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Solar - Geophysical Data

Part I (Prompt Reports)

NO. 516 AUGUST 1987

DATA FOR
JULY 1987
JUNE 1987

Michael A. Chinnery, Director
NATIONAL GEOPHYSICAL DATA CENTER
BOULDER, COLORADO

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S O L A R - G E O P H Y S I C A L D A T A

NUMBER 516

(Issued in Two Parts)

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C O N T E N T S

PART I (PROMPT REPORTS)

PART II (COMPREHENSIVE REPORTS)

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C O N T E N T S

Prompt Reports DATA FOR JULY 1987 Number 516 Part I

ALERT PERIODS

INTERNATIONAL URSIGRAM AND WORLD DAYS SERVICE

Summary of the Geoalert Messages JULY 1987

Julian Day	Date of Issue	Date of Observation	Wolf No.	10-cm Solar Flux	A-index	Location °Lat °Long	Flares Total	M	X	Date of Forecast	Location °Lat °Long	Region Forecast[1]	Geoalerts
182	01	30	023	068	005	N22 W98	0	0	0	01	N22 W98	Q	Solquiet, Magquiet.
						N30 E14	0	0	0		N30 E14	Q	
183	02	01	000	074	003	Spotnil				02	Spotnil		Solquiet, Magquiet.
184	03	02	000	072	003	Spotnil				03	Spotnil		Solquiet, Magquiet.
185	04	03	000	071	010	Spotnil				04	Spotnil		Solquiet, Magquiet.
		Presto:[2] Kakioka Magstorm begins 03/1916 UT.											
186	05	04	000	071	008	Spotnil				05	Spotnil		Solquiet, Magquiet.
187	06	05	000	071	005	Spotnil				06	Spotnil		Solquiet, Magquiet.
188	07	06	000	071	005	Spotnil				07	Spotnil		Solquiet, Magquiet.
189	08	07	012	072	007	S18 W38	0	0	0	08	S18 W38	Q	Solquiet, Magquiet.
190	09	08	014	074	012	S17 W52	1	0	0	09	S17 W52	Q	Solquiet, Magquiet
191	10	09	014	074	010	S18 W66	4	0	0	10	S18 W66	Q	Solquiet, Magquiet
192	11	10	013	074	012	S17 W80	0	0	0	11	S17 W80	Q	Solquiet, Magquiet
193	12	11	000	073	008	Spotnil				12	Spotnil		Solquiet, Magquiet
194	13	12	000	073	010	Spotnil	0	0	0	13	Spotnil		Solquiet, Magquiet
195	14	13	000	073	005	Spotnil	0	0	0	14	Spotnil		Solquiet, Magquiet
196	15	14	000	074	005	Spotnil	0	0	0	15	Spotnil		Solquiet, Magquiet
197	16	15	015	076	015	N27 W60	0	0	0	16	N27 W60	Q	Solquiet, Magalert 16/16.
198	17	16	027	078	025	N27 W74	0	0	0	17	N27 W74	Q	Solquiet, Magalert 17/17.
						S32 E68	0	0	0		S32 E68	Q	
199	18	17	013	079	016	S32 E57	0	0	0	18	S32 E57	Q	Solquiet, Magnil.
200	19	18	025	080	015	S32 E44	0	0	0	19	S32 E44	Q	Solquiet, Magquiet
						S27 E31	0	0	0		S27 E31	Q	
201	20	19	027	082	010	S32 E32	0	0	0	20	S32 E32	Q	Solquiet, Magquiet
						S28 E19	0	0	0		S28 E19	Q	
202	21	20	042	091	007	S32 E20	0	0	0	21	S32 E20	Q	Solquiet, Magquiet,
						S28 E07	0	0	0		S28 E07	Q	
						S23 E74	0	0	0		S23 E74	Q	
203	22	21	084	093	007	S31E07	0	0	0	22	S31 E07	Q	Solquiet, Magquiet
						S28 W07	0	0	0		S28 W07	Q	
						S23 E64	1	0	0		S23 E64	E	
						N19 W02	0	0	0		N19 W02	Q	
						S18 E24	0	0	0		S18 E24	Q	

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Julian Day	Date of Issue	Date of Observation	Wolf No.	10-cm Solar Flux	A-index	Location °Lat °Long	Flares Total	M	X	Date of Forecast	Location °Lat °Long	Region Forecast[1]	Geoalerts
204	23	22	105	106	009	S32 W06	0	0	0	23	S32 W06	Q	Solquiet, Magquiet.
						S28 W20	5	0	0		S28 W20	E	
						S23 E52	9	0	0		S23 E52	E	
						N21 W15	0	0	0		N21 W15	Q	
						S18 E11	0	0	0		S18 E11	Q	
						S20 E39	0	0	0		S20 E39	Q	
205	24	23	119	112	005	S32 W18	0	0	0	24	S32 W18	Q	Solquiet, Magquiet.
						S28 W32	11	0	0		S28 W32	E	
						S23 E38	4	0	0		S23 E38	E	
						N22 W31	0	0	0		N22 W31	Q	
						S18 W03	1	0	0		S18 W03	Q	
						S19 E26	0	0	0		S19 E26	Q	
						N29 E75	0	0	0		N29 E75	Q	
206	25	24	107	111	013	S31 W31	0	0	0	25	S31 W31	Q	Solquiet, Magquiet.
						S28 W44	4	1	0		S28 W44	E	
						S22 E26	1	0	0		S22 E26	E	
						S18 W13	0	0	0		S18 W13	Q	
						N29 E65	1	0	0		N29 E65	Q	
		Presto:	Boulder Tenflare 130 flux units 24/0957 UT duration 15 minutes. Kakioka Magstorm begins 24/1636 UT.										
207	26	25	100	111	017	S31 W44	0	0	0	26	S31 W44	Q	Solquiet, Magquiet.
						S29 W57	7	0	0		S29 W57	E	
						S22 E13	1	0	0		S22 E13	E	
						S19 W28	1	0	0		S19 W28	Q	
						N29 E51	1	0	0		N29 E51	E	
208	27	26	111	110	003	S31 W56	0	0	0	27	S31 W56	Q	Solquiet, Magquiet.
						S29 W70	3	0	0		S29 W70	E	
						S22 W01	0	0	0		S22 W01	E	
						S19 W44	2	0	0		S19 W44	Q	
						S21 W06	0	0	0		S21 W06	Q	
						N29 E38	0	0	0		N29 E38	Q	
209	28	27	092	102	005	S31 W70	0	0	0	28	S31 W70	Q	Solquiet, Magquiet.
						S29 W84	6	1	0		S29 W84	E	
						S23 W14	1	0	0		S23 W14	E	
						S22 W22	0	0	0		S22 W22	Q	
						N29 E26	0	0	0		N29 E26	Q	
		Presto:	Boulder Tenflare 220 flux units 27/1810 UT duration 4 minutes.										
210	29	28	076	099	015	S32 W84	0	0	0	29	S32 W84	Q	Solquiet, Magalert Minor 29/29.
						S23 W24	0	0	0		S23 W24	Q	
						S21 W32	0	0	0		S21 W32	Q	
						N29 E13	0	0	0		N29 E13	Q	
		Presto:	Kakioka Magstorm begins 28/0850 UT.										
211	30	29	069	094	040	S24 W39	0	0	0	30	S24 W39	Q	Solquiet, Magnil.
						N29 E01	0	0	0		N29 E01	Q	
						S30 W29	0	0	0		S30 W29	Q	
						N22 W07	0	0	0		N22 W07	Q	

ALERT PERIODS

INTERNATIONAL URSIGRAM AND WORLD DAYS SERVICE

Summary of the Geoalert Messages JULY 1987

Julian Day	Date of Issue	Date of Observation	Wolf No.	10-cm Solar Flux	A-index	Location °Lat °Long	Flares Total	M	X	Date of Forecast	Location °Lat °Long	Region Forecast[1]	Geoalerts
212	31	30	078	091	010	S23 W50	3	0	0	31	S23 W50	Q	Solquiet, Magquiet.
						N30 W12	0	0	0		N30 W12	Q	
						S29 W42	3	0	0		S29 W42	Q	
						N21 W21	0	0	0		N21 W21	Q	
						N15 E12	0	0	0		N15 E12	Q	
213	01	31	074	089	012	S21 W61	0	0	0	01	S21 W61	Q	Solquiet, Magquiet.
						N30 W25	1	0	0		N30 W25	Q	
						S28 W57	0	0	0		S28 W57	Q	
						N23 W32	0	0	0		N23 W32	Q	
						N16 W03	1	0	0		N16 W03	Q	

[1]Q = quiet, E = eruptive, A = active, P = proton.
[2]Presto message is a rapid report of a major event.

INTERNATIONAL RELATIVE SUNSPOT NUMBERS

Day	Final Aug 86	Sep	Oct	Nov	Dec	Final Jan 87	Feb	Mar	Prov Apr	May	Jun	Jul
01	12	9	12	44	0	19	0	13	14	35	15	0
02	11	9	14	35	0	15	0	23	12	40	11	0
03	11	8	23	37	0	13	0	15	10	22	0	0
04	11	8	24	37	0	12	0	16	13	23	0	0
05	11	0	24	35	0	11	0	24	28	22	10	13
06	10	11	22	31	0	10	0	23	47	27	0	0
07	8	13	27	24	0	11	0	24	56	29	0	9
08	9	12	20	15	0	0	0	22	64	25	0	12
09	8	10	32	10	12	0	0	14	69	23	0	13
10	0	8	29	9	20	0	7	11	72	25	0	11
11	0	8	23	9	23	0	0	9	80	23	11	0
12	0	0	26	0	22	0	0	0	77	19	21	0
13	0	0	22	14	24	0	0	0	79	22	14	0
14	0	0	0	12	13	8	8	10	74	13	10	0
15	0	0	0	12	0	9	7	11	78	35	9	11
16	9	0	11	12	11	0	0	11	60	47	12	17
17	8	0	16	12	9	13	0	22	41	64	15	12
18	0	0	22	12	0	13	0	21	36	46	24	17
19	0	0	31	12	0	9	0	12	29	62	13	23
20	11	0	39	12	0	9	0	12	16	46	22	33
21	12	0	47	11	11	14	7	15	19	41	29	67
22	12	0	57	10	16	20	7	17	26	35	38	87
23	14	0	71	18	16	23	0	19	25	36	38	102
24	9	0	76	12	13	14	0	19	35	35	38	92
25	9	0	68	0	9	13	7	16	23	37	38	88
26	9	0	60	0	0	14	9	12	21	34	41	85
27	9	0	65	13	0	13	8	11	11	31	33	77
28	9	0	61	0	0	20	8	12	14	19	41	60
29	9	8	63	8	0	15		13	20	12	25	60
30	9	9	62	0	0	14		15	30	12	16	62
31	9		50		11	11		15		10		73
Mean	7.4	3.8	35.4	15.2	6.8	10.4	2.4	14.7	39.3	30.6	17.5	33.0

The yearly mean sunspot number equaled 13.4 in 1986.

Algonquin Radio Observatory — OTTAWA 2800 MHz (10.7 cm) SOLAR FLUX — Adjusted to 1 AU

Day	Aug 86	Sep	Oct	Nov	Dec	Jan 87	Feb	Mar	Apr	May	Jun	Jul
01	72.8	69.8	71.2	87.6*	70.7	71.6	69.2	72.8	72.5	79.3	77.8	76.0
02	72.3	69.2	71.6	84.1	70.6	70.5	69.8	73.3	71.9	80.2	77.9	74.4
03	72.9	69.3	72.1	80.8	70.2	69.1	70.0	71.6	72.4	82.8	76.4	73.7
04	71.8	69.4	70.7	82.3	69.2	69.0	68.3	73.3	74.0	84.4	77.3	73.2
05	71.7	69.6	71.1	81.5	70.0	70.3	67.5	73.7	77.6	86.1	76.1	73.4
06	72.1	69.5	72.4	80.6	69.1	69.3	67.7	75.6	89.4	87.9	75.8	73.3
07	71.9	69.9	74.3	76.9	68.2	69.7	69.1	75.5	94.4	88.1	76.0	74.1
08	71.3	69.4	74.8	73.5	69.1	68.2	68.9	76.9	94.8	89.1	77.0	76.1
09	71.3	69.4	74.6	71.9	70.8	68.0	69.2	73.6	100.5	87.3	76.8	76.3
10	70.5	69.3	73.3	70.4	72.3	67.4	69.3	71.4	100.0	89.5	78.1	76.3
11	68.8	68.8	73.2	69.9	73.0F	68.0	68.5	70.5	101.3	86.4	80.7	75.7
12	68.4	68.8	75.3	71.4	71.1	68.9	67.8	69.5	98.6	85.4	82.1	75.5
13	67.9	69.0	75.1	76.0*	71.5	69.7	68.0	69.6	99.3	87.4	82.3	75.1
14	68.2	70.0	75.0	74.1	71.4	71.1	68.3	71.1	97.7	91.2	80.6	76.6
15	69.5	71.5	71.8	75.1	70.9	71.5	69.3	70.5	97.8	93.6	80.4	78.8
16	69.4	70.5	79.1	75.0	70.8	70.7	68.4	71.0	95.3*	98.2	81.3	80.9
17	68.9	69.2	82.6	73.8	71.7	70.8	68.1	71.2	97.3	96.7	81.8	81.5
18	69.1	68.8	86.3	73.0	71.4	70.6	69.8	72.5	94.0	98.5	82.9	82.5
19	69.3	68.7	88.8	72.5	71.0	70.0	69.5	71.5	91.7	100.1	82.4	85.1
20	70.7	68.8	92.2	72.5	70.4	68.9	69.8	73.8	85.6	99.8	81.1	93.8
21	70.5	68.8	91.5	74.1	70.6	71.2*	70.7	74.2	78.3	99.9	82.6	95.6
22	70.1	68.3	94.4	74.5	71.4	73.8*	70.4	73.8	76.5	101.0	87.1	102.6*
23	69.6	68.7	97.9	75.8	70.8	72.1	70.5	75.5	76.5	94.9	87.5	115.6
24	69.1	68.8	97.3	77.0	70.0	71.6	72.1	75.9	78.6	98.5	89.1	115.0
25	69.3	69.4	94.4	75.5	70.0	71.5	73.5	75.7	75.8	96.8	86.3	114.9
26	69.9	68.5	94.2	74.3	69.7	72.6	73.9	75.6	74.3	92.3	84.3	109.8*
27	69.1	68.9	94.3	73.6	69.4	69.9	74.0	75.4	74.8	87.5	78.9	105.4
28	68.8	70.3	93.6	73.1	69.2	70.8	72.7*	75.0	74.3	85.1	79.2	102.5
29	68.8	71.5	91.4	72.4	69.2	70.6		75.3	73.6E	79.3	76.6	97.3
30	69.3	71.8	89.8	70.9	69.6	69.8		74.6	76.8	77.9	75.9H	94.0
31	69.6		89.2		68.1	68.7		71.9G		77.3		91.9
Mean	70.1	69.4	82.4	75.5	70.4	70.2	69.8	73.3	85.5	89.8	80.4H	87.0

* = corrected for burst in progress; E = corrected for snow on antenna; F = uncorrected for interference during calibration; G = corrected for ice on antenna; H = measured at Penticton.
The yearly mean 2800 MHz flux equaled 74.0 in 1986.

D A I L Y S O L A R I N D I C E S

July 1987

Day	Julian Day	Bartels Cycle Day	Sunspot Numbers Int	Sunspot Numbers Amer	Obs Flux Ottawa (2800)	Solar Flux Adjusted to 1 Astronomical Unit SGMR (15400)	SGMR (8800)	SGMR (4995)	Ottawa (2800)	SGMR (2695)	SGMR (1415)	SGMR (610)	SGMR (410)	SGMR (245)
01	182	3	0	0	73.5	486	262	119	76.0	76	55	31	15	7
02	183	4	0	0	72.0	479	236	113	74.4	92	54	30	15	9
03	184	5	0	0	71.3	457	225	122	73.7	72	53	35	21	9
04	185	6	0	0	70.8	488	252	117	73.2	74	55	43	21	9
05	186	7	13	8	71.0	491	260	116	73.4	71	55	42	21	9
06	187	8	0	8	70.9	496	242	117	73.3	73	53	39	22	10
07	188	9	9	9	71.7	495	220	114	74.1	79	55	39	21	9
08	189	10	12	11	73.6	485	241	118	76.1	75	55	40	22	9
09	190	11	13	13	73.8	484	228	114	76.3	77	59	39	22	9
10	191	12	11	11	73.8	485	229	116	76.3	78	55	39	23	10
11	192	13	0	0	73.2	487	235	117	75.7	73	56	41	22	10
12	193	14	0	0	73.1	484	224	119	75.5	78	55	38	22	10
13	194	15	0	0	72.7	478	239	116	75.1	75	55	39	23	10
14	195	16	0	0	74.1	490	254	120	76.6	78	57	40	23	10
15	196	17	11	7	76.3	498	257	119	78.8	78	60	42	23	13
16	197	18	17	11	78.3	490	255	122	80.9	85	60	42	25	11
17	198	19	12	13	78.9	493	253	120	81.5	81	60	44	25	13
18	199	20	17	19	79.9	483	252	116	82.5	83	61	43	24	12
19	200	21	23	24	82.4	487	253	122	85.1	83	63	42	24	11
20	201	22	33	40	90.8	488	256	132	93.8	93	72	46	27	13
21	202	23	67	69	92.6	478	246	132	95.6	95	70	44	25	13
22	203	24	87	93	99.4*	507	235	140	102.6*	106	77	49	26	11
23	204	25	102	107	112.0	501	247	146	115.6	116	82	49	26	12
24	205	26	92	100	111.4	506	253	150	115.0	117	82	48	26	12
25	206	27	88	96	111.4	496	239	149	114.9	114	80	48	25	11
26	207	1	85	90	106.4*	428	240	141	109.8*	109	80	44	24	10
27	208	2	77	78	102.2	495	234	134	105.4	108	78	43	24	10
28	209	3	60	56	99.4	495	238	132	102.5	103	75	43	23	10
29	210	4	60	59	94.4	507	250	132	97.3	99	73	46	23	10
30	211	5	62	74	91.2	496	257	126	94.0	91	70	41	24	10
31	212	6	73	66	89.2	500	263	128	91.9	88	69	44	24	9
Mean			33.0	34.3	84.2	488	244	125	87.0	87	64	41	22	10

All sunspot numbers shown above are preliminary values.

The observed and the adjusted Ottawa fluxes tabulated here are the "Series C" daily values reported by the Algonquin Radio Observatory, Ottawa, Ontario, Canada. Numbers in parentheses in the column headings denote frequencies in MHz. Qualifiers after an entry have the following meaning:

* = corrected for burst in progress

Equipment problems produced any gaps shown above in the Air Weather Service's Sagamore Hill (SGMR) observations.

OBSERVED AND PREDICTED SOLAR ACTIVITY INDICES

JULY 1987

Date	RELATIVE SUNSPOT NUMBERS International (R_i) Monthly Mean	International Smoothed	American (R_a) Monthly Mean	American Smoothed	Derived (R_s) Monthly Mean	Derived Smoothed	2800 MHz RADIO FLUX Adjusted to 1 AU (S_a) Monthly Mean	Smoothed
Sep 83	50.3	68	47.4	66	57.0	67	110.2	119
Oct	55.8	68	52.3	66	58.6	67	111.7	120
Nov	33.3	59	30.2	65	35.6	67	90.4	120
Dec	33.4	64	32.3	62	35.7	65	90.5	118
Jan 84	57.0	60	54.4	58	59.4	61	112.4	115
Feb	85.4	56	81.5	54	86.2	58	137.2	101
Mar	83.5	53	83.0	51	68.5	55	120.8	108
Apr	69.7	50	66.5	48	78.1	52	129.7	105
May	76.4	48	72.1	45	79.6	49	131.1	103
Jun	46.1	46	45.2	44	49.8	48	103.5	102
Jul	37.4	44	36.2	42	37.6	39	92.2	99
Aug	25.5	40	24.5	38	30.7	41	85.8	95
Sep	15.7	34	13.6	32	23.2	35	78.9	90
Oct	12.0	29	9.8	27	16.9	31	73.1	86
Nov	22.8	25	19.4	23	18.6	26	74.6	72
Dec	18.7	22	17.0	20	17.4	23	73.5	79
Jan 85	16.5	20	14.5	19	15.9	21	72.1	77
Feb	15.9	20	16.3	18	15.7	20	71.9	76
Mar	17.2	19	11.8	16	16.3	19	72.5	75
Apr	16.2	18	17.1	17	19.8	19	75.7	75
May	27.5	18	24.0	17	26.6	19	82.0	75
Jun	24.2	18	22.2	16	22.8	19	78.5	75
Jul	30.7	17	30.8	16	25.8	19	81.3	75
Aug	11.1	17	10.7	15	17.2	19	73.3	75
Sep	3.9	17	3.4	16	13.8	20	70.2	76
Oct	18.6	17	16.5	16	18.1	20	74.2	76
Nov	16.2	17	16.4	15	16.4	19	72.6	75
Dec	17.3	15	10.1	14	16.2	19	72.4	75
Jan 86	2.5	14	2.3	12	14.6	18	70.9	74
Feb	23.2	13	23.8	11	26.0	17	81.5	74
Mar	15.1	13	12.5	11	20.3	17	76.2	73
Apr	18.5	14	13.8	12	19.6	18	75.6	74
May	13.7	14	11.6	12	18.1	18	74.2	74
Jun	1.1	14	0.8	11	13.3	18	69.7	74
Jul	18.1	14	17.7	11	16.3	18	72.5	74
Aug	7.4	13	7.6	11	13.7	17	70.1	73
Sep	3.8	12	3.5	10	13.0	17	69.4	73
Oct	35.4	13*	19.8	11	27.0	17	82.4	73
Nov	15.2	15*	14.7	13	19.5	18	75.5	74
Dec	6.8	16*	5.1	14	14.0	19	70.4	75
Jan 87	10.4	17*	9.4	16*	13.8	20	70.2	76
Feb	2.4	18(2)*	3.0	16	13.4	20	69.8	--
Mar	14.7	19(3)*	13.3	17	17.2	21	73.3	--
Apr	39.3*	20(4)*	39.4	19	30.3	22	85.5	--
May	30.6*	21(5)*	30.7	20	35.0	24	89.8	--
Jun	17.5*	23(7)*	18.0	22	24.8	26	80.4	--
Jul	33.0*	25(8)*	34.3*	23	32.0	28	87.0	--
Aug	----	26(10)*	----	25	----	29	----	--
Sep	----	29(12)*	----	27	----	31	----	--
Oct	----	32(15)*	----	30	----	35	----	--
Nov	----	36(18)*	----	34	----	40	----	--
Dec	----	41(21)*	----	39	----	45	----	--
Jan 88	----	46(24)*	----	44	----	50	----	--

*An asterisk marks either a preliminary value or one based in part on prelimnary observations.

Underlined entries indicate predicted values and parentheses enclose the absolute value of the 90% confidence limits. The two columns headed "Derived" represent a sunspot number computed from a linear regression equation between the 2800 MHz solar flux (adjusted to 1 astronomical unit) and the Zurich sunspot number.

SMOOTHED (OBSERVED AND PREDICTED) SUNSPOT NUMBERS: CYCLES 21 AND 22

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1980	164	163	161	159	156	155	153	150	150	150	148	143
1981	140	142	143	143	143	142	140	141	143	142	139	138
1982	137	133	129	124	120	117	115	109	101	96	95	95
1983	93	90	86	82	77	71	66	66	68	68	67	64
1984	60	56	53	50	48	47	44	40	34	29	25	22
1985	21	20	19	18	18	18	17	17	17	17	17	15
1986	14	13	13	14	14	14	14	13	12*	13	15	16
1987	17	18	19	20	21	23	25	26	29	32	36	41
		(2)	(3)	(4)	(5)	(7)	(8)	(10)	(12)	(15)	(18)	(21)
1988	46	50	53	56	58	62	68	74	78	83	86	87
	(24)	(27)	(30)	(34)	(37)	(40)	(44)	(49)	(52)	(56)	(59)	(62)
1989	90	94	99	105	113	120	124	127	131	134	135	136
	(62)	(62)	(65)	(68)	(70)	(73)	(74)	(75)	(80)	(83)	(84)	(85)
1990	135	136	135	131	127	125	124	124	124	122	118	116
	(86)	(86)	(85)	(81)	(74)	(68)	(65)	(64)	(58)	(52)	(45)	(40)

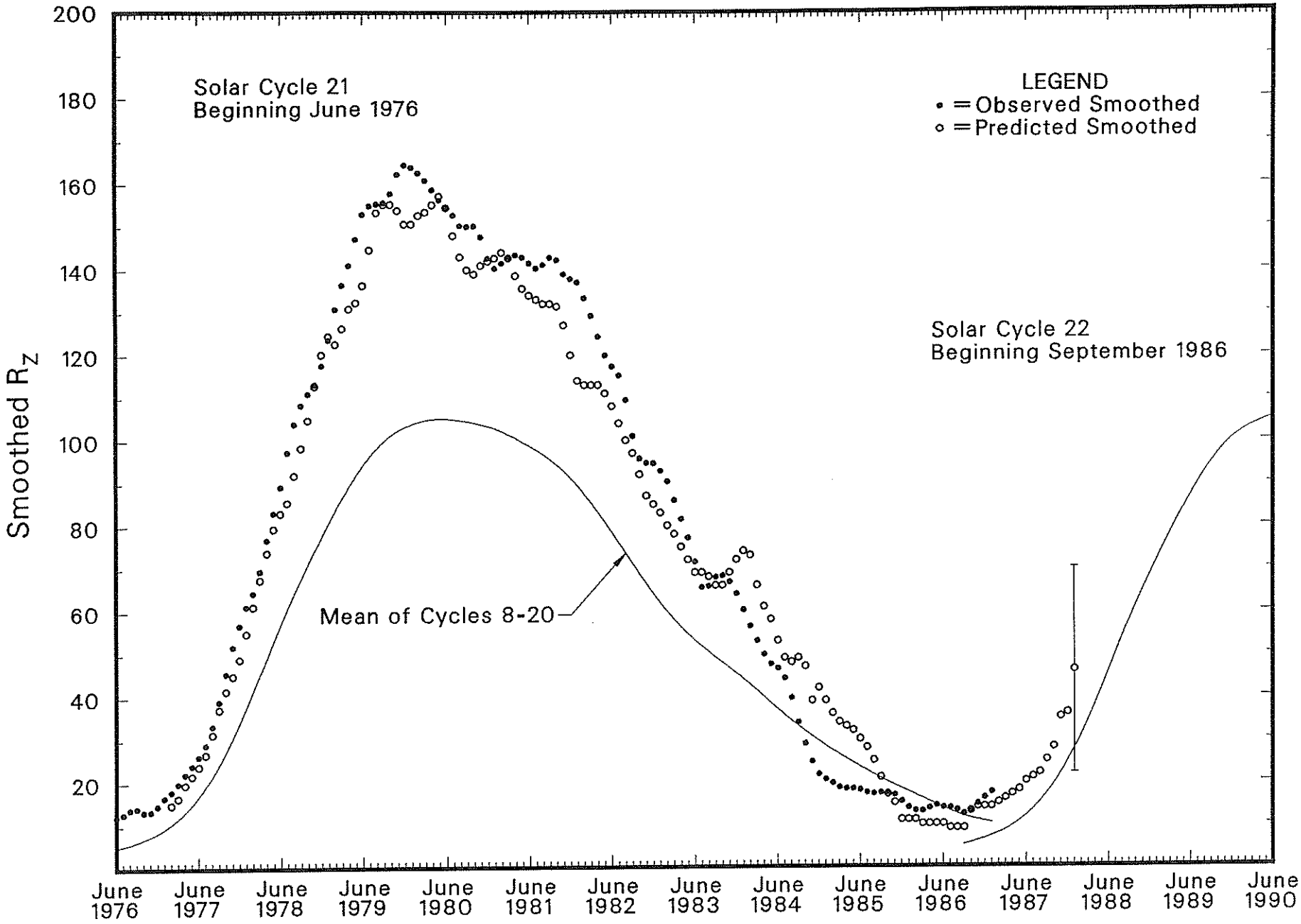
*September 1986 may be the onset of Sunspot Cycle 22.

For the end of Solar Cycle 21, and perhaps the beginning of Cycle 22, the table gives observed smoothed sunspot numbers up to the one calculated from the most recently measured monthly mean. These smoothed observed values are based on final, unsmoothed monthly means through March 1987 and on provisional numbers thereafter.

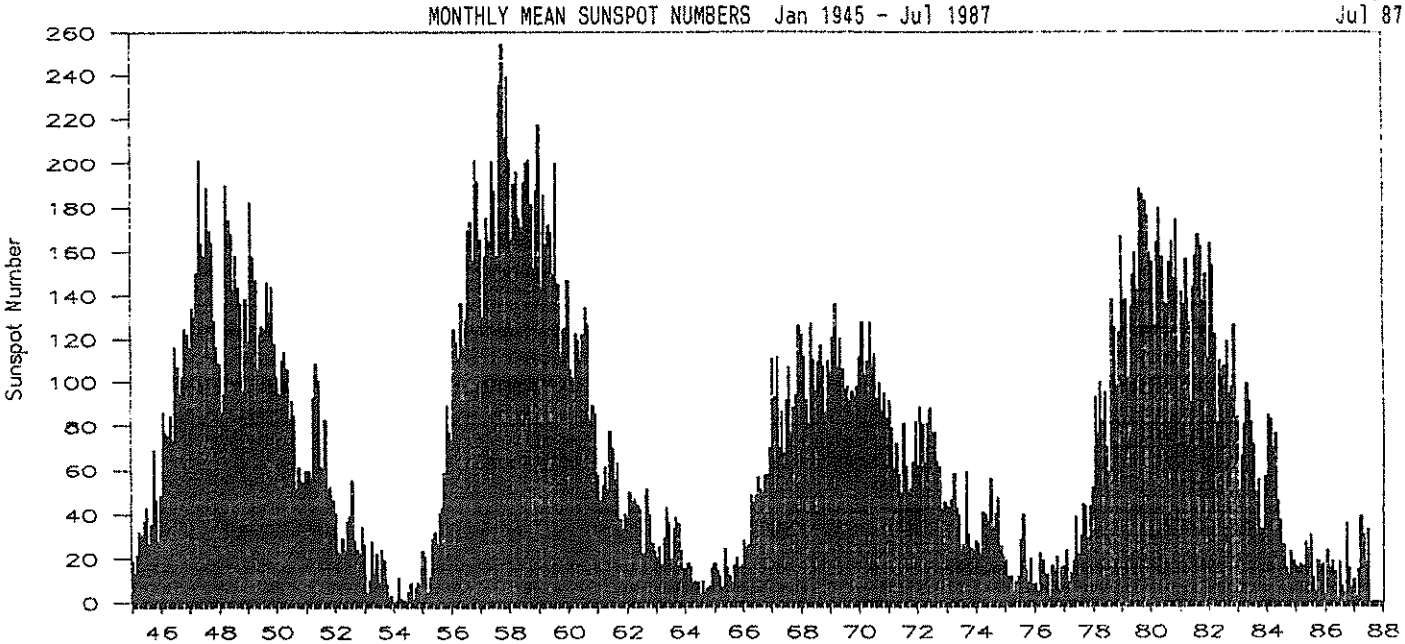
Table entries, with numbers in parentheses below them, denote predictions by the McNish-Lincoln method. (See page 9 in the March 1986 supplement to Solar-Geophysical Data.) Adding the number in parentheses to the predicted value generates the upper limit of the 90% confidence interval; subtracting the number from the predicted value generates the lower limit. Consider, for example, the January 1988 prediction. There exists a 90% chance that in January 1988 the actual smoothed sunspot number will fall somewhere between 22 and 70.

THE MCNISH-LINCOLN PREDICTION METHOD GENERATES USEFUL ESTIMATES OF SMOOTHED, MONTHLY MEAN SUNSPOT NUMBERS FOR NO MORE THAN 12 MONTHS AHEAD. Beyond a year the predictions regress rapidly toward the mean of all 14 cycles used in the computation. Moreover, the method is very sensitive to the date defined as the beginning of the current sunspot cycle, that is, to the date of the most recent sunspot minimum. The new-cycle predictions tabulated above are based on the assumption that the September 1986 value of 12.3 is the minimum. If a smoothed number lower than 12.3 occurs, the predictions will change.

OBSERVED AND ONE-YEAR-AHEAD PREDICTED SUNSPOT NUMBERS



MONTHLY MEAN SUNSPOT NUMBERS Jan 1945 - Jul 1987



Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Mean
1945	18.5	12.7	21.5	32.0	30.6	36.2	42.6	25.9	34.9	68.8	46.0	27.4	33.2
1946	47.6	86.2	76.6	75.7	84.9	73.5	116.2	107.2	94.4	102.3	123.8	121.7	92.6
1947	115.7	133.4	129.8	149.8	201.3	163.9	157.9	188.8	169.4	163.6	128.0	116.5	151.6 M
1948	108.5	86.1	94.8	189.7	174.0	167.8	142.2	157.9	143.3	136.3	95.8	138.0	136.3
1949	119.1	182.3	157.5	147.0	106.2	121.7	125.8	123.8	145.3	131.6	143.5	117.6	134.7
1950	101.6	94.8	109.7	113.4	106.2	83.6	91.0	85.2	51.3	61.4	54.8	54.1	83.9
1951	59.9	59.9	55.9	92.9	108.5	100.6	61.5	61.0	83.1	51.6	52.4	45.8	69.4
1952	40.7	22.7	22.0	29.1	23.4	36.4	39.3	54.9	28.2	23.8	22.1	34.3	31.5
1953	26.5	3.9	10.0	27.8	12.5	21.8	8.6	23.5	19.3	8.2	1.6	2.5	13.9
1954	0.2	0.5	10.9	1.8	0.8	0.2	4.8	8.4	1.5	7.0	9.2	7.6	4.4 m
1955	23.1	20.8	4.9	11.3	28.9	31.7	26.7	40.7	42.7	58.5	89.2	76.9	38.0
1956	73.6	124.0	118.4	110.7	136.6	116.6	129.1	169.6	173.2	155.3	201.3	192.1	141.7
1957	165.0	130.2	157.4	175.2	164.6	200.7	187.2	158.0	235.8	253.8	210.9	239.4	190.2 M
1958	202.5	164.9	190.7	196.0	175.3	171.5	191.4	200.2	201.2	181.5	152.3	187.6	184.8
1959	217.4	143.1	185.7	163.3	172.0	168.7	149.6	199.6	145.2	111.4	124.0	125.0	159.0
1960	146.3	106.0	102.2	122.0	119.6	110.2	121.7	134.1	127.2	82.8	89.6	85.6	112.3
1961	57.9	46.1	53.0	61.4	51.0	77.4	70.2	55.8	63.6	37.7	32.6	39.9	53.9
1962	38.7	50.3	45.6	46.4	43.7	42.0	21.8	21.8	51.3	39.5	26.9	23.2	37.6
1963	19.8	24.4	17.1	29.3	43.0	35.9	19.6	33.2	38.8	35.3	23.4	14.9	27.9
1964	15.3	17.7	16.5	8.6	9.5	9.1	3.1	9.3	4.7	6.1	7.4	15.1	10.2 m
1965	17.5	14.2	11.7	6.8	24.1	15.9	11.9	8.9	16.8	20.1	15.8	17.0	15.1
1966	28.2	24.4	25.3	48.7	45.3	47.7	56.7	51.2	50.2	57.2	57.2	70.4	47.0
1967	110.9	93.6	111.8	69.5	86.5	67.3	91.5	107.2	76.8	88.2	94.3	126.4	93.8
1968	121.8	111.9	92.2	81.2	127.2	110.3	96.1	109.3	117.2	107.7	86.0	109.8	105.9 M
1969	104.4	120.5	135.8	106.8	120.0	106.0	96.8	98.0	91.3	95.7	93.5	97.9	105.5
1970	111.5	127.8	102.9	109.5	127.5	106.8	112.5	93.0	99.5	86.6	95.2	83.5	104.5
1971	91.3	79.0	60.7	71.8	57.5	49.8	81.0	61.4	50.2	51.7	63.2	82.2	66.6
1972	61.5	88.4	80.1	63.2	80.5	88.0	76.5	76.8	64.0	61.3	41.6	45.3	68.9
1973	43.4	42.9	46.0	57.7	42.4	39.5	23.1	25.6	59.3	30.7	23.9	23.3	38.0
1974	27.6	26.0	21.3	40.3	39.5	36.0	55.8	33.6	40.2	47.1	25.0	20.5	34.5
1975	18.9	11.5	11.5	5.1	9.0	11.4	28.2	39.7	13.9	9.1	19.4	7.8	15.5
1976	8.1	4.3	21.9	18.8	12.4	12.2	1.9	16.4	13.5	20.6	5.2	15.3	12.6 m
1977	16.4	23.1	8.7	12.9	18.6	38.5	21.4	30.1	44.0	43.8	29.1	43.2	27.5
1978	51.9	93.6	76.5	99.7	82.7	95.1	70.4	58.1	138.2	125.1	97.9	122.7	92.5
1979	166.6	137.5	138.0	101.5	134.4	149.5	159.4	142.2	188.4	186.2	183.3	176.3	155.4 M
1980	159.6	155.0	126.2	164.1	179.9	157.3	136.3	135.4	155.0	164.7	147.9	174.4	154.6
1981	114.0	141.3	135.5	156.4	127.5	90.9	143.8	158.7	167.3	162.4	137.5	150.1	140.4
1982	111.2	163.6	153.8	122.0	82.2	110.4	106.1	107.6	118.8	94.7	98.1	127.0	115.9
1983	84.3	51.0	66.5	80.7	99.2	91.1	82.2	71.8	50.3	55.8	33.3	33.4	66.6
1984	57.0	85.4	83.5	69.7	76.4	46.1	37.4	25.5	15.7	12.0	22.8	18.7	45.9
1985	16.5	15.9	17.2	16.2	27.5	24.2	30.7	11.1	3.9	18.6	16.2	17.3	17.9
1986	2.5	23.2	15.1	18.5	13.7	1.1	18.1	7.4	3.8	35.4	15.2	6.8	13.4
1987	10.4	2.4	14.7	39.3*	30.6*	17.5*	33.0*						21.1*

*Preliminary

For the yearly means, each "M" marks a sunspot cycle maximum and each "m" a minimum.

The smoothed sunspot number reached a minimum of 12.3 in September 1986. Recent numbers have been sufficiently large that it is unlikely that a lower number will be observed in the coming months. Assuming that September stands as the minimum, we focus on the question of interest: the size and shape of the new cycle -- designated cycle 22.

A conservative prediction at this early point for cycle 22 is for a mean cycle, having a peak smoothed number of 106, shown as the mean of cycles 8–21 in figure 1 (Coffey, private communication). Most analyses use data starting with Cycle 8 (beginning in 1833) because of indications that the older data either are of a different statistical population (McNish and Lincoln, 1949) or of a lesser quality (Eddy, 1974).

For users who need a more specific prediction, we include several recently published forecasts. Reviews of long-term prediction methods are given in McIntosh (1979) and Brown (1984a). We have selected three of the general methods described in the reviews and provide representative predictions given by each. From these, we can arrive at some indication of the range of possibilities for cycle 22.

Method one is the use of direct or indirect observations of the solar magnetic field, made late in one solar cycle to predict the sunspot number in the ensuing cycle. Brown (1974) and Ohl (1976) suggested methods that correlate some measure of geomagnetic field activity near solar minimum with the peak sunspot number of the following cycle. The assumption is implied that the terrestrial field variation is dominated by solar field variations. Sargent (1978) used a variation of the Ohl method to predict a maximum smoothed number of 156 for cycle 21. The observed value was 164.5. For cycle 22, the Sargent–Ohl method predicts 118.6. Using the observation that sorting the cycles by odd and even numbers provides two sets of typical profiles, Sargent obtained the curve in figure 2 by averaging even cycles in the modern era and adjusting the result to the predicted maximum of 118.6. Other predictions using this general method are listed in Table 1.

Table 1. Predictions of Cycle 22 using observations of solar magnetic field parameters of the preceding cycle.

Author(s)	Predicted Smoothed Sunspot Number	Date of Maximum
Brown	120	----
Kane	185	1990
Sargent	118	1991
Schatten & Sofia	170	1990
Thompson	159	----

Another well-known method of prediction is comparison of the early phase of the new cycle to the average behavior of past cycles to establish a trend for the new one. A venerable technique is that of McNish and Lincoln (op. cit.) whose prediction for cycle 22 is shown in figure 1, with smoothed monthly maxima of 136 in December of 1989 and

February of 1990. An updated McNish-Lincoln prediction is published monthly in Solar Geophysical Data, Prompt Reports, along with 90 percent confidence limits. The McNish-Lincoln method is most accurate when limited to predictions 12 months ahead, but for comparison we note that the method at this relative time in the last solar cycle predicted a maximum of 141 for that cycle. A maximum of 164.5 was subsequently observed. The NASA Marshall Space Flight Center Systems Analysis and Integration Laboratory at Huntsville, Alabama uses a comparison of the current solar cycle to past cycles to predict a smoothed maximum 10 cm radio flux. When their number is converted to an equivalent smoothed sunspot number, it gives a smoothed maximum number of 172. Table 2 tabulates published predictions made with the cycle comparison technique.

Table 2. Solar cycle predictions made by comparing the new cycle to past cycles.

Author(s)	Predicted Smoothed Sunspot Number	Date of Maximum
McNish & Lincoln	136	1990
Marshall Group	172	1990

As we move further into the new cycle, additional observations will allow refinement of the predictions made by the cycle comparison technique. The McNish-Lincoln technique essentially depends on the ordering of the cycles according to their rate of rise. Because of this ordering, the error bars begin to narrow through the period of rapid rise of the cycle. We expect these conditions to be met in the next one to two years.

We include a third set of predictions that use what are termed "secular techniques." These methods project future solar cycles on the basis of long-term periodicities that may exist in past cycles such as the the observation of an 80 year cycle by Gleissberg (1942). Wilson (1984) provides an extensive discussion of the characteristic rise and decay times and maximum sunspot numbers of past cycles including the identification of longer period variations superimposed on the eleven-year cycle.

Table 3. Cycle 22 predictions made using secular behavior of past cycles.

Author(s)	Predicted Smoothed Sunspot Number	Date of Maximum
Wilson	107	1991

Most operational applications using solar cycle predictions require lower and upper confidence limits. For the present time, we suggest that reasonable limits are the lowest and highest cycles observed in the modern era. The two limiting cases, Cycles 14 and 19, are also shown in figure 1. Users are left to calculate their own confidence limits with the information that these are the extrema in 14 good cycles of observation.

At the time of Brown (1984a), there were already 31 reported predictions for solar cycle 22. As noted in his review, after all the predictions for a cycle are accumulated, predicted

maximum numbers typically range from extremely low to very high. We have endeavored to use recently published predictions where the record of the method can be evaluated for past predictions. We apologize for omitting undoubtedly worthy techniques.

From these predictions, we conclude:

1. It is too early to make a consensus forecast with small error bars.

2. The most probable cycle maximum will be average or higher.

3. Users who need worst case predictions may make use of the maximum value of cycle 19 and the minimum of cycle 14. They need to calculate the probability that the new cycle may still exceed one of these limits.

4. Users who need predictions with legitimate small error bars need to wait for more observations. As the new cycle progresses, the additional data points allow the prediction to be refined by comparison.

We warn that the prediction of solar cycles is inexact and that wide error bars should be assumed. NOAA assumes no responsibility for consequences of the use of these predictions. Regular updates will be provided in this publication.

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From the staff of the NOAA National Geophysical Data Center Solar Terrestrial Division and the NOAA Space Environment Laboratory including the Space Environment Services Center.

