included only those with lower particle energies and the less confident solar or geophysical associations.

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SOLAR AND GEOPHYSICAL ASSOCIATIONS WITH THE PRINCIPAL
ENERGETIC PARTICLE EVENTS IN 1971 AND 1972

- I. Introduction
- II. Evaluation of Principal Energetic Particle Events,
1971 and 1972
- III. References

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I. INTRODUCTION

This report presents results to date of a continuing effort to identify the solar and geophysical phenomena associated in time with the principal energetic particle enhancements near the earth in the post-maximum years of solar cycle 20. It is a partial extension of the studies started in the "Catalogue of Solar Particle Events, 1955-1969," (editors Z. Svestka and P. Simon). A first supplement to this catalogue with data for 1970 was published by the present authors as Report AFGL-TR-77-0222, "Survey and Comparison of Solar Activity and Energetic Particle Emission in 1970." The present study continues the survey of particle events through 1971 and 1972. It must be remembered at all times that the sensitivity of the satellite records has increased significantly over the years and has introduced a certain lack of homogeneity in that which is recognized as a particle event.

II. EVALUATION OF PRINCIPAL ENERGETIC PARTICLE EVENTS, 1971 AND 1972

Energetic particle records for 1971 and 1972 have been examined and distinctive particle events have been tabulated by Ms. M. A. Shea and Mr. Don Smart of AFGL. Lists and graphical representations of the recognized particle events were given to Miss E. R. Hedeman, Dr. H. Dodson-Prince, and Dr. O. C. Mohler for study in conjunction with the organized solar data at the McMath-Hulbert Observatory. The particle data included times of start, maximum, and duration for each event, and information relating to levels of energy detection and multiple spacecraft response. A total of 202 energetic particle events in 1971 and 1972 have been studied. The solar data used in the comparisons included not only flare-occurrence, but also the formation, growth, and disk transit of major centers of activity, and the activation of large filaments. The occurrence of geomagnetic disturbance and the passage of interplanetary sector

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boundaries also were considered in the evaluation of the probable or possible causes of observed particle enhancements.

In 1971, 83 distinctive particle events were studied and in 1972, 119 particle increases were evaluated. The conventions and symbols used in the two prior studies of particle enhancement mentioned above, have been followed in the present survey. The symbols used for flare and other associations are as follows:

- Flare association is certain
- ⊙ Flare association is probable
- Flare association is possible
- ⊕ The flare is probably a "contributor"
- Possible flare on invisible hemisphere
- △ Time-associated with a sudden commencement or an SC geomagnetic storm
- ◇ A modulation effect, including geomagnetic disturbance, and CM transit of an active region

Tables 1 and 2 and their appendices contain the principal results of the present study. The tables give information relating to all proton enhancements in 1971 and 1972, respectively, with confident flare or geomagnetic associations. The tabulations include both particle and flare data as well as remarks relating to the dynamic radio spectrum, X-ray flux, electron data (when known) and other pertinent comments. The appendices to Tables 1 and 2 give data and remarks relating to all high energy proton events (19-80 or >60 MEV or with PCA) in the years in question for which confident flare or geomagnetic associations could not be made.

For 93, 46%, of the 202 particle events, confident flare or geomagnetic associations could be established (see Tables 1 and 2). Of the remaining 109 particle enhancements without such explanations, 17 were events that included relatively high energy protons (19-80 or >60 MEV or PCA.) (See Appendices to Tables 1 and 2). In the two years studied,

there was a total of 44 such high energy events in the particle data. The "problem" high energy cases thus constituted 39% of the most energetic particle increases in the years 1971 and 1972. Do these rather numerous, energetic, "problem" enhancements perhaps stem from a certain ease of propagation from the invisible hemisphere in these simplified post-maximum years in solar cycle 20? Together, Tables 1 and 2 and their appendices account for approximately 50% of the identified energetic particle events in 1971 and 1972. The remaining events included only those with lower particle energies and the less confident solar or geophysical associations.

III. REFERENCES

- Dodson, H. W., E. R. Hedeman, Experimental Comprehensive Flare Indices for Certain Flares, 1970-1974, Report UAG-52, WDC A for Solar Terrestrial Physics, Boulder, Colorado, 1975.
- Catalogue of Solar Particle Events, 1955-1969, Z. Svestka and P. Simon, editors, Astrophysics and Space Science Library, D. Reidel; Dordrecht, Holland 1975.
- Quarterly Bulletin on Solar Activity of the International Astronomical Union, No. 173-180 (Jan. 1971-Dec. 1972), Publisher Eidgen. Sternwarte in Zurich.
- Solar Geophysical Data of Environmental Research Laboratories of U. S. Department of Commerce, NOAA No. 323-340.