Figure 1. Observed and Predicted Sunspot Numbers from the McNish-Lincoln Analysis

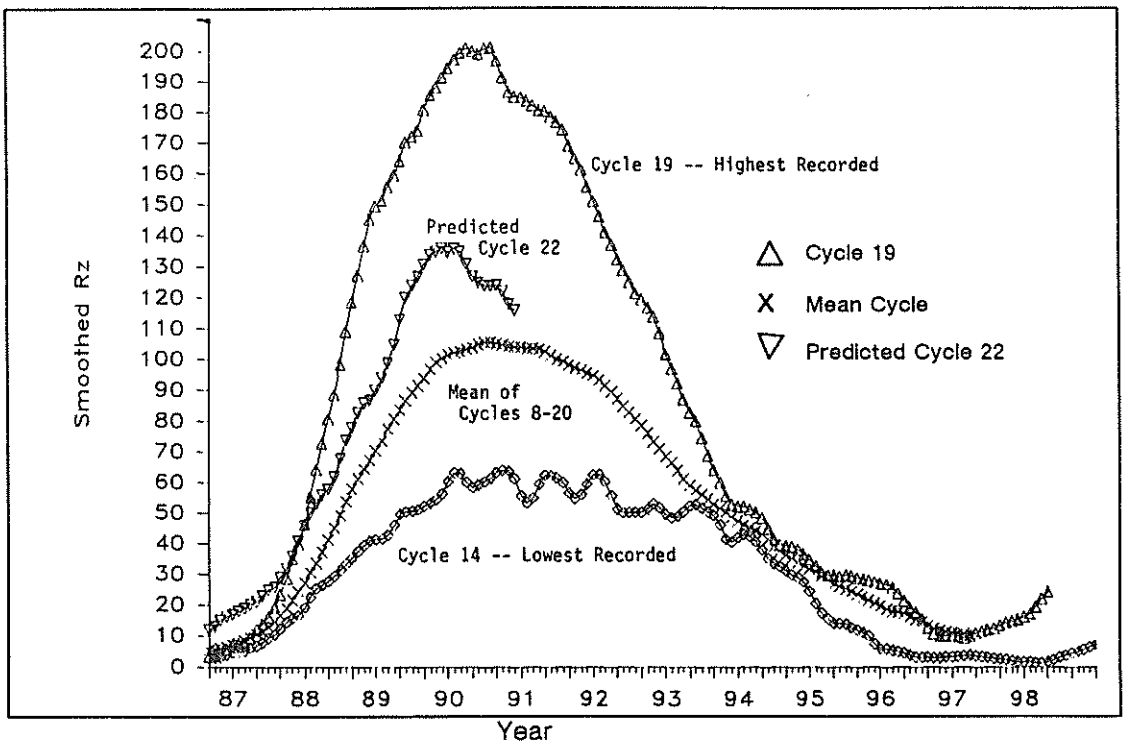
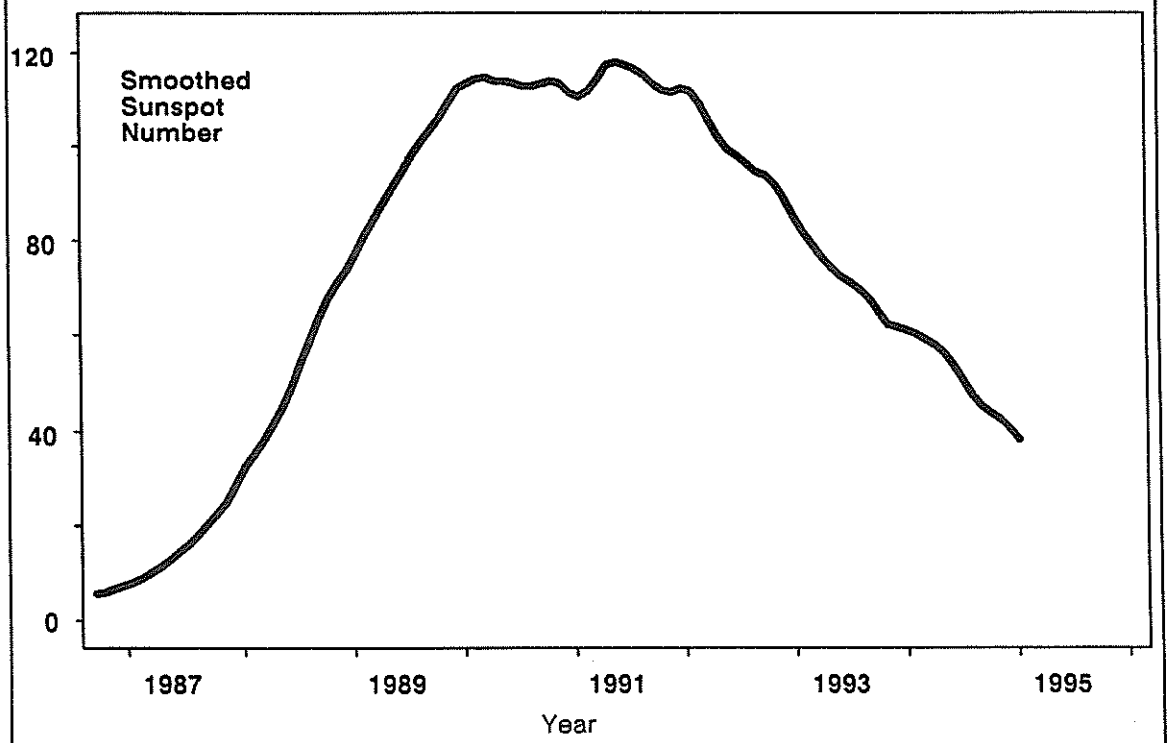


Figure 2. Predicted Sunspot Numbers from the Sargent-Ohl Method



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Grp #	Sta	Day	Start (UT)	Max (UT)	End (UT)	Lat	CMD	NOAA/ USAF Region	CMP Mo	CMP Day	Dur (Min)	Imp Opt	Xray	See	Obs Type	Time (UT)	Area Measurement Apparent (10^{-6} Disk)	Corr (Sq Deg)	Remarks
0001	LEAR	08	0551	0551	0601	S18	W40	4822	07	5.2	10	SF		4	C		37		
0002	HOLL	09	1429	1433	1447	S20	W60	4822	07	5.0	18	SF		3	C		22		
0003		09	15111	1521	1525	S20	W61	4822	07	5.0	14	SF					15		
	RAMY	09	1511	1521	1526	S19	W61	4822	07	5.0	15	SF		3	C		17		
	HOLL	09	1512	1521	1524	S20	W61	4822	07	5.0	12	SF		3	C		13		
0004	HOLL	09	1549	1556	1629	S19	W59	4822	07	5.1	40	SF		3	C		36		
0005	HOLL	09	1646	1647	1652	S19	W61	4822	07	5.0	6	SF		3	C		17		
0006	KAND	10	0817	0820	0823	S18	W71	4822	07	4.9	6	SN			P		21		D
0007	KAND	16	1015		1020	N24	W09		07	15.7	5	SF			P				CEG
0008	HOLL	17	2157	2157	2159	N22	E86	4825	07	24.5	2	SF		3	C		22		
0009	HOLL	17	2250E	2250U	2256	N26	W82	4823	07	11.6	6D	SF		3	C		26		
0010	YUNN	18	0531	0538	0540D	S28	E43	4826	07	21.6	9D	SN			P		16	.3	D
0011	YUNN	18	0534	0538	0541	N20	E78	4825	07	24.2	7	SN			C		16		EGHW
0012	YUNN	18	0611D	0612	0638	S27	E44	4826	07	21.7	27	SN			P		9	.2	D
0013	YUNN	18	0616	0617	0619	S14	E34		07	20.8	3	SF			C		8	.1	DG
0014	SVTO	18	0840	0840	0846	N20	E76	4825	07	24.2	6	SF		3	C		20		
0015	KAND	20	0820	0825	0845D	S29	E17	4826	07	21.7	25D	SN			P		42	.5	E
0016	KAND	20	1041	1046	1107	S29	E17	4826	07	21.8	26	SB			P		94	1.2	D
0017	KAND	20	1243	1246	1256	S29	E14	4826	07	21.6	13	SN			P		21	.3	D
0018		20	1814	1815	1844D	N22	E46	4825	07	24.3	30D	SF					33		
	RAMY	20	1814	1815	1840D	N22	E45	4825	07	24.2	26D	SF		3	C		24		
	HOLL	20	1814	1815	1844D	N22	E46	4825	07	24.3	30D	SF		3	C		42		
0019	KAND	21	0638	0654	0706	S29	E02	4826	07	21.4	28	SN			P		21	.3	D
0020		21	0710*	07219	0738	S29	E02	4826	07	21.4	28	SN					42	.5	D
	BUCA	21	0710	0730	0750	S29	E01	4826	07	21.4	40	SN			C	0730	54	.6	D
	KAND	21	0720	0721	0725	S29	E02	4826	07	21.5	5	SF			P		31	.4	D
0021	KAND	21	1035	1037	1042	S24	E70	4827	07	26.8	7	SF			P		21		D
0022	HOLL	21	1726	1727	1734	S21	E63	4827	07	26.5	8	SF		3	C		21		
0023	KAND	22	1013	1015	1020	S30	W06	4826	07	21.9	7	SF			P		42	.5	DT
0024	KAND	22	1102	1102	1106	S29	W10	4826	07	21.7	4	SN			P		31	.4	ET
0025		22	12308	12383	1245	S22	E61	4827	07	27.2	15	SN					32	1.0	DT
	KAND	22	1230	1238	1245	S24	E61	4827	07	27.2	15	SN			P		42	1.0	DT
	RAMY	22	1238	1241	1245	S20	E61	4827	07	27.2	7	SF		3	C		22		
0026	KAND	22	1315	1325	1330D	S29	W12	4826	07	21.6	15D	SN			P		21	.3	DT
0027		22	15186	1526	1554	S29	W14	4826	07	21.5	36	SF	C 2.1				32		
	RAMY	22	1518	1526	1559	S29	W13	4826	07	21.6	41	SN	C 2.1	3	C		47		
	HOLL	22	1524	1526	1552	S28	W14	4826	07	21.5	28	SF	C 2.1	3	C		24		
	SVTO	22	1536E	1536U	1550	S30	W14	4826	07	21.5	14D	SF	C 2.1	2	C		26		
0028		22	1620*	1651	1707	S29	W13	4826	07	21.7	47	SN	C 2.8				46		F
	RAMY	22	1620	1651	1708	S29	W13	4826	07	21.7	48	SN	C 2.8	3	C		66		F
	HOLL	22	1641	1651	1707	S29	W13	4826	07	21.7	26	SF	C 2.8	3	C		36		F
	PALE	22	1645E	1651	1705	S29	W12	4826	07	21.7	20D	SN	C 2.8	3	C		35		

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Grp #	Sta	Day	Start (UT)	Max (UT)	End (UT)	Lat	CMD	NOAA/ USAF Region	CMP Mo Day	Dur (Min)	Imp Opt	Xray	See	Obs Type	Time (UT)	Area Measurement Apparent (10^{-6} Disk)	Corr (Sq Deg)	Remarks
0029	HOLL	22	1648	1648	1652	S22	E58	4827	07 27.1	4	SF		3	C		17		
0030		22	1659	1700	1704	S21	E58	4827	07 27.1	5	SF					18		F
	RAMY	22	1659	1700	1702	S20	E58	4827	07 27.1	3	SF		3	C		17		
	HOLL	22	1659	1700	1705	S22	E57	4827	07 27.1	6	SF		3	C		20		F
0031	HOLL	22	1720	1734	1738	S22	E58	4827	07 27.2	18	SF		3	C		16		
0032		22	1802	1802	1813	S21	E58	4827	07 27.2	11	SF					14		
	HOLL	22	1802	1802	1812	S22	E57	4827	07 27.1	10	SF		3	C		13		
	RAMY	22	1802	1802	1814	S20	E58	4827	07 27.2	12	SF		3	C		14		
0033		22	1835*	1846*	1906	S22	E55	4827	07 27.0	31	SF					18		
	RAMY	22	1835	1846	1910	S20	E53	4827	07 26.8	35	SF		3	C		31		
	HOLL	22	1842	1848	1853	S22	E57	4827	07 27.1	11	SF		3	C		14		
	HOLL	22	1855	1855	1908	S23	E53	4827	07 26.9	13	SF		3	C		14		
	PALE	22	1859	1901	1913	S22	E57	4827	07 27.2	14	SF		3	C		11		
0034	RAMY	22	1913	1921	1921	S20	E53	4827	07 26.8	8	SF		3	C		27		
0035		22	1915*	1934*	2001	S28	W16	4826	07 21.5	46	SF	C 1.4				21		F
	RAMY	22	1915	1934	2041	S29	W14	4826	07 21.7	86	SF		3	C		39		
	HOLL	22	1931	1934	1938	S29	W15	4826	07 21.6	7	SF		3	C		17		
	PALE	22	1932	1935	1939	S28	W18	4826	07 21.4	7	SF		3	C		16		
	HOLL	22	2000	2001	2006	S28	W16	4826	07 21.6	6	SF	C 1.4	3	C		14		F
	PALE	22	2003E	2005	2006D	S29	W16	4826	07 21.6	3D	SF	C 1.4	3	C		20		
0036		22	20495	2059	2140D	S28	W16	4826	07 21.6	51D	SF	C 1.9				38		
	RAMY	22	2049	2059	2140D	S29	W15	4826	07 21.7	51D	SF	C 1.9	3	C		53		
	HOLL	22	2054	2059	2134D	S27	W17	4826	07 21.5	40D	SF	C 1.9	3	C		22		
0037		23	00102	00242	0028	S29	W18	4826	07 21.6	18	SF					30		
	PALE	23	0010	0024	0032D	S29	W17	4826	07 21.7	22D	SF		2	C		47		
	LEAR	23	0012	0026	0028	S29	W18	4826	07 21.6	16	SF		3	C		14		
0038		23	0018	00213	0024	S22	E54	4827	07 27.2	6	SF					23		
	LEAR	23	0018	0021	0024	S22	E54	4827	07 27.2	6	SF		3	C		13		
	PALE	23	0022E	0024	0032D	S22	E54	4827	07 27.2	10D	SF		2	C		33		
0039		23	0106*	0131*	0148	S30	W17	4826	07 21.7	42	SF					21		F
	PALE	23	0106	0145	0146	S29	W18	4826	07 21.6	40	SF		2	C		19		
	LEAR	23	0121	0131	0151	S31	W16	4826	07 21.8	30	SF		3	C		23		F
0040	LEAR	23	0454	0455	0516	S30	W20	4826	07 21.6	22	SN	C 1.8	3	C		39		U
0041	LEAR	23	0526	0529	0543	S21	E51	4827	07 27.1	17	SN	C 1.1	3	C		37		F
0042		23	0715*	0715*	0741	S29	W21	4826	07 21.6	26	SN	C 2.3				43	.7	DEF
	LEAR	23	0715	0715	0737	S29	W21	4826	07 21.6	22	SN	C 2.3	3	C		31		
	KAND	23	0715	0718	0722	S30	W20	4826	07 21.7	7	SN			P		10	.1	DEF
	BUCH	23	0720	0729	0800	S29	W20	4826	07 21.7	40	1N	C 2.3		C	0729	215	2.8	E
	KAND	23	0722	0723	0736	S29	W21	4826	07 21.7	14	SN			P		21	.3	DEF
	KAND	23	0723		0733	S29	W19	4826	07 21.8	10	SF			P		26	.3	DEF
	SVTO	23	0723	0725	0732	S31	W20	4826	07 21.7	9	SF	C 2.3	2	C		18		
	SVTO	23	0735	0749	0750	S30	W21	4826	07 21.7	15	SF		3	C		13		
	KAND	23	0756		0800	S28	W24	4826	07 21.4	4	SN			P		10	.1	D
0043	BUCA	23	0732	0737	0800	S24	E50	4827	07 27.2	28	1F			C	0737	128	2.3	E
0044	KAND	23	0854		0900	S19	E09	4829	07 24.0	6	SF			P				D
0045	SVTO	23	0920	0922	0947	S31	W22	4826	07 21.6	27	SF	C 3.1	3	C		47		
0046	KAND	23	0957		1002	S34	W07		07 22.8	5	SF			P		26	.3	D
0047	HOLL	23	1333	1333	1348	S22	E45	4827	07 27.0	15	SF		3	C		11		
0048		23	13491	13502	1402	S30	W24	4826	07 21.7	13	SF	C 1.1				20		F
	SVTO	23	1349	1350	1406	S30	W24	4826	07 21.7	17	SF	C 1.1	3	C		26		F
	RAMY	23	1350	1350	1357	S31	W23	4826	07 21.8	7	SF	C 1.1	3	C		11		F
	HOLL	23	1350	1352	1404	S29	W24	4826	07 21.7	14	SF	C 1.1	3	C		22		

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Grp #	Sta	Day	Start (UT)	Max (UT)	End (UT)	Lat	CMD	NOAA/ USAF Region	CMP Mo Day	Dur (Min)	Imp Opt	Xray	See	Obs Type	Time (UT)	Area Measurement Apparent (10^{-6} Disk)	Corr (Sq Deg)	Remarks
0049	HOLL	23	1600	1601	1612	S19	E04	4829	07 24.0	12	SF		4	C		12		
0050	HOLL	23	1657	1657	1702	S30	W25	4826	07 21.7	5	SF		3	C		21		F
0051	PALE	23	1715	1715	1728	S29	W26	4826	07 21.7	13	SF		3	C		21		
0052		23	1726*	1804*	1828	S29	W28	4826	07 21.5	62	SF	C 2.6				26		EF
	RAMY	23	1726	1804	1811	S29	W28	4826	07 21.5	45	SF		3	C		14		
	RAMY	23	1813	1815	1845	S29	W28	4826	07 21.6	32	SN	C 2.6	3	C		43		
	HOLL	23	1814	1815	1835	S28	W28	4826	07 21.6	21	SF	C 2.6	3	C		34		FE
	PALE	23	1819	1819	1823	S29	W28	4826	07 21.6	4	SF	C 2.6	3	C		12		F
0053	HOLL	23	1836	1842	1848	S22	E43	4827	07 27.1	12	SF		3	C		15		
0054		23	19115	19233	1944	S30	W28	4826	07 21.6	33	SN	C 3.7				28		E
	HOLL	23	1911	1923	1945	S29	W28	4826	07 21.6	34	SN	C 3.7	3	C		43		E
	PALE	23	1916	1926	1943	S30	W29	4826	07 21.5	27	SF	C 3.7	3	C		14		
0055		24	0022*	0035*	0116	S28	W31	4826	07 21.6	54	SN	C 3.7				102	1.9	EFT
	HOLL	24	0022	0035	0055D	S28	W28	4826	07 21.8	33D	SF	C 3.7	3	C		50		FE
	URUM	24	0035	0040	0105	S29	W31	4826	07 21.6	30	SN	C 3.7		C		63	.9	ET
	PURP	24	0058E	0104	0127	S28	W34	4826	07 21.4	29D	1N			C	0104	193	2.9	E
0056	SVTO	24	0817	0819	0837	S29	W35	4826	07 21.6	20	SN	C 1.4	3	C		28		
0057		24	0956	1000	1050	S29	W36	4826	07 21.6	54	1B	M 3.0				100	1.0	DEFT
	SVTO	24	0956	1000	1055	S29	W36	4826	07 21.6	59	1B	M 3.0	3	C		139		F
	KAND	24	1009E		1045	S29	W37	4826	07 21.5	36D	SB			P		62	1.0	DEFT
0058	SVTO	24	1111	1111	1115	S20	E34	4827	07 27.1	4	SF		3	C		13		
0059		24	15512	1556	1619	N31	E70	4831	07 30.2	28	SN	C 1.0				60		
	SVTO	24	1551	1556	1618	N31	E69	4831	07 30.1	27	SN	C 1.0	3	C		58		
	RAMY	24	1553	1556	1620	N31	E70	4831	07 30.2	27	SF	C 1.0	3	C		62		
0060		24	1654*	1702*	1814	N20	W10	4825	07 23.9	80	SF					66		EFU
	RAMY	24	1654	1702	1824D	N22	W11	4825	07 23.8	90D	SN		2	C		73		UE
	PALE	24	1659	1702	1715	N19	W10	4825	07 23.9	16	SF		3	C		12		
	SVTO	24	1700E	1702U	1712D	N19	W10	4825	07 23.9	12D	SF		2	C		31		F
	PALE	24	1721	1734	1751	N20	W11	4825	07 23.9	30	SF		3	C		45		U
	HOLL	24	1755E	1755U	1935	N22	W11	4825	07 23.9	100D	1F		3	C		171		UF
0061	HOLL	24	1938	1938	2003	S27	W42	4826	07 21.5	25	SF		3	C		12		
0062		25	0620*	0627*	0701	S27	W51	4826	07 21.3	41	SN	C 1.6				91	2.4	D
	BUCA	25	0620	0627	0705	S27	W50	4826	07 21.4	45	SB	C 1.6		C	0627	107	2.0	D
	SVTO	25	0623	0630	0649	S28	W52	4826	07 21.2	26	SF	C 1.6	3	C		24		
	YUNN	25	0656	0659	0710	S27	W51	4826	07 21.3	14	1N			C		141	2.8	
0063	SVTO	25	0840	0845	0901	S20	E20	4827	07 26.9	21	SF		3	C		32		
0064		25	1052	1055	1112	S22	E22	4827	07 27.1	20	SF					52		
	RAMY	25	1024E	1055	1112	S22	E22	4827	07 27.1	48D	SF		3	C		19		
	SVTO	25	1052	1055	1206D	S22	E21	4827	07 27.1	74D	SF		3	C		86		
0065	RAMY	25	1145	1147	1158	S20	W17	4829	07 24.2	13	SF	C 1.1	3	C		12		
0066	RAMY	25	1235	1235	1240	S30	W48	4826	07 21.7	5	SF		3	C		25		
0067		25	15242	1526*	1604	S28	W54	4826	07 21.4	40	SN					22		
	RAMY	25	1524	1539	1610	S29	W54	4826	07 21.4	46	SF		3	C		25		
	HOLL	25	1526	1526	1557	S27	W54	4826	07 21.4	31	SN		3	C		19		
0068		25	16325	16382	1648	S29	W50	4826	07 21.8	16	SN					18		E
	HOLL	25	1632	1640	1659	S28	W52	4826	07 21.6	27	SN		3	C		27		E
	PALE	25	1636E	1638	1643	S29	W48	4826	07 21.9	7D	SN		2	C		14		
	RAMY	25	1637	1639	1643	S30	W51	4826	07 21.7	6	SF		3	C		12		
0069	HOLL	25	1744	1746	1754	S28	W54	4826	07 21.5	10	SF		3	C		18		

H - ALPHA S O L A R F L A R E S

JULY 1987

Grp #	Sta	Day	Start (UT)	Max (UT)	End (UT)	Lat	CMD	NOAA/ USAF Region	CMP Mo	CMP Day	Dur (Min)	Imp Opt	Imp Xray	Imp See	Obs Type	Time (UT)	Area Measurement Apparent (10^{-6} Disk)	Area Measurement Corr (Sq Deg)	Remarks
0070	RAMY	25	1814	1815	1819	N31	E58	4831	07	30.3	5	SF		3	C		16		
0071	HOLL	25	1841	1846	1853	S28	W55	4826	07	21.5	12	SF		3	C		15		
0072	HOLL	25	2107	2122U	2153	S27	W58	4826	07	21.4	46	SN	C 5.5	3	C		48		F
0073		25	2206*	22154	2249	S18	W28	4829	07	23.8	43	SF	C 2.4				77		
	CULG	25	2206	2215	2215D	S19	W29	4829	07	23.7	9D	SF	C 2.4		C		100		
	HOLL	25	2218	2219	2249	S18	W28	4829	07	23.8	31	SF	C 2.4	3	C		54		
0074	YUNN	26	0303E	0303U	0307	S26	E14	4827	07	27.2	4D	SN			P	0303	8	.1	D
0075		26	0316*	0318*	0340	S25	W60	4826	07	21.5	24	SN	C 1.8				16		E
	YUNN	26	0316	0318	0325	S27	W61	4826	07	21.4	9	SN			C		16		E
	YUNN	26	0328	0332	0354	S23	W59	4826	07	21.6	26	SN	C 1.8		C		16		E
0076	YUNN	26	0353	0358	0426	N30	E54	4831	07	30.4	33	SN			C		11	.2	E
0077	YUNN	26	0547	0550U	0550D	S29	W61	4826	07	21.4	3D	SN			P	0550	94		
0078	SVTO	26	0921	0954	1014	S30	W61	4826	07	21.6	53	SN	C 2.6	3	C		19		F
0079	RAMY	26	1201	1202	1219	S19	W35	4829	07	23.8	18	SF		3	C		15		
0080		26	13503	1355	1402	S28	W68	4826	07	21.3	12	SN					28		
	RAMY	26	1350	1355	1402	S29	W67	4826	07	21.3	12	SN		3	C		35		
	HOLL	26	1353	1355	1402	S28	W69	4826	07	21.2	9	SF		3	C		22		
0081	HOLL	26	1523	1523	1534	S27	W65	4826	07	21.6	11	SF		3	C		11		
0082	HOLL	26	1806	1809	1836	S18	W39	4829	07	23.8	30	SF		3	C		24		F
0083	PALE	27	0224E	0224U	0224D	S27	W71	4826	07	21.6	30D	SF	C 3.8	3	C		11		
0084	HOLL	27	1608	1614	1617	S26	W71	4826	07	22.1	9	SF		3	C		27		
0085	HOLL	27	1639	1641	1650D	S26	W71	4826	07	22.2	11D	SF		3	C		14		
0086	SVTO	27	1709	1711	1714	S31	W78	4826	07	21.6	5	SF		3	C		10		
0087	HOLL	27	1914E		1927D	S23	W70	4826	07	22.4	13D	SF		3	C		22		
0088	BUCA	29	0745	0746	0805	N29	E13	4831	07	30.3	20	SN			C	0746	107	1.2	E
0089	HOLL	29	2020	2022	2026	S21	W39	4827	07	26.8	6	SF		3	C		14		
0090		29	20211	20222	2041	N17	W82	4825	07	23.6	20	SF					26		
	HOLL	29	2021	2022	2050	N17	W79	4825	07	23.8	29	SF		3	C		28		
	RAMY	29	2022	2024	2034	N16	W78	4825	07	23.9	12	SF		3	C		28		
	PALE	29	2024E	2024	2040	N17	W88	4825	07	23.2	16D	SF		2	C		21		
0091	RAMY	29	2053	2055	2110	N16	W78	4825	07	23.9	17	SF		3	C		28		
0092	CULG	30	0140	0142	0142D	S26	W40	4827	07	27.0	2D	SF			C		120		
0093	LEAR	30	0417	0418	0423	S29	W34	4827	07	27.5	6	SF		3	C		22		
0094		30	0627	06271	0631	S22	W38	4827	07	27.3	4	SF					18		
	SVTO	30	0627	0627	0632	S23	W39	4827	07	27.3	5	SF		3	C		19		
	LEAR	30	0627	0628	0630	S21	W37	4827	07	27.4	3	SF		3	C		16		
0095	SVTO	30	1114	1119	1124	S29	W36	4832	07	27.6	10	SF		3	C		14		
0096		30	11554	1157	1212	S28	W36	4832	07	27.7	17	SN					16		ET
	RAMY	30	1155	1157	1210	S29	W36	4832	07	27.7	15	SF		3	C		16		
	KAND	30	1159		1213	S26	W37	4832	07	27.6	14	SN			P				ET
0097		30	1159	12018	1220	S22	W39	4827	07	27.5	21	SN					46		FU
	RAMY	30	1159	1201	1221	S21	W39	4827	07	27.5	22	SN		3	C		53		UF
	SVTO	30	1159	1209	1218	S22	W39	4827	07	27.5	19	SF		3	C		38		F

H - ALPHA S O L A R F L A R E S

JULY 1987

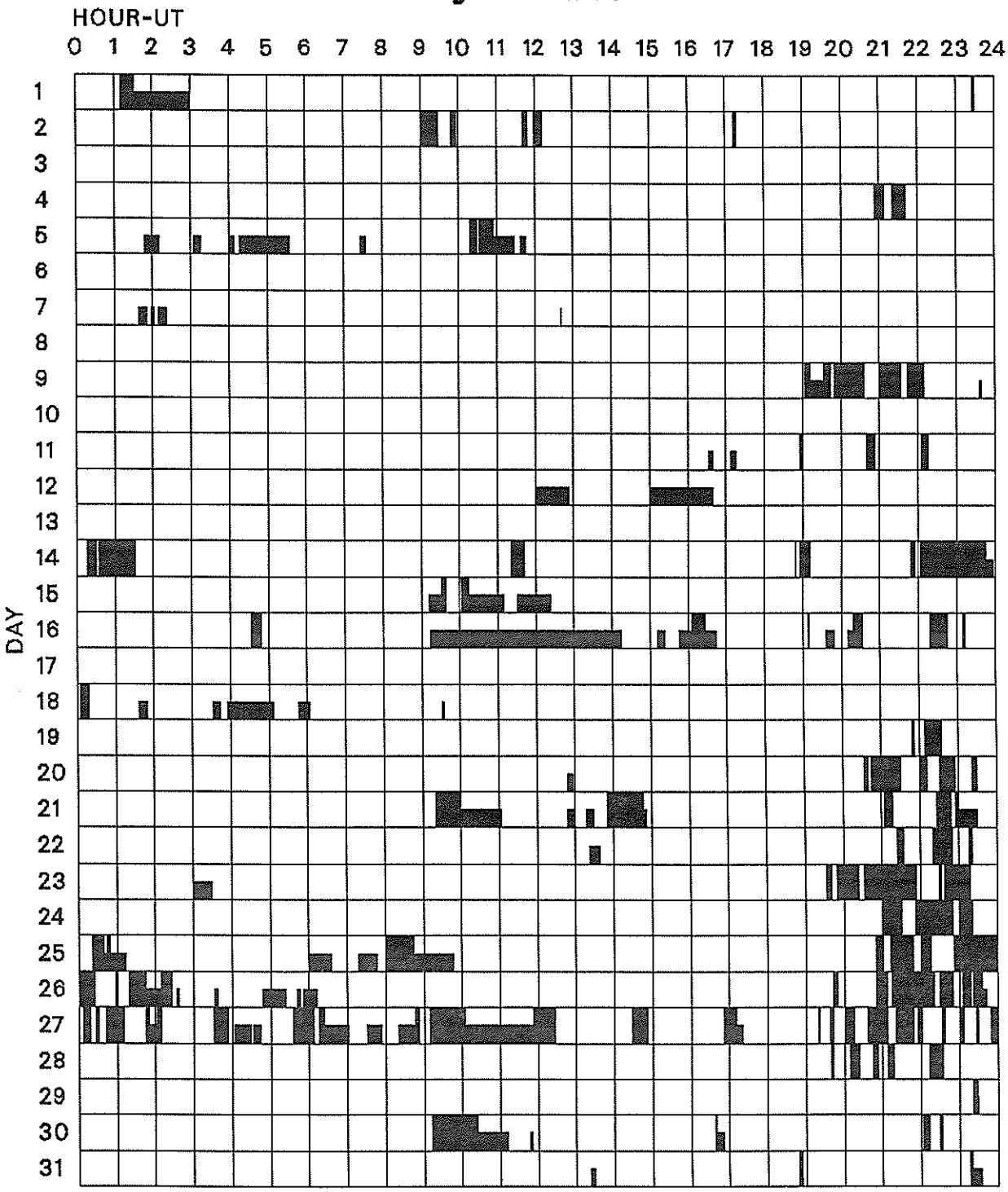
Grp #	Sta	Day	Start (UT)	Max (UT)	End (UT)	Lat	CMD	NOAA/ USAF Region	CMP Mo	CMP Day	Dur (Min)	Imp Opt	Imp Xray	Imp See	Obs Type	Time (UT)	Area Measurement Apparent (10^{-6} Disk)	Area Measurement Corr (Sq Deg)	Remarks
0098	YUNN	31	0040	0041	0056	N16	E10	4834	07	31.8	16	SN			C		8	.1	D
0099	YUNN	31	0045	0046	0054	N20	W24		07	29.2	9	SN			C		31	.4	D
0100	YUNN	31	0048	0050	0054	N31	W08	4831	07	30.4	6	SB			C		16	.2	D
0101	YUNN	31	0147	0149	0158	S30	W44	4832	07	27.6	11	SN			C		47	.8	D
0102		31	0347	0347	0353	N30	W12	4831	07	30.2	6	SN					26		F
	PALE	31	0347	0347	0350	N30	W14	4831	07	30.0	3	SF		2	C		20		F
	LEAR	31	0347	0347	0356	N30	W10	4831	07	30.4	9	SN		3	C		32		F
0103	HOLL	31	1831	1900	1912	N15	W01	4834	07	31.7	41	SF		3	C		15		FH

"Remarks"

A = Eruptive prominence whose base is less than 90 degrees from central meridian.
B = Probably the end of a more important flare.
C = Invisible 10 minutes before.
D = Brilliant point.
E = Two or more brilliant points.
F = Several eruptive centers.
G = No visible spots in the neighborhood.
H = Flare accompanied by high-speed dark filament.
I = Active region very extended.
J = Distinct variations of plage intensity before or after the flare.
K = Several intensity maxima.
L = Existing filaments show signs of sudden activity.
M = White-light flare.
N = Continuous spectrum shows effects of polarization.
O = Observations have been made in the H and K lines of Ca II.
P = Flare shows Helium D3 in emission.
Q = Flare shows Balmer continuum in emission.
R = Marked asymmetry in H-alpha line suggests ejection of high-velocity material.
S = Brightness follows disappearance of filament in same position.
T = Region active all day.
U = Two bright branches, parallel or converging.
V = Occurrence of an explosive phase; important, expansion within roughly 1 minute that often includes a significant intensity increase.
W = Great increase in area after time of maximum intensity.
X = Unusually wide H-alpha line.
Y = System of loop-type prominences.
Z = Major sunspot umbra covered by flare.

INTERVALS OF NO FLARE PATROL OBSERVATION
FOR PRECEDING SOLAR FLARE TABLE

JULY 1987



Times of no flare patrol, shown here as shaded areas, combine reports from the observatories listed below. Portions of a panel completely shaded mark dates and times of no patrol of any kind, that is, of neither visual nor cinematographic; portions of a panel with only the bottom half shaded mark times of strictly visual patrol.

Bucharest	Istanbul	Learmonth	Peking	San Vito
Holloman	Kandilli	Palehua	Purple Mt.	Urumqi
			Ramey	Yunnan

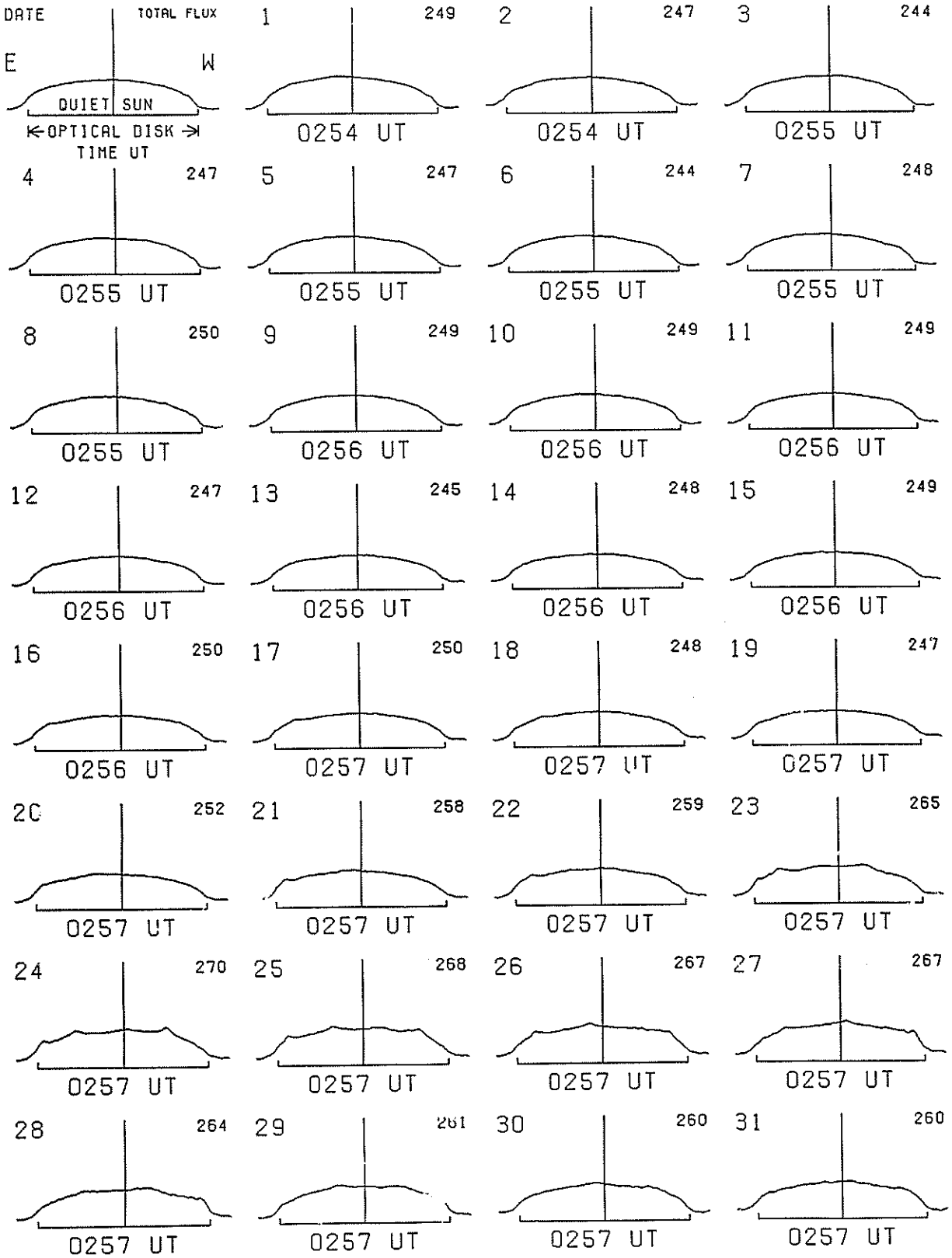
24
Jul 87

EAST-WEST SOLAR SCANS

JULY 1987

TOYOKAWA, JAPAN

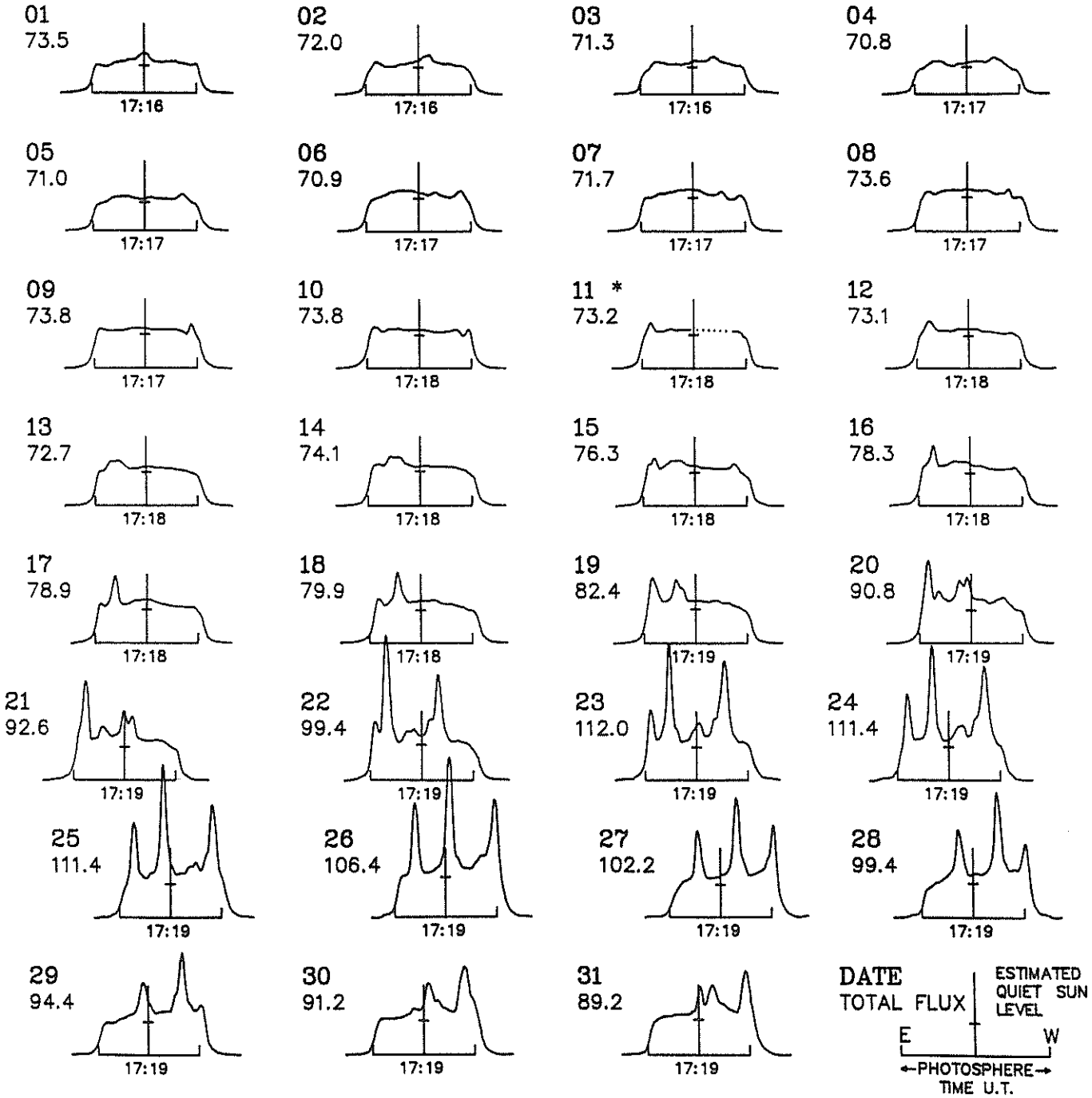
3 CM
FAN BEAM WITH 1.1 MINUTES OF ARC



EAST – WEST SOLAR SCANS
JULY 1987

ALGONQUIN RADIO OBSERVATORY
CANADA

10.7 cm
Fan Beam with 1.5 minutes of arc
E – W Resolution



* Scan interupted

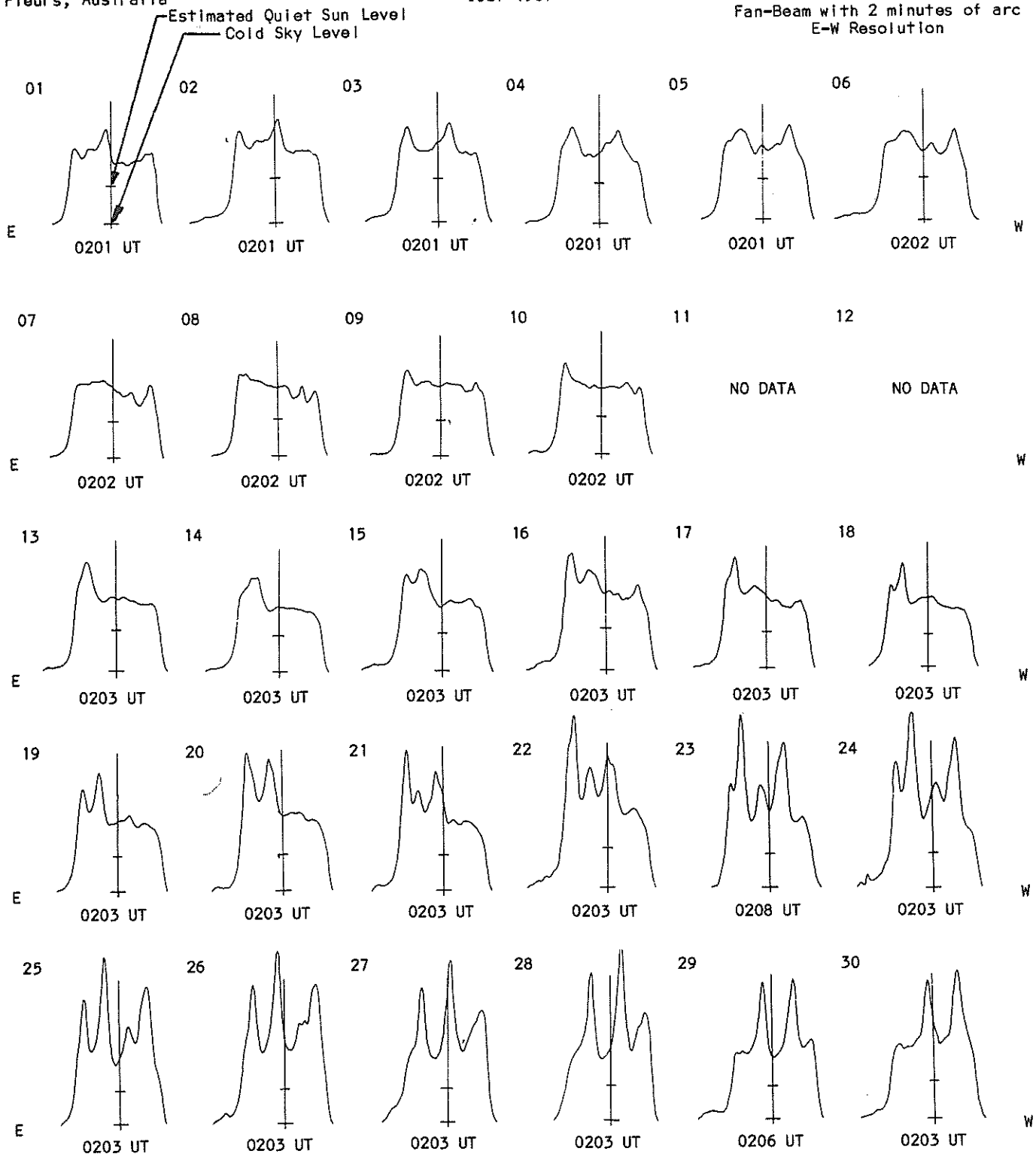
26
Jul 87

EAST-WEST SOLAR SCANS

Fleurs, Australia

JULY 1987

21 cm
Fan-Beam with 2 minutes of arc
E-W Resolution



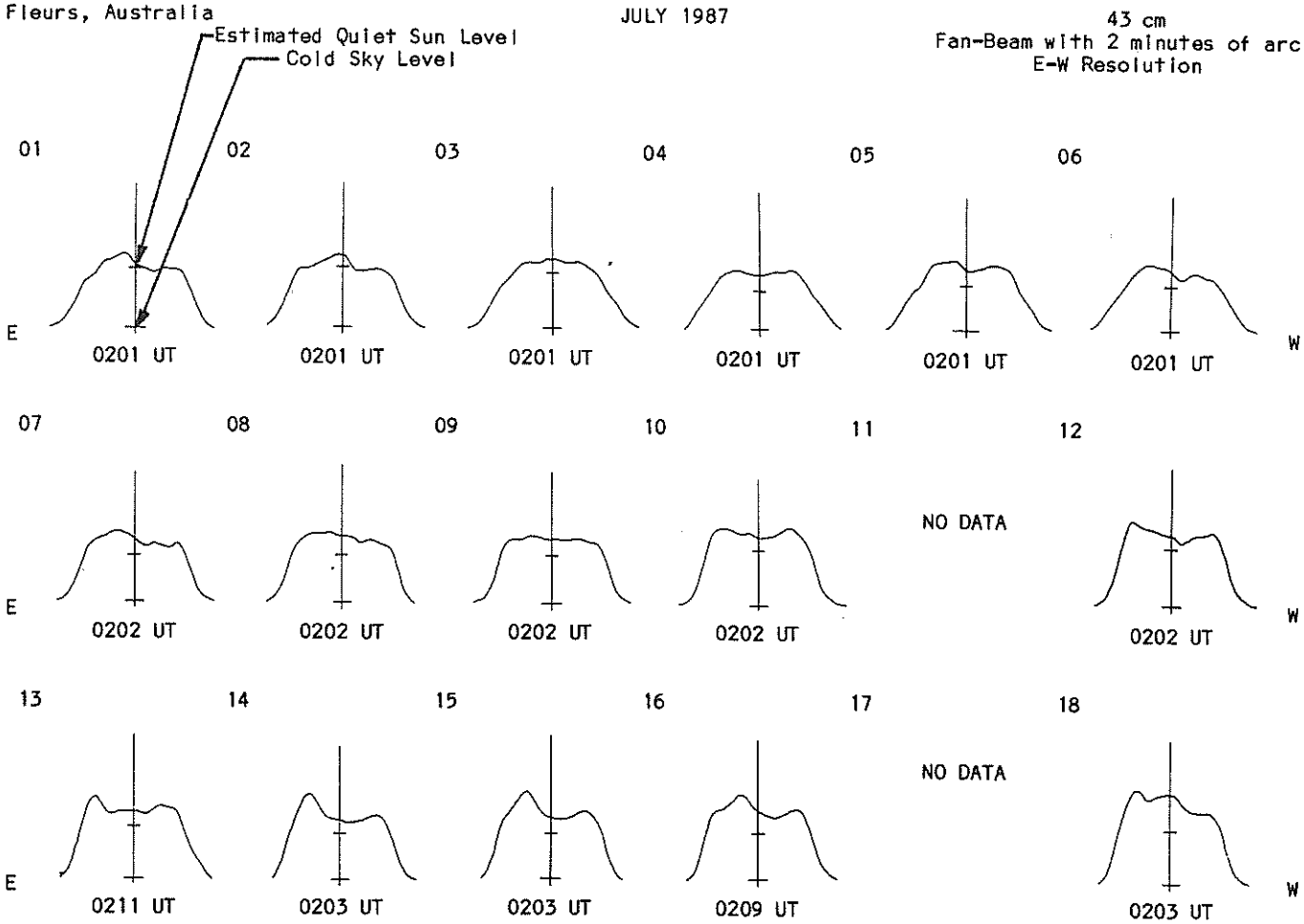
NO DATA July 31, 1987

E A S T - W E S T S O L A R S C A N S

Fleurs, Australia

JULY 1987

43 cm
Fan-Beam with 2 minutes of arc
E-W Resolution



NO DATA 19-JULY 31, 1987

SOLAR RADIO EMISSION
SELECTED FIXED FREQUENCY EVENTS

JULY 1987

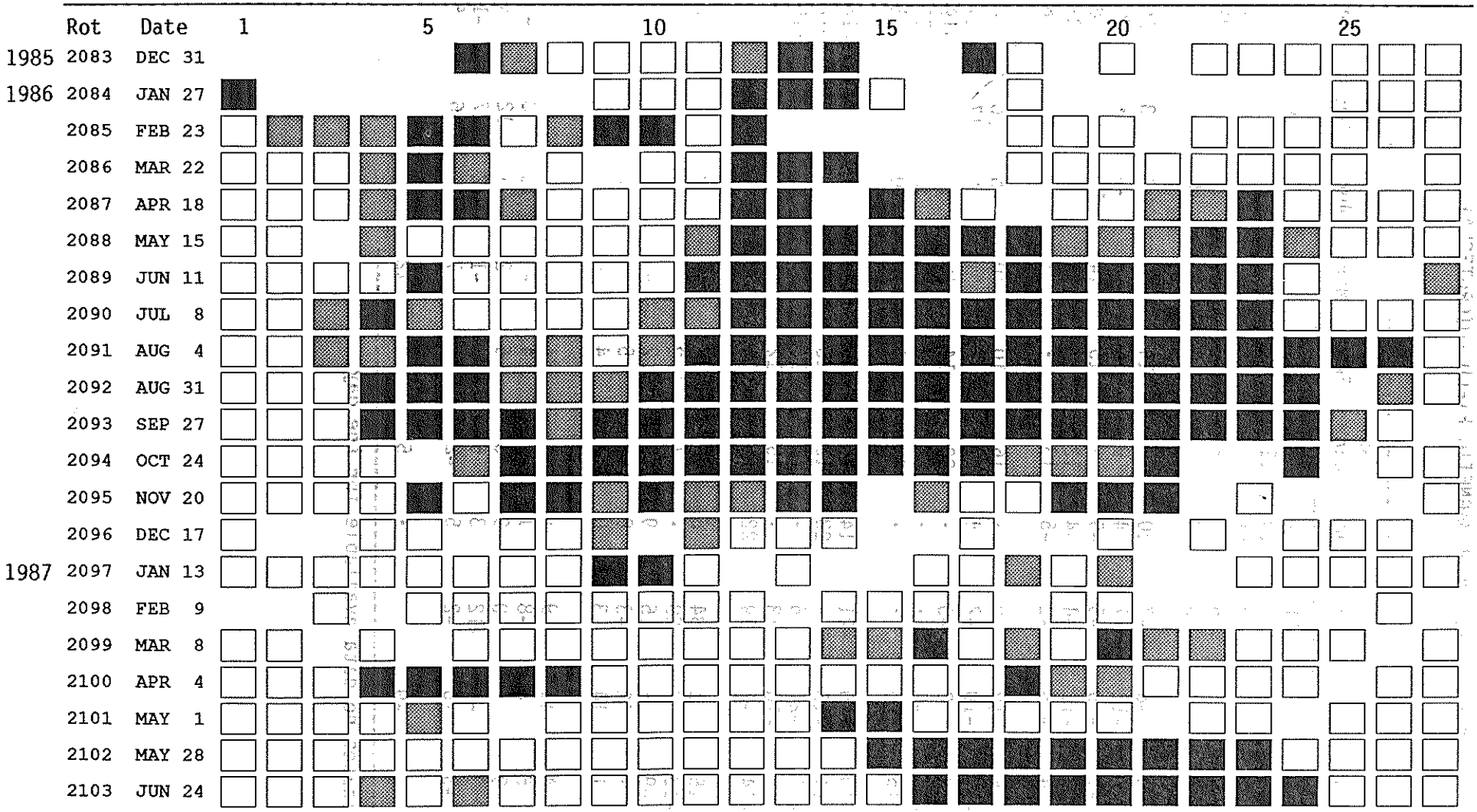
Day	Freq	Sta	Type		Start (UT)	Time of Maximum (UT)	Duration (Min)	Flux Density Peak (10 -22 W/m 2 Hz)	Flux Density Mean (10 -22 W/m 2 Hz)	Int	Remarks
07	8800	SVTO	8	S	0427.0E	0428.0	1.0D	34.0			QL=5 ST=2 TYP=3
	2800	OTTA	20	GRF	2008.0		352.0D	6.1	3.4		
19	2800	OTTA	20	GRF	1826.0	2230.0	320.0	2.9	2.0		
21	2800	OTTA	22	GRF	1728.0	2136.0	332.0D	5.3	2.6		
22	2800	OTTA	23	GRF	1438.0	2057.0	488.0	8.2	4.1		
	2695	SGMR	46	C	1557.0E	1558.0	2.0D	52.0			QL=5 ST=2 TYP=5
	2800	OTTA	4	S/F	1557.1	1558.5	6.5	52.5	7.9		
	2695	SVTO	8	S	1558.0E	1558.0	1.0D	49.0			QL=5 ST=2 TYP=3
	2800	OTTA	1	S	1628.7	1629.0	3.0	5.6	2.2		
23	2695	PALE	8	S	0019.0E	0020.0	1.0D	28.0			QL=5 ST=2 TYP=3
	2695	LEAR	8	S	0019.0E	0020.0	1.0D	28.0			QL=5 ST=2 TYP=3
	2695	SGMR	45	C	1346.0E	1346.0	1.0D	50.0			QL=5 ST=3 TYP=5
	8800	SVTO	8	S	1346.0E	1346.0	1.0D	27.0			QL=5 ST=2 TYP=3
	8800	SGMR	8	S	1346.0E	1346.0	1.0D	48.0			QL=5 ST=3 TYP=3
	2695	SVTO	8	S	1346.0E	1346.0	1.0D	47.0			QL=5 ST=2 TYP=3
	2800	OTTA	3	S	1346.0	1346.8	6.7	48.3	10.8		
	2800	OTTA	21	GRF	1346.0	1413.5	71.0	5.3	2.6		
	2800	OTTA	20	GRF	1520.0	1558.0	91.0	2.1	1.9		
	2800	OTTA	1	S	1656.3	1656.8	2.0	2.0	1.0		
	2800	OTTA	22	GRF	1744.0	1929.0	124.0	5.1	2.6		
	2800	OTTA	42	SER	2055.0	2055.2	1.2	6.1	2.8		
	2800	OTTA	42	SER	2055.0	2125.3	31.2	29.4	3.3		
	2695	PALE	8	S	2057.0E	2058.0	1.0D	28.0			QL=5 ST=2 TYP=3
	2695	SGMR	8	S	2057.0E	2058.0	1.0D	28.0			QL=5 ST=2 TYP=3
	2800	OTTA			2057.5	2057.9	2.8	24.9	7.3		
	2800	OTTA			2108.5	2109.0	1.7	8.5	2.5		
	2695	PALE	8	S	2123.0E	2123.0	2.0D	33.0			QL=5 ST=2 TYP=3
	2695	SGMR	4	S/F	2123.0E	2123.0	3.0D	28.0			QL=1 ST=3 TYP=3
	2800	OTTA			2123.2	2123.3	1.7	25.2	6.3		
	2800	OTTA			2125.0	2125.3	1.3	29.4	5.9		
24	8800	SVTO	46	C	0956.0E	0958.0	12.0D	230.0			QL=5 ST=3 TYP=5
	2695	SVTO	46	C	0957.0E	0958.0	15.0D	130.0			QL=5 ST=3 TYP=5
	2800	OTTA	22	GRF	1100.0E	1111.0	328.0D	6.0	4.0		
	2800	OTTA	22	GRF	1716.0	1753.0	164.0	6.2	3.1		
25	8800	PALE			0220.0E	0223.0	4.0D	110.0			QL=1 ST=2 TYP=8
	2800	OTTA	20	GRF	1508.0	1529.0	85.0	2.5	1.2		
	2800	OTTA	20	GRF	1934.0	1943.0	70.0	5.3	1.8		
	2800	OTTA	20	GRF	2107.0	2111.7	53.0	3.6	1.6		
26	2695	PALE	8	S	0328.0E	0328.0	2.0D	18.0			QL=5 ST=2 TYP=3
	8800	PALE	4	S/F	0328.0E	0328.0	1300.0D	23.0			QL=5 ST=2 TYP=3
	8800	LEAR	8	S	0328.0E	0328.0	1.0D	33.0			QL=5 ST=2 TYP=3
	2695	LEAR	4	S/F	0328.0E	0328.0	1421.0D	12.0			QL=5 ST=2 TYP=3
	2800	OTTA	20	GRF	1410.0E	1524.0	324.0D	4.1	2.0		
27	8800	LEAR	4	S/F	0217.0E	0218.0	3.0D	31.0			QL=5 ST=2 TYP=3
	8800	PALE	8	S	0218.0E	0218.0	1.0D	26.0			QL=5 ST=2 TYP=3
	2800	OTTA	20	GRF	1240.0E		238.0D	8.9	4.4		
	2800	OTTA	24	R	1649.0	1700.0	11.0	1.5	.7		
	8800	SGMR	46	C	1810.0E	1811.0	4.0D	440.0			QL=5 ST=2 TYP=5
	8800	PALE	46	C	1810.0E	1811.0	3.0D	440.0			QL=5 ST=2 TYP=5
	2695	PALE	46	C	1810.0E	1811.0	4.0D	220.0			QL=5 ST=2 TYP=5
	2695	SGMR	46	C	1810.0E	1811.0	5.0D	260.0			QL=5 ST=2 TYP=5
	2800	OTTA	3	S	1810.2	1811.8	8.0	235.6	70.7		
	2800	OTTA	30	PBI	1818.2	1818.2	74.0	6.8	3.4		
	2800	OTTA	1	S	1824.2	1826.0	4.5	3.4	1.7		
	2800	OTTA	8	S	1825.0	1825.2	.3	2.9	1.4		
	2800	OTTA	24	R	2115.3	2124.7	9.4	1.9	1.1		
	2800	OTTA	24	R	2202.0	2215.0	13.0	1.6	.9		
28	2800	OTTA	22	GRF	1100.0E	1150.0	310.0D	4.7	2.8		
	2695	SGMR	8	S	1258.0E	1259.0	2.0D	48.0			QL=5 ST=2 TYP=3
29	2800	OTTA	1	S	2137.0	2137.2	1.2	2.5	1.2		

STANFORD MEAN SOLAR MAGNETIC FIELD (MICROTESLA)

Day	1986 Aug	Sep	Oct	Nov	Dec	1987 Jan	Feb	Mar	Apr	May	Jun	Jul
1	3	4	-7	-11	-1	•	1	•	10	14	2	11
2	7	5	-7	-11	-10	11	•	•	•	17	3	20
3	4	-6	-6	-12	-11	•	•	•	8	11	12	26
4	10	-6	1	-5	•	•	9	•	13	5	23	33
5	10	-3	-7	-10	0	6	10	•	10	0	27	33
6	0	0	-6	-7	20	•	14	9	2	3	24	32
7	-2	-2	-12	-7	4	9	16	•	-5	•	29	17
8	-5	-1	-15	-5	-9	•	15	14	-14	6	38	2
9	-4	-9	-11	-4	-4	12	•	15	-13	6	31	-10
10	-2	-14	-15	-2	-5	13	•	•	-12	5	8	-13
11	1	-16	-18	-2	•	16	10	10	-5	20	-8	-19
12	3	-17	-10	-2	4	•	•	•	5	17	-17	-29
13	-1	-18	-8	-5	•	20	14	10	18	5	-19	-24
14	-12	-19	-9	•	•	25	8	23	30	-6	-21	-22
15	-17	-15	-10	•	•	23	7	18	30	-4	-21	-18
16	-21	-10	-10	-21	14	17	15	22	25	2	-16	-15
17	-23	-11	-15	•	23	13	13	22	19	4	-12	-9
18	-21	-11	-21	6	•	11	11	17	13	3	-16	4
19	-18	-13	-10	13	•	15	12	13	6	4	-6	9
20	-13	-14	-7	19	22	11	11	7	2	7	9	11
21	-14	-15	1	34	6	-6	•	-1	-3	•	13	7
22	-13	-13	7	29	•	-4	2	1	-2	19	12	11
23	-15	-9	•	15	9	9	2	-3	1	21	7	-5
24	-8	•	33	-3	8	•	5	2	2	•	7	-12
25	-16	1	14	3	0	7	4	0	6	3	11	-11
26	-9	4	11	-9	•	•	•	3	8	8	6	-10
27	-9	6	6	-8	1	•	4	-3	10	8	-1	-10
28	-8	9	•	0	9	3	6	-2	•	12	4	- 5
29	-3	3	-1	-12	3	5		-1	12	17	-1	-10
30	5	-3	-6	-2	5	-2		7	12	16	5	6
31	12		-9		•	5		12		4		27

Dot symbol indicates no data available for the day.

STANFORD MEAN SOLAR MAGNETIC FIELD



Mean Solar Magnetic Field Polarity: □ = field > 2 microT; ▒ = -2 microT ≤ field ≤ 2 microT

■ = field <-2 microT; No box = no data available

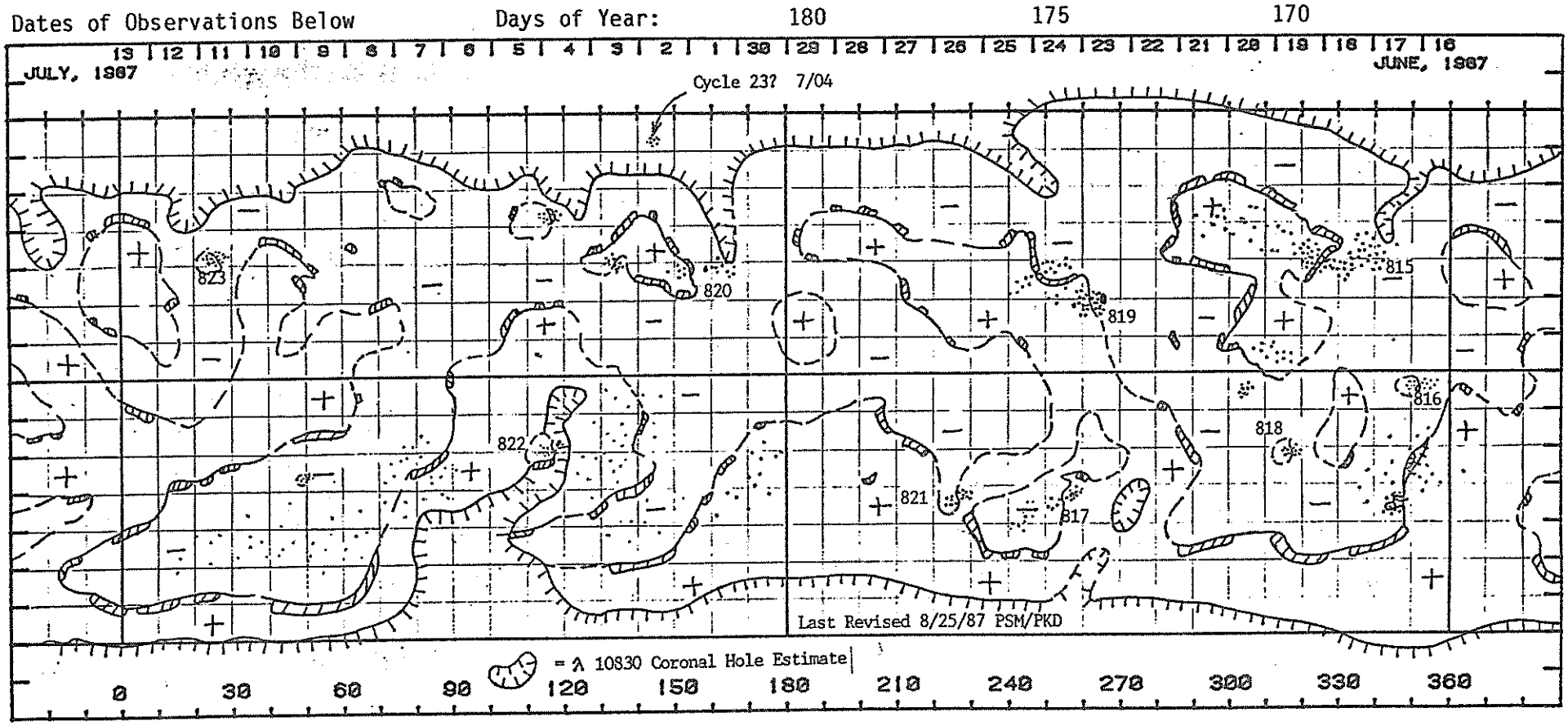
Observations are taken at 2000 UT. Rotation numbers given are the Bartels series, but the dates are not; these dates mark times of occurrence of phenomena on the Sun that affect the Earth during the given Bartels Rotation.

C O N T E N T S

Prompt Reports DATA FOR JUNE 1987 Number 516 Part I

PRELIMINARY H-ALPHA SOLAR SYNOPTIC CHART

CARRINGTON ROTATION NUMBER 1790
(16 June to 13 July 1987)



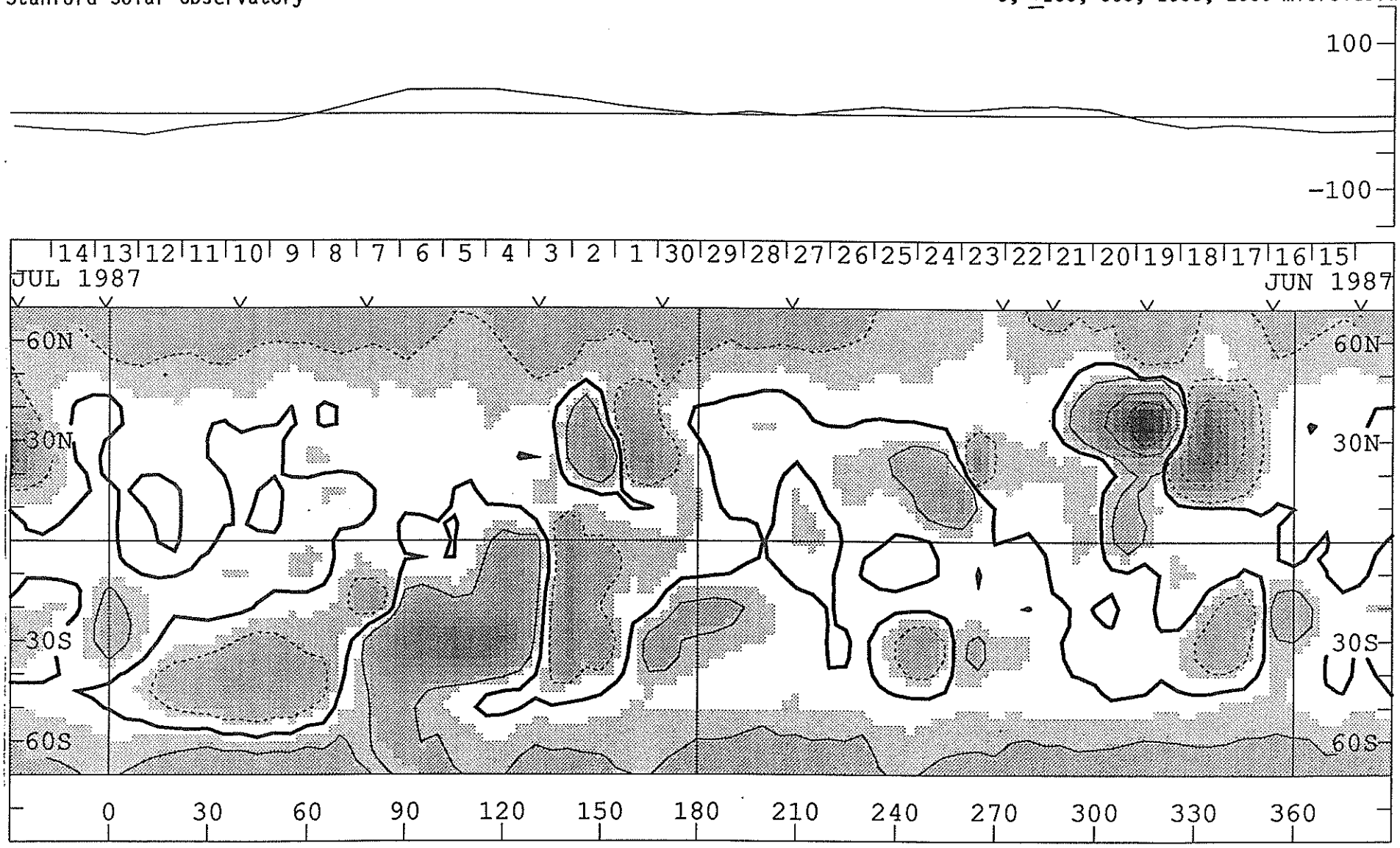
SOLAR MAGNETIC FIELD SYNOPTIC CHART

CARRINGTON ROTATION NUMBER 1790

(16 June to 13 July 1987)

Stanford Solar Observatory

0, ±100, 500, 1000, 2000 microTesla

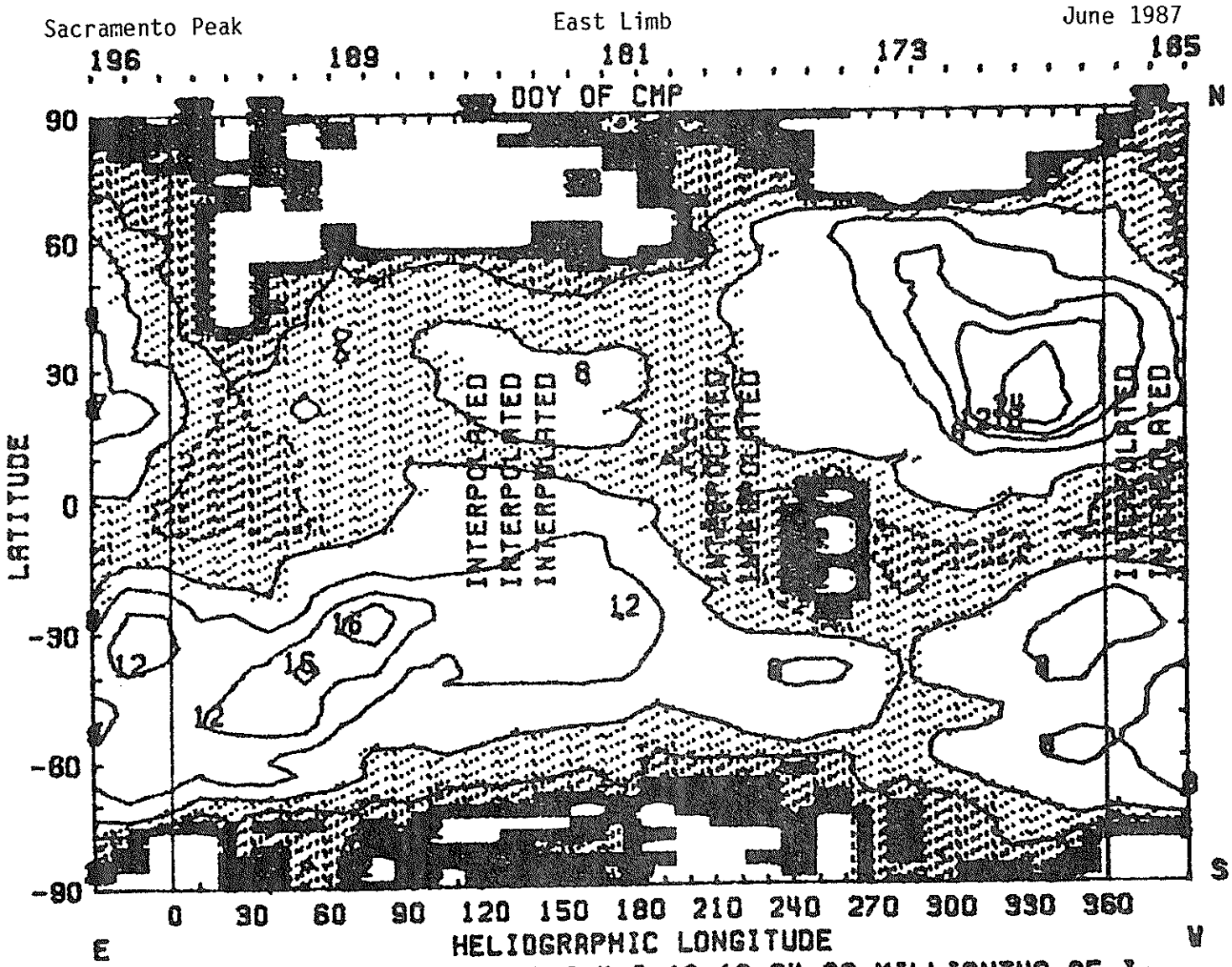


Heliographic Longitude

33
Jun 87

CORONAL GREEN LINE SYNOPTIC MAP

CARRINGTON ROTATION NUMBER 1790
(16 June to 13 July 1987)

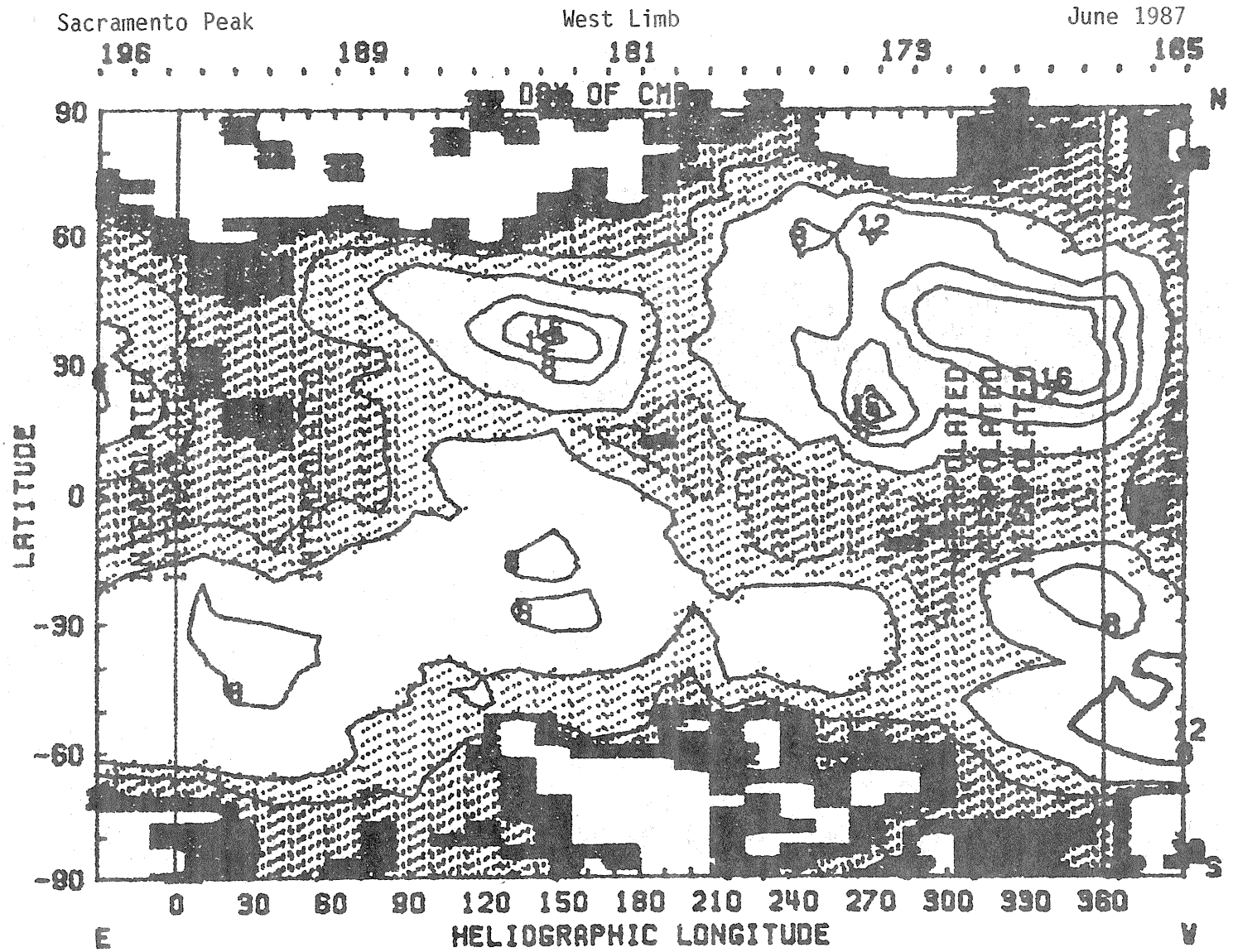


1987 E LIMB CONTOURS: .5,1,2,4,8,12,16,24,32 MILLIONTHS OF Io
CORONAL HOLES ARE SHOWN AS WHITE SURROUNDED BY BLACK

CORONAL GREEN LINE SYNOPTIC MAP

CARRINGTON ROTATION NUMBER 1790

(16 June to 13 July 1987)



1987 W LIMB CONTOURS: .5,1,2,4,8,12,16,24,32 MILLIONTHS OF Io

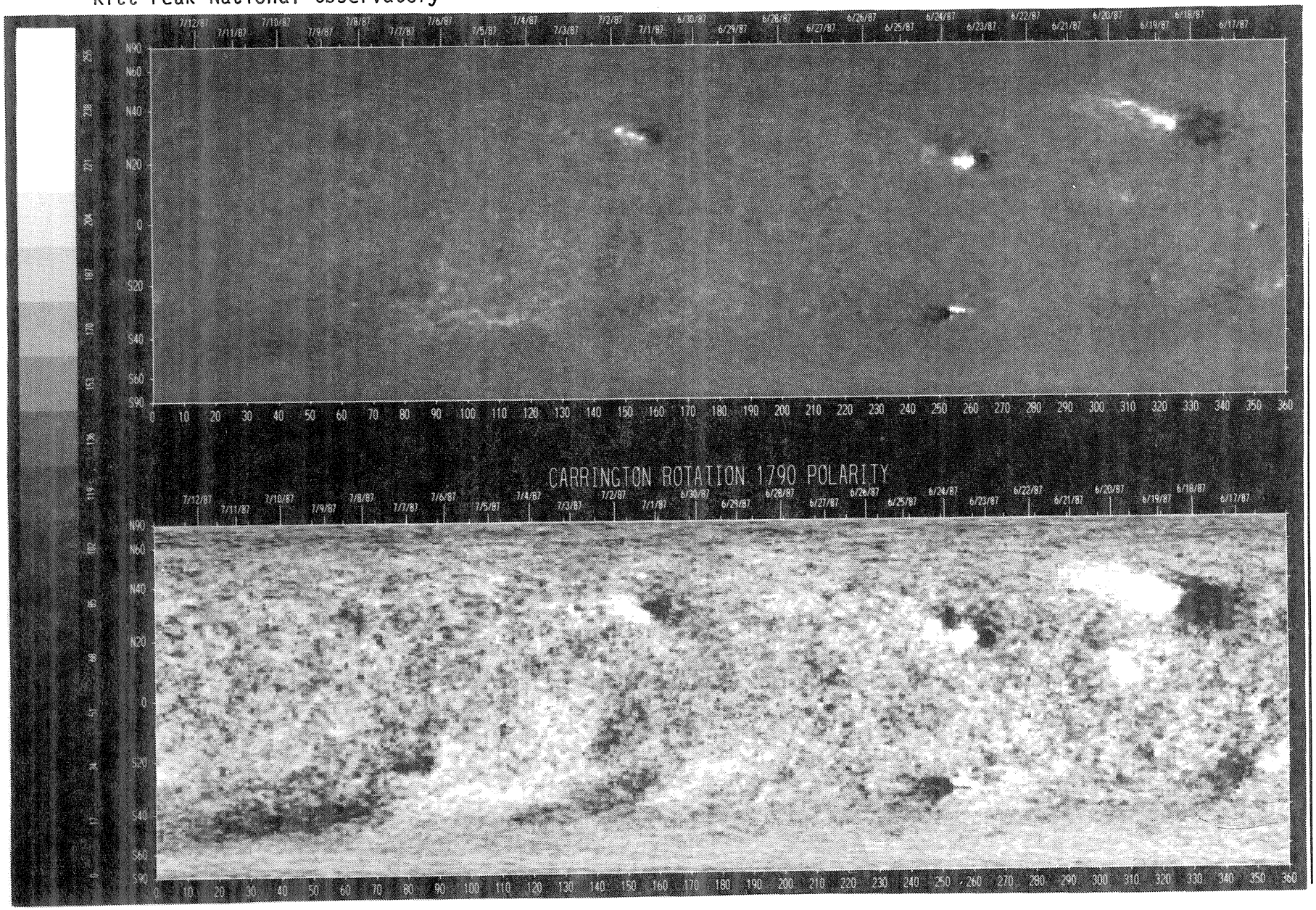
CORONAL HOLES ARE SHOWN AS WHITE SURROUNDED BY BLACK

SOLAR MAGNETIC FIELD SYNOPTIC CHART

CARRINGTON ROTATION NUMBER 1790
(16 June to 13 July 1987)

Kitt Peak National Observatory

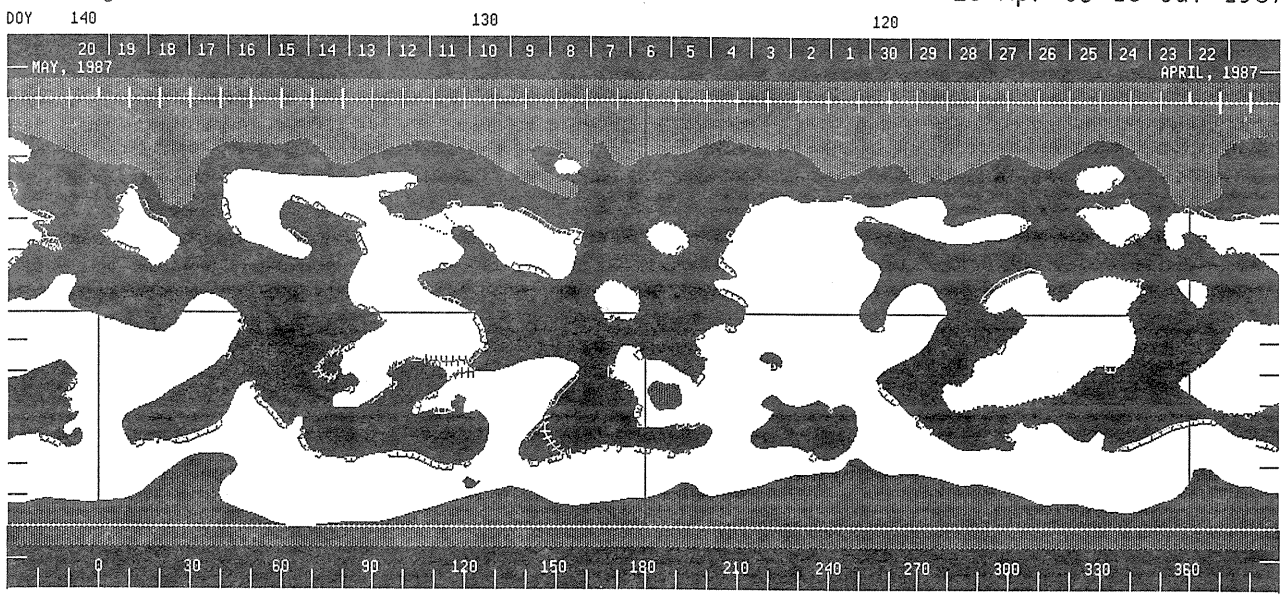
Dates of Observations

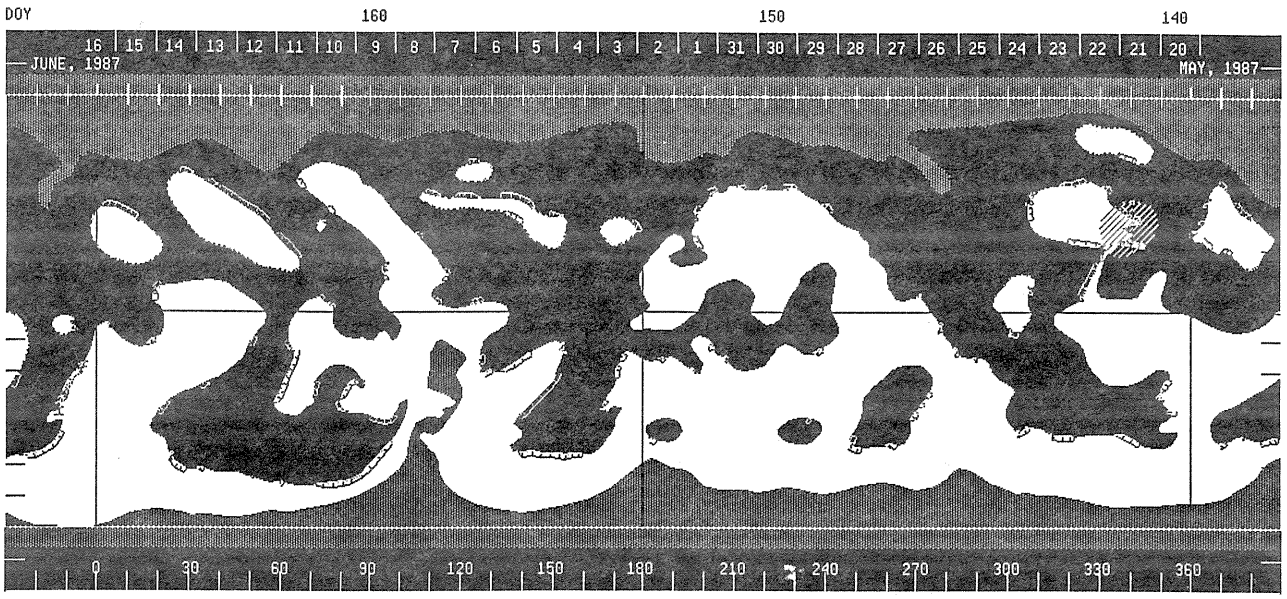


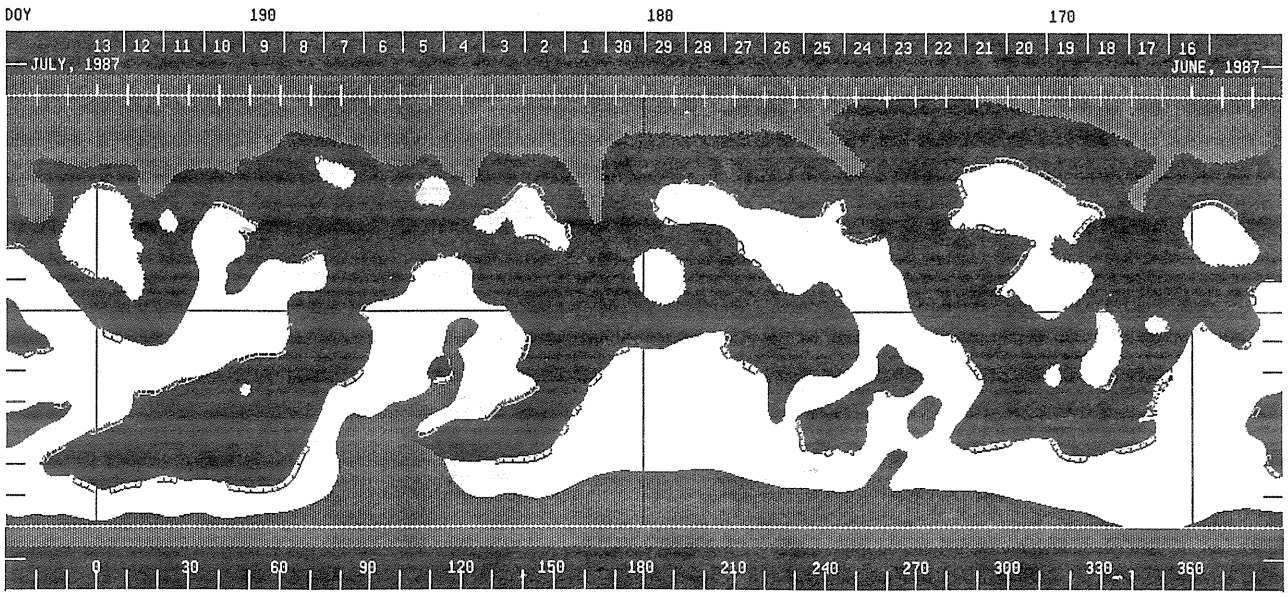
SHADED H-ALPHA SOLAR SYNOPTIC CHARTS

Carrington Rot. 1788-1790

23 Apr to 13 Jul 1987







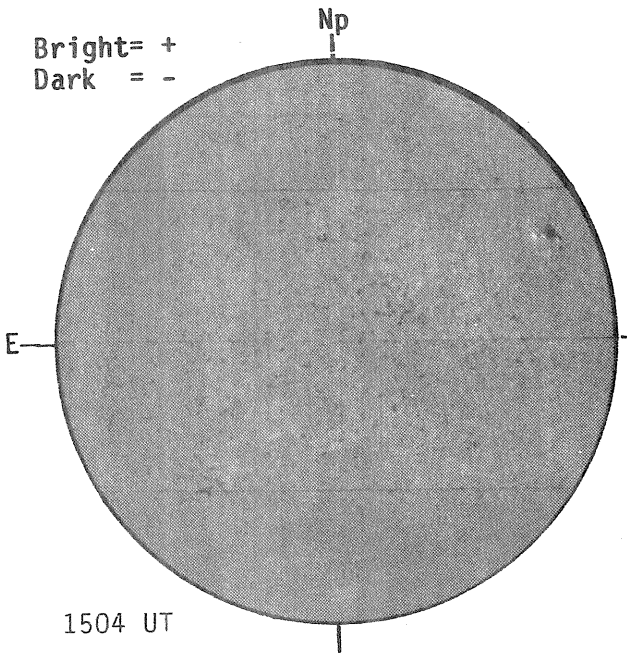
□ = *Positive Polarity* ■ = *Negative Polarity* ■ = *10830 Coronal Hole Estimate*