TABLE 1

ALL ENERGETIC PARTICLE EVENTS IN 1971 WITH CONFIDENT FLARE OR GEOMAGNETIC ASSOCIATIONS

Particle Data			Flare Data				Comments	
Time 1971	MEV	PCA	Time 1971(U.T.)	Imp.	Coord.	Plage Pro- No. file		CFI
Jan. 13 ^d 12h	P/6-19/0.004	-	☉ Jan. 12 ^d 2352 1b	S08W36	11111	11102	5	II(M); X=510
Jan. 14 ^d (1052) (1136)	E/0.5-1.1/1.4	-	● { Jan. 14 ^d 1045 sn Jan. 14 ^d 1121 1b	S08W56 S09W56	11111 11111	10102 11213	4 8	
Jan. 14 ^d 1130	P/19-80/0.00025	-	● Jan. 14 ^d 2032 sn	S24W77	11124	20101	4	
Jan. 15 ^d 02h	P/1-10/0.4	-	☉ Jan. 15 ^d 0401 sn	S22W79	11124	10000	1	X>770
Jan. 15 ^d 06h	E/0.5-1.1/1.0	-	● Jan. 16 ^d 0804 2n	N18E65	11128	22222	10	Previous pro- ton event still in prog. X=300
Jan. 16 ^d 18h	P/1-10/0.3 >14 (P8, P9)	-	● Jan. 24 ^d 2308 2b	N18W49	11128	22333	13	Is, cont. (M), X=900, Dur. 15 hr. Also E23 ^h 30 ^m , 35-150Key.
Jan. 24 ^d 2330	GLE(26%)	-	⊕ Jan. 27 ^d 0430 SC	magnetic storm begins				Also seen on OGO 5 & Pion. 8 & 9. G.B. at 9400 to 2000 MHz; II & IV; great X=4900/ dur. 36 hr.
24 ^d 2340	E/0.5-1.1/100	24 ^d 23h/ 11.8db	● Feb. 3 ^d 1524 1b	S08E33	11145	11131	7	IV(DKM), cont(M); X>92
24 ^d 2336	P/>>60/89	-	● Feb. 4 ^d 2259 sn	S08E16	11145	00000	0	No low energy protons observ.. IIIg, V, U(DCM, M).
Feb. 3 ^d 17h	P/1-10/0.90	-	☉ Feb. 5 ^d 1032 sn	S10E10	11145	10101	3	II & IV(M); X=91.
Feb. 4 ^d 2330	E/0.5-1.1/1.0	-	● Feb. 5 ^d 2221 2n	S09E02	11145	12232	10	
Feb. 5 ^d 12h	P/1-10/2.2	-						
Feb. 6 ^d 10h	P/1-10/3.6	-						

Feb. 17 ^d 21h	P/1-10/4.28 14(P8)	-	● Feb. 17 ^d 1556 sn	S17E82	11165	20000	2	X=730.
Feb. 20 ^d 12h	P/1-10/2.4	-	● Feb. 20 ^d 0814 1n	N21W45	11162	11111	5	II(M); X>170
Mar. 21 ^d 0350 06h	E/18-139KEV/100 P/1-10/0.14		● Mar. 21 ^d 0330 sn	S04W78	11207	00001	1	
Apr. 2 ^d 0030 2 ^d 03h	E/0.5-1.1/2.1 P/>30/0.06	1 ^d -/ 0.4db	● Apr. 1 ^d 1300 1n	S19W13	11221	11132	8	IV(M,DKM); X>56/2 1/2 hr.
Apr. 6 ^d 1005 6 ^d 1018 6 ^d 11h	E/>45KEV/1300 E/0.5-1.1/23 P/>60/1.14	6 ^d 12h/ 3.8db	+ ▲ Apr. 3 ^d 2139	SC magnetic storm begins.				
Apr. 20 ^d 2000 20 ^d 21h	E/0.5-1.1/1.25 P/>30/.19	21 ^d 00h 0.9 db	● Apr. 6 ^d 0936 1b	S19W80	11221	212-1	6	Major cm bursts 37000 to 1400 MHz; X>130/4 hrs.
Apr. 21 ^d 08h	E/0.5-1.1/0.83	-	● Apr. 20 ^d 1919 1n	S06W49	11250	21221	8	II(M,DKM), cont (DKM); X=300/4 hr.
Apr. 22 ^d 1237 22 ^d 13h	E/0.5-1.1/1.2 P/>30/.22	-	● Apr. 21 ^d 0605 sn	N18W45	11256	10010	2	II(M), X=60. Protons still in prog. from prev. flare.
Apr. 23 ^d 07h	P/6-19/0.066	-	⊙ Apr. 22 ^d 0941 sn	N18W60	11256	10100	2	X=86/1 hr.
May 4 ^d 06h	P/1-10/1.45	-	⊙ Apr. 22 ^d 2201 sf	N18W68	11256	20001	3	III G(DCM,M); X=300/1.5 hr.
May 6 ^d 02h	P/1-10/0.2	-	● May 3 ^d 1412 sb	N15E47	11294	30213	9	II(M); major radio bursts at all freq; X=1500.
			● May 5 ^d 1211 1b	N13E17	11294	21100	4	X=690/2.5 hr. Seq. mag. storm in prog. May 6 ^d 00h- 8 ^d 00h U.T.