Heliographic Longitude

J U N E 01, 1 9 8 7 (P=-15.54, B_0=-0.74, L_0= 204.37)

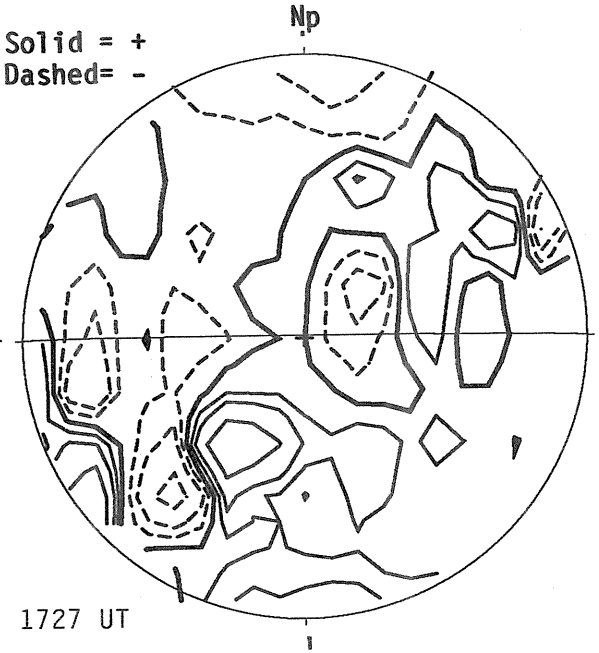
KITT PEAK MAGNETOGRAM

Bright= +
Dark = -



STANFORD MAGNETOGRAM

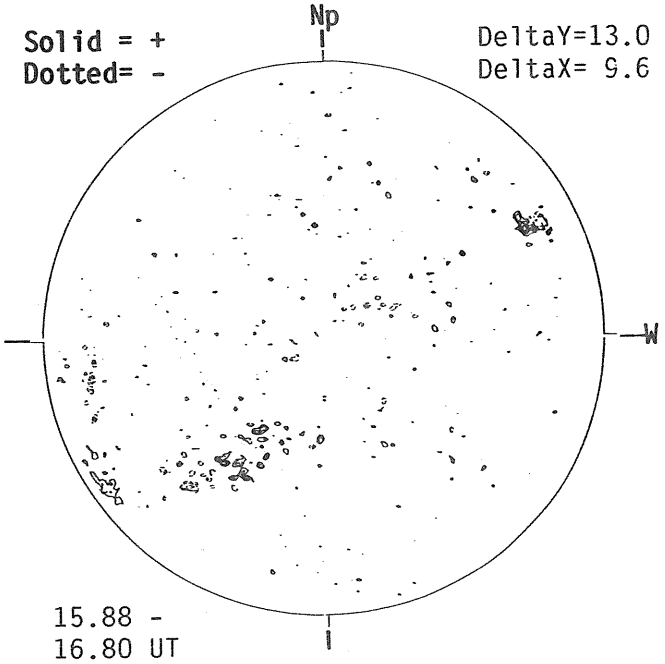
Solid = +
Dashed= -



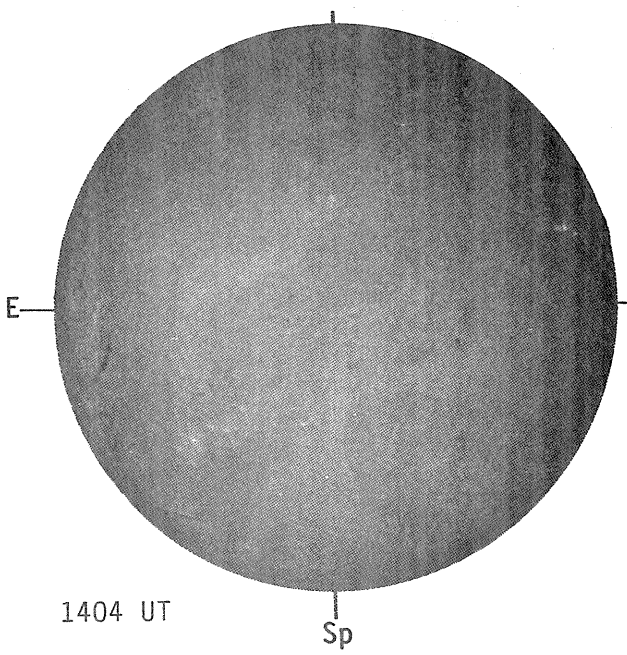
MT. WILSON MAGNETOGRAM

Solid = +
Dotted= -

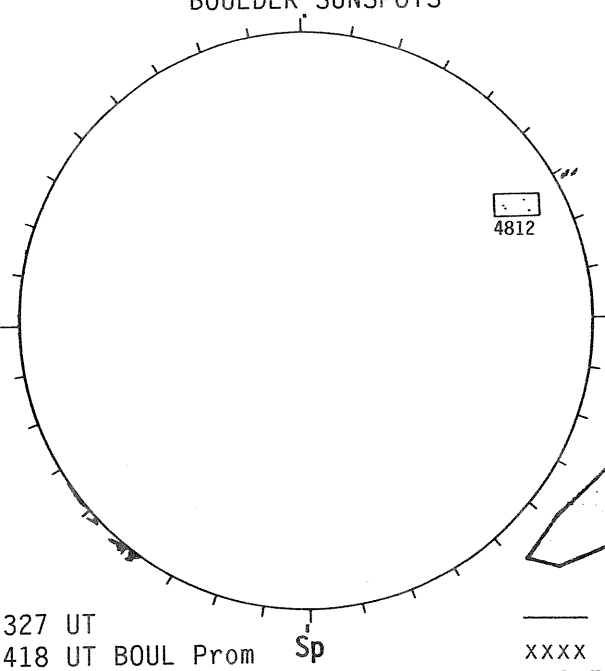
DeltaY=13.0
DeltaX= 9.6



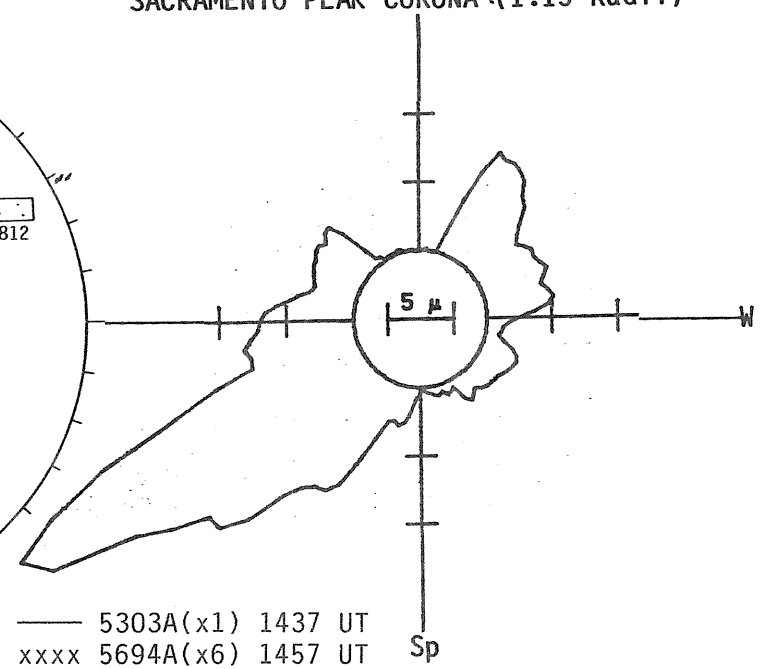
SACRAMENTO PEAK H-ALPHA



BOULDER SUNSPOTS



SACRAMENTO PEAK CORONA (1.15 Radii)

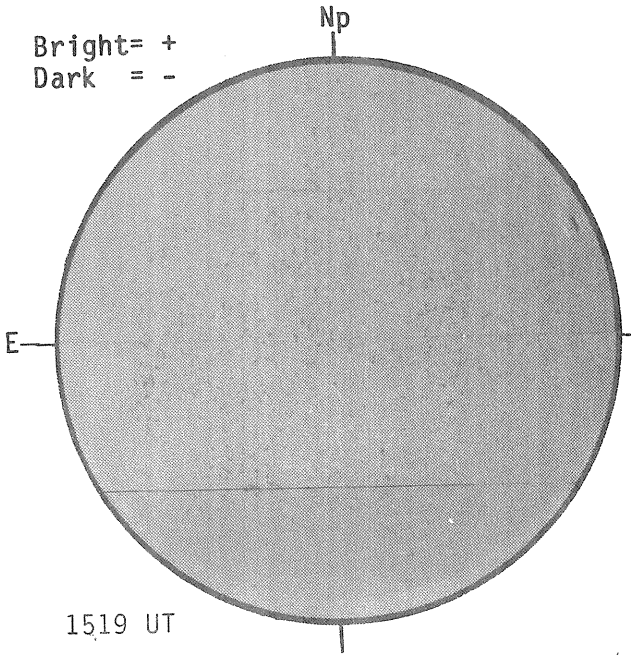


—— 5303A(x1) 1437 UT
xxxx 5694A(x6) 1457 UT
NO 5694A ACTIVITY TODAY

J U N E 02, 1 9 8 7 (P=-15.17, B_o=-0.62, L_o= 191.14)

KITT PEAK MAGNETOGRAM

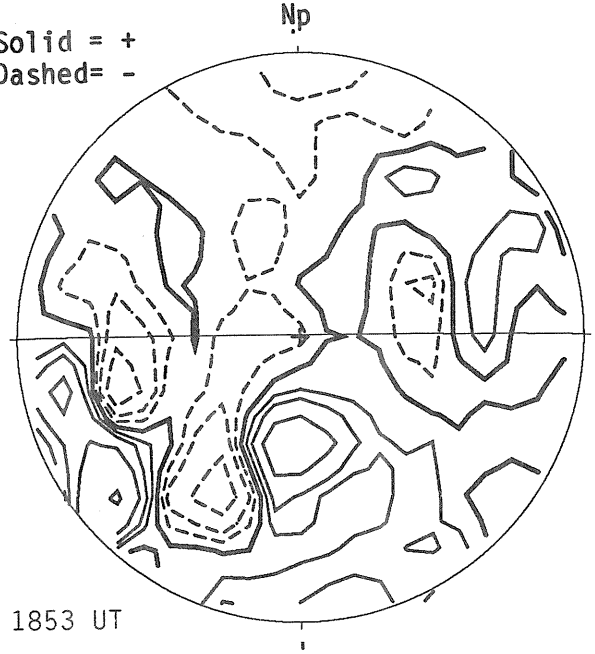
Bright= +
Dark = -



1519 UT

STANFORD MAGNETOGRAM

Solid = +
Dashed= -

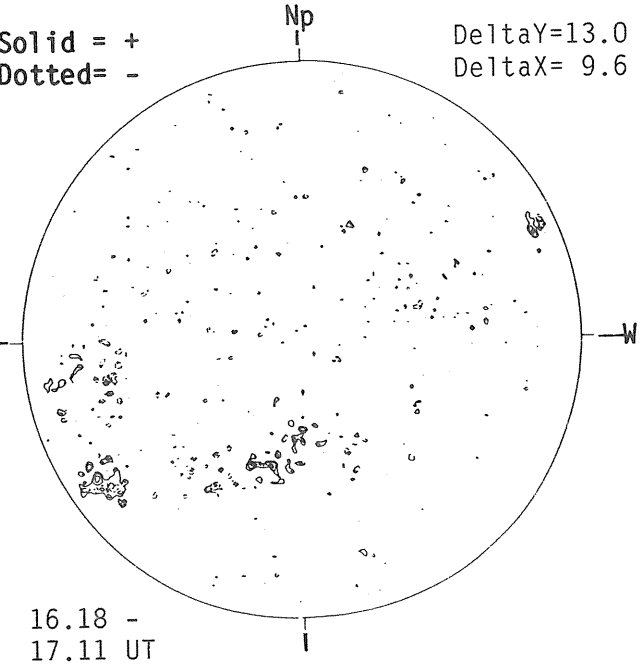


1853 UT

MT. WILSON MAGNETOGRAM

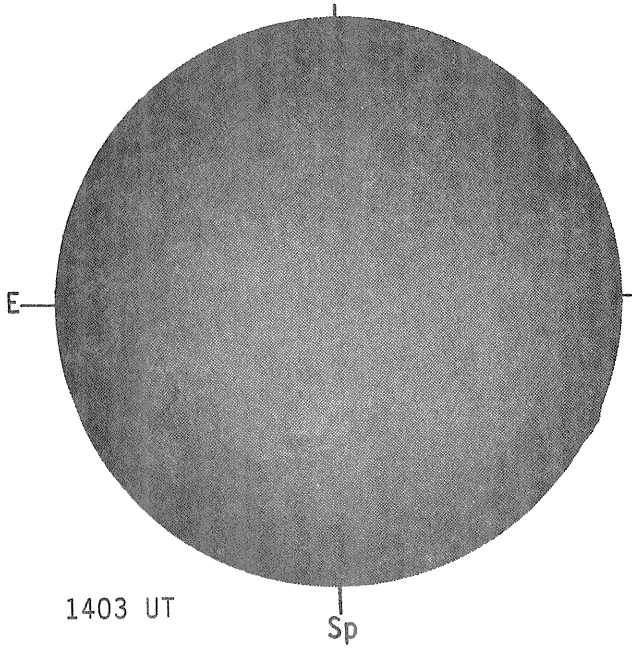
Solid = +
Dotted= -

DeltaY=13.0
DeltaX= 9.6



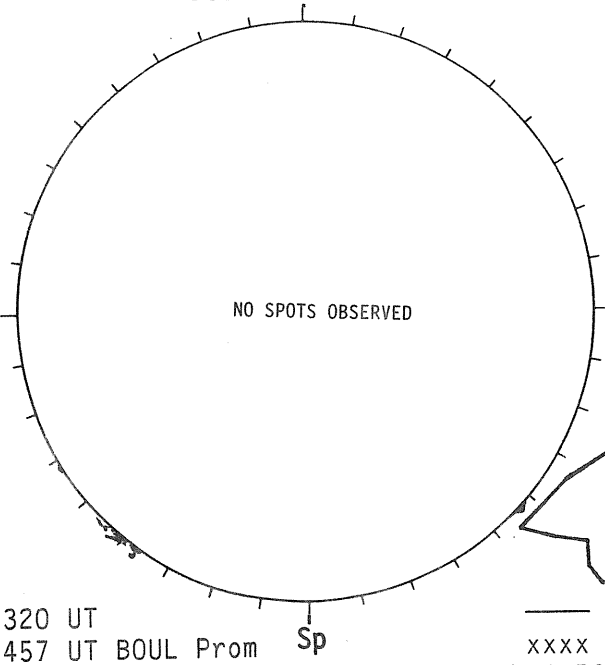
16.18 -
17.11 UT

SACRAMENTO PEAK H-ALPHA



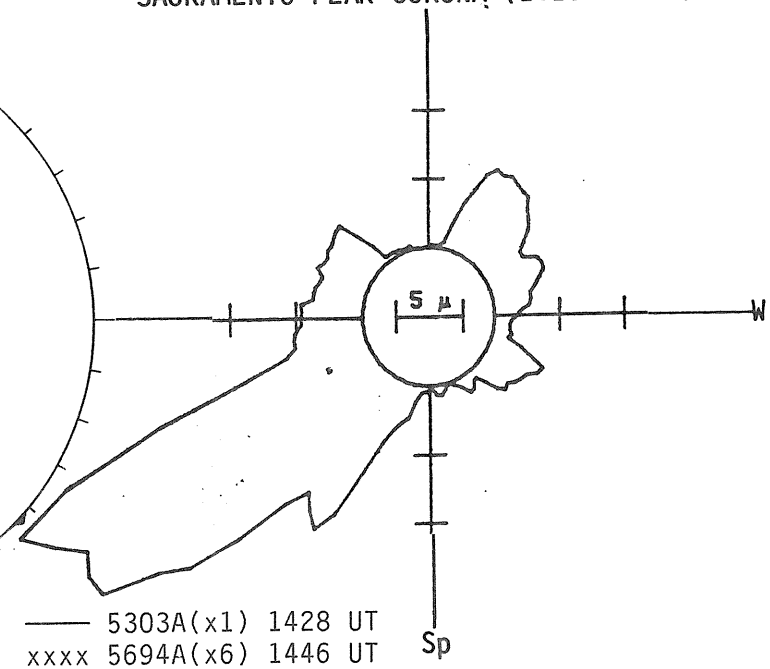
1403 UT

BOULDER SUNSPOTS



1320 UT
1457 UT BOUL Prom

SACRAMENTO PEAK CORONA (1.15 Radii)

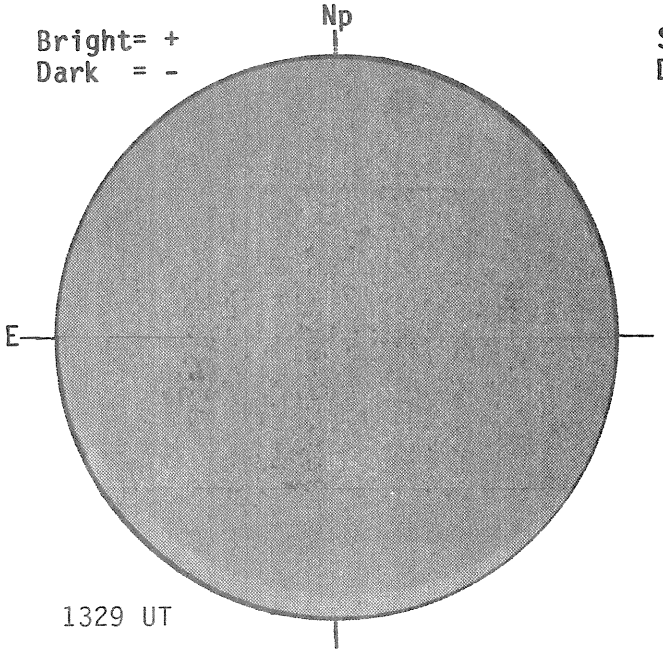


—— 5303A(x1) 1428 UT
xxxx 5694A(x6) 1446 UT
NO 5694A ACTIVITY TODAY

J U N E 03, 1 9 8 7 (P=-14.79, B_0=-0.50, L_0= 177.91)

KITT PEAK MAGNETOGRAM

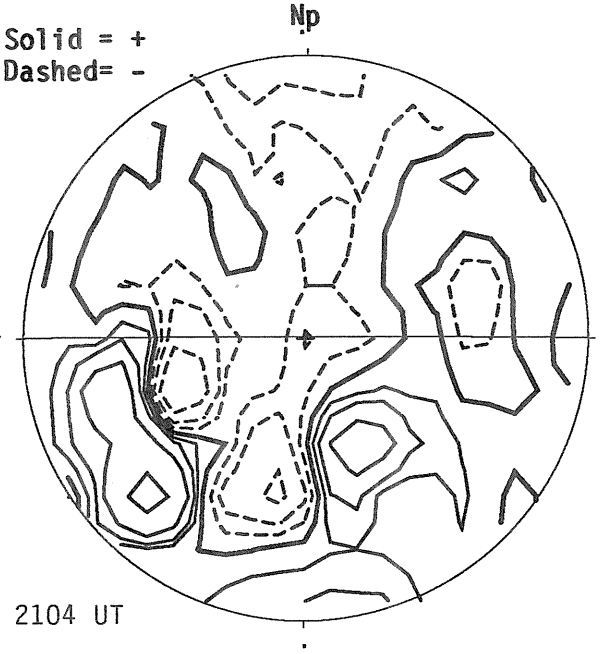
Bright= +
Dark = -



1329 UT

STANFORD MAGNETOGRAM

Solid = +
Dashed= -

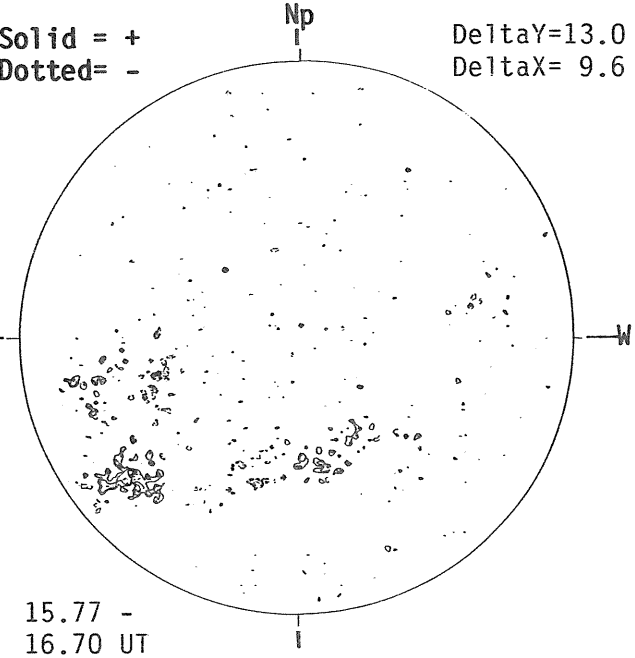


2104 UT

MT. WILSON MAGNETOGRAM

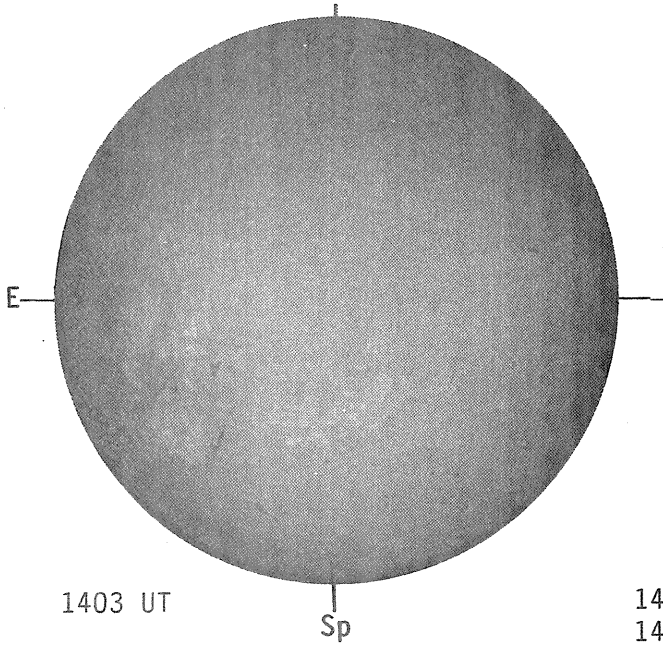
Solid = +
Dotted= -

DeltaY=13.0
DeltaX= 9.6



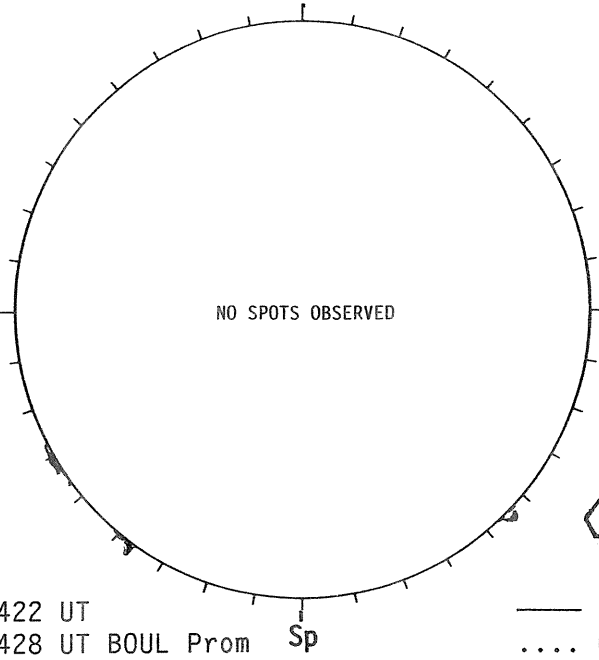
15.77 -
16.70 UT

SACRAMENTO PEAK H-ALPHA



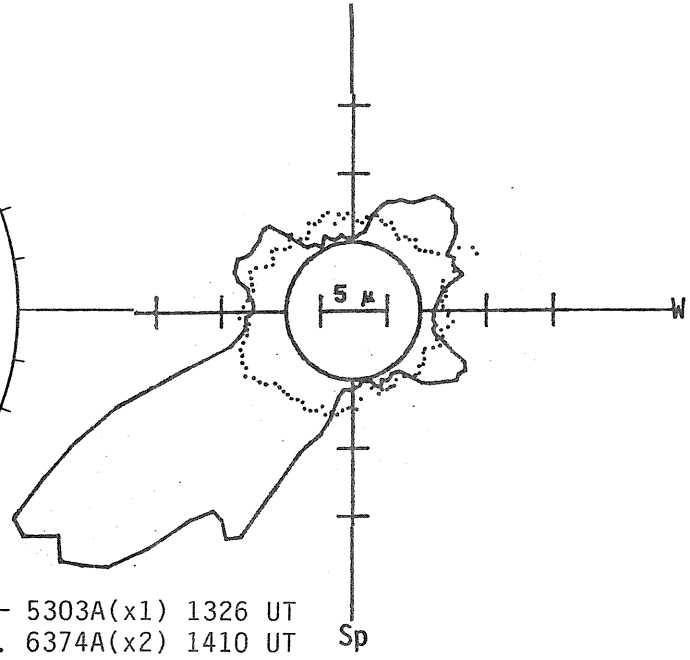
1403 UT

BOULDER SUNSPOTS



1422 UT
1428 UT BOUL Prom

SACRAMENTO PEAK CORONA (1.15 Radii)

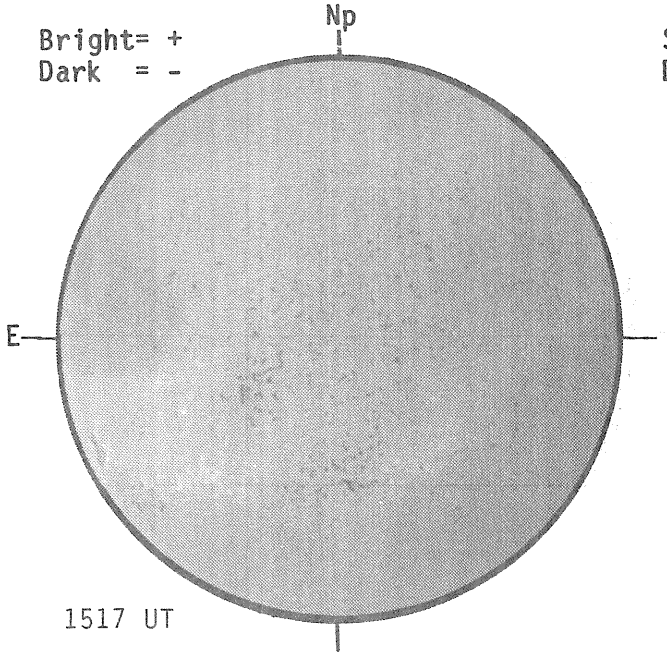


—— 5303A(x1) 1326 UT
.... 6374A(x2) 1410 UT
xxxx 5694A(x6) 1350 UT
NO 5694A ACTIVITY TODAY

J U N E 04, 1 9 8 7 (P=-14.41, B_0=-0.38, L_0= 164.67)

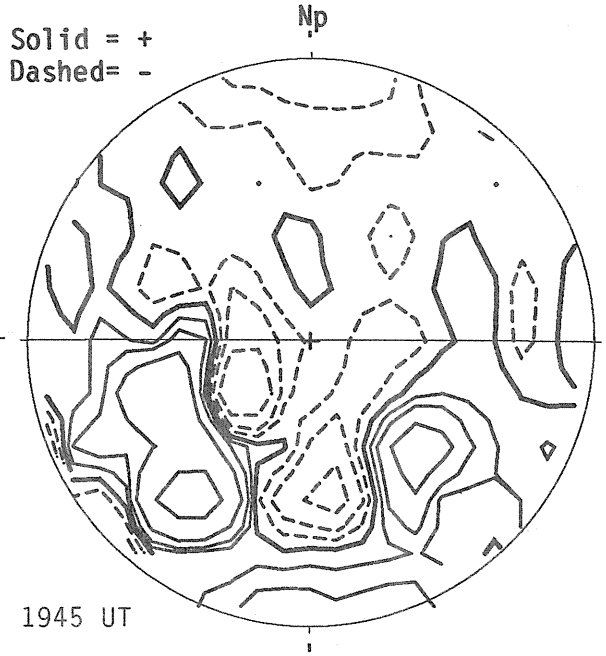
KITT PEAK MAGNETOGRAM

Bright= +
Dark = -



STANFORD MAGNETOGRAM

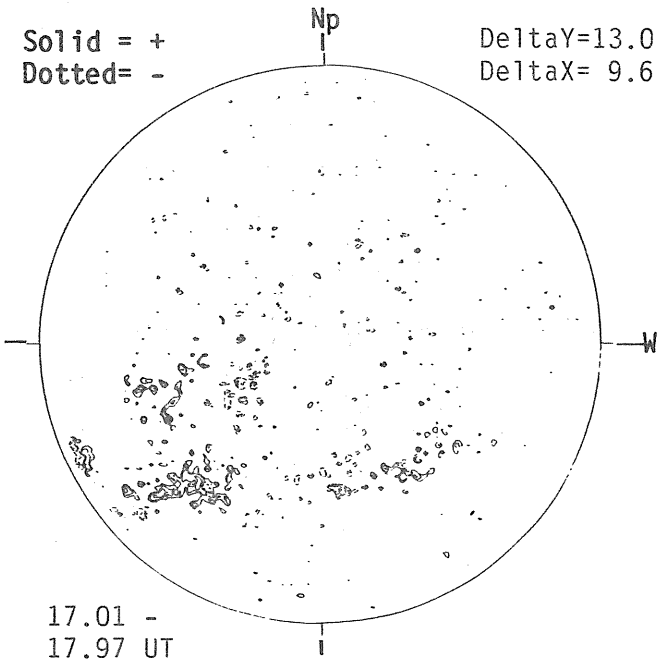
Solid = +
Dashed= -



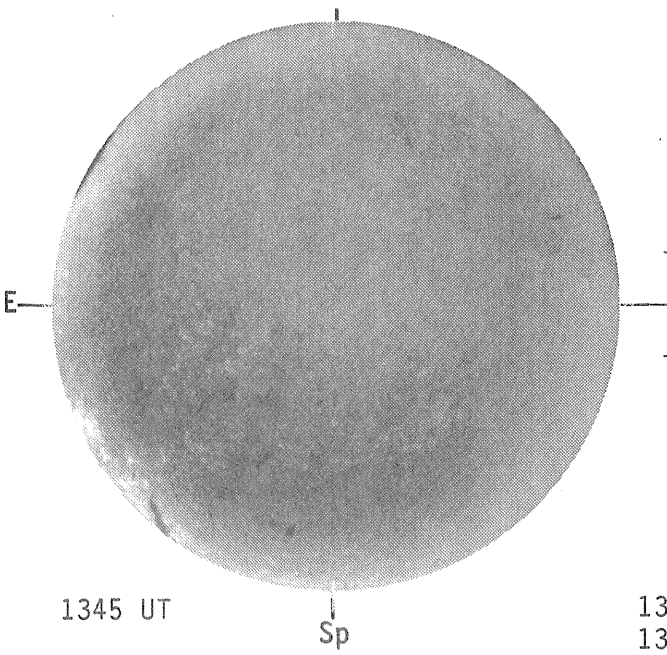
MT. WILSON MAGNETOGRAM

Solid = +
Dotted= -

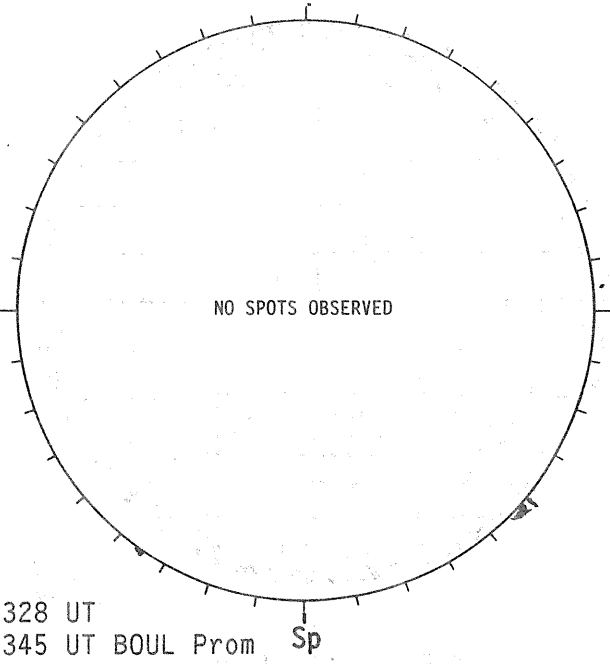
DeltaY=13.0
DeltaX= 9.6



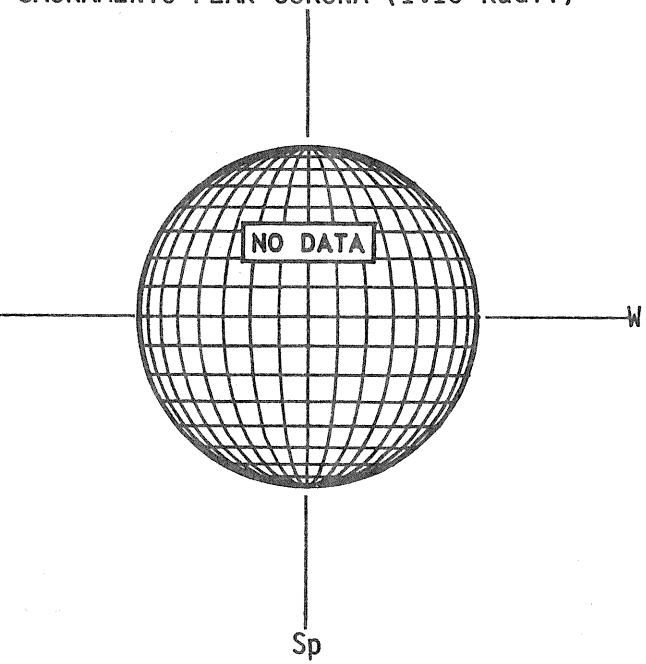
BOULDER H-ALPHA



BOULDER SUNSPOTS



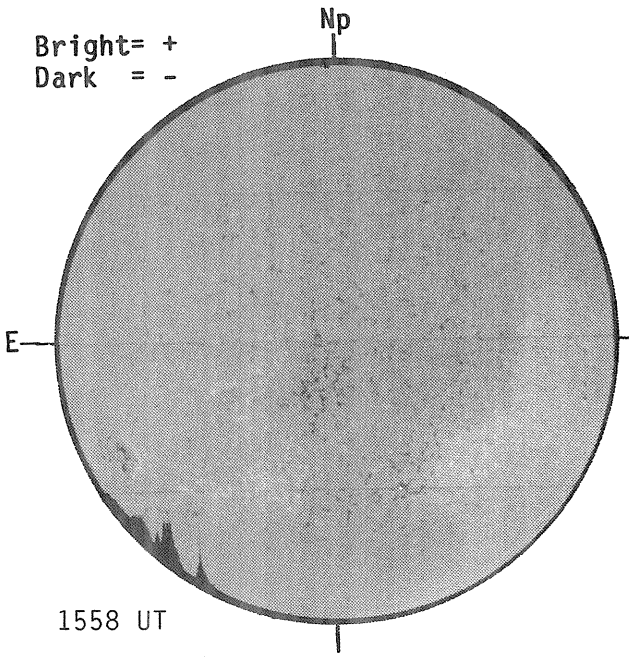
SACRAMENTO PEAK CORONA (1.15 Radii)



J U N E 05, 1 9 8 7 (P=-14.02, B_0=-0.26, L_0= 151.44)

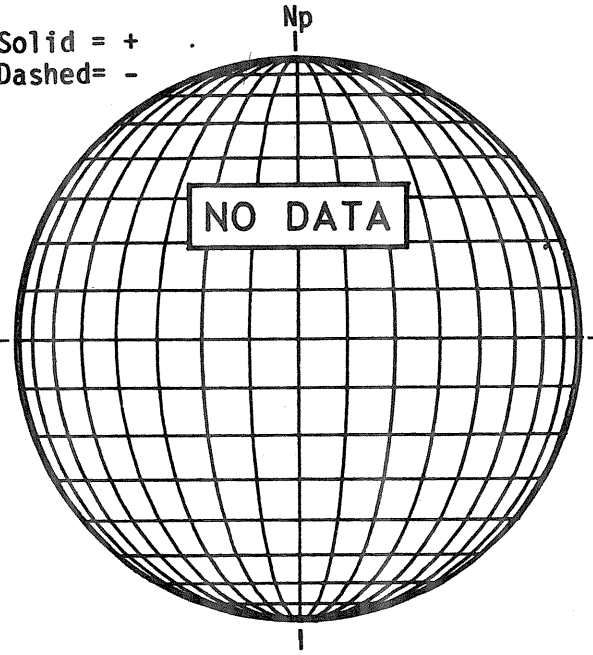
KITT PEAK MAGNETOGRAM

Bright= +
Dark = -



STANFORD MAGNETOGRAM

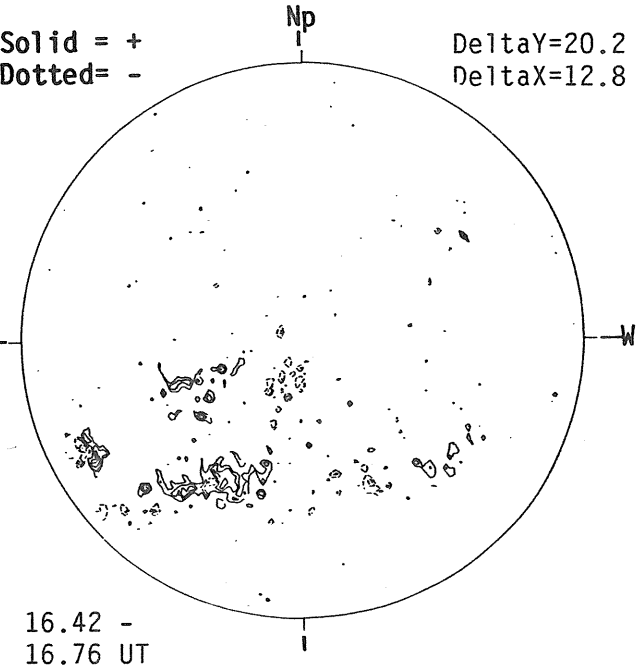
Solid = +
Dashed= -



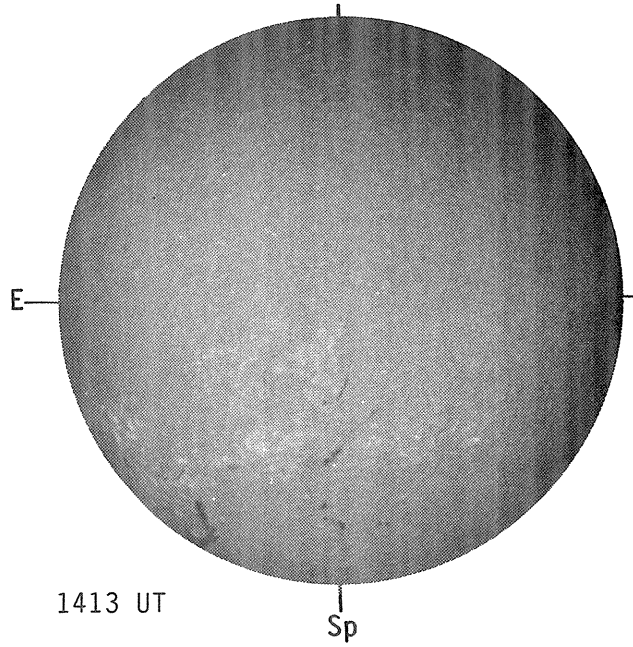
MT. WILSON MAGNETOGRAM

Solid = +
Dotted= -

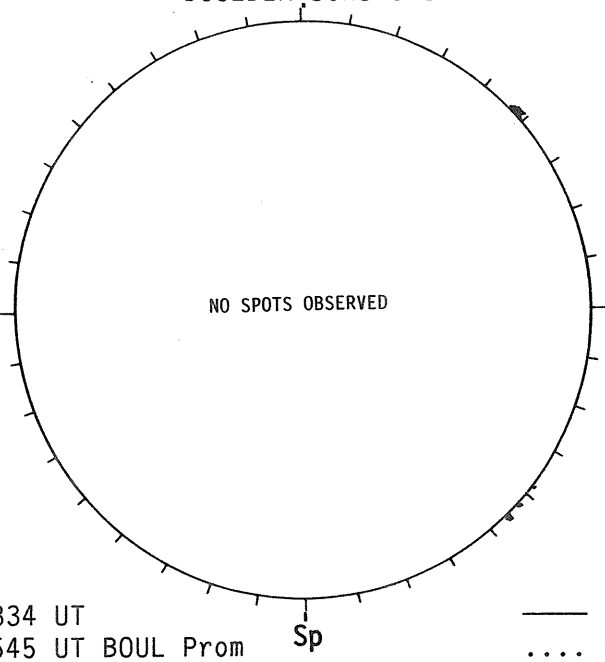
DeltaY=20.2
DeltaX=12.8



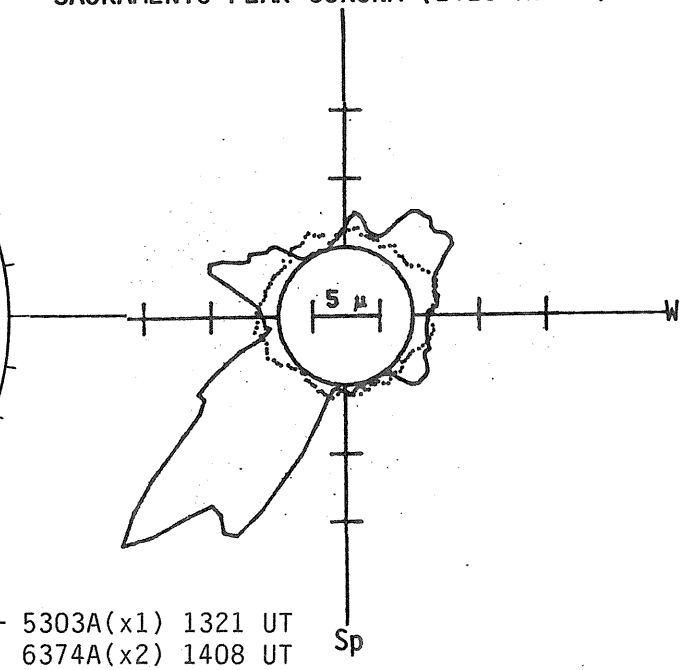
SACRAMENTO PEAK H-ALPHA



BOULDER SUNSPOTS

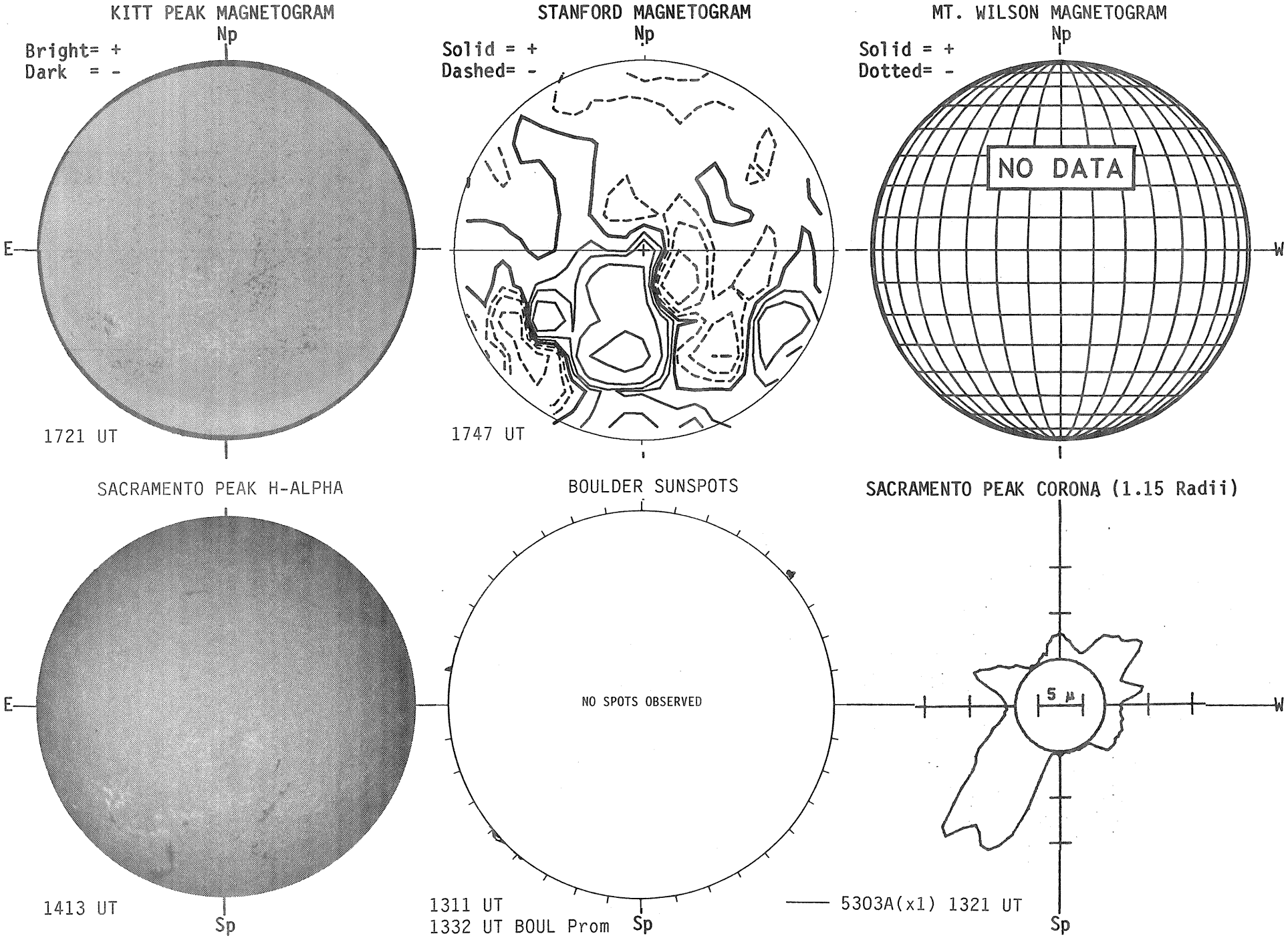


SACRAMENTO PEAK CORONA (1.15 Radii)



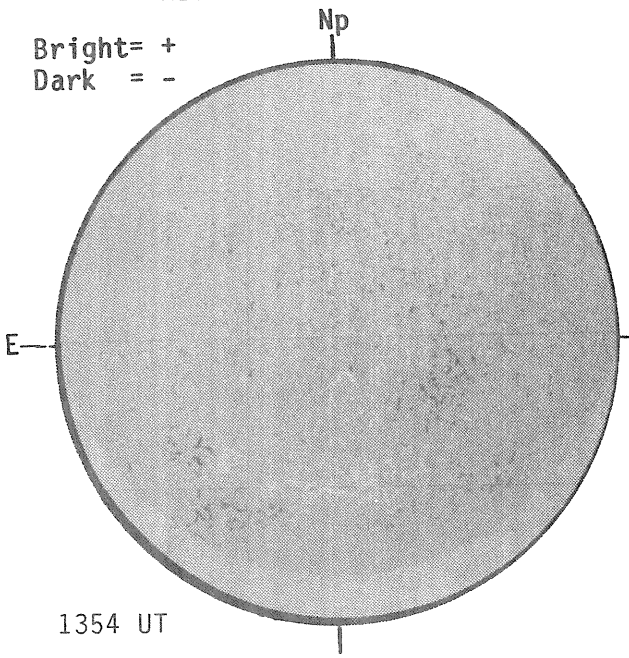
—— 5303A(x1) 1321 UT
.... 6374A(x2) 1408 UT
xxxx 5694A(x6) 1336 UT
NO 5694A ACTIVITY TODAY

J U N E 06, 1 9 8 7 (P=-13.63, B_0=-0.14, L_0= 138.20)

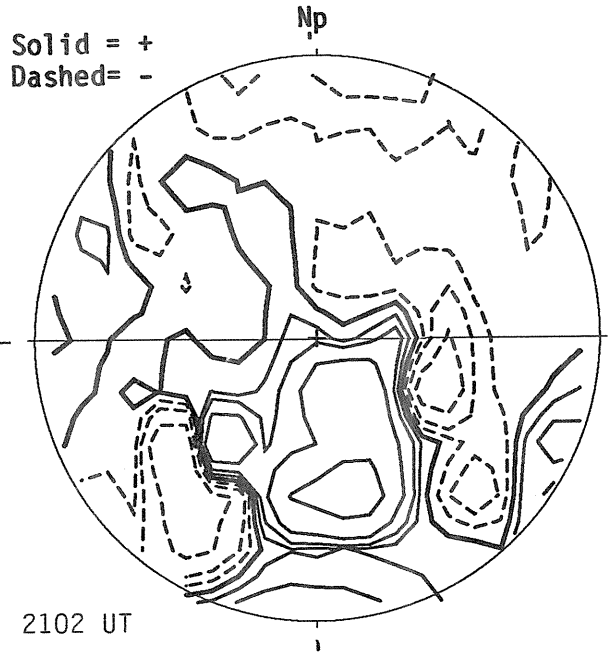


J U N E 07, 1 9 8 7 (P=-13.24, B_o=-0.02, L_o= 124.97)

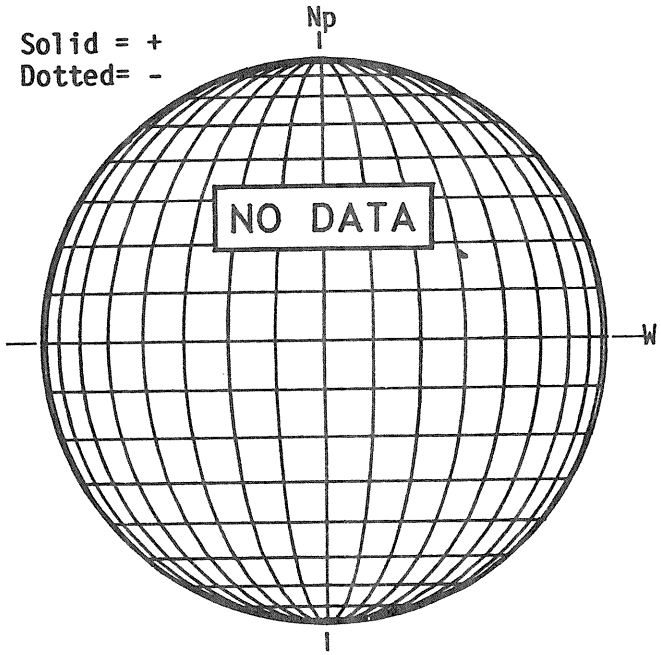
KITT PEAK MAGNETOGRAM



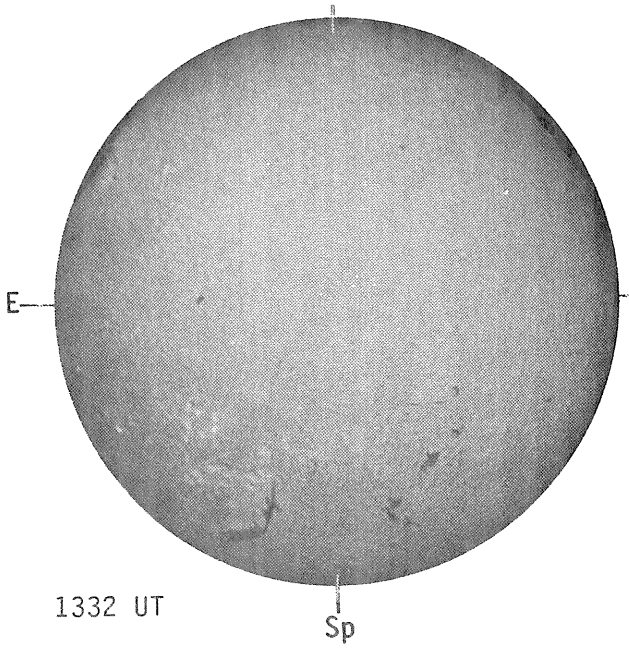
STANFORD MAGNETOGRAM



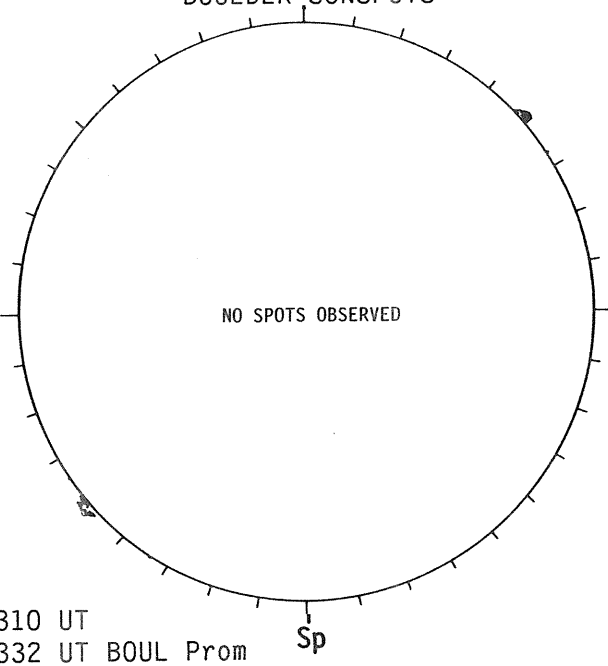
MT. WILSON MAGNETOGRAM



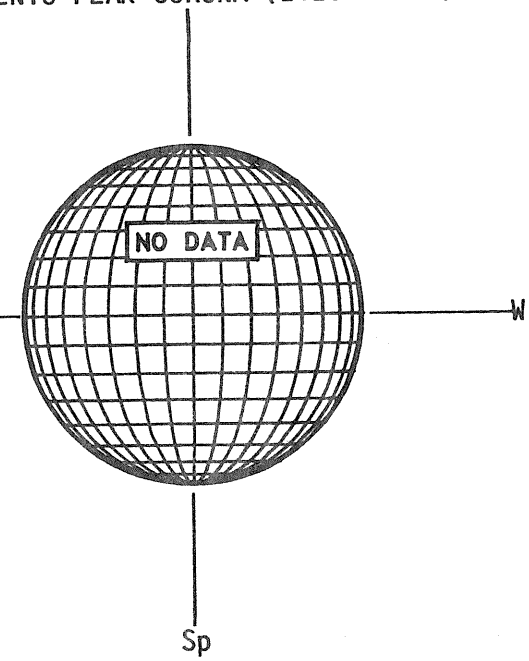
BOULDER H-ALPHA



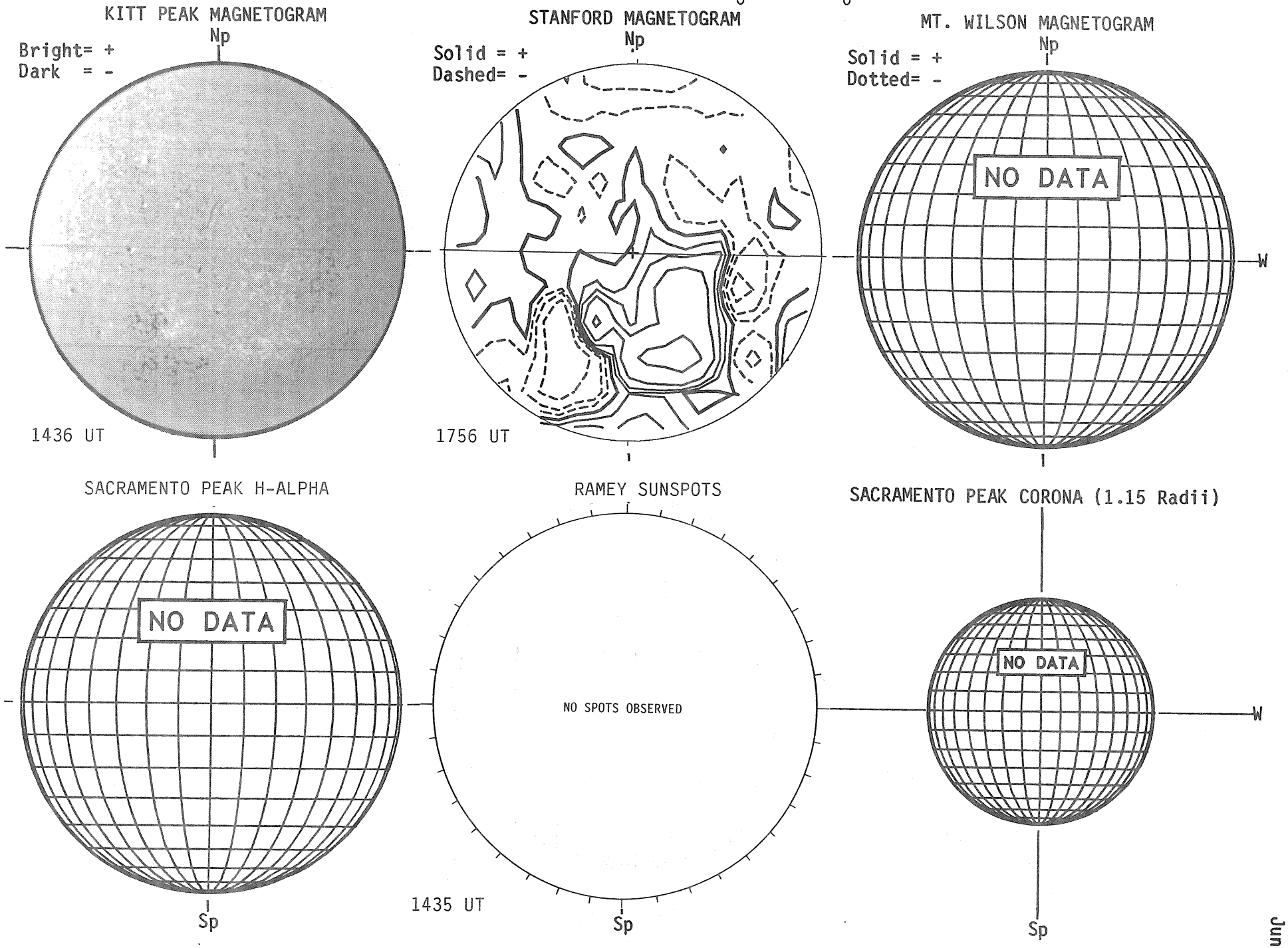
BOULDER SUNSPOTS



SACRAMENTO PEAK CORONA (1.15 Radii)



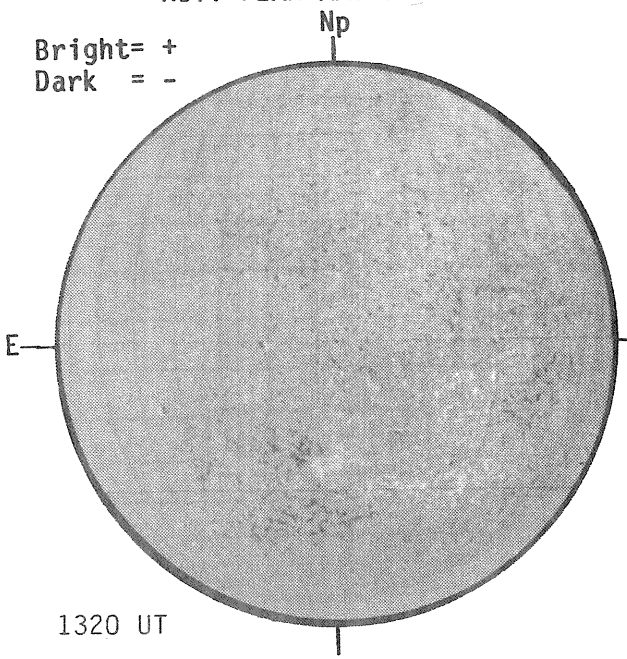
J U N E 08, 1 9 8 7 (P=-12.84, B_0= 0.10, L_0= 111.73)



J U N E 09, 1 9 8 7 (P=-12.44, B_0= 0.22, L_0= 98.50)

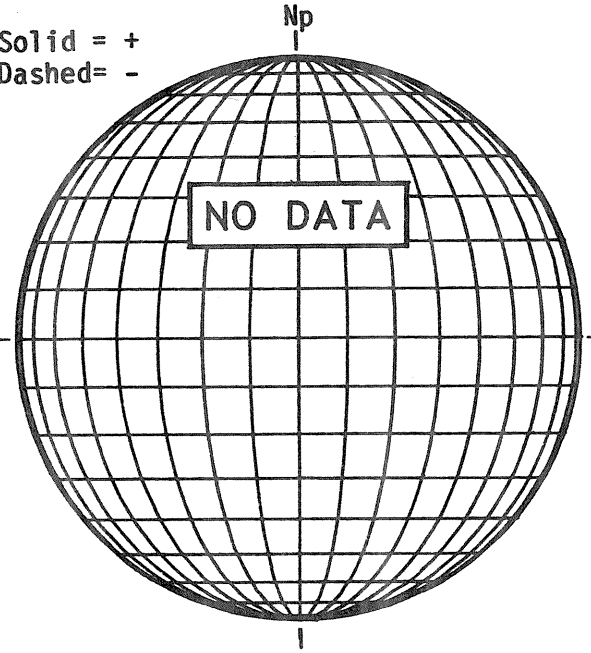
KITT PEAK MAGNETOGRAM

Bright= +
Dark = -



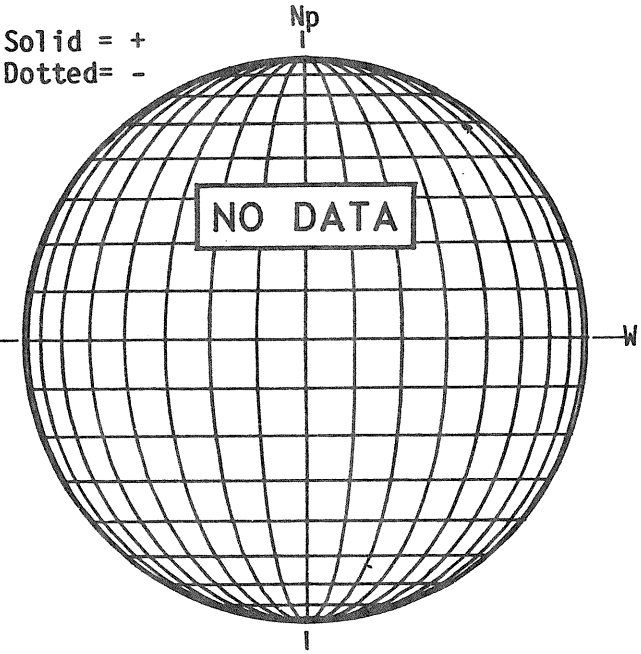
STANFORD MAGNETOGRAM

Solid = +
Dashed= -

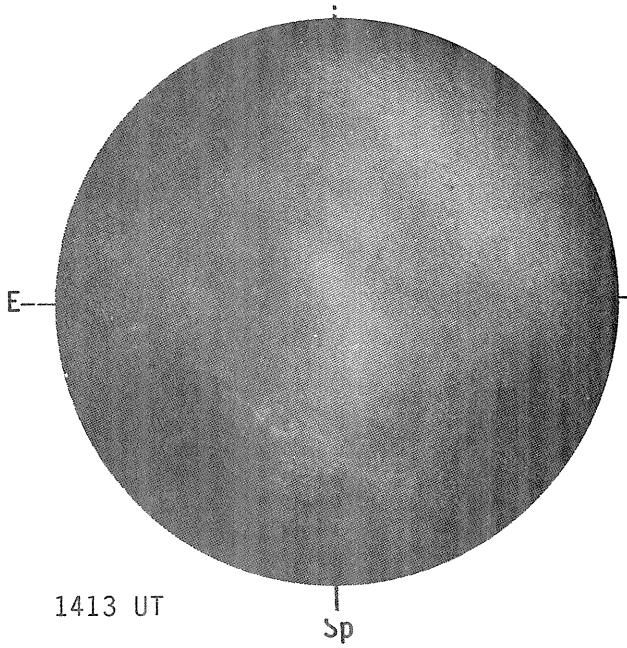


MT. WILSON MAGNETOGRAM

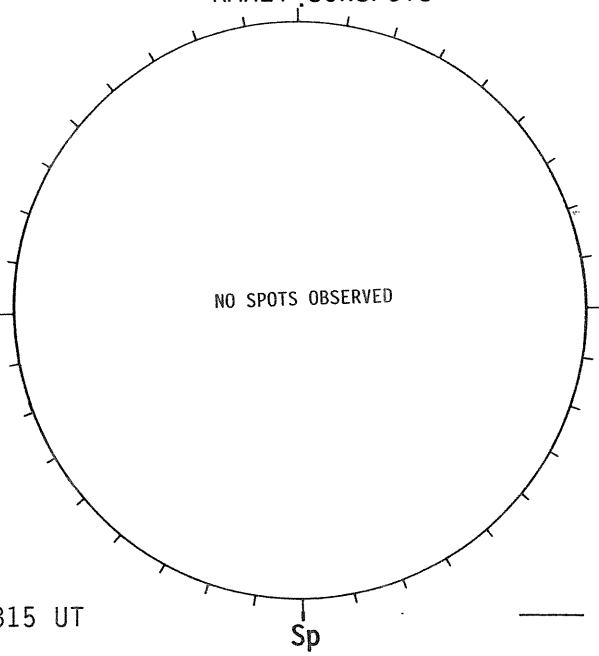
Solid = +
Dotted= -



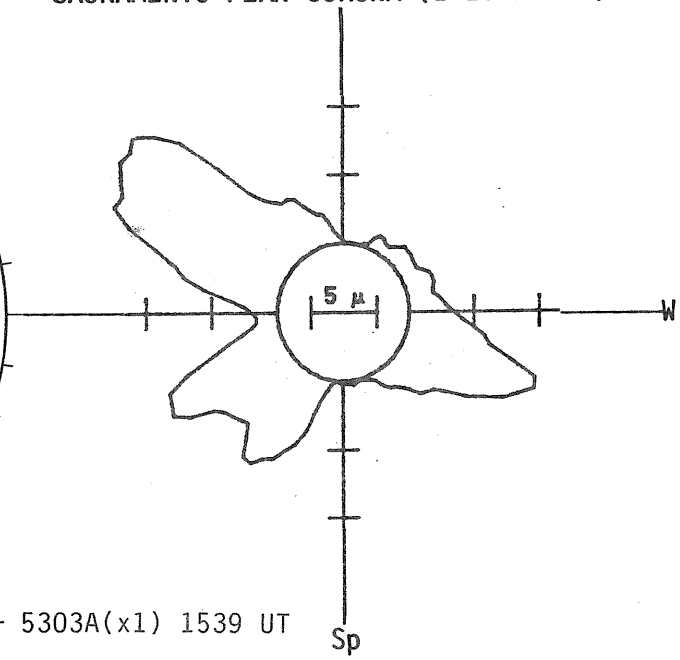
SACRAMENTO PEAK H-ALPHA



RAMEY SUNSPOTS



SACRAMENTO PEAK CORONA (1.15 Radii)

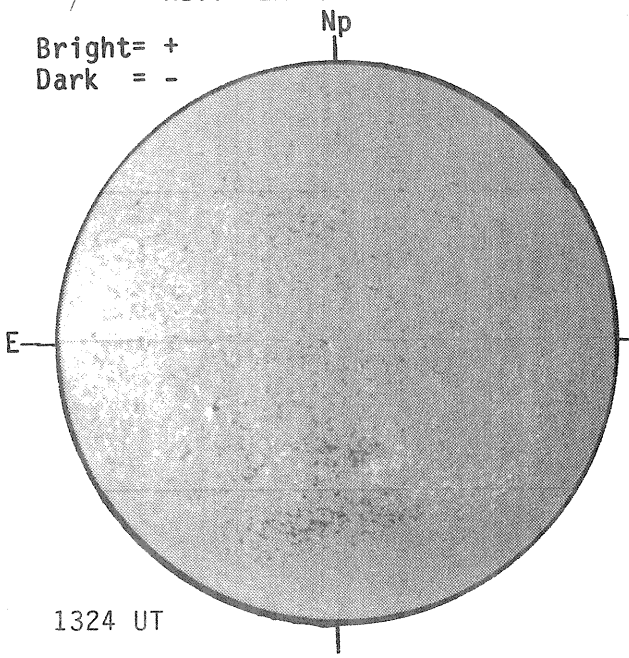


—— 5303A(x1) 1539 UT

J U N E 10, 1 9 8 7 (P=-12.03, B_0= 0.33, L_0= 85.26)

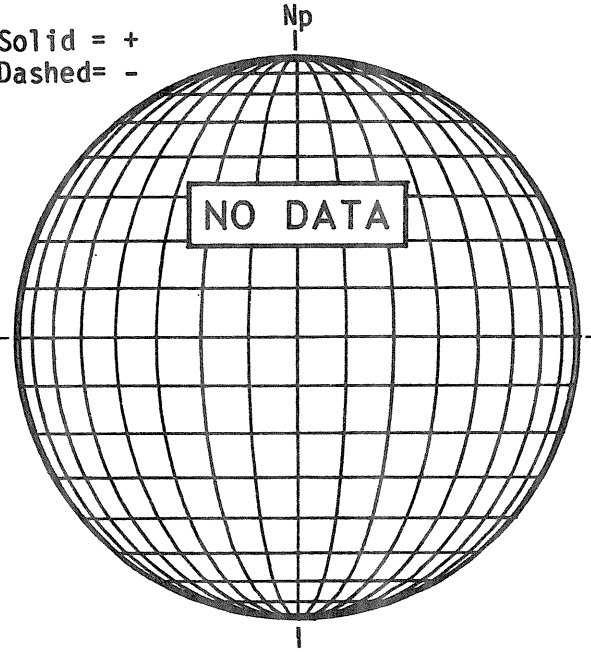
KITT PEAK MAGNETOGRAM

Bright= +
Dark = -



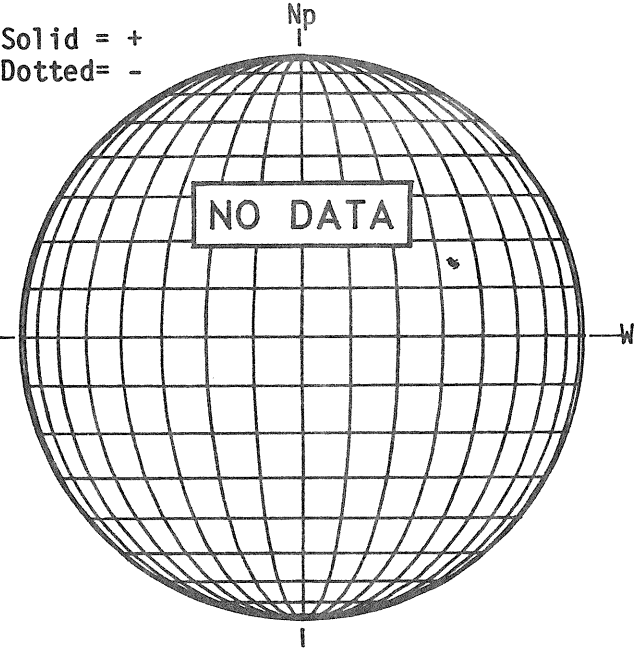
STANFORD MAGNETOGRAM

Solid = +
Dashed= -

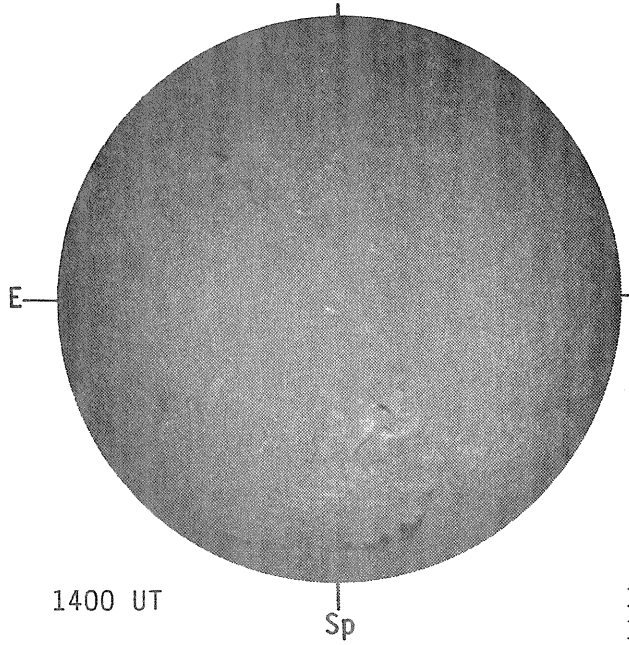


MT. WILSON MAGNETOGRAM

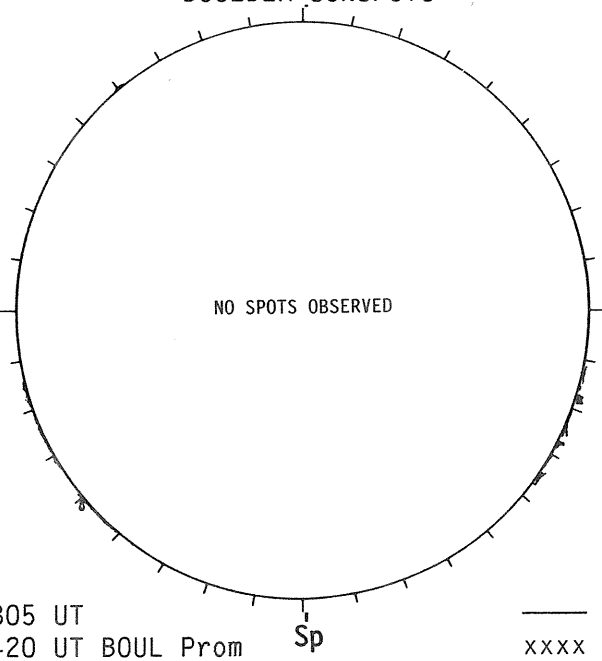
Solid = +
Dotted= -



SACRAMENTO PEAK H-ALPHA

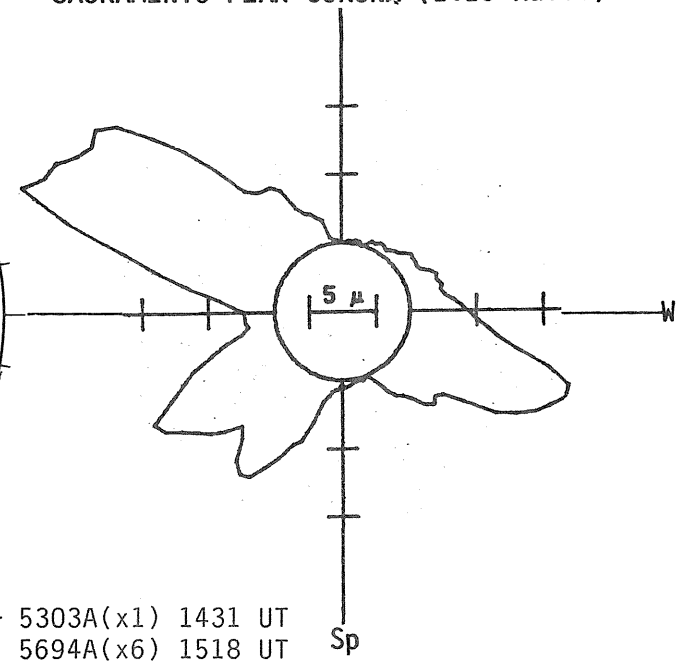


BOULDER SUNSPOTS



1305 UT
1420 UT BOUL Prom

SACRAMENTO PEAK CORONA (1.15 Radii)

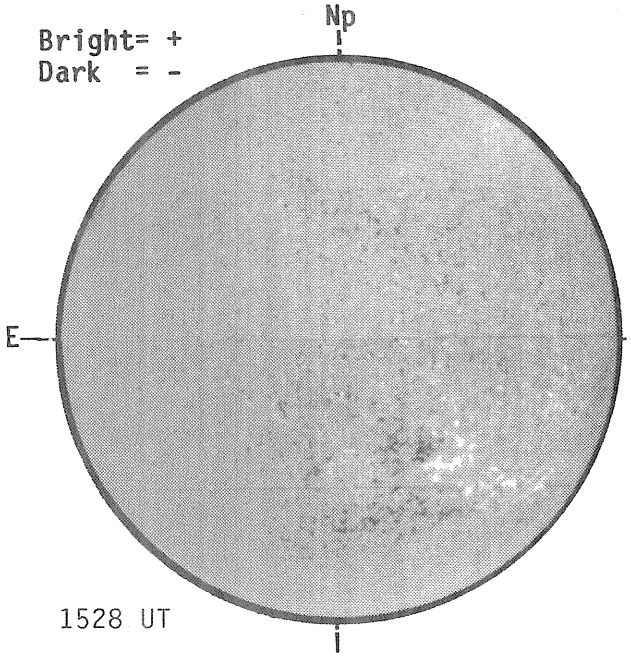


—— 5303A(x1) 1431 UT
xxxx 5694A(x6) 1518 UT
NO 5694A ACTIVITY TODAY

J U N E 11, 1 9 8 7 (P=-11.62, B_o= 0.45, L_o= 72.03)

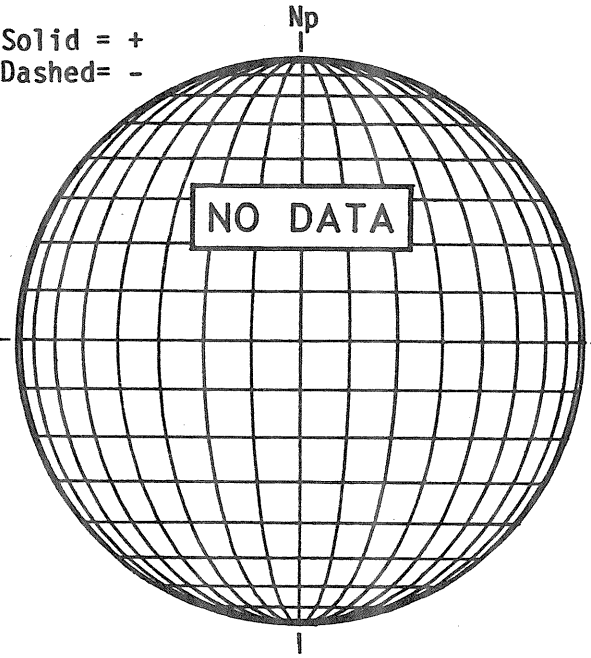
KITT PEAK MAGNETOGRAM

Bright= +
Dark = -



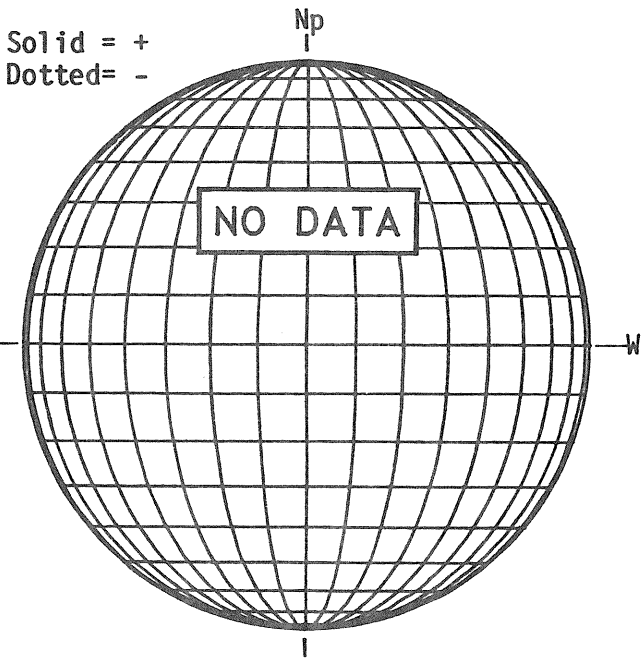
STANFORD MAGNETOGRAM

Solid = +
Dashed= -

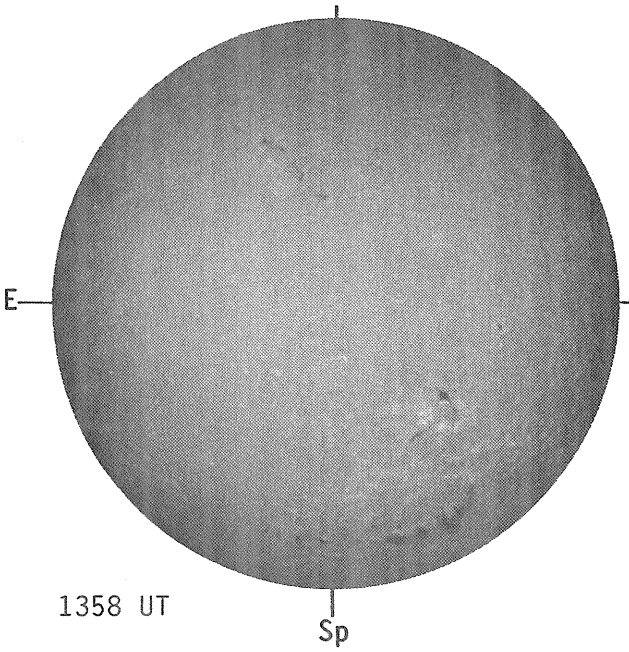


MT. WILSON MAGNETOGRAM

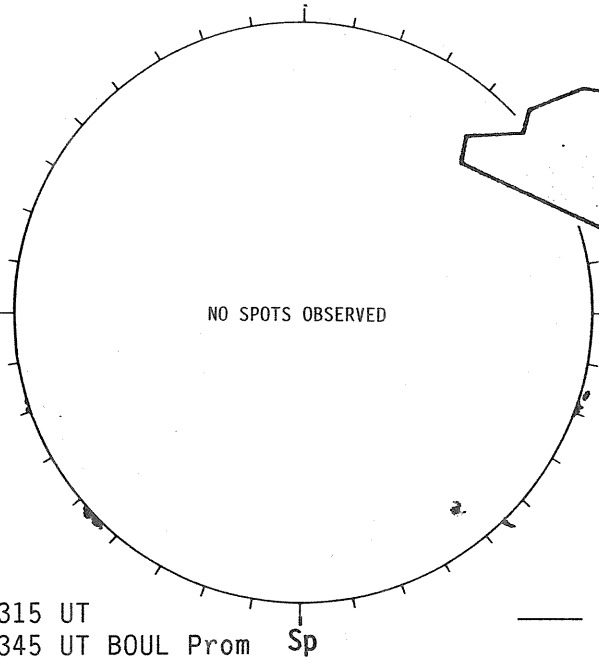
Solid = +
Dotted= -



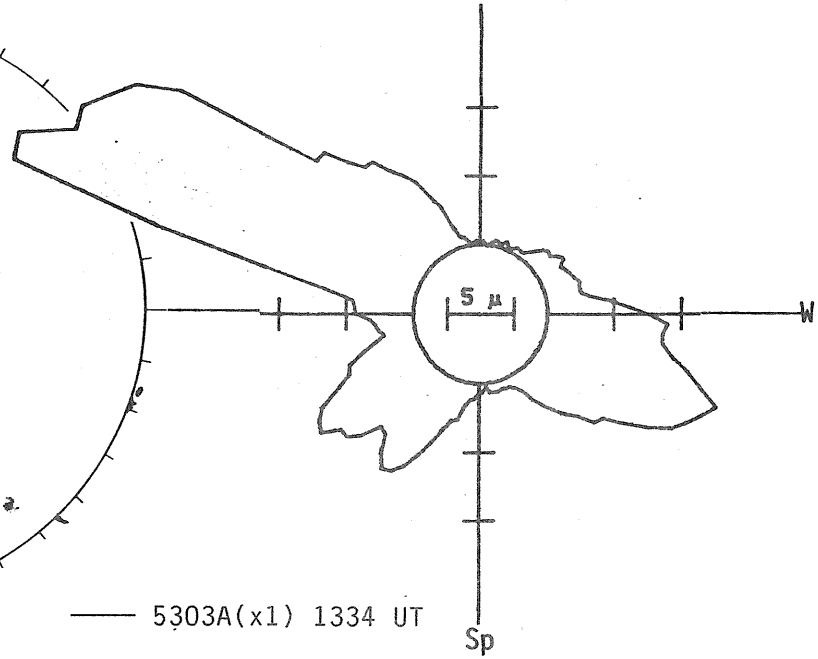
SACRAMENTO PEAK H-ALPHA



BOULDER SUNSPOTS



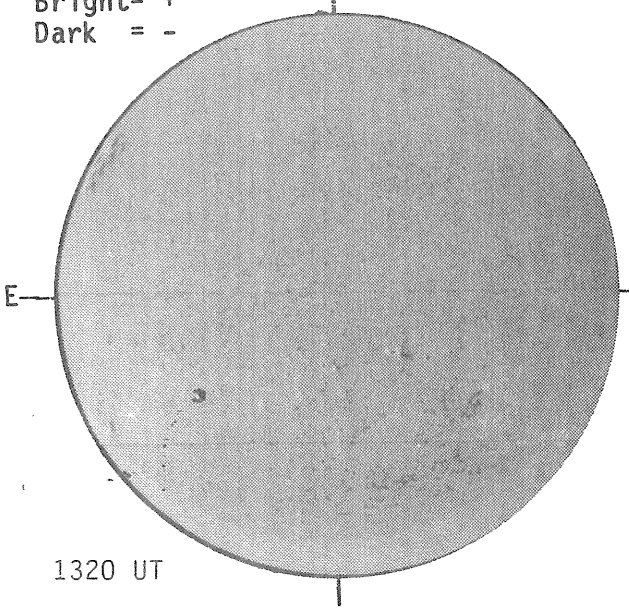
SACRAMENTO PEAK CORONA (1.15 Radii)



J U N E 12, 1 9 8 7 (P=-11.20, B_o= 0.57, L_o= 58.79)

KITT PEAK MAGNETOGRAM

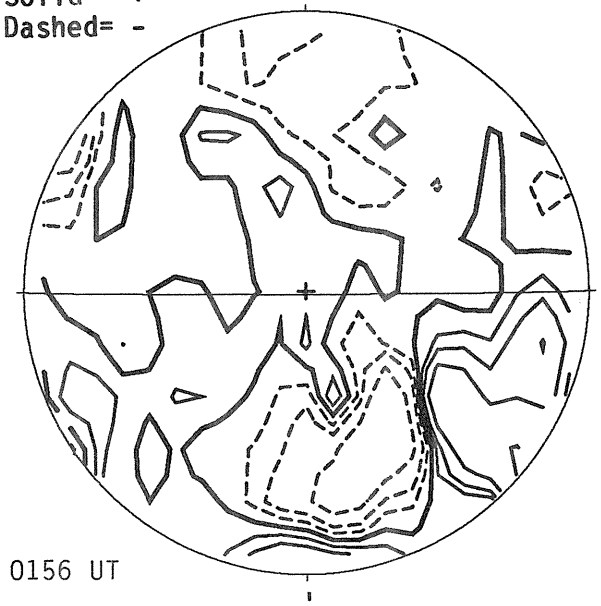
Bright= +
Dark = -



1320 UT

STANFORD MAGNETOGRAM

Solid = +
Dashed= -

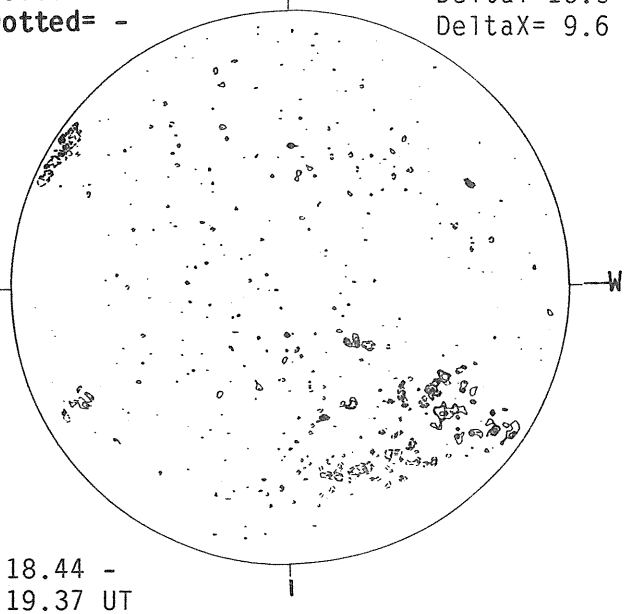


0156 UT

MT. WILSON MAGNETOGRAM

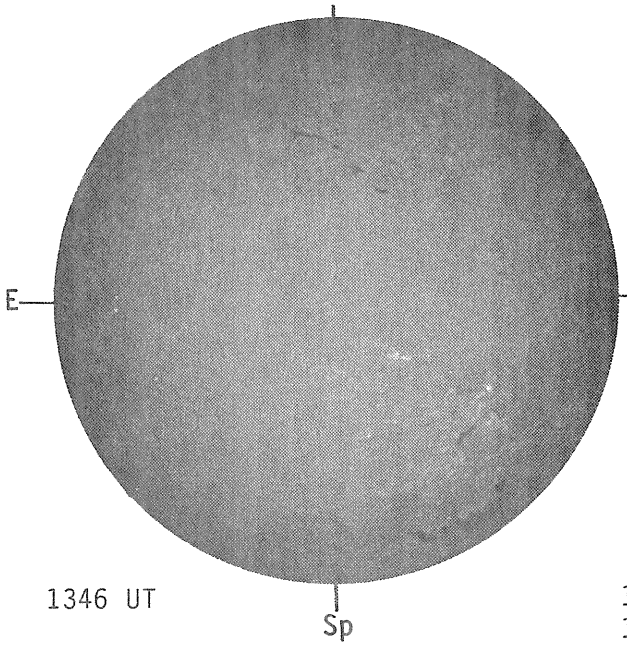
Solid = +
Dotted= -

DeltaY=13.0
DeltaX= 9.6



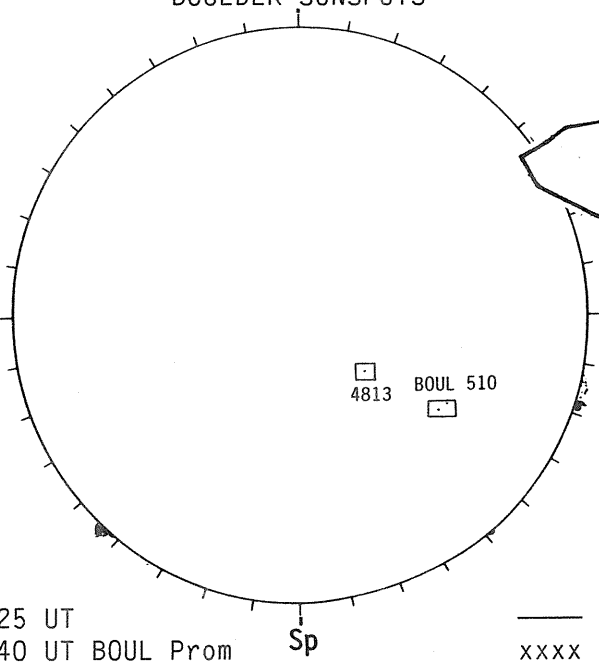
18.44 -
19.37 UT

SACRAMENTO PEAK H-ALPHA



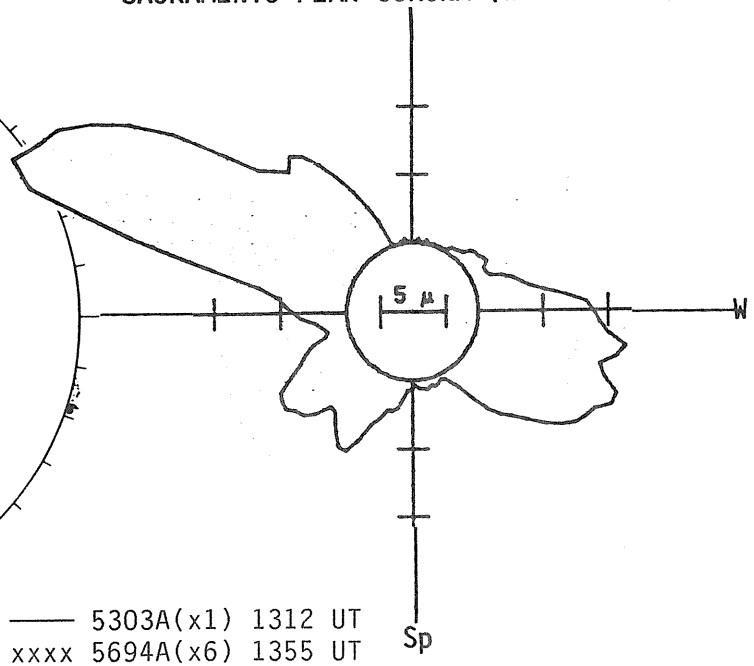
1346 UT

BOULDER SUNSPOTS



1325 UT
1340 UT BOUL Prom

SACRAMENTO PEAK CORONA (1.15 Radii)