TABLE 1 (con't)

Particle Data			Flare Data				Comments	
Time 1971	MEV	PCA	Time 1971(U.T.)	Imp.	Coord.	Plage No.	Pro- file	CFI
May 12 ^d 0730	E/0.5-1.1/-	-	May 12 ^d 0131	2n	N13W70	11294	22211	8
May 12 ^d 03h	P/19-80/0.0022		May 12 ^d 0208	1n	N08E75	11313		II(M); X=730/6hr. Flare-Ambiguous.
May 13 ^d 1930	E/0.5-1.1/1.6	-	May 13 ^d 1750	1n	N10W85	11294	21231	9
May 13 ^d 20h	P/19-80/0.00025							IV(DCM), cont. (DKM); X>730/5 hr. Bright limb flare-surge, spray and loops.
May 14 ^d 1520	E/0.5-1.1/2.4	-	May 14 ^d 1411	1b	N04E11	11312	21232	10
May 14 ^d 17h	P/>30/.22							II & IV(M,DKM); X=860/2 hr.
Jun. 29 ^d 14h	P/1-10/0.43	-	Jun. 29 ^d 1230	sn	N18W15	11393	20132	8
Jun. 29 ^d 2345	E/0.5-1.1/0.77	-	Jun. 29 ^d 2235	sb	N18W22	11393	10233	9
Jun. 30 ^d 03h	P/19-80/0.0024							IV(DCM,M); X=220. Seq.Mag.Storm is in progress.
Sep. 1 ^d 2000	GLE (16%)		Sep. 1 ^d 1934UT		II&IV(DCM,M, DKM), No flare	00232		7
1 ^d 2000	E/>45 KEV/-				reported but active			II & IV(M,DKM); Major radio burst from 400-200 MHz.
1 ^d 2000	E/0.5-1.1/100	1 ^d 22h/			is at west limb.			X(GR & F)=20/4 hr. also E>45 KEV. Event also observed by Pion. 8 & 9.
1 ^d 20h	P/>60/66.5	5.2 db			Active reg. 11482 is on invisible hemisphere, about 2 1/2 days beyond west limb.			
					Sept. 4 ^d 1645h U.T. SC magnetic storm begins.			

Sep. 15 ^d 01 ^h	P/1-10/3.39	-	⊙	Sep. 14 ^d 2338	sn	S14E59	11516	10112	7	II(M,DKM); X=220.
			+	Sep. 15 ^d 0320	1n	S12E53	11516	21112	7	II(M); X=400/4 hr.
Oct. 4 ^d <01 ^h	E/0.5-1.1/2.5	3 ^d --/	●	Oct. 3 ^d 1330	2n	N13E14	11537	32232	12	II & IV(M,DKM); X=800/6 1/2 hr.
Oct. 3 ^d 14 ^h	P/>60/.35	0.6 db	+	Oct. 5 ^d 2245	SC	magnetic storm begins.				
Nov. 23 ^d 14 ^h	P/>10/.27	-	●	Nov. 22 ^d 1511	1b	N15E72	11621	21332	11	G.B. 35000-600 MHz; II(M,DKM), IV (DCM,M), X=1900/8hr.
			●	Nov. 23 ^d 0537	1b	S18E59	11619	21322	10	G.B. 10cm; II(M), cont. (DCM, M) X=490/7 hr.
			●	Dec. 2 ^d 0104	1b	S15W66	11619	21231	9	II & IV(M), X=580/7 hr.

TABLE I APPENDIX

MAJOR ENERGETIC PARTICLE EVENTS IN 1971 WITH UNUSUAL OR UNKNOWN SOLAR ASSOCIATIONS

Particle Data			Flare Data			Comments
Time 1971	MEV	PCA	Time 1971(U.T.)	Imp. Coord. No.	Plage Pro-file	
May 16 ^d 1218	E/18-38KEV	120	May 16 ^d 1236	- IV(DCM,DKM)		Active region 11294 is on invisible hemisphere, about 2-3 days beyond west limb. Mag.storm begins gradually, + Later SC May 17d 0630 U.T.
May 16 ^d 1300	E/0.5-1.1/4.0	16 ^d -/	No flare reported	11294?	00031	
May 16 ^d 14 ^h	P/>60/.24	1.3 db	May 16 ^d 22 ^h	Major magnetic storm begins, partly sequential.		
Jul.25 ^d <30h	P/19-80/0.00017	-	Jul.24 ^d 1758	sn N07W77	11425 10220	II(M), Cont.(M, DKM); X=130.
Sep.25 ^d 08h	P/19-80/0.00021	-	Jul.24 ^d 1547	sf N12W41	11433 00020	Cont.(M,DKM).
			Jul.24 ^d 1023	ln N14W44	11433 21121	Cont.(DKM); X=710/2 hr.
			(Flare-Ambiguous)			
			No suitable flares or ? Geomagnetic storm in prog. since Sep.24 ^d 14h U.T.			Region 11514 is on invis. hem., just beyond west limb. Mag. storm increases in intensity after 25 ^d 03h U.T.
Dec.14 ^d 03 ^h	P/>60/.24	-	Dec.14 ^d 0240	- II & IV	(11656?)00032	
			No flare reported.			
Dec.16 ^d 23h	P/>10/5.0	17 ^d -/	No suitable flares. Are these "delayed" particles due to a "storage" process?			
Dec.17 ^d 01h	(Thule Riom.)	1.9 db	Dec.16 ^d 1905h U.T. - SC magnetic storm begins.			

TABLE 2

ALL ENERGETIC PARTICLE EVENTS IN 1972 WITH CONFIDENT FLARE OR GEOMAGNETIC ASSOCIATIONS

Particle Data		Flare Data				Comments			
Time 1972	MEV	PCA	Time 1972 (U.T.)	Imp.	Coord.		Plage NO.	Pro-file	CFI
Jan. 10 ^d 23h	P/>60/.15		Jan. 10 ^d 0204	1n	S11E47	11687	01010	2	II(M); X=25/Dur. 3 hr.
			Jan. 10 ^d 2212	sn	S08E30	11687	10030	4	II(M), IV(DCM,M); X=20.
			Also geomagnetic storm Jan. 10 ^d 18h-12 ^d 06hUT						
Jan. 20 ^d 18h	P/>30/.10	20d08 ^h / 20d21 ^h / 1.8db	Jan. 20 ^d 0321	sb	S15W02	11693	10102	4	III G(M); X=86
			Jan. 20 ^d 0910	sn	S15W05	11693	10102	4	Mag. storm contributes to particle max. and long duration.
			Jan. 21 ^d 1151	SC	mag. storm begins.				
Feb. 11 ^d 08h <12 ^d 00h	E(EOSW) P/6-19/0.064		Feb. 11 ^d 0056	1f	S14E78	11734	21201	6	X=360/8 hr.
			Feb. 10 ^d 2313	1n	S17E79	11734	21111	6	II(M); X=270.
			Feb. 10 ^d 2019	sn	S19E84	11734	10130	5	IV(M,DKM); X=38
			(All could contribute to particle onset)						
Feb. 13 ^d 11h 13 ^d 13h <14 ^d	E(EOSW) P(EOSW) P/9-36/(EOS2)		Feb. 13 ^d 0827	2b	S19E47	11734	22213	10	Active region 11734 is a return of Jan. reg. 11693.
Feb. 17 ^d 15h	P/1-10/13.34		Feb. 16 ^d 1934	sf	N08E82	11748	10130	5	G.B. 10cm; II(M); X=840 - Previous proton event continues in prog.
			Feb. 17 ^d 0608	sn	S14E50	11743	10022	5	II(DKM), IV(M,DKM); X=95/2 hr.
			(Perhaps flare-ambiguous) Sequential mag. storm in prog. Feb. 17 ^d 09h-18 ^d 09h UT						

TABLE 2 (con't)

Particle Data			Flare Data				Comments	
Time 1972	MEV	PCA	Time 1972(U.T.)	Imp. Coord.	Plage No.	Pro- file		CFI
Feb. 17 ^d 22 ^h 18 ^d <20 ^h	E/EOSW P/6-19/0.015	-	Feb. 17 ^d 20 ⁵⁴ sn	S23E84	11751	20231	8	II & IV(M,DKM); X=1500/>2 hr., Magnetic storm contributes to particle max. & long duration.
			Feb. 18 ^d 23 ³⁹	SC mag.	storm begins.			
Feb. 22 ^d 01 ^h 22 ^d 01 ^h	E/EOSW P/19-80/0.0011	-	Feb. 22 ^d 00 ²⁹ 2n	N03W02	11748	22333	13	Great radio bursts at cm- and m- wavelengths; II & IV(M,DKM); X=930. Note sharp second rise at 22 ^d 15 ^h on Imp.6 low energy record.
			Feb. 22 ^d 13 ¹⁰ 1b	N07W04	11748	31102	7	
Mar. 6 ^d <15 ^h 5 ^d 19 ^h	E/0.5-1.1/- P/19-80/0.0018	6 ^d 01 ^h 3.3 db	(a) Mar. 5 ^d 12 ²¹ 1n	S07E40	11769	21122	8	Cont. (M,DKM); X=530.
			(b) Mar. 5 ^d 11 ³⁵ sn	S08E40	11769	20213	8	II(DCM); X=180.
			(c) Mar. 5 ^d 08 ⁰⁷ 1b	S07E42	11769	213-4	≥10	Great bursts at all radio frequen. (Probably Type IV); X=5100.
			(Flare-ambiguous - all could contribute to particle onset.)					
			(d) Mar. 6 ^d 02 ³⁷ sb	S07E32	11769	20232	9	IV(DCM,M); X=360.
			(e) Mar. 6 ^d 10 ⁴⁵ 1b	S07E26	11769	31234	13	G.B. 37000-5000MHz and 410-200MHz; II & IV(M); X=1600.
			(f) Mar. 7 ^d 02 ¹⁶ 1b	S11E20	11769	21233	11	IV(DCM,M).
			(These flares are "contributors" to particle max. and long duration of event.)					Particle max. is 6 ^d 21 ^h U.T.
			Mar. 6 ^d 21 ⁰⁸ U.T.	-	SC storm begins.			