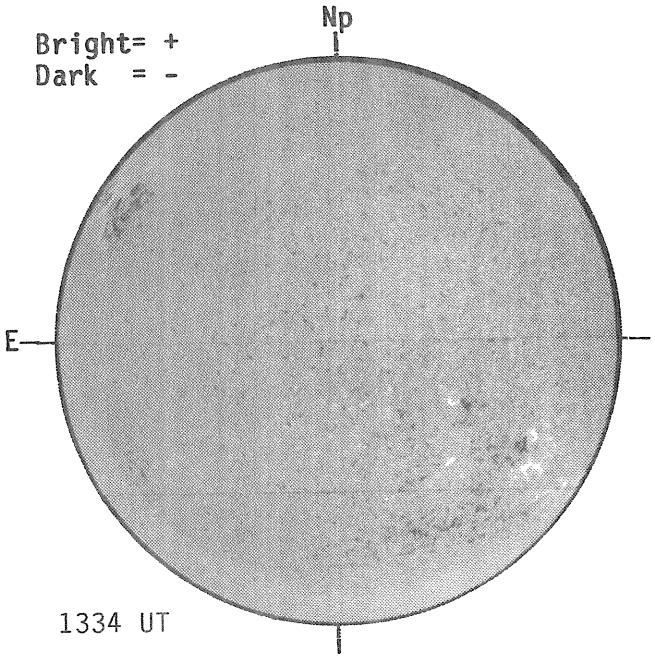


—— 5303A(x1) 1312 UT
xxxx 5694A(x6) 1355 UT
NO 5694A ACTIVITY TODAY

J U N E 13, 1 9 8 7 (P=-10.79, B_0= 0.69, L_0= 45.55)

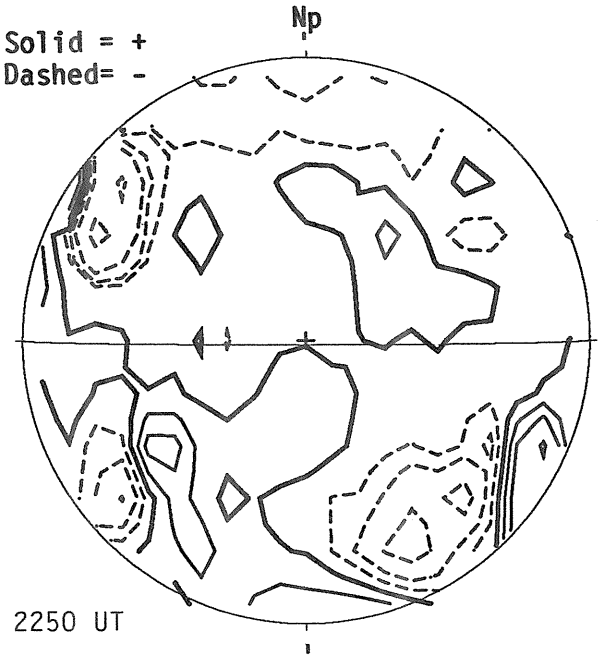
KITT PEAK MAGNETOGRAM

Bright= +
Dark = -



STANFORD MAGNETOGRAM

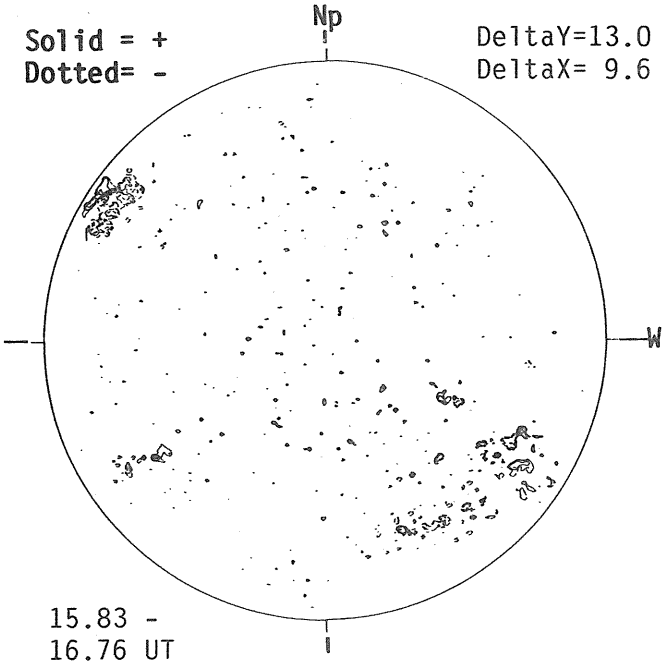
Solid = +
Dashed= -



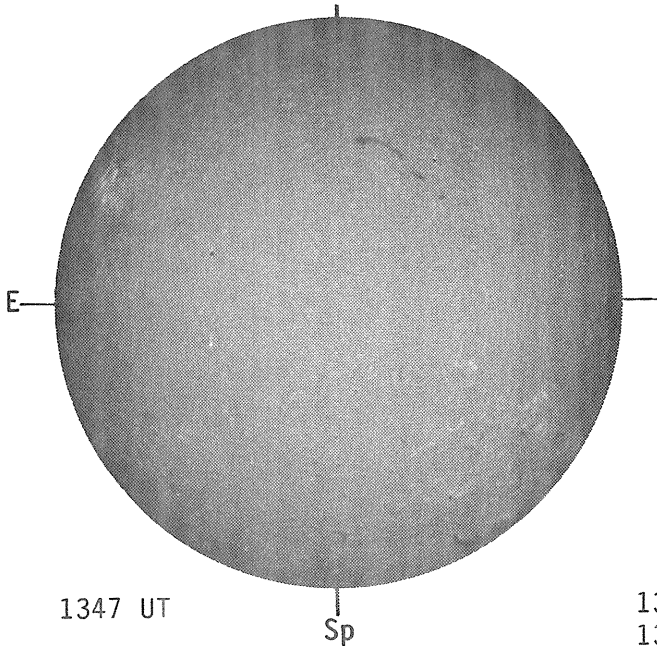
MT. WILSON MAGNETOGRAM

Solid = +
Dotted= -

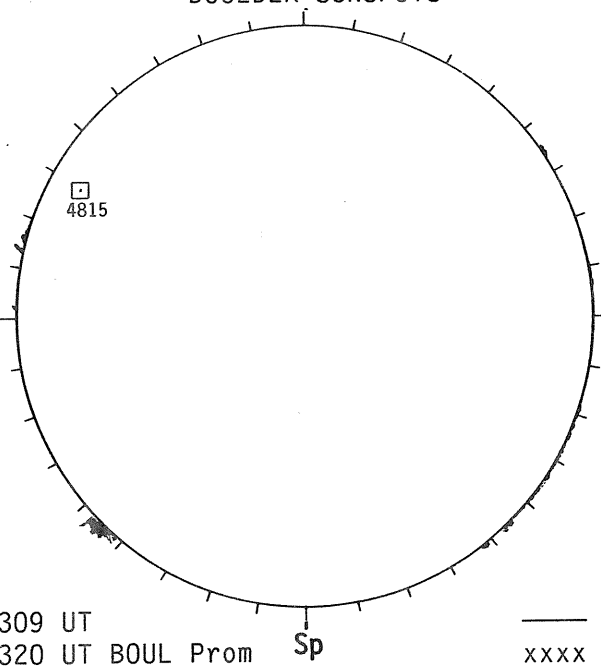
DeltaY=13.0
DeltaX= 9.6



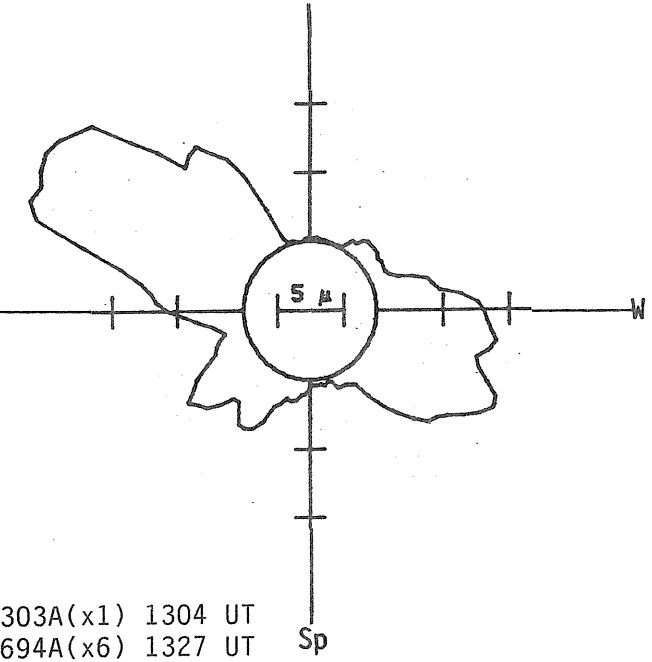
SACRAMENTO PEAK H-ALPHA



BOULDER SUNSPOTS



SACRAMENTO PEAK CORONA (1.15 Radii)

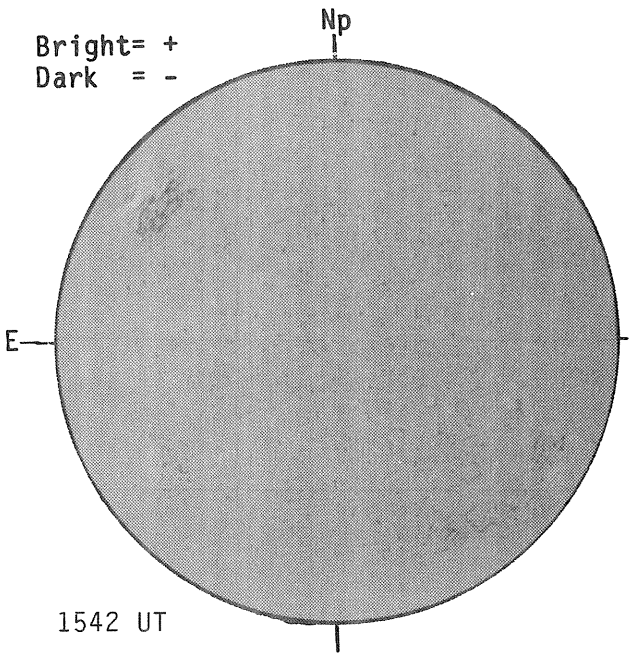


—— 5303A(x1) 1304 UT
xxxx 5694A(x6) 1327 UT
NO 5694A ACTIVITY TODAY

J U N E 14, 1 9 8 7 (P=-10.37, B_0= 0.81, L_0= 32.32)

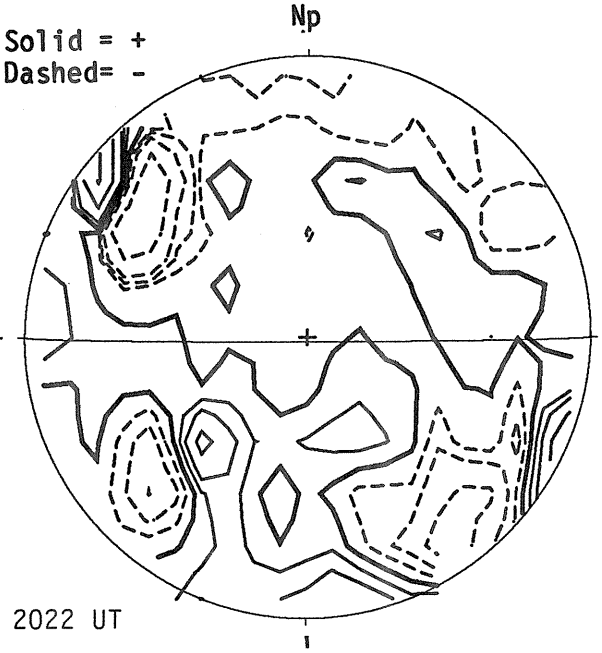
KITT PEAK MAGNETOGRAM

Bright= +
Dark = -



STANFORD MAGNETOGRAM

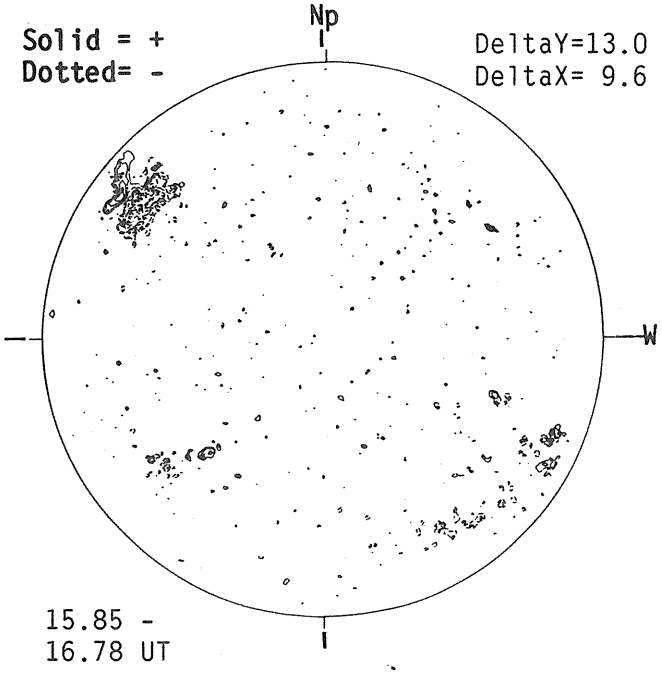
Solid = +
Dashed= -



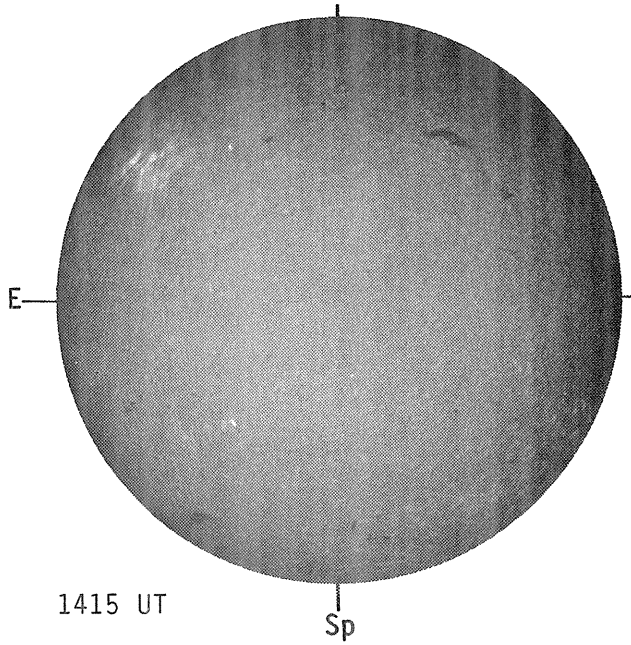
MT. WILSON MAGNETOGRAM

Solid = +
Dotted= -

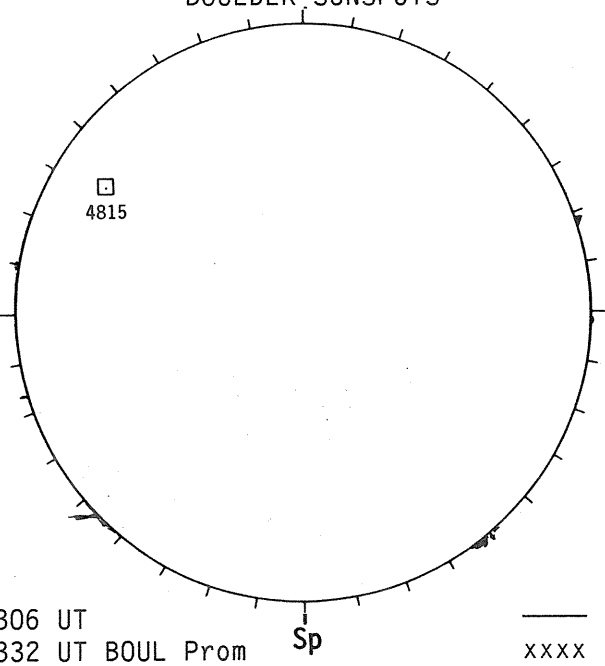
DeltaY=13.0
DeltaX= 9.6



SACRAMENTO PEAK H-ALPHA

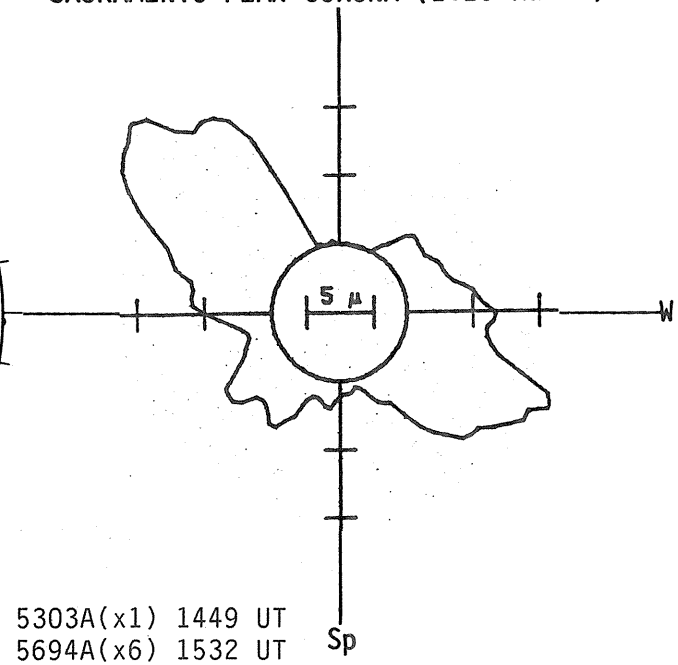


BOULDER SUNSPOTS



1306 UT
1332 UT BOUL Prom

SACRAMENTO PEAK CORONA (1.15 Radii)

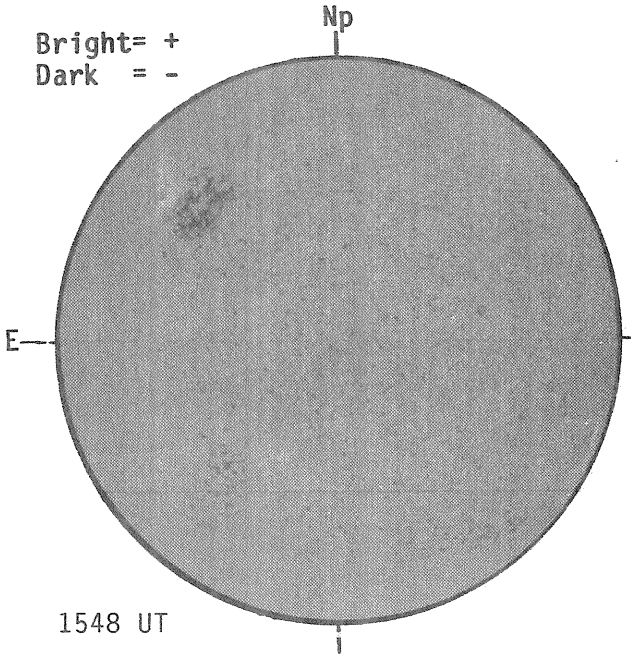


—— 5303A(x1) 1449 UT
xxxx 5694A(x6) 1532 UT
NO 5694A ACTIVITY TODAY

J U N E 15, 1 9 8 7 (P=- 9.94, B_0= 0.93, L_0= 19.08)

KITT PEAK MAGNETOGRAM

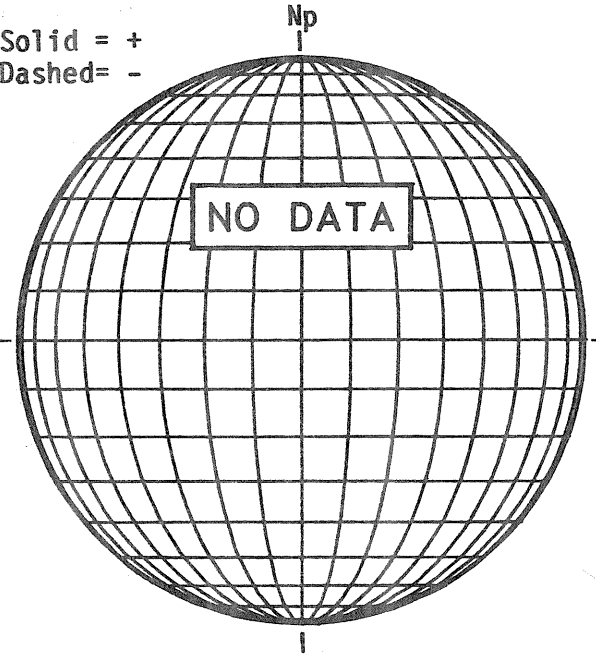
Bright= +
Dark = -



1548 UT

STANFORD MAGNETOGRAM

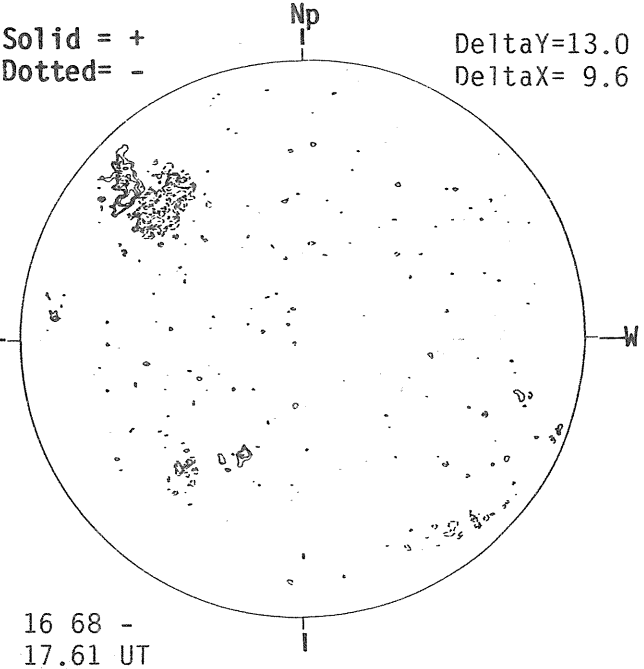
Solid = +
Dashed= -



MT. WILSON MAGNETOGRAM

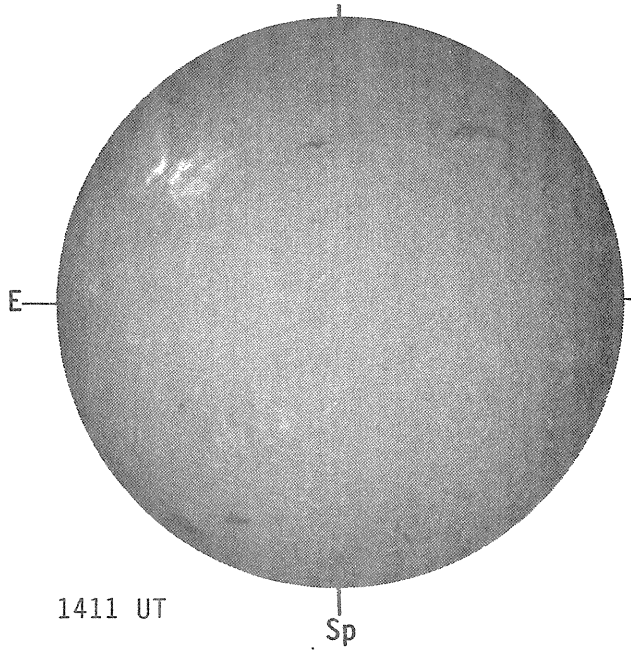
Solid = +
Dotted= -

DeltaY=13.0
DeltaX= 9.6



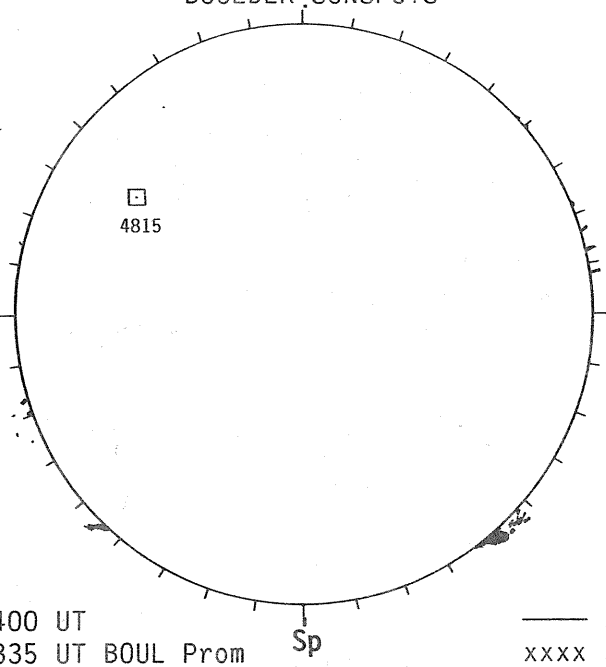
16 68 -
17.61 UT

SACRAMENTO PEAK H-ALPHA



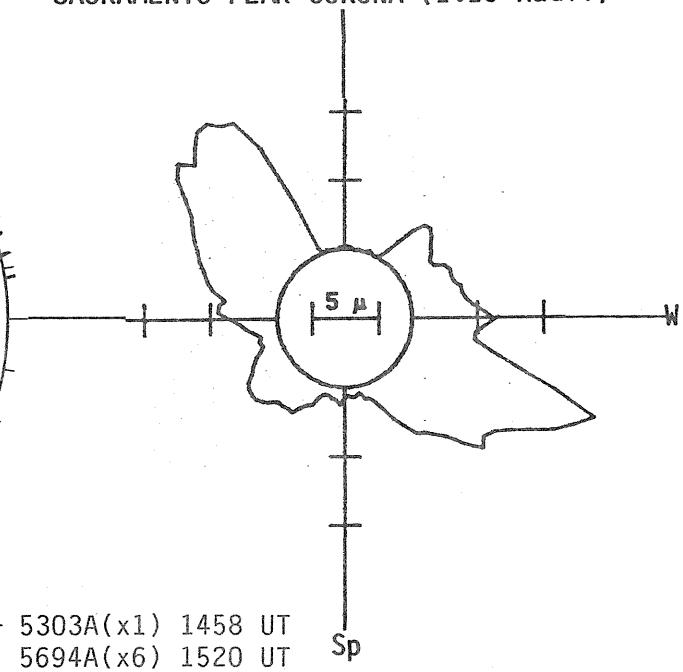
1411 UT

BOULDER SUNSPOTS



1400 UT
1335 UT BOUL Prom

SACRAMENTO PEAK CORONA (1.15 Radii)

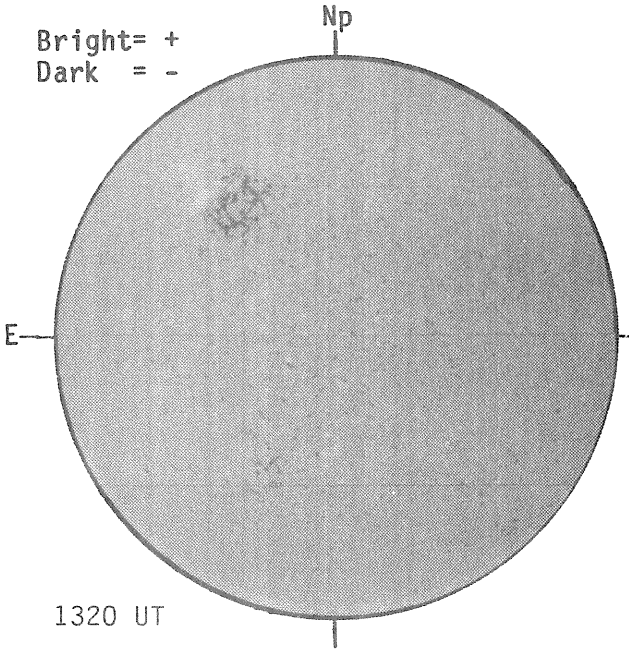


—— 5303A(x1) 1458 UT
xxxx 5694A(x6) 1520 UT
NO 5694A ACTIVITY TODAY

J U N E 16, 1 9 8 7 (P=- 9.51, B_0= 1.04, L_0= 5.84)

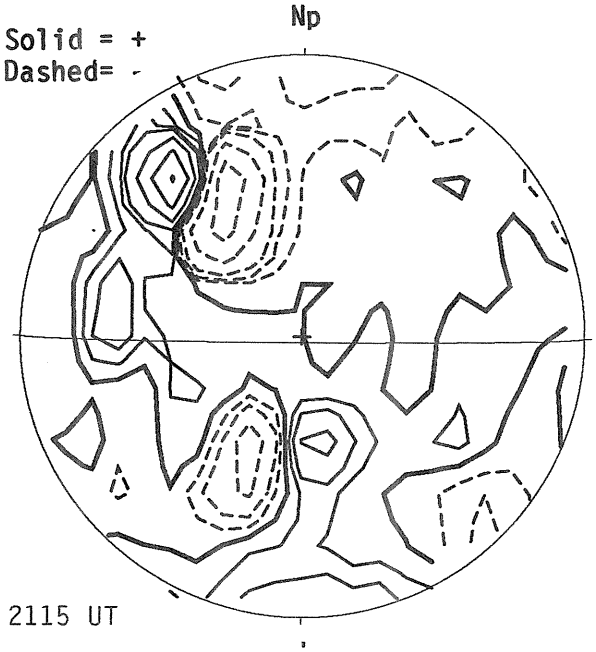
KITT PEAK MAGNETOGRAM

Bright= +
Dark = -



STANFORD MAGNETOGRAM

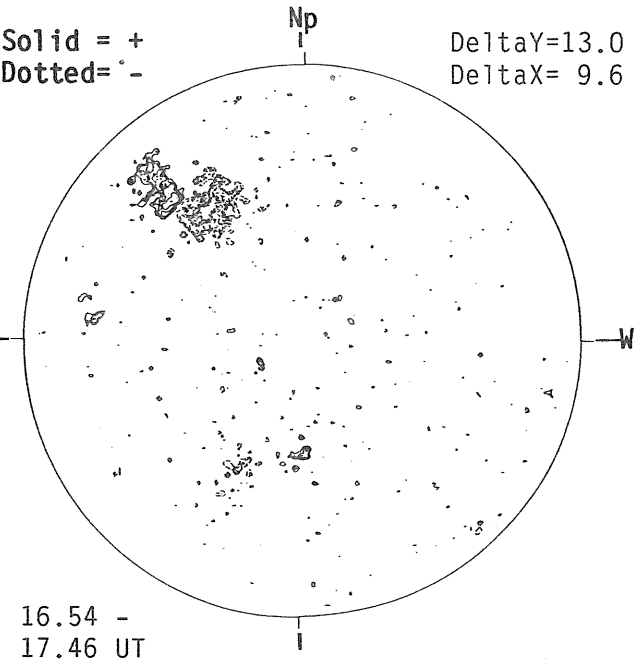
Solid = +
Dashed= -



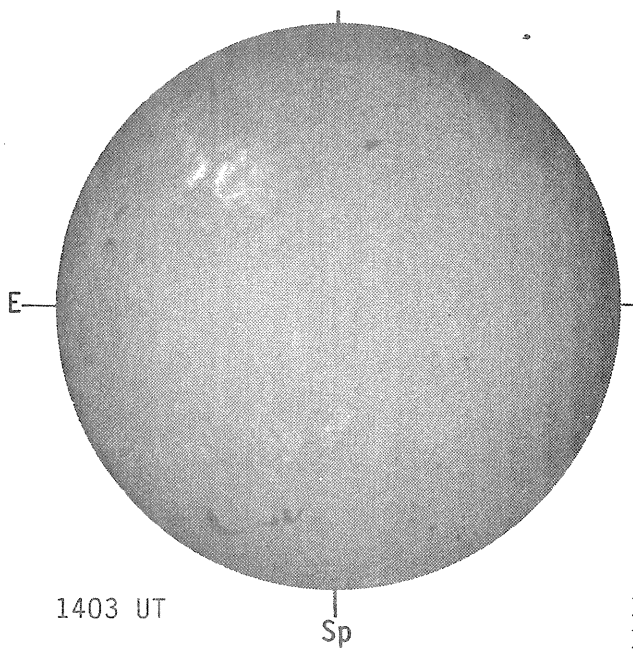
MT. WILSON MAGNETOGRAM

Solid = +
Dotted= -

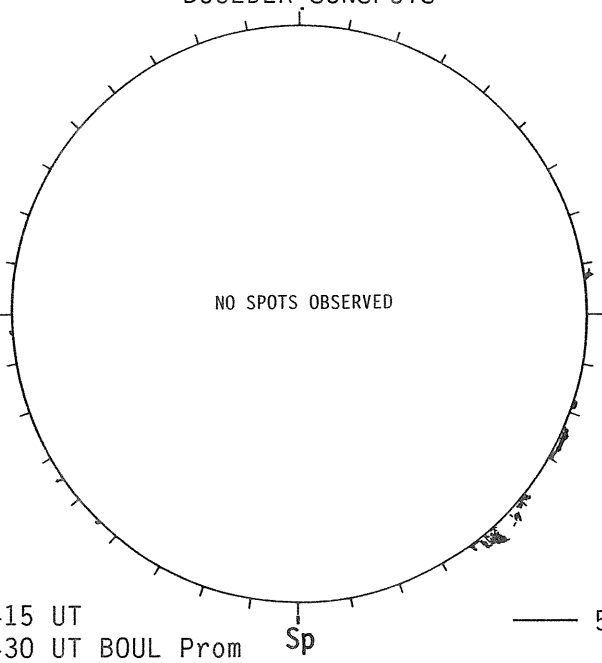
DeltaY=13.0
DeltaX= 9.6



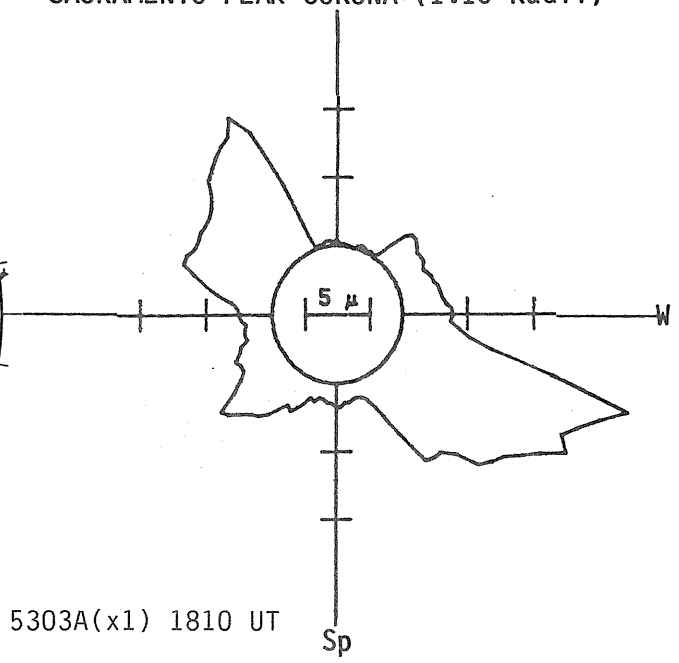
SACRAMENTO PEAK H-ALPHA



BOULDER SUNSPOTS



SACRAMENTO PEAK CORONA (1.15 Radii)

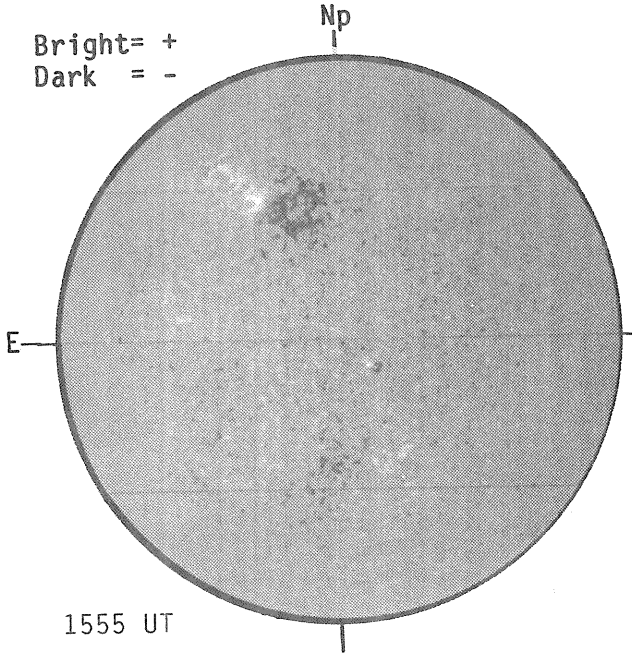


—— 5303A(x1) 1810 UT

J U N E 17, 1 9 8 7 (P=- 9.08, B_0= 1.16, L_0= 352.61)

KITT PEAK MAGNETOGRAM

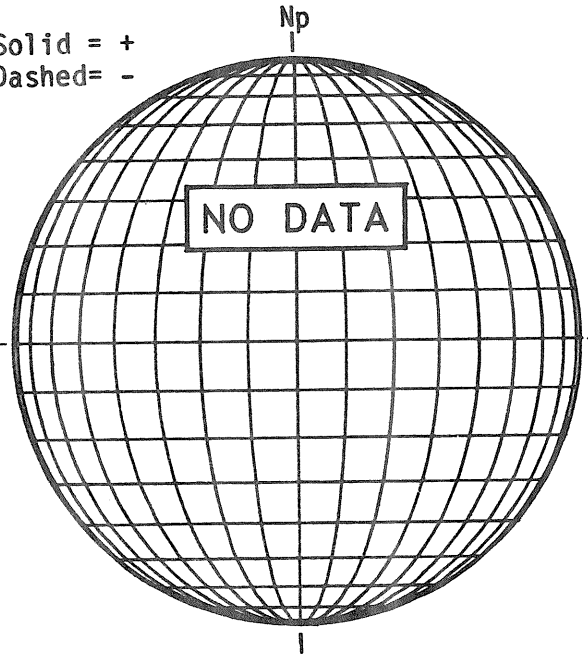
Bright= +
Dark = -



1555 UT

STANFORD MAGNETOGRAM

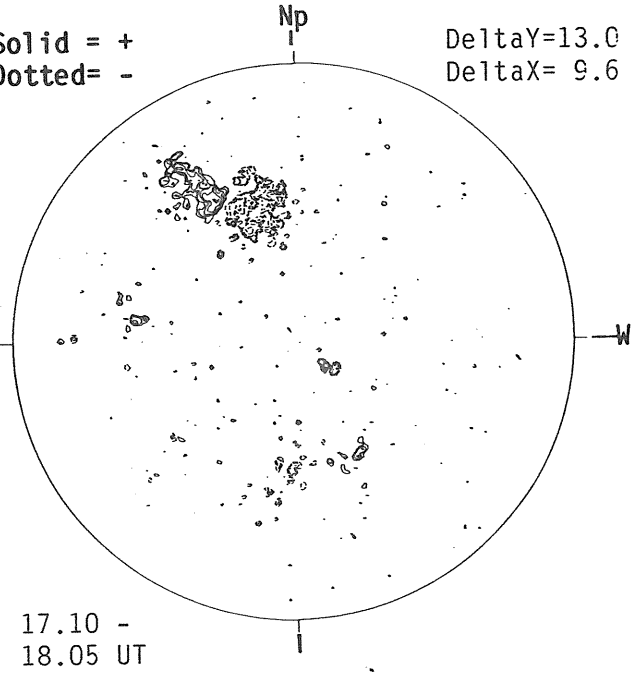
Solid = +
Dashed= -



MT. WILSON MAGNETOGRAM

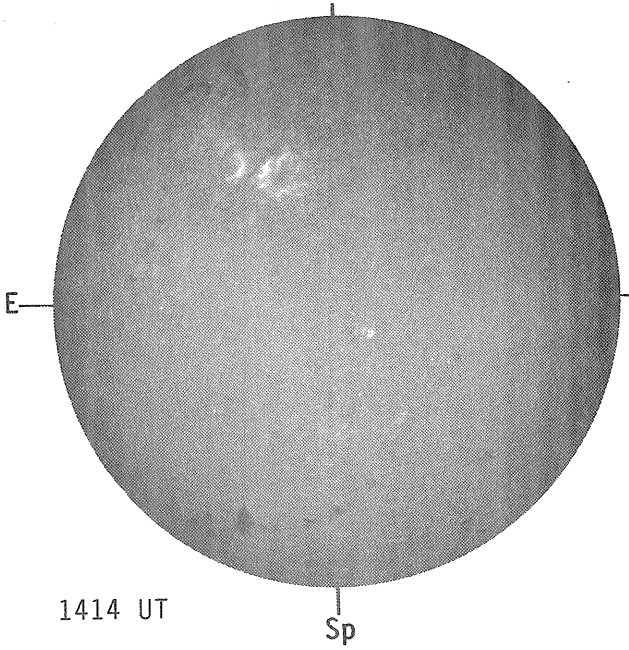
Solid = +
Dotted= -

DeltaY=13.0
DeltaX= 9.6



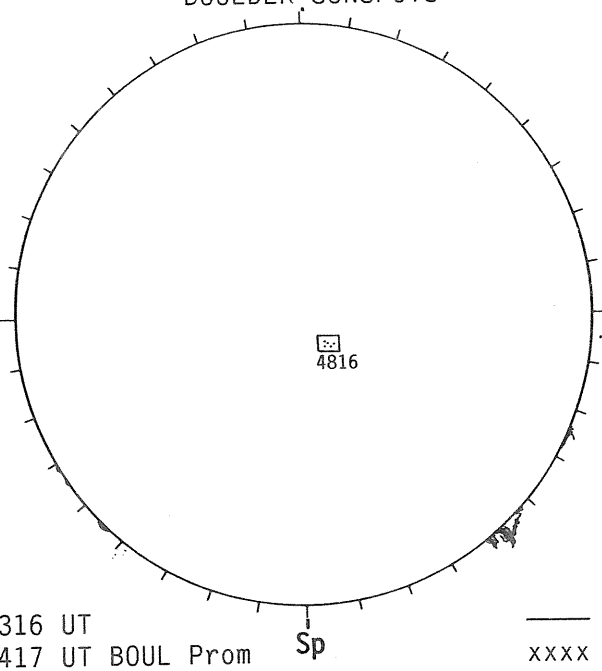
17.10 -
18.05 UT

SACRAMENTO PEAK H-ALPHA



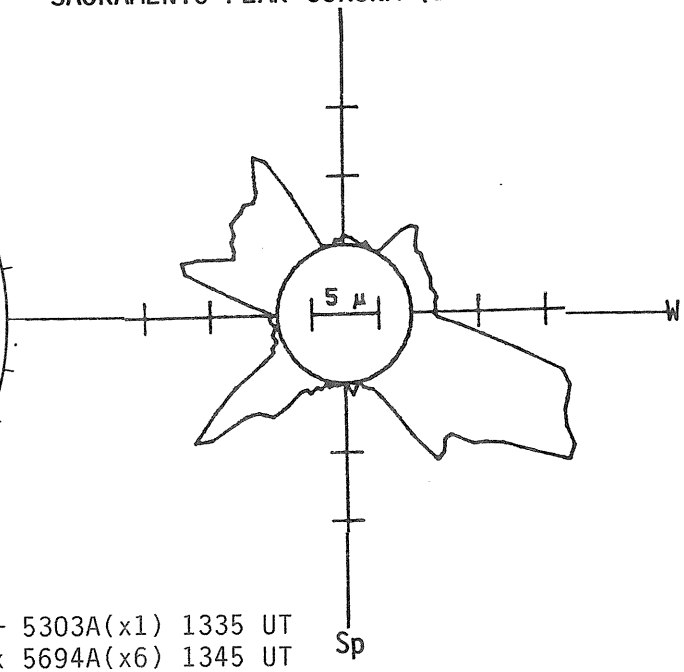
1414 UT

BOULDER SUNSPOTS



1316 UT
1417 UT BOUL Prom

SACRAMENTO PEAK CORONA (1.15 Radii)

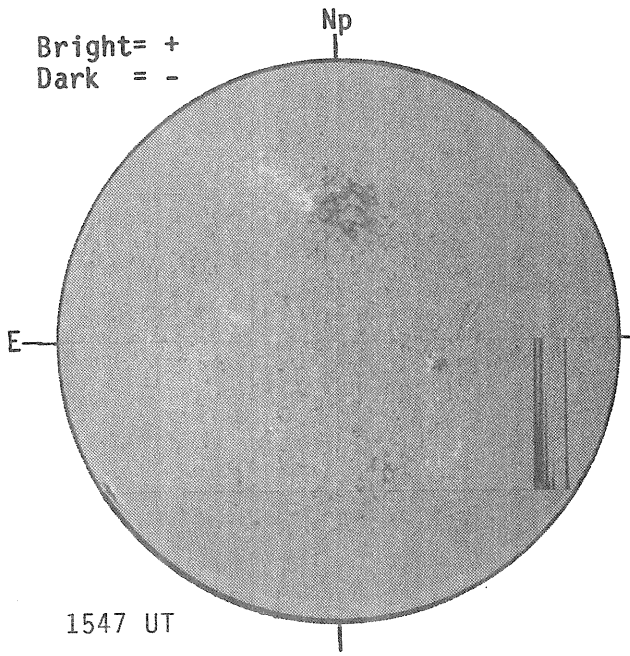


—— 5303A(x1) 1335 UT
xxxx 5694A(x6) 1345 UT
NO 5694A ACTIVITY TODAY

J U N E 18, 1 9 8 7 (P=- 8.65, B_0= 1.28, L_0= 339.37)

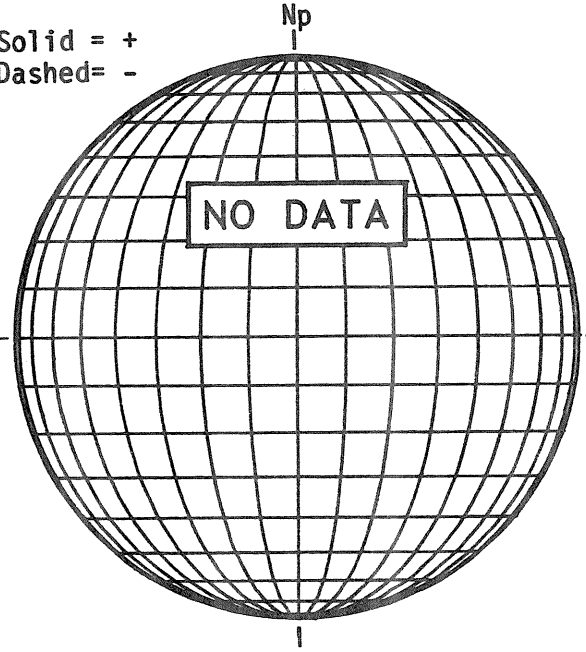
KITT PEAK MAGNETOGRAM

Bright= +
Dark = -



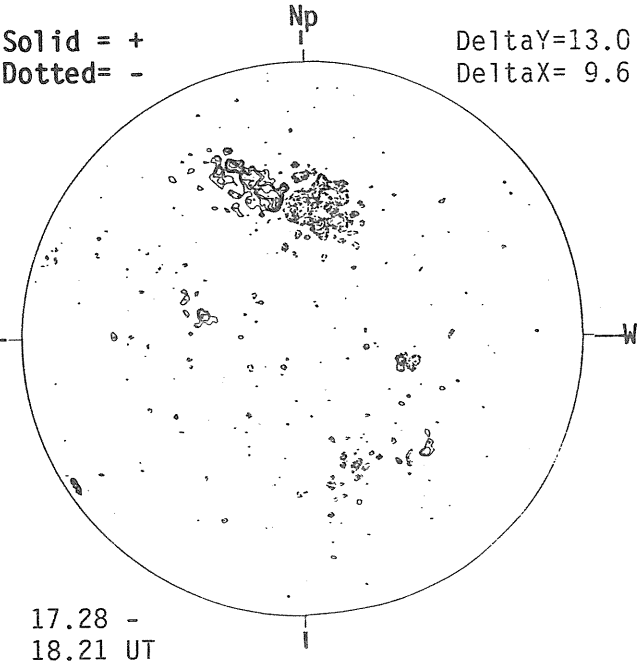
STANFORD MAGNETOGRAM

Solid = +
Dashed= -

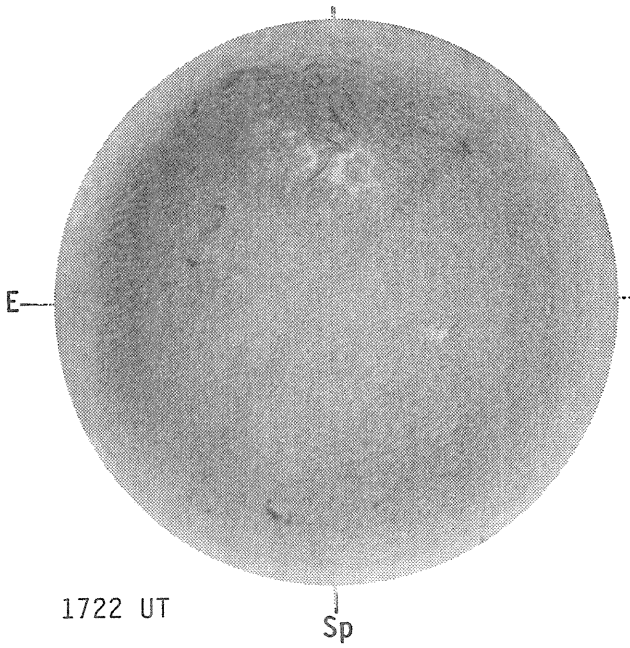


MT. WILSON MAGNETOGRAM

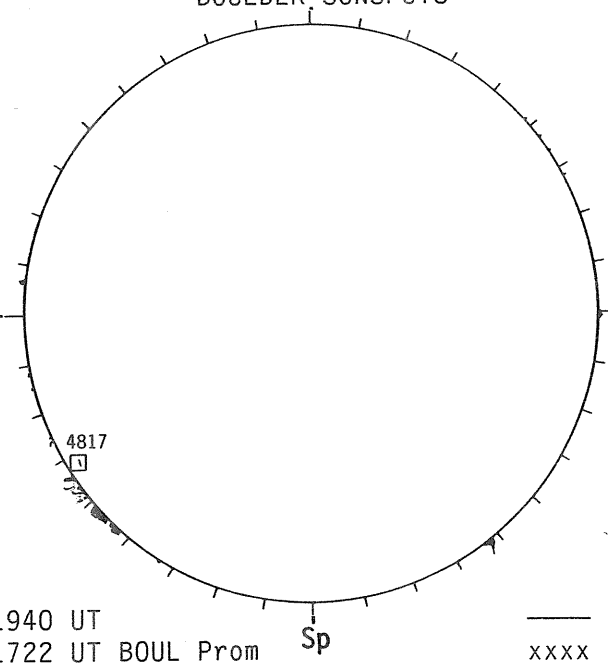
Solid = +
Dotted= -



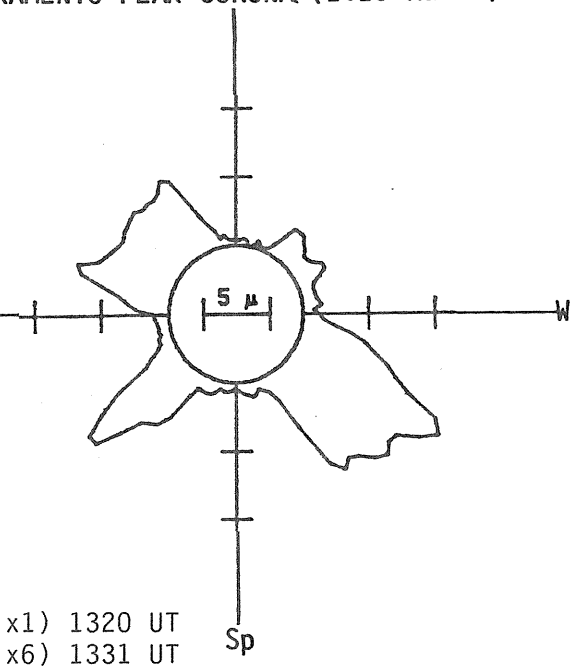
BOULDER H-ALPHA



BOULDER SUNSPOTS



SACRAMENTO PEAK CORONA (1.15 Radii)

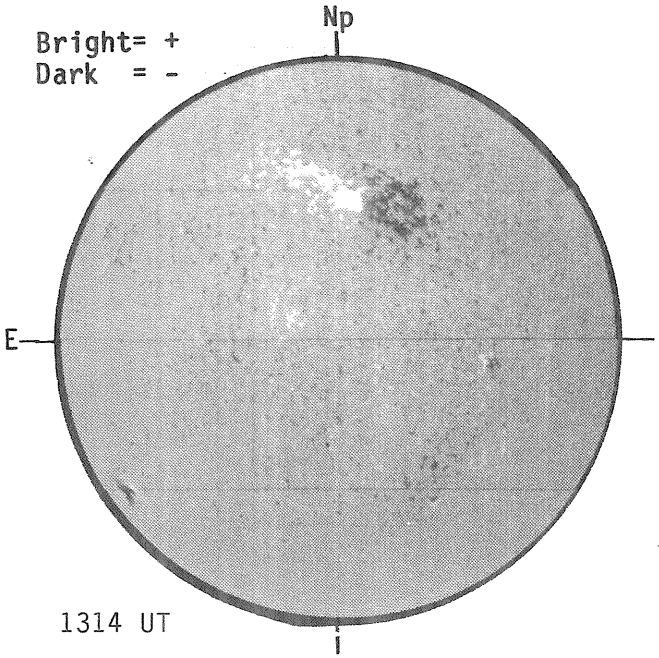


—— 5303A(x1) 1320 UT
xxxx 5694A(x6) 1331 UT
NO 5694A ACTIVITY TODAY

J U N E 19, 1 9 8 7 (P=- 8.22, B_0= 1.40, L_0= 326.13)

KITT PEAK MAGNETOGRAM

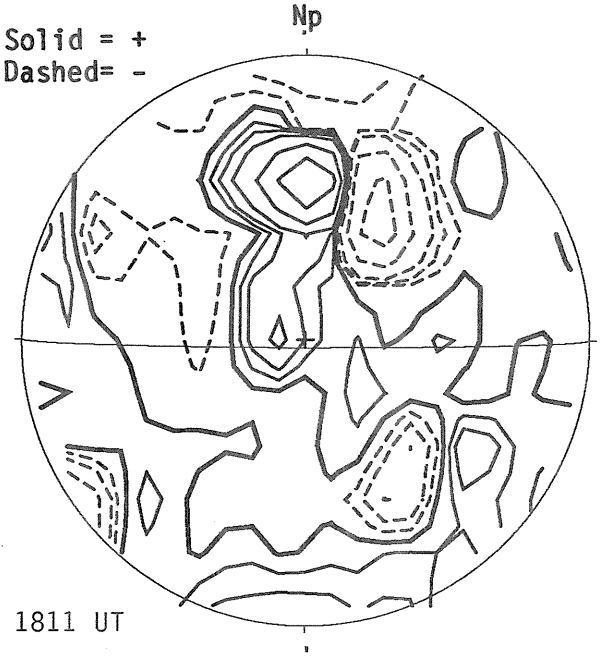
Bright= +
Dark = -



1314 UT

STANFORD MAGNETOGRAM

Solid = +
Dashed= -

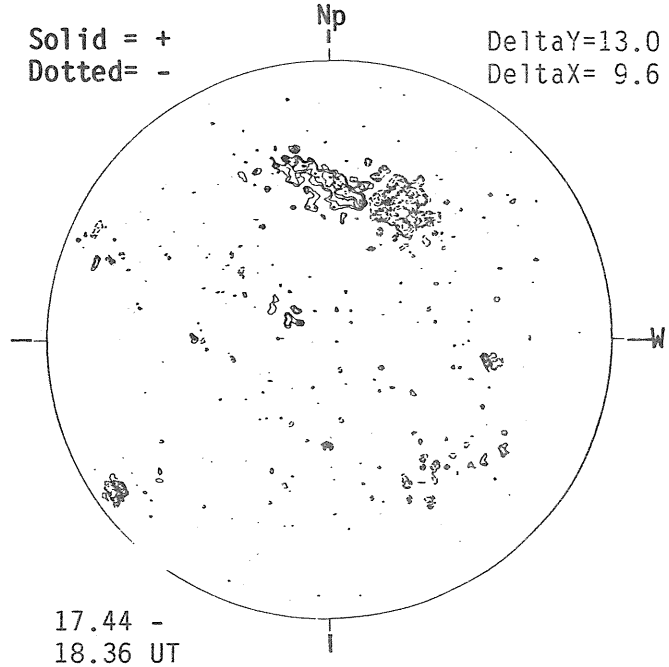


1811 UT

MT. WILSON MAGNETOGRAM

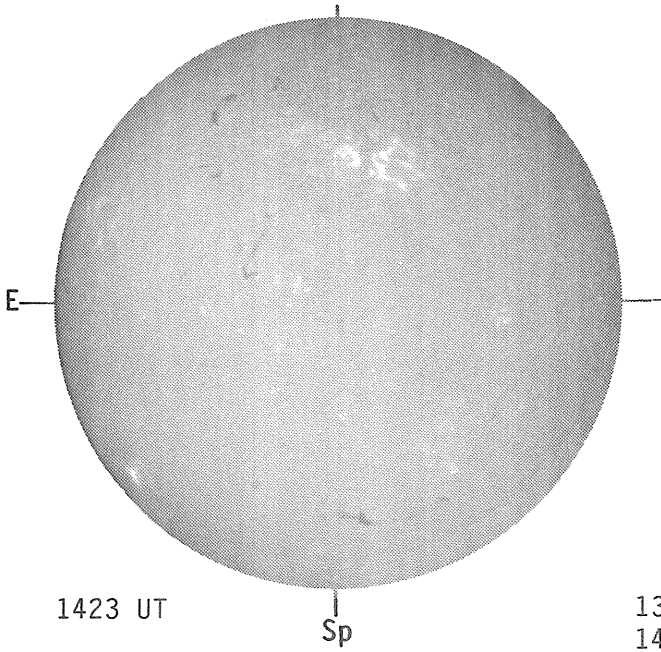
Solid = +
Dotted= -

DeltaY=13.0
DeltaX= 9.6



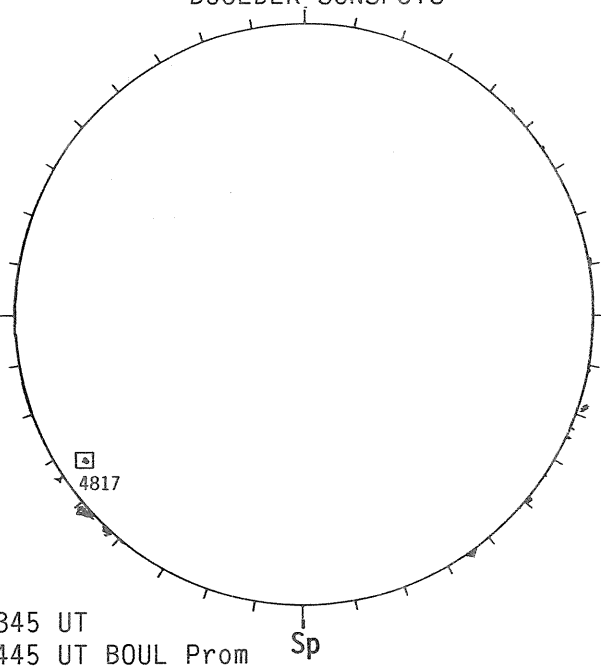
17.44 -
18.36 UT

SACRAMENTO PEAK H-ALPHA



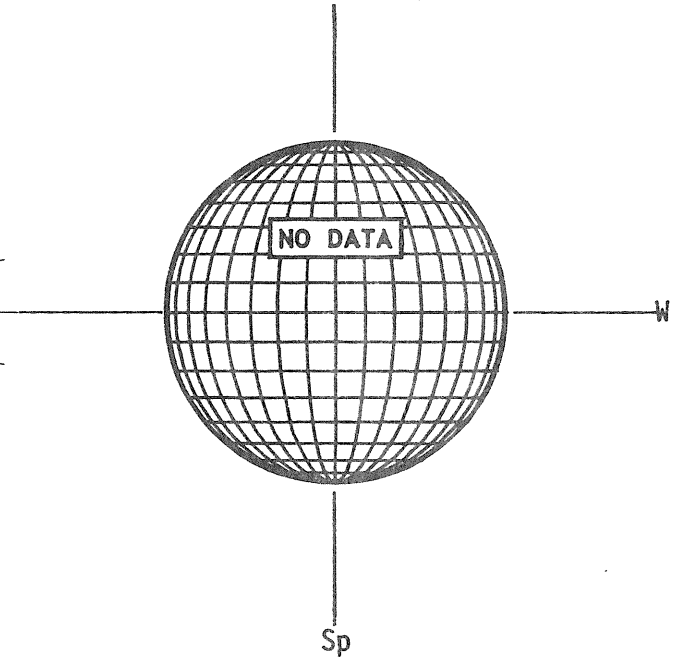
1423 UT

BOULDER SUNSPOTS



1345 UT
1445 UT BOUL Prom

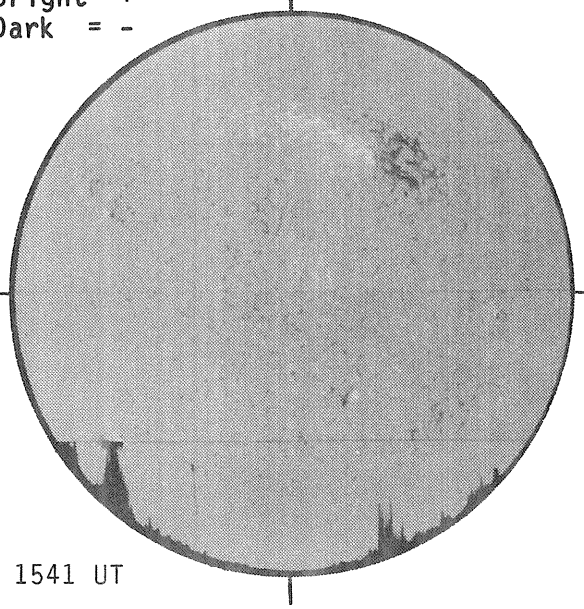
SACRAMENTO PEAK CORONA (1.15 Radii)



J U N E 20, 1 9 8 7 (P=- 7.78, B_o= 1.51, L_o= 312.90)

KITT PEAK MAGNETOGRAM

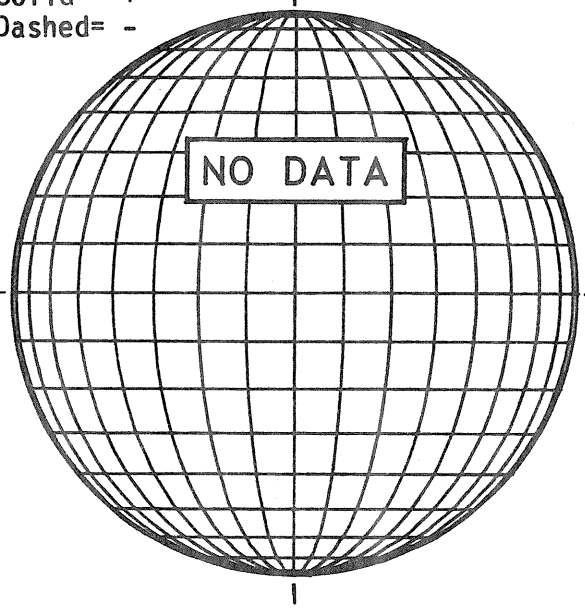
Bright= +
Dark = -



1541 UT

STANFORD MAGNETOGRAM

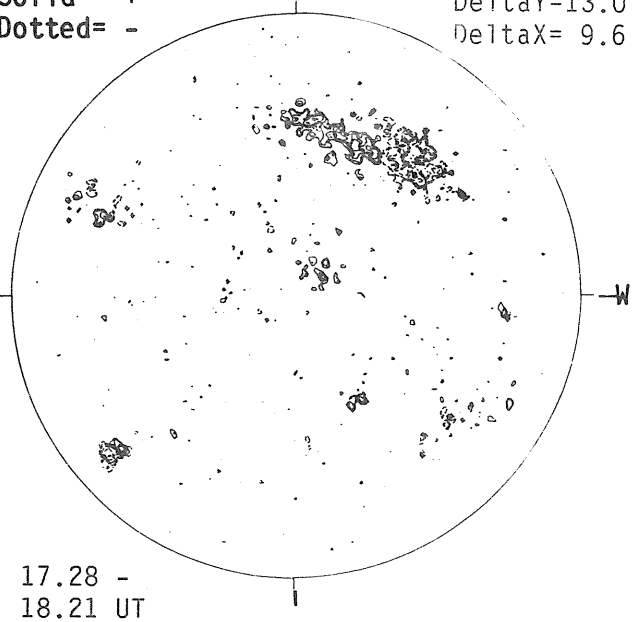
Solid = +
Dashed= -



MT. WILSON MAGNETOGRAM

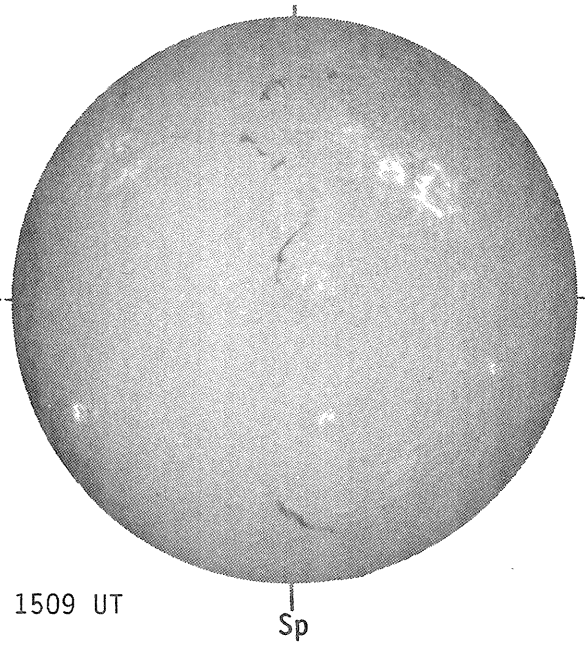
Solid = +
Dotted= -

DeltaY=13.0
DeltaX= 9.6



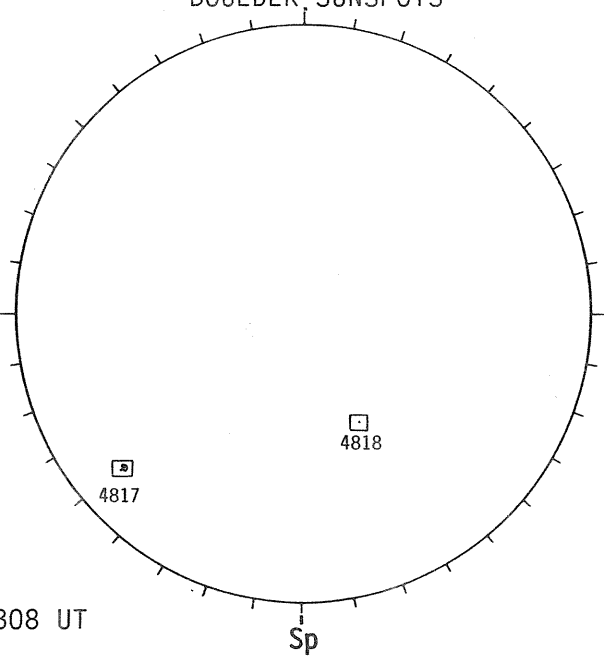
17.28 -
18.21 UT

SACRAMENTO PEAK H-ALPHA



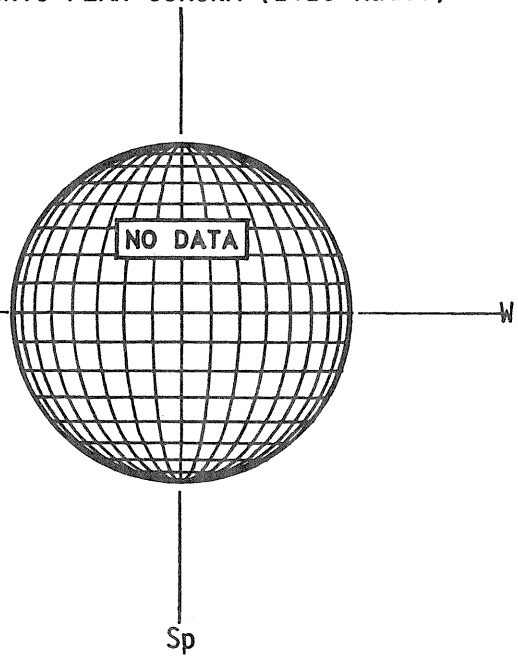
1509 UT

BOULDER SUNSPOTS



1308 UT

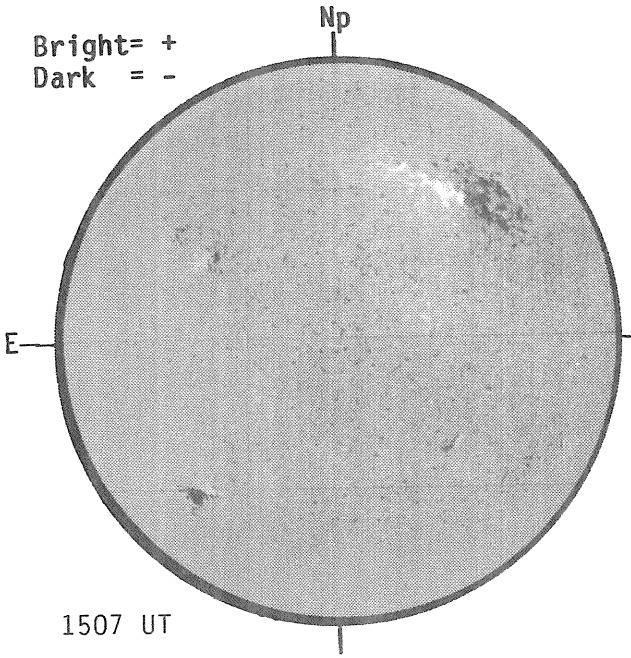
SACRAMENTO PEAK CORONA (1.15 Radii)



J U N E 21, 1 9 8 7 (P=- 7.34, B_0= 1.63, L_0= 299.66)

KITT PEAK MAGNETOGRAM

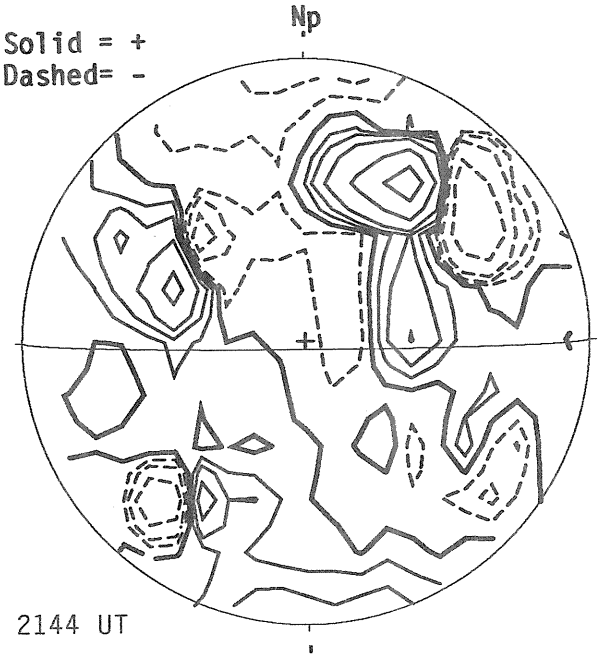
Bright= +
Dark = -



1507 UT

STANFORD MAGNETOGRAM

Solid = +
Dashed= -

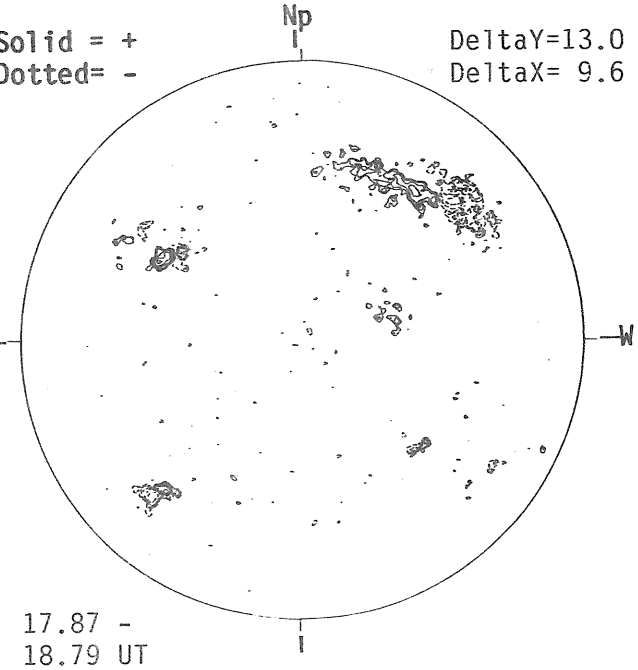


2144 UT

MT. WILSON MAGNETOGRAM

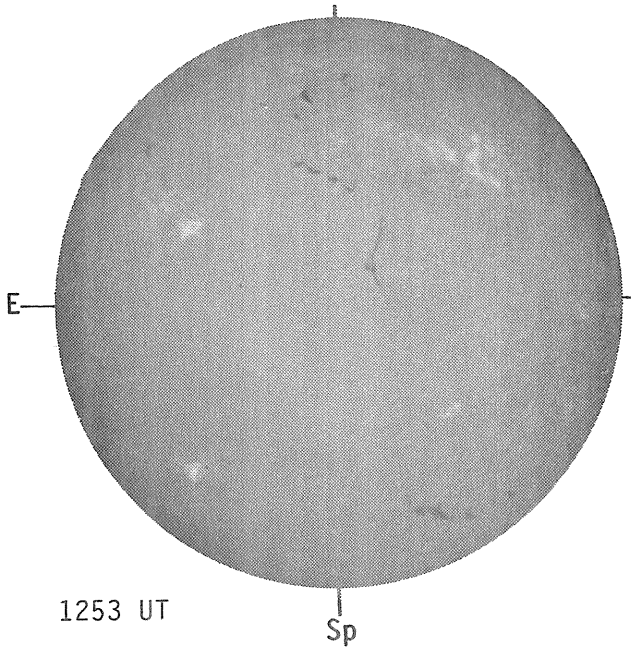
Solid = +
Dotted= -

DeltaY=13.0
DeltaX= 9.6



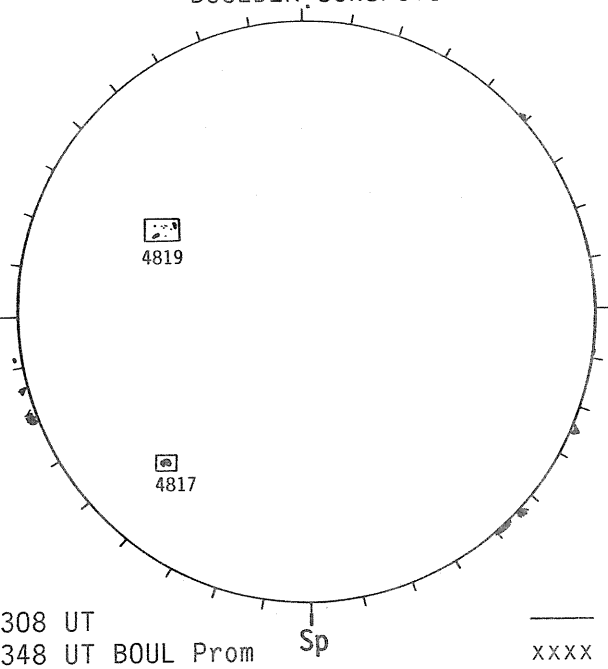
17.87 -
18.79 UT

SACRAMENTO PEAK H-ALPHA



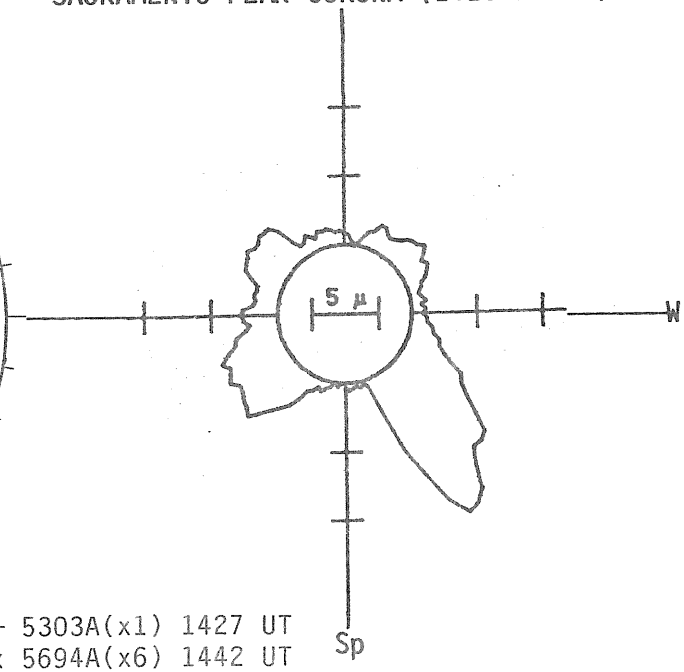
1253 UT

BOULDER SUNSPOTS



1308 UT
1348 UT BOUL Prom

SACRAMENTO PEAK CORONA (1.15 Radii)

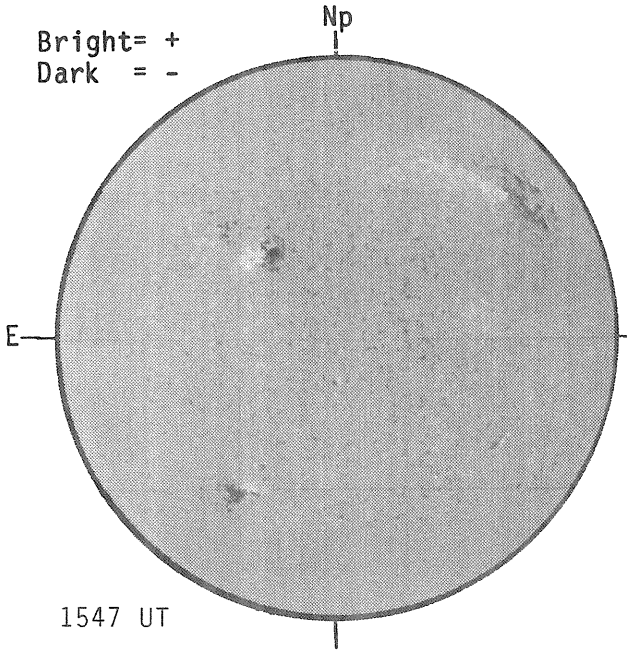


—— 5303A(x1) 1427 UT
xxxx 5694A(x6) 1442 UT
NO 5694A ACTIVITY TODAY

J U N E 22, 1 9 8 7 (P=- 6.90, B_0= 1.74, L_0= 286.42)

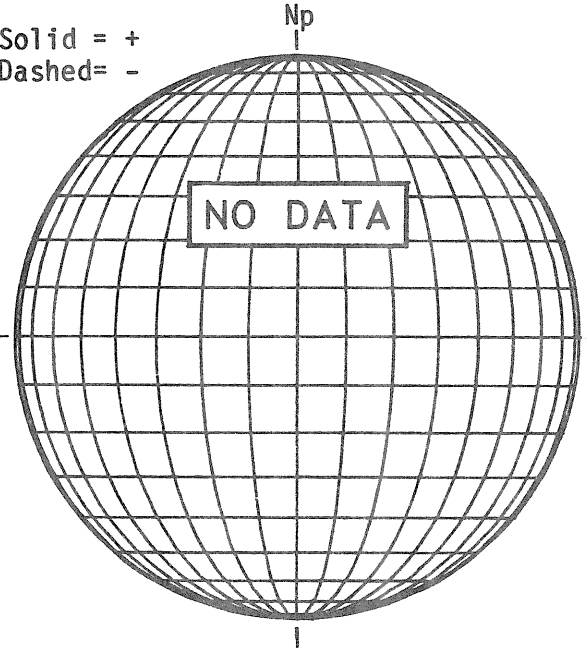
KITT PEAK MAGNETOGRAM

Bright= +
Dark = -



STANFORD MAGNETOGRAM

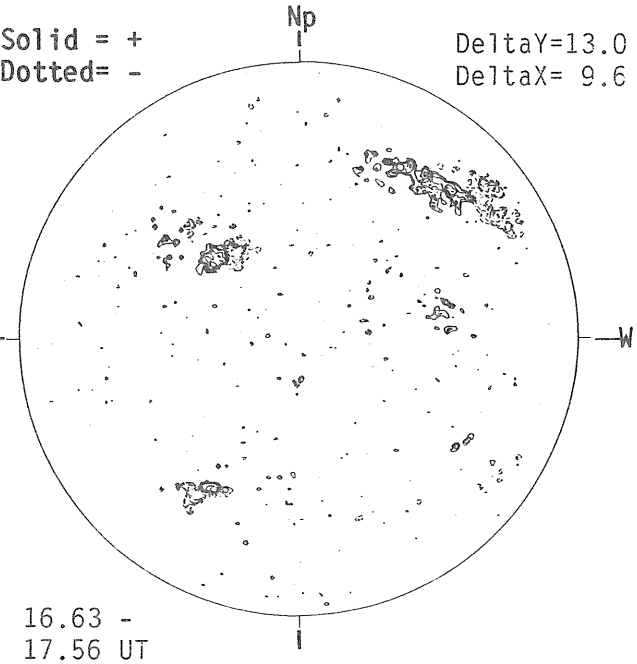
Solid = +
Dashed= -



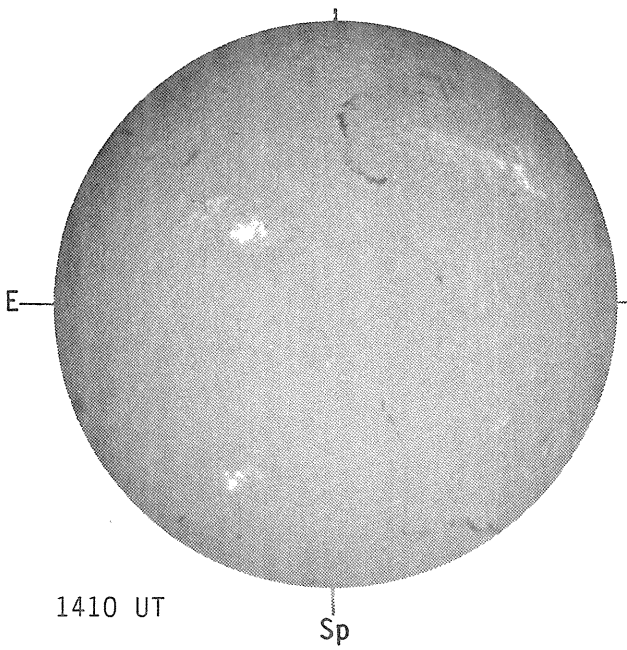
MT. WILSON MAGNETOGRAM

Solid = +
Dotted= -

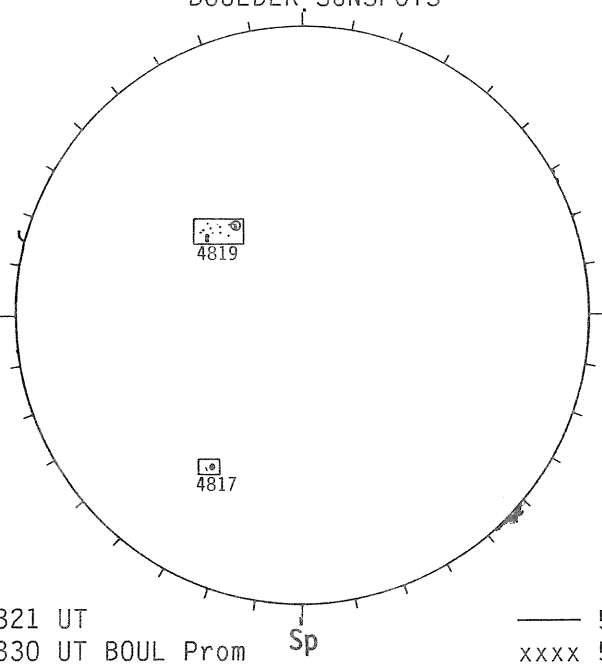
DeltaY=13.0
DeltaX= 9.6



SACRAMENTO PEAK H-ALPHA

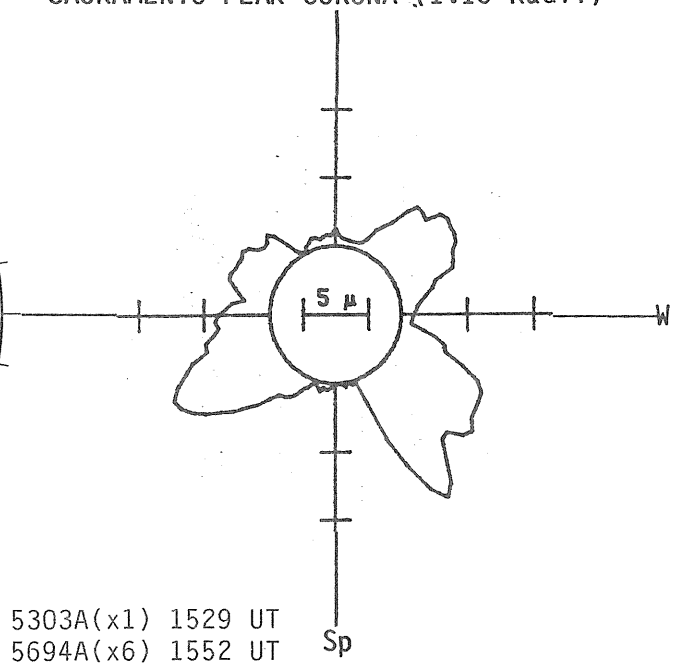


BOULDER SUNSPOTS



1321 UT
1330 UT BOUL Prom

SACRAMENTO PEAK CORONA (1.15 Radii)



—— 5303A(x1) 1529 UT
xxxx 5694A(x6) 1552 UT
NO 5694A ACTIVITY TODAY

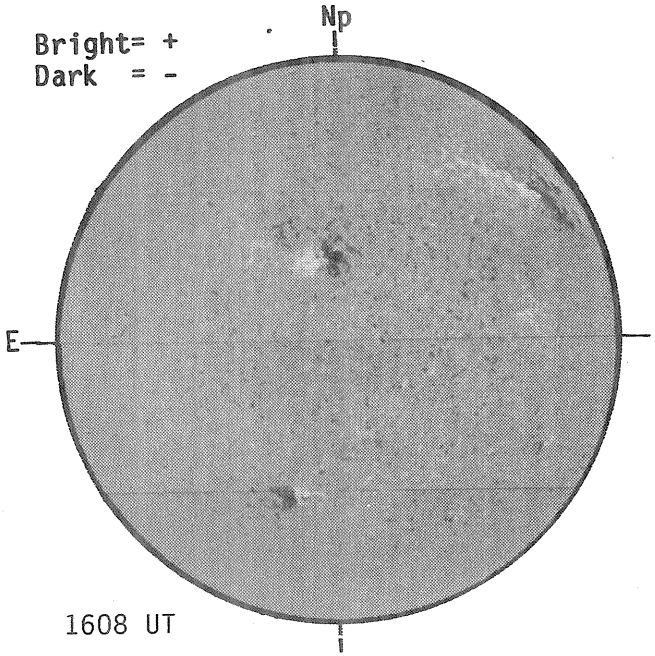
59
Jun 87

J U N E 23, 1 9 8 7 (P=- 6.45, B_0= 1.86, L_0= 273.19)