Mar. 5 ^d 22 ^h (Protons from previous event are in progress)	E/EOSW	-	●	{ Mar. 5 ^d 2108 Mar. 5 ^d 2226	sn sn	S12E20 S07E35	11769 11769	10030 10122	4 IV (M, DKM) 6 Cont (M, DKM)
Apr. 10 ^d 04 ^h	P/1-10/.38	-	●	Apr. 9 ^d 2318	1b	S11W73	11799	11031	6 II (M, DKM), IV (DCM, M); X=220.
Apr. 14 ^d 20 ^h 25 ^m	E/>30KEV/35	-	●	Apr. 14 ^d 1957	1b	S12W32	11813	11102	5 An electron event on USSR Prognoz satellite. No protons registered on Imp.5 at 1-10MEV
Apr. 27 ^d 20 ^h 45 ^m (Also small R & F on 1-10 MEV record)	E/43-86KEV/50000	-	●	Apr. 27 ^d 1953	sf	N10W64	11838	10000	1 No unique new proton events. Geomagnetic storm in prog. Apr. 27 ^d 15 ^h -30 ^d 03 ^h U.T.
May 1 ^d 07 ^h 30 ^m	E/>30KEV/15	-	●	May 1 ^d 0658	sn	S06E68	11848	00002	2 IIIg, V, U (DCM, M) No discernible low energy (1-10MEV) protons.
May 12 ^d 20 ^h	E/>30KEV/29	-	●	May 12 ^d 1928	sb	N21W48	11857	10132	7 IV (M, DKM); X=60. No discernible low energy protons.
May 15 ^d 04 ^h	P/1-10/3.2	-	●	May 15 ^d 0221	1n	S04E43	11876	21100	4 IIIg, U, IIIb (M); X=180.
May 15 ^d 07 ^h 50 ^m 08 ^h	E/>30KEV/40 P/1-10/96.8	-	● +	May 15 ^d 0737	sn	S07W04	11870	101-1	≥3 X=40
May 15 ^d 20 ^h 14 ^m	E/>30KEV/500	-	●	May 15 ^d 1849	Major SC storm begins.				Storm onset produces "spike" at 15 ^d 18 ^h on 1-10MEV record and contributed to duration of particle event. CM radio bursts only; X=310. Previous particle event continues in prog.

TABLE 2 (con't)

Particle Data		Flare Data			Comments	
Time	MEV	Time	Coord.	Plage No.	Pro-file	
1972		1972(U.T.)	Imp.		CFI	
May 16 ^d 03 ^h 31 ^m	E/>30KEV/300	● May 16 ^d 0307 1b	S06W15	11870	21232	10 IV(nCM,M); X=440/1 hr.
16 ^d 05 ^h 10 ^m	E/>30KEV/-	● May 16 ^d 0403 1b	S06E29	11876	11000	2 IIIb(DCM), Is(M); X=130.
16 ^d 12 ^h	P/1-10/10.7					
May 17 ^d 05 ^h 30 ^m	E/>30KEV/115	● May 17 ^d 0510 sn	S06W31	11870	00102	3 IIIg, V(DCM,M,DKM); X=30. Contributes to max. of low energy event already in progress.
(P/1-10/ in prog.)						
May 28 ^d 14 ^h 30 ^m	E/>30KEV/480	● May 28 ^d 1305 2b	N09E30	11895	32333	14 G.B. at all freq.; II (M,DKM) & IV(DCM,M,DKM); X>5100/8 hr.
14 ^h 52 ^m	E/0.5-0.8/12					
16 ^h	P/>60/1.2	▲ May 30 ^d 1421 U.T.				SC storm begins. Mag. storm is weak and brief.
May 29 ^d 10 ^h 32 ^m	E/>30KEV/2900	● May 29 ^d 1015 1b	N08E16	11895	21222	9 Cont(M,DKM); X=490/2 hr.
(Protons from previous event in prog.)		A "contributor" to proton max. of previous event.				
Jun. 3 ^d 15 ^h 23 ^m	E/>30KEV/70	● Jun. 3 ^d 1402 1n	N10W53	11895	21232	10 G.B. 37000-4995MHZ, also at M-λ; II(M) & IV(M,DKM). X>130/1hr.
15 ^h 30 ^m	P/>30MEV/- (Prognoz)	+ Jun. 4 ^d 0558 sf	N11W64	11895	00201	3 IN(DCM) in prog. Seq. sector boundary passage (+/-) occurs between Jun. 3-4, with very weak geomagnetic disturbance.

Jun. 5d20h 30m	E / > 30KEV / 360	-	●	Jun. 5d2008	sf	S05E02	11911	00000	0	III(M,DKM)
Jun. 8d13h 40m	E / > 30KEV / 220	8d15h 0.6 db		Jun. 8d1317 1330	} II(M)					
8d<17h	P / > 60 / 0.35		☐	Jun. 8d1319		sf	S06W30	11911	00011	2
				} Active region 11895 on invis. hem. 2 days beyond west limb.						
Jun. 8d17h 45m	E / > 30KEV / 80	-	◎	Jun. 8d1552	sn	S19W44	11911	10000	1	I(DCM). No new proton event. PCA is in prog.
17h45m (Prognoz)	P / > 30 / -									
Jun. 8d23h 35m	E / > 30KEV / 130	-	●	Jun. 8d2306	sf	N06W03	11916	00000	0	Protons and PCA in prog.
Jun. 12d02h 20m	E / > 30KEV / 17	-	●	Jun. 12d0153	sf	S07N76	11911	10002	3	IIIg, V(DCM, M); X=35. No low energy protons detectable.
Jun. 12d20h 14d16h	E / > 30KEV / 80	-	●	Jun. 12d1318	1b	S11E53	11926	31132	10	II(M,DKM), IV(DKM); X>1900/4 hr.
12d21h 14d12h	E / 0.5-1.1 / 0.8 1.0									Is late particle onset due to "storage", or possibly start of a "particle stream" related to region?
13d22h	P / 19-80 / 0.0010									
Jun. 15d11h	P / 1-10 / 14.0	-	●	Jun. 15d0928	1n	S11E10	11926	21212	8	II(M); X=130.

Jul. 28 ^d 13 ^h 35 ^m 14 ^h	E/>30KEV/430 P/19-80/0.027	-	Jul. 28 ^d 1320 sn	S20E49 11974 10102	4 X=180
Aug. 1 ^d 13 ^h 30 ^m 1d20 ^h	E/>30KEV/- P/1-10/10.1	-	{ Aug. 1 ^d 1133 sn N13E46 11976 } + { Aug. 1 ^d 1148 sb S20W04 11974 } ⊗ Aug. 1 ^d 0841 ln N13E48 11976 21102	10102 10102	4 6 X>326.
Aug. 2 ^d 08 ^h 00 ^m	E/>30KEV/-	3 ^d 06 ^h 2 db	● Aug. 2 ^d 0316 1b N13E35 11976 31322		11 G.B. 10cm/2600; Is + cont/DCM,M; X=1790/14 hr.
{ 2 ^d 05 ^h 15 ^m 3 ^d 02 ^h 30 ^m }	E/0.5-1.1/3.1 E/0.5-1.1/9.0		+		
{ 2 ^d 08 ^h 3 ^d 03 ^h }	P/19-80/0.045 P/19-80/-		● Aug. 2 ^d 1958 2b N13E27 11976 22334		14 G.B. 10 cm/9735; IV (DCM,M,DKM); X=1470/16 hr.
Aug. 3 ^d 15 ^h 18 ^m	E/>30KEV/100	-	● Aug. 3 ^d 1502 1n S12W57 11970 11102		5 X=76.
(Protons and PCA from previous event in prog.)					
Aug. 4 ^d 13 ^h 00 ^m	GLE				
Aug. 4 ^d 08 ^h	P/>60/-	4 ^d 04 ^h >20 db	● Aug. 4 ^d 0620 3b N14E08 11976 33335		17 G.B. 10cm/4500; IV(M); X>4560/ 15 hr.
(Electron record saturated since 4 ^d 02 ^h U.T.)					
Aug. 7 ^d 15 ^h 30 ^m	GLE				
7 ^d <17 ^h	E/>30KEV/4700	7 ^d 18 ^h 14db	● Aug. 7 ^d 1443 3b N14W36 11976 33333		15 G.B. 10cm/4500; II (M,DKM) IV (DCM,M, DKM); X>4560/12 hr.
7 ^d 15 ^h 40 ^m	E/0.5-1.1/100		+		
7 ^d 16 ^h	P/>60/70.5		▲ Severe geomag ^d storm begins, two SC's at 8 ^d 2354 UT and 9 ^d 0036 UT.		Storm continues through Aug. 11.

TABLE 2 (con't)

Particle Data			Flare Data			Comments
Time 1972	MEV	PCA	Time 1972(U.T.)	Imp. Coord.	Flare Pro- file No. file CFI	
Aug. 10 ^d 08 ^h 27 ^m	E/>30KEV/-	-	● Aug. 10 ^d 0810 1n	N16W48	11987 01000	1 No electron event on 0.5-1.1 Mev.
(protons from previous event continue in prog.)						
Aug. 19 ^d 14 ^h 55 ^m	E/>30KEV/60	-	● Aug. 19 ^d 1431 1b	N17W67	11985 21101	5 IIIg (M,DKM); X=326. No proton event on 1-10 MEV records.
Aug. 26 ^d 20 ^h	P/1-10/19.05	-	☐ Aug. 26 ^d 0348 - II(M) (0350 - IV(M))	12011?	10132	7 Large, bright and active region 12011 is on invisible disk, just beyond east limb.
			+ No known flare.			
			◇ Moderate geomagnetic storm (SC 25 ^d 2258 U.T.) is in progress and increases in intensity.			
Sep. 4 ^d 01 ^h	P/0.2-0.56/9.9	-	☉ Sep. 4 ^d 0020 1f	S11W50	12005 01001	2
Sep. 6 ^d 13 ^h	P/1-10/0.28	-	● Sep. 6 ^d 0407 1b	S07W87	12005 21132	9 II & IV(M).
Sep. 6 ^d 22 ^h 03 ^m	E/~ 30KEV/57	-	● Sep. 6 ^d 2149 sn	S08W29	12016 10133	8 II & IV(DCM,M).
6 ^d 22 ^h 02 ^m	E/0.5-1.1/1.4					
6 ^d 23 ^h	P/19-80/0.100					
Sep. 10 ^d 16 ^h	P/1-10/8.17	-	☉ Sep. 10 ^d 1237 sf	N11W62	12023 10030	4 IV(M,DKM).
			+ Sep. 10 ^d 1745 - II(M,DKM)	12011?	10010	2 Small bright spike reported at N.W. limb at 1730 U.T. (McM-H. notes).

Sep. 26 ^d 06h	P/1-10/0.17	-	⊙	Sep. 26 ^d 0147 1n	S06E06	12044	21100	4	X=204/1.5 hr. Region 12044 is a return of active region 12005.
			+	CMP of active region		12044			
Oct. 8 ^d 03h	P/1-10/0.76	-	●	Oct. 7 ^d 2225	2n	N19W25	12057 02031	6	IV(M,DKM); X ₂ 10/8 hr.
Oct. 15 ^d 12h 45m	E/100-200KEV/ 815	-	●	Oct. 15 ^d 1016	1n	S11E87	12086 01000	1	
Oct. 25 ^d 14h	P/1-10/-	-	⊙	{ Oct. 25 ^d 1004	1b	S13E59	12094 21002	5	IIIg(M); X=2770.
			+	{ Oct. 25 ^d 1135	1n	S08E55	12094 21224	11	IIIg & cont(M,DKM); X=197.
			⊗	Oct. 26 ^d 0638	2b	S12E47	12094 22200	6	Is, C in prog; X=3100. A contributor to particle max. at 26 ^d 10h U.T.
Oct. 29 ^d 07h 45m	P/0.8-2.1/2.7	-	●	Oct. 29 ^d 0257	1n	S13E08	12094 11102	5	IIIg,U(DCM,M); X=/159.
Oct. 29 ^d 19h 00m	E/30KEV/800	30 ^d 14h/ 2 db	●	Oct. 29 ^d 1613	sb	S15W02	12094 20230	7?	IV(M,DKM) called I c and cont. by others. Major X>326/15hr.
29 ^d 20h	P/19-80/0.0025		+						The moderately severe SC storm seems related to additional burst of particles on 31st, and to particle max. at 31 ^d 16h U.T.
Oct. 30 ^d 02h 40m	E/30KEV/280	-	●	Oct. 30 ^d 0142	sn	S09W09	12094 00100	1	III G,V(M,DKM). Protons in prog.
30 ^d 5h	E/0.5-1.1/-								

TABLE 2 (con't)

Particle Data			Flare Data				Comments
Time 1972	MEV	PCA	Time 1972(U.T)	Imp. Coord.	Plage No.	Pro- file CFI	
Oct. 30 ^d 08h 40m 30 ^d 12h	E/>30KEV/300 P/>30/231	30 ^d 14h 2 db	● Oct. 30 ^d 0722 1n	S10W04	12094 111-2	≥5 X=489.	Protons in prog. from major earlier event of Oct. 29th. New injections of particles after ~05h and 09h UT.
Oct. 30 ^d 17h 25m	E/>30KEV/>600	PCA in prog.	● Oct. 30 ^d 1646 1b	S10W10	12094 21101	5 III S(M,DKM); X=212.	
Oct. 31 ^d 06h 10m	E/>30KEV/150	PCA in prog.	● Oct. 31 ^d 0417 1b	S14W15	12094 21100	4 III G(DCM,M);X=1960 Also new injection of low energy par- ticles after ~31d09h U.T.	
Nov. 24 ^d 17h	P/1-10/0.79	-	● Nov. 24 ^d 1234 sn	S07W33	12115 20132	8 IV(M);X=159/7 hr.	
Nov. 25 ^d 09h 25 ^d 09h	E/>30KEV/1000 P/19-80/.00066	-	● Nov. 25 ^d 0817 1b	S06W44	12115 21233	11 II & IV(M); X=490/7 hr.	
Nov. 28 ^d 04h 40m 28 ^d 08h	E/>30KEV/100 P/19-80/0.001	-	● Nov. 28 ^d 0358 1n	S08W81	12115 11130	6 II & IV(M); X=114/7 hr.	
Dec. 16 ^d 04h 00m 16 ^d 06h	E/>30KEV/100 P/>10/0.76	-	● Dec. 16 ^d 0341 1b	N12W57	12136 21232	10 II(M), IV(DCM,M); X>1010/6 hr.	
							Moderate geomag. storm in progress since 15 ^d 08h U.T.

TABLE 2 APPENDIX

OTHER MAJOR PARTICLE EVENTS - 1972

Particle Data			Flare Data				Comments
Time 1972	MEV	PCA	Time 1972(U.T.)	Imp. Coord.	Plage No.	Pro- file	
Jan. 3 ^d 11h	P/>30/.13	-	Jan. 3 ^d 0728	sn S06W46	11666	00001	1
			or				
			Jan. 3 ^d 0402	- II(M)	11661?	00010	1
					11657?		
Mar. 11 ^d 01h	E/0.5-1.1/-	-	(Problem)				
30 ^m			Mar. 11 ^d 0020-0730 UT:				
11 ^d 01h	P/19-80/.0002		X-ray event with very gradual rise and fall, peak flux = 73 at 0055UT. Several sf flares at S11W32 during this interval, in region 11769. (I=1 & 2)				No geomag. disturbance is in prog.
Mar. 11 ^d 12h	P/19-80/.0003	-	(Problem)				
			Numerous sub-flares prior to particle onset, mostly in region 11769 (I = 3 & 4). Active region 11776 is transiting the central portion of the solar disk between Mar. 11-17.				
Mar. 28 ^d 07h	E/EOSW	-	(Problem)				
28 ^d 08h	P/19-80/.0038		No suitable flares				
			Several active regions are on invis. hem., about 1 to 3 days beyond west limb.				
			A new + sector is introduced on Mar. 27 & 28, into what had been a predominantly-sector for the previous 5 solar rotations.				Gradual geomag. storm occurs during particle event (Mar. 29d-31d).

TABLE 2 APPENDIX (con't)

Particle Data			Flare Data			Comments
Time 1972	MEV	PCA	Time 1972(U.I.)	Imp. Coord.	Flare Pro- No. file	
Apr. 17 ^d 21h	E-/30KEV/24	18 ^d -/	(Problem)		CFI	
17 ^d 22h 17m	E/0.5-1.1/4.4	4.5 db	(a) Apr. 17 ^d 1654 sn	S10E52 11827	10000	1 IIIb(M,DKM); X=small burst.
17 ^d 23h	P/19-80/0.14		(b) Apr. 17 ^d 1843 sf	S19W70 11813	00100	1 Long GR & F at 10 cm and X-rays (1840 > 2500 UT).
			+ eruptive prom. at SW limb (S35W90) beginning ~1800UT. Prom. gone at 1900 UT.			
			(c) Apr. 17 ^d 2108 sf	S13E50 11827	00000	0 X=small burst
			+ Apr. 17 ^d 23hUT - Gradual sequential geomag. storm begins.			Possible "contribu- tors" to particle onset and long duration.
			+ Region 11827 very flare-active on Apr. 17 & 18; transits central area of disk Apr. 17-24			
			+ Apr. 18 ^d 0055 1b	S12E47 11827	21121	7 Is + cont(M); X=270. A "contribu- tor" to particle Max.
			+ Apr. 20 ^d 2050 - SC storm begins.			Active region 11827 is on disk; approach- ing west limb, but is not "flaring."
Apr. 26 ^d 09h	E/0.5-1.1/0.86	-	(Problem) No suitable flares			
26 ^d 12h	P/19-80/.00095		New region 11838 (N10, CMP Apr. 23) grows rapidly on disk on and after Apr. 26. Sequential sector boundary passage (+/-) occurs between April 26 and 27. Geomagnetic storm begins gradually Apr. 27 ^d 15h UT.			

Jul. 19 ^d 05 ^h 03 ^m	E/>30KEV/400	-	□	Jul. 19 ^d 03 ⁴⁵ 04 ²⁰	II(M) II(M)	11976? 00011 2	Regions 11947 and 11957 (which return as active region 11976) are about 4 days beyond west limb.
19 ^d 05 ^h 10 ^m	E/0.5-1.1/3.4						
19 ^d 05 ^h	P/19-80/0.016						
Jul. 22 ^d 04 ^h 02 ^m	E/>30KEV/730	22 ^d -/ 0.5 db	□	Jul. 22 ^d 03 ³⁴	II(M)	11976? 00010 1	The great Aug. region 11976 would be at the C.M. on the Invis. hemis.
22 ^d 05 ^h 30 ^m	E/0.5-1.1/20.0						
22 ^d <12 ^h	P/>60/1.39						
Jul. 23 ^d 00 ^h 23 ^d 04 ^h	E/0.5-1.1/- P/19-80/0.033	-	◇				Long gradual flux increases lasting >6-10 days. Region 11976 is first seen at east limb on Jul.28th.
Aug. 5 ^d 03 ^h	P/>60/-	-	○	Aug. 5 ^d 02 ³⁴	sf N14E19	11976 00110 2	II(M); X=5.
			▲				Severe geomagnetic storm in prog. SC 4 ^d 20 ⁵⁴ UT.
Aug. 16 ^d 02 ^h 05 ^m	E/0.5-1.1/5.2	-	?	Aug. 16 ^d 01 ⁴⁰ UT			Also sequential sector boundary passage (-/+ between Aug. 16 and 17.
16 ^d 02 ^h 30 ^m	P/19-80/0.0063						
Aug. 16 ^d 13 ^h 20 ^m	E/>30KEV/700	-	?	Aug. 16 ^d 12 ²⁷ UT			MCM-H observers report "calm disk" at this time.
16 ^d 12 ^h 45 ^m	E/0.5-1.1/8.0						
16 ^d 13 ^h	P/19-80/0.032						