60 Jun 87

KITT PEAK MAGNETOGRAM

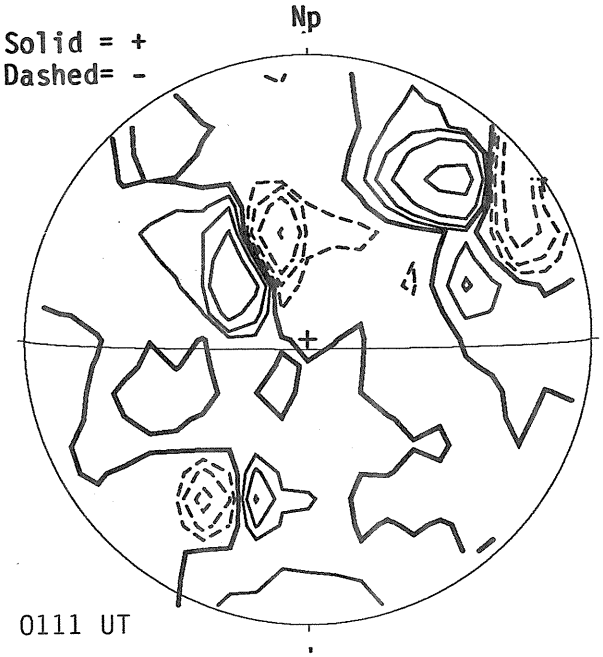
Bright= +
Dark = -



1608 UT

STANFORD MAGNETOGRAM

Solid = +
Dashed= -

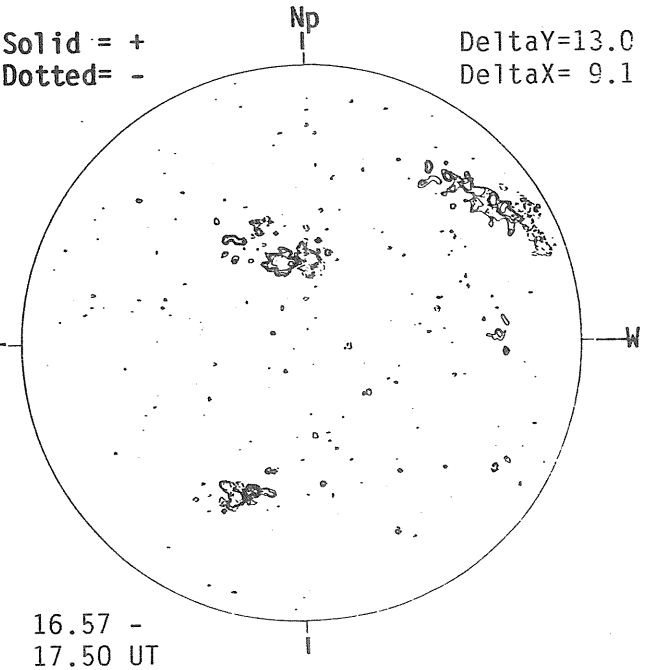


0111 UT

MT. WILSON MAGNETOGRAM

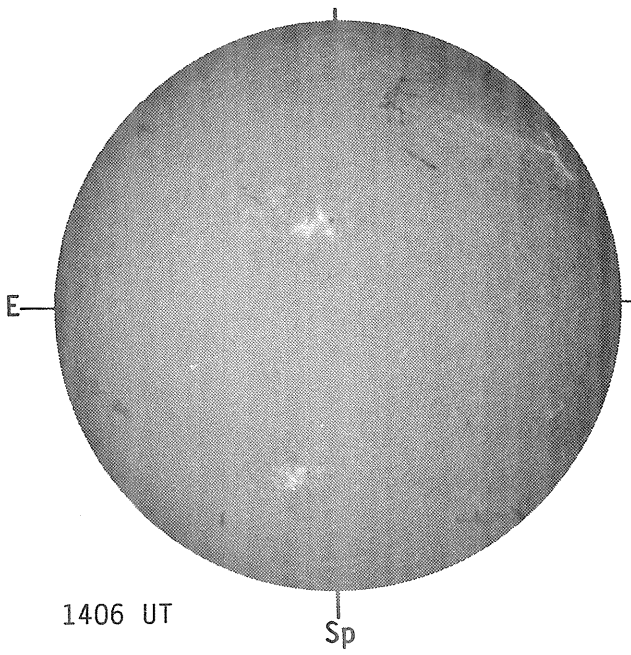
Solid = +
Dotted= -

DeltaY=13.0
DeltaX= 9.1



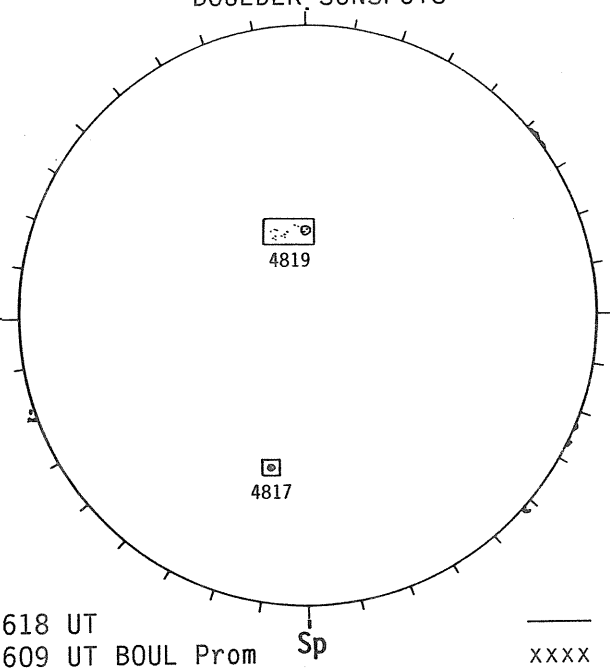
16.57 -
17.50 UT

SACRAMENTO PEAK H-ALPHA



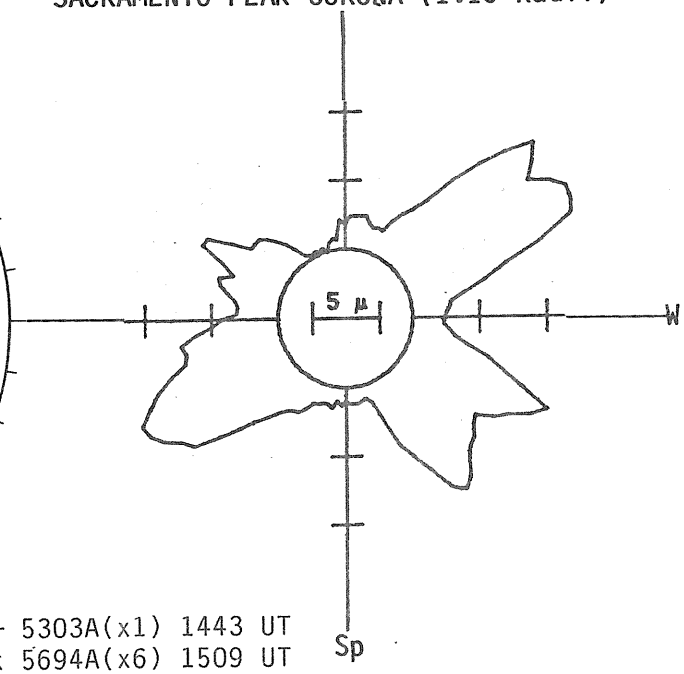
1406 UT

BOULDER SUNSPOTS



1618 UT
1609 UT BOUL Prom

SACRAMENTO PEAK CORONA (1.15 Radii)

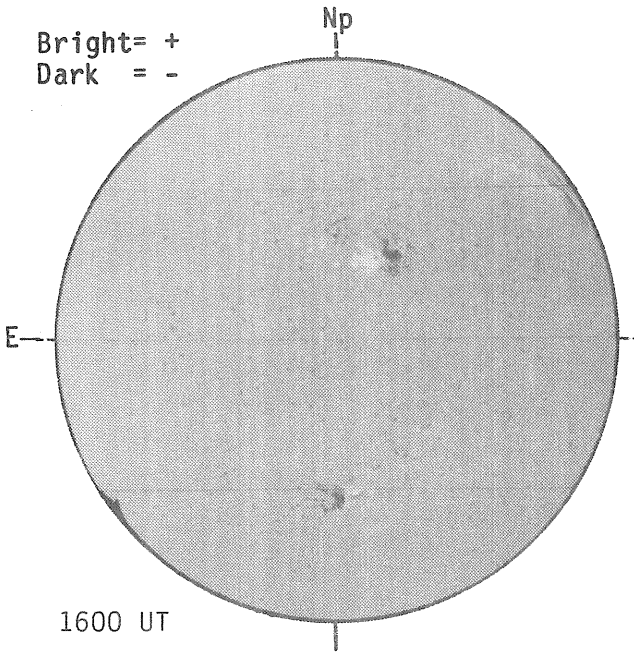


—— 5303A(x1) 1443 UT
xxxx 5694A(x6) 1509 UT
NO 5694A ACTIVITY TODAY

J U N E 24, 1 9 8 7 (P=- 6.01, B_0= 1.97, L_0= 259.95)

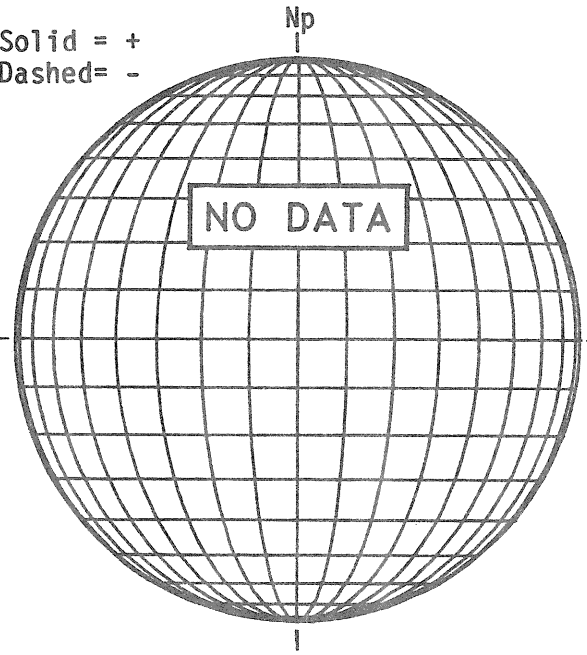
KITT PEAK MAGNETOGRAM

Bright= +
Dark = -



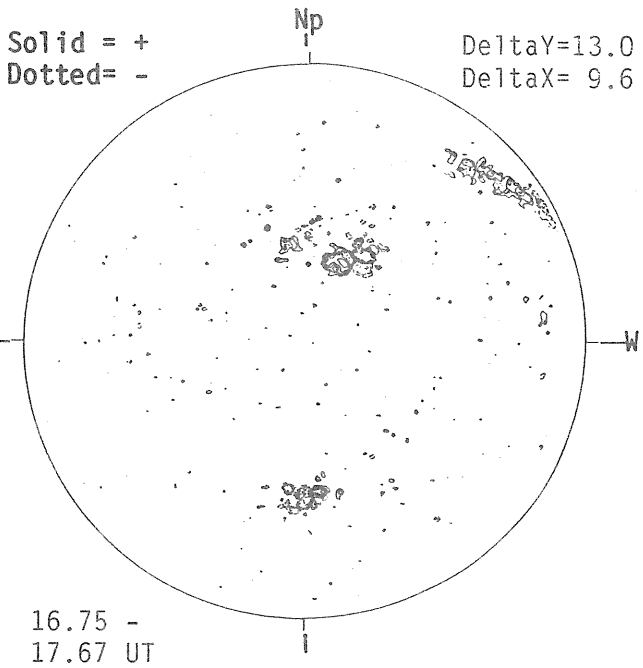
STANFORD MAGNETOGRAM

Solid = +
Dashed= -

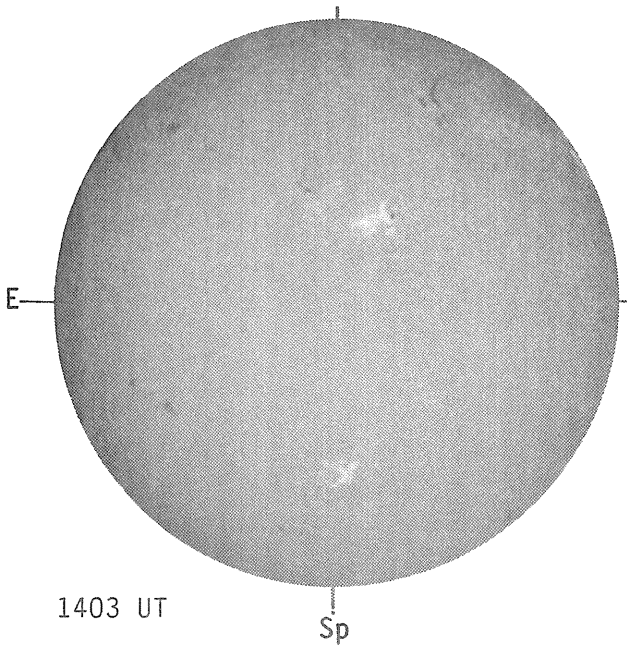


MT. WILSON MAGNETOGRAM

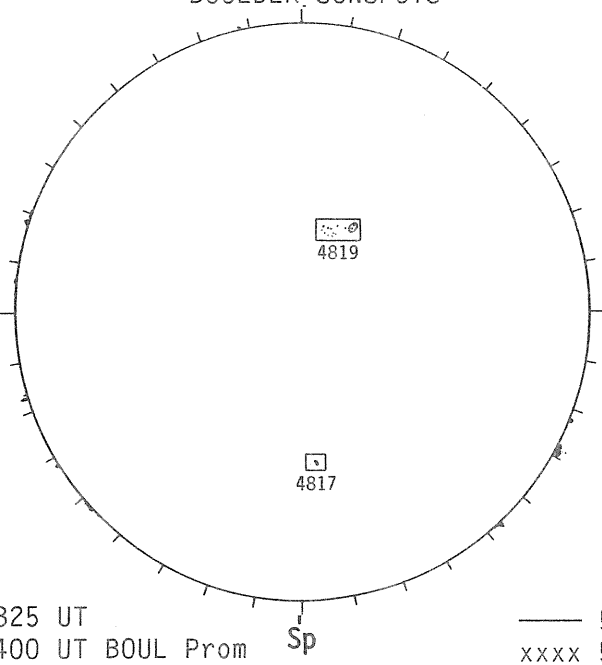
Solid = +
Dotted= -



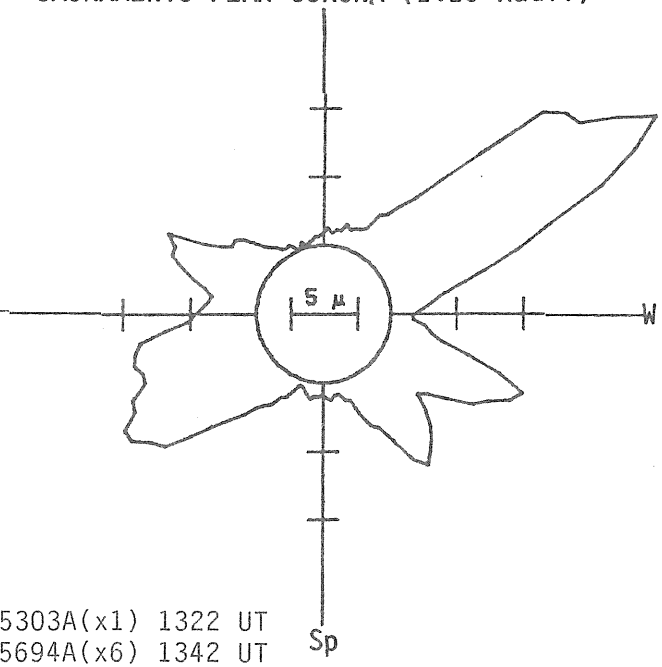
SACRAMENTO PEAK H-ALPHA



BOULDER SUNSPOTS



SACRAMENTO PEAK CORONA (1.15 Radii)



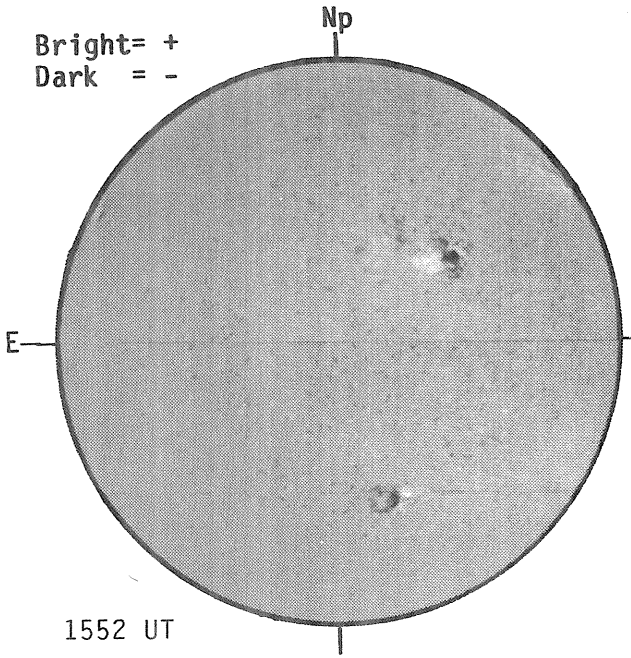
—— 5303A(x1) 1322 UT
xxxx 5694A(x6) 1342 UT
NO 5694A ACTIVITY TODAY

61
Jun 87

J U N E 25, 1 9 8 7 (P=- 5.56, B_0= 2.09, L_0= 246.71)

KITT PEAK MAGNETOGRAM

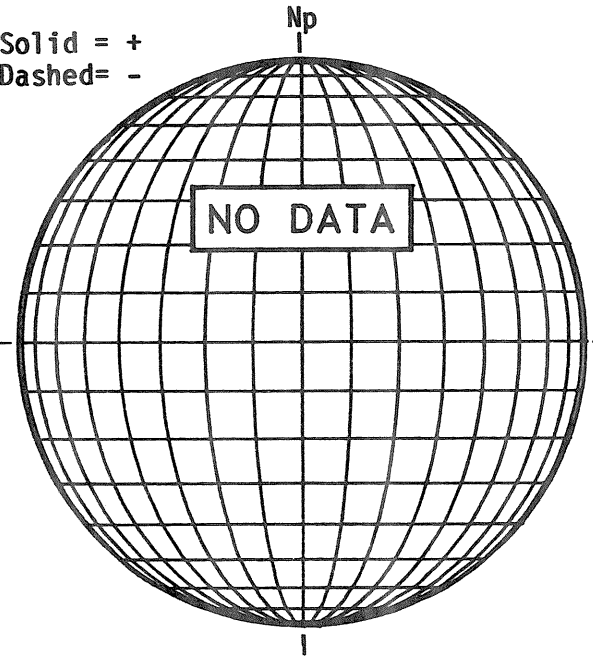
Bright= +
Dark = -



1552 UT

STANFORD MAGNETOGRAM

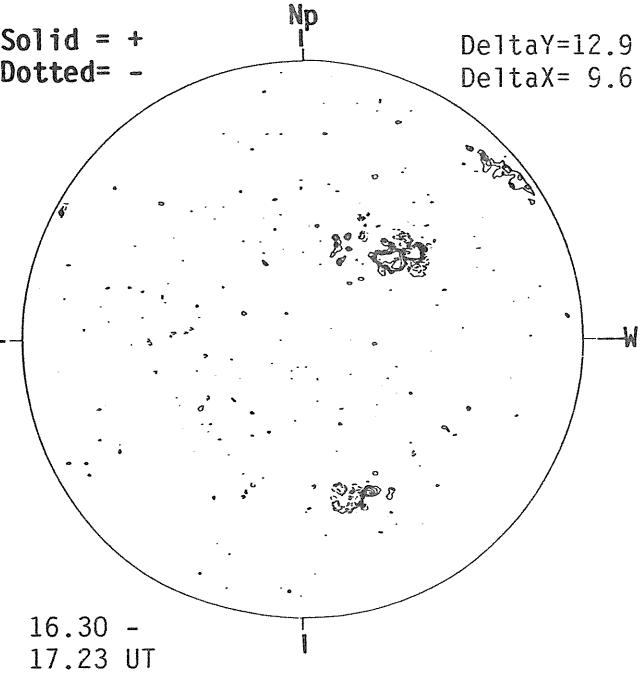
Solid = +
Dashed= -



MT. WILSON MAGNETOGRAM

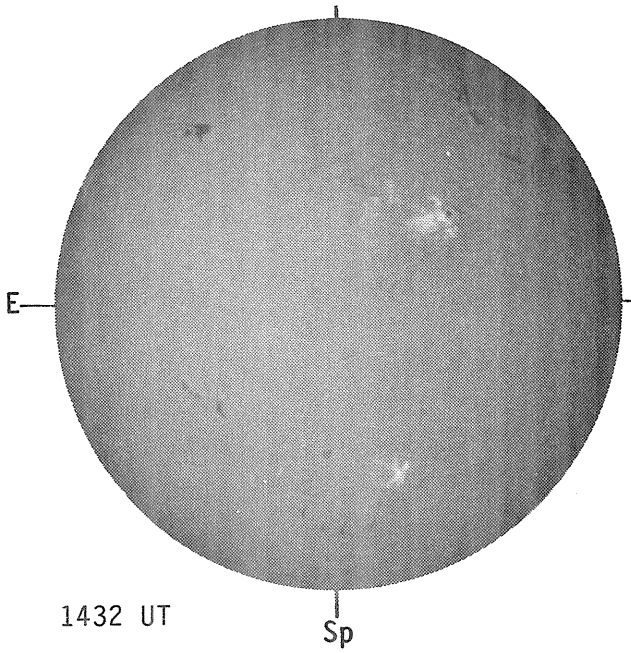
Solid = +
Dotted= -

DeltaY=12.9
DeltaX= 9.6



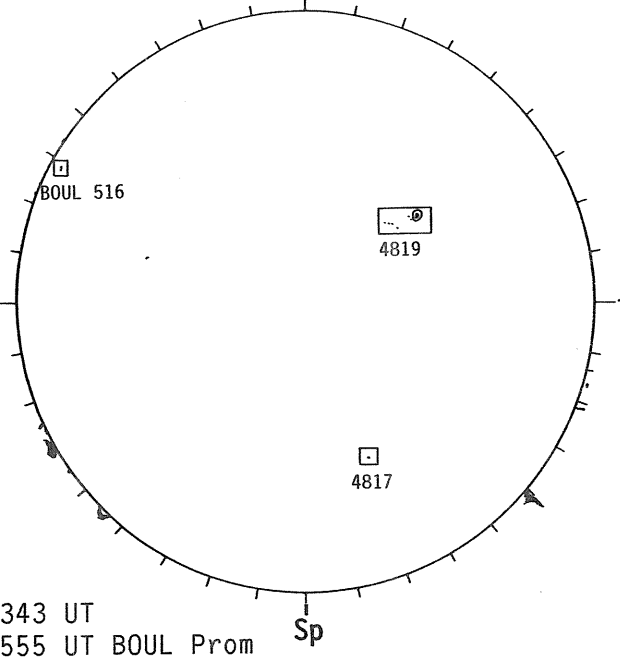
16.30 -
17.23 UT

SACRAMENTO PEAK H-ALPHA



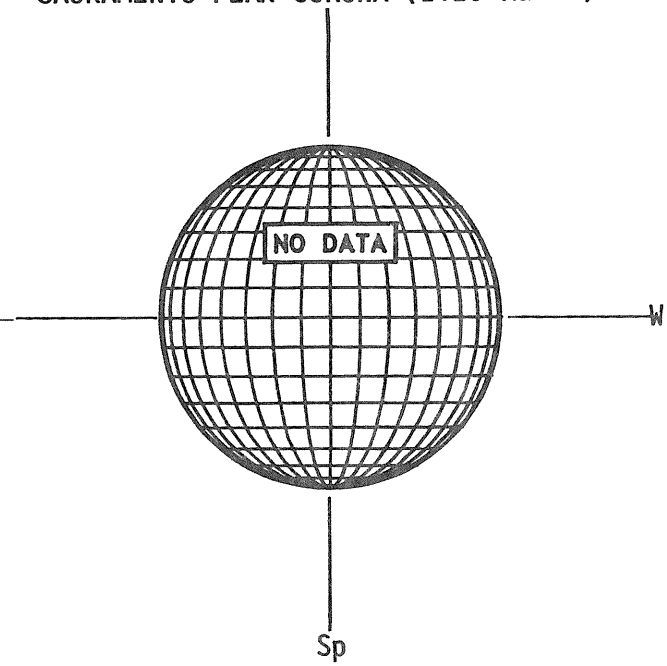
1432 UT

BOULDER SUNSPOTS

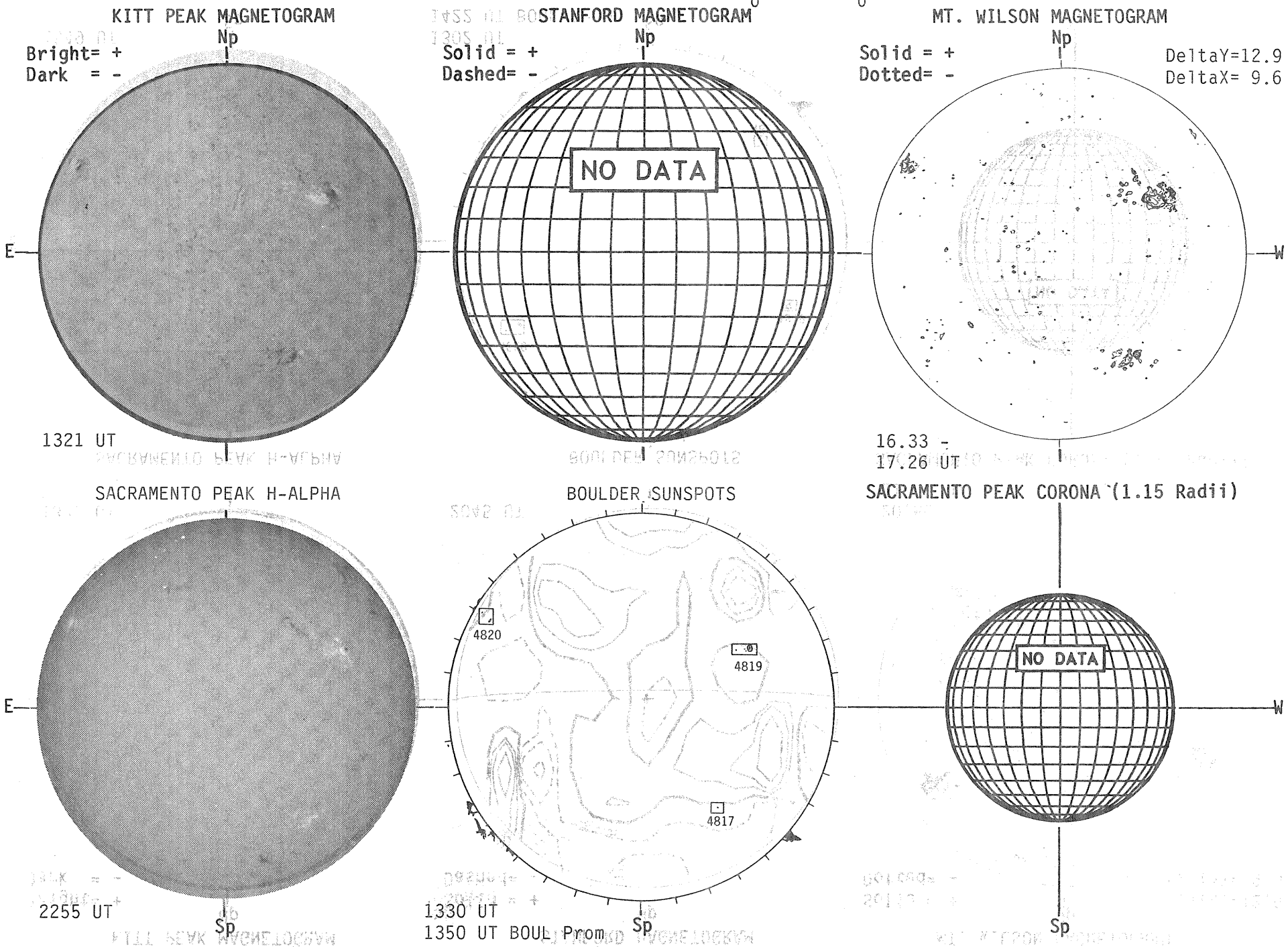


1343 UT
1555 UT BOUL Prom

SACRAMENTO PEAK CORONA (1.15 Radii)



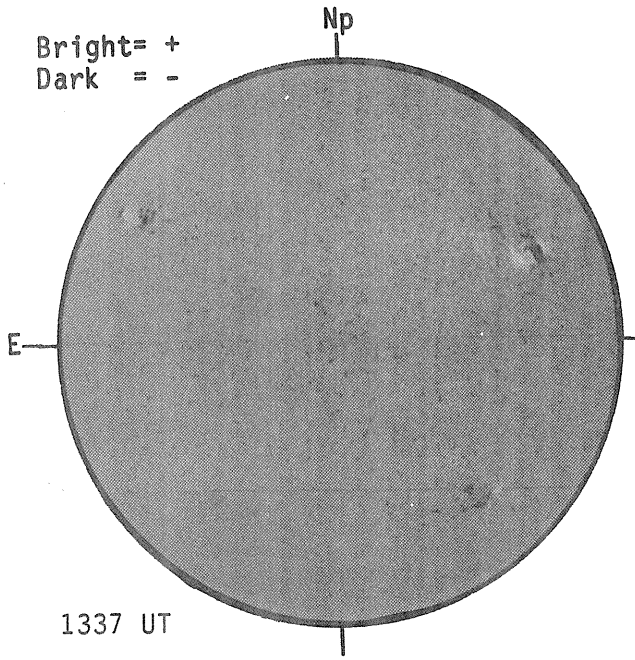
J U N E 26, 1 9 8 7 (P=- 5.11, B_o= 2.20, L_o= 233.48)



J U N E 27, 1 9 8 7 (P=- 4.66, B_0= 2.31, L_0= 220.24)

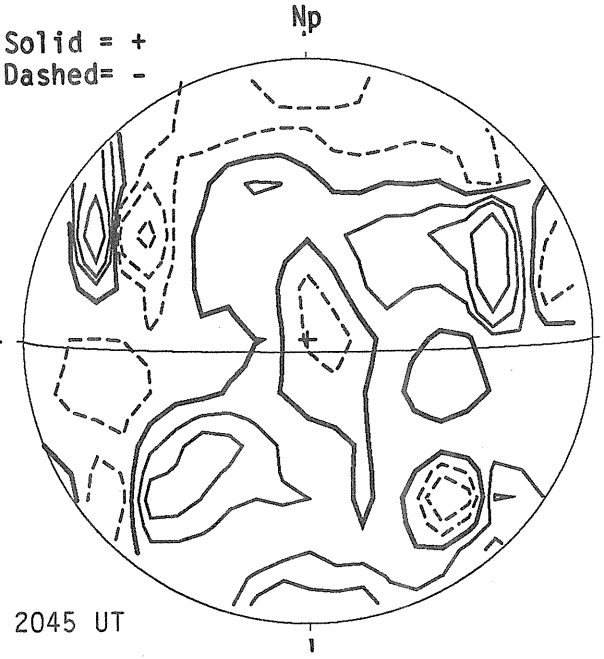
KITT PEAK MAGNETOGRAM

Bright= +
Dark = -



STANFORD MAGNETOGRAM

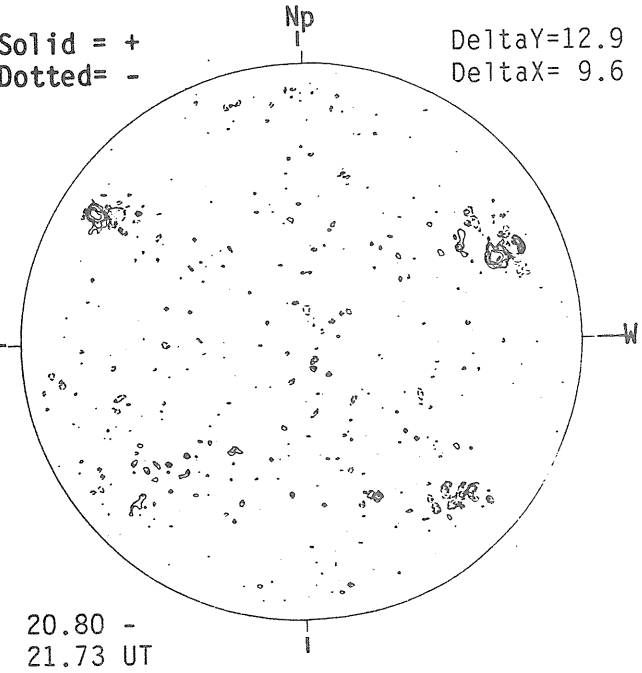
Solid = +
Dashed= -



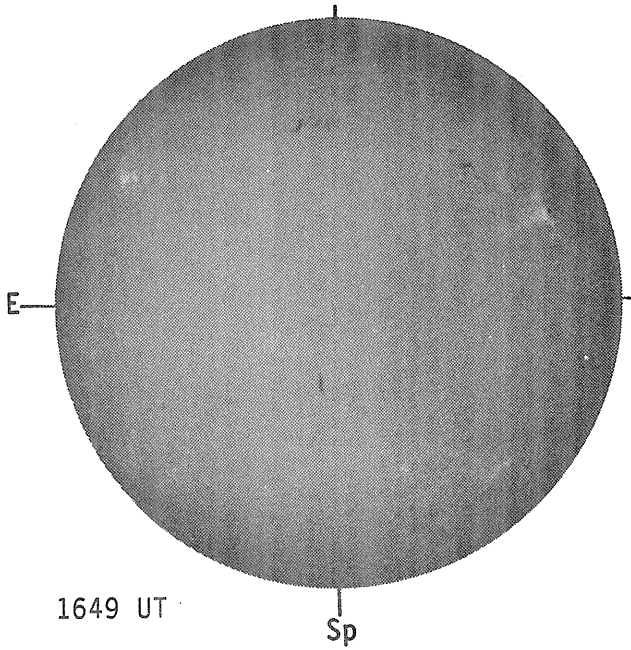
MT. WILSON MAGNETOGRAM

Solid = +
Dotted= -

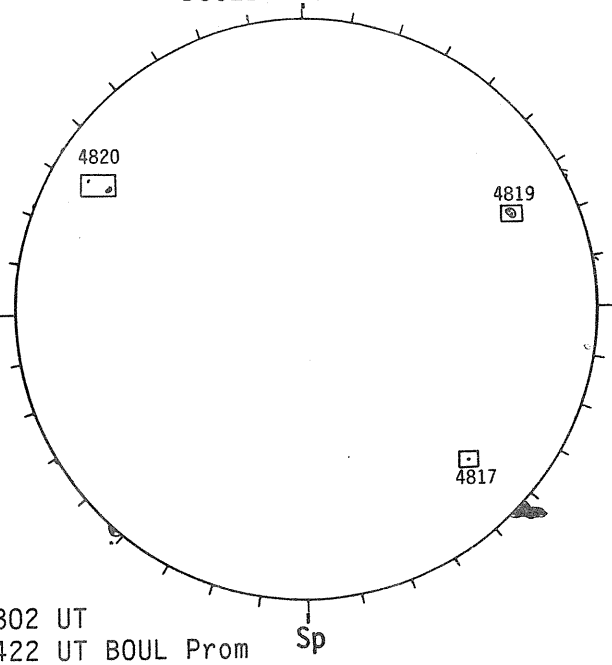
DeltaY=12.9
DeltaX= 9.6



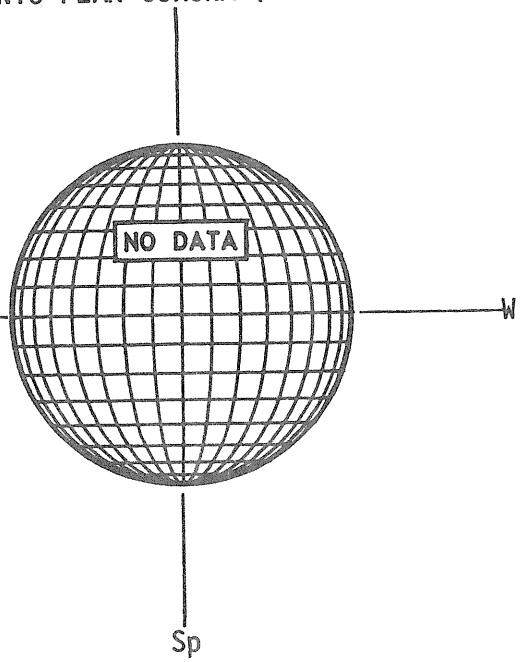
SACRAMENTO PEAK H-ALPHA



BOULDER SUNSPOTS



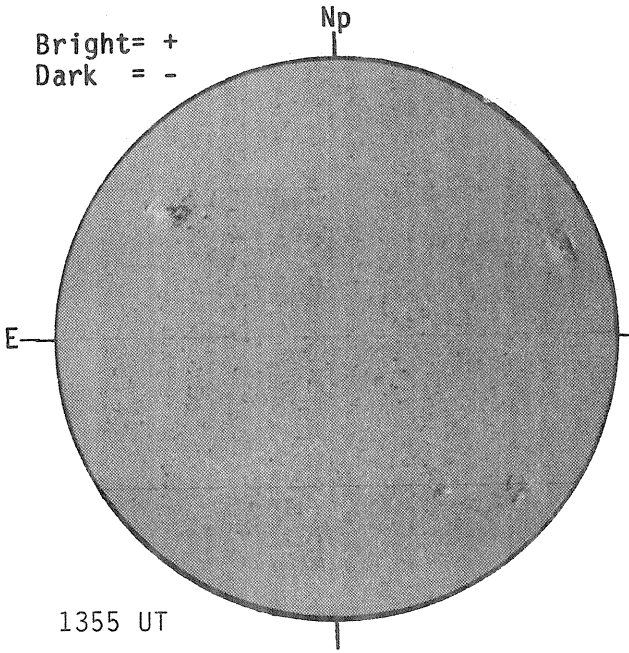
SACRAMENTO PEAK CORONA (1.15 Radii)



J U N E 28, 1 9 8 7 (P=- 4.21, B_o= 2.42, L_o= 207.00)

KITT PEAK MAGNETOGRAM

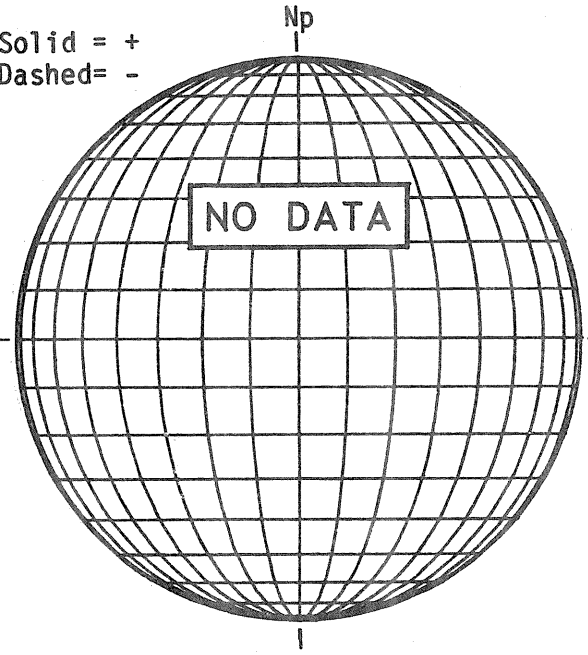
Bright= +
Dark = -



1355 UT

STANFORD MAGNETOGRAM

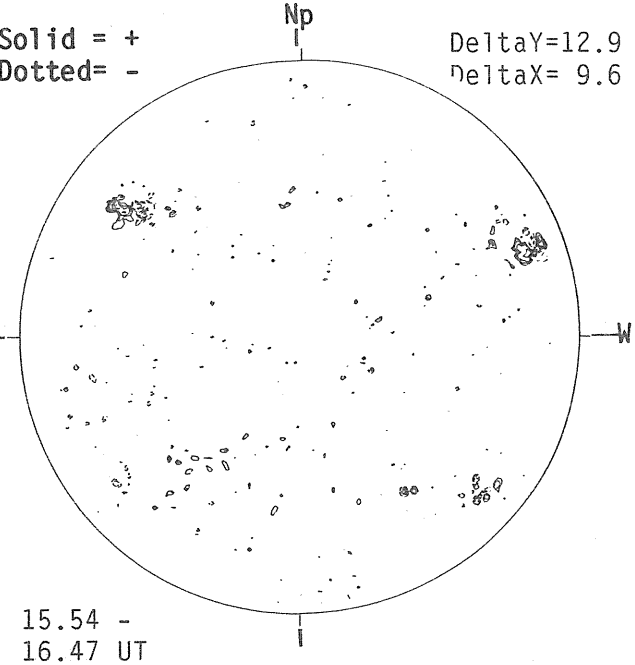
Solid = +
Dashed= -



MT. WILSON MAGNETOGRAM

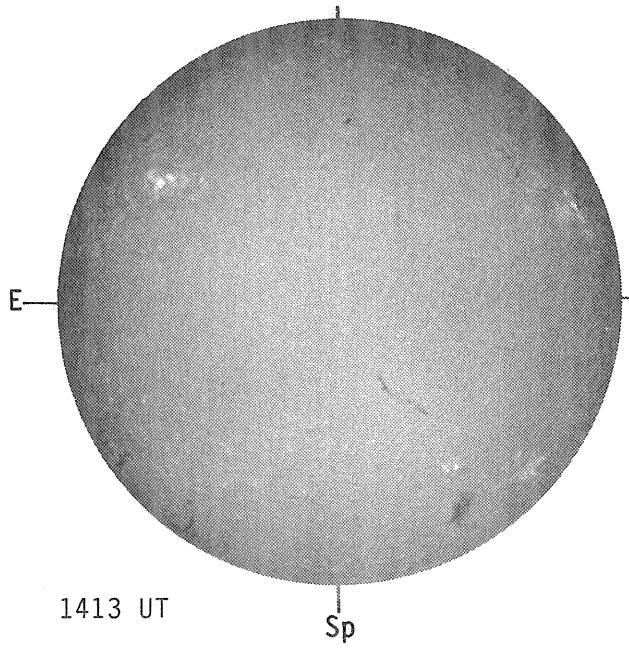
Solid = +
Dotted= -

DeltaY=12.9
DeltaX= 9.6



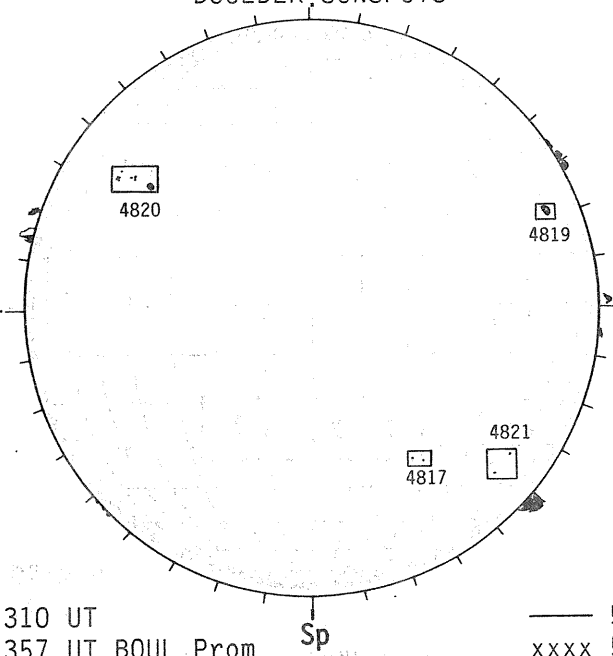
15.54 -
16.47 UT

SACRAMENTO PEAK H-ALPHA



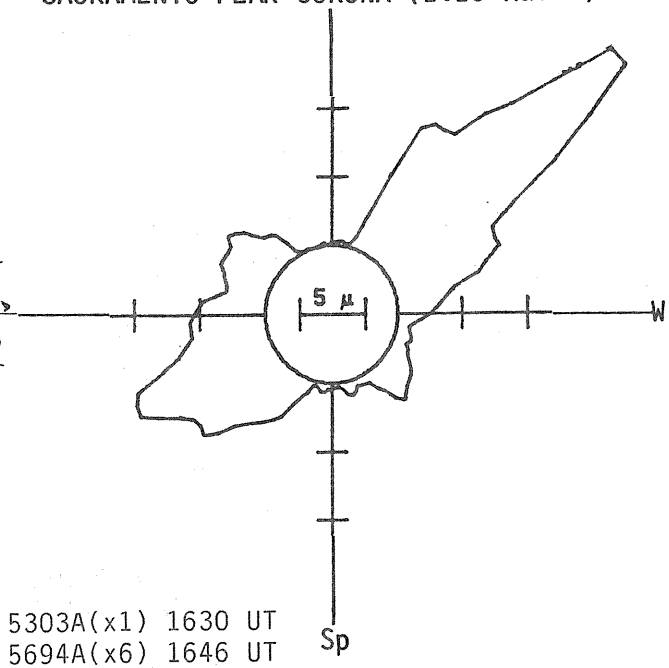
1413 UT

BOULDER SUNSPOTS



1310 UT
1357 UT BOUL Prom

SACRAMENTO PEAK CORONA (1.15 Radii)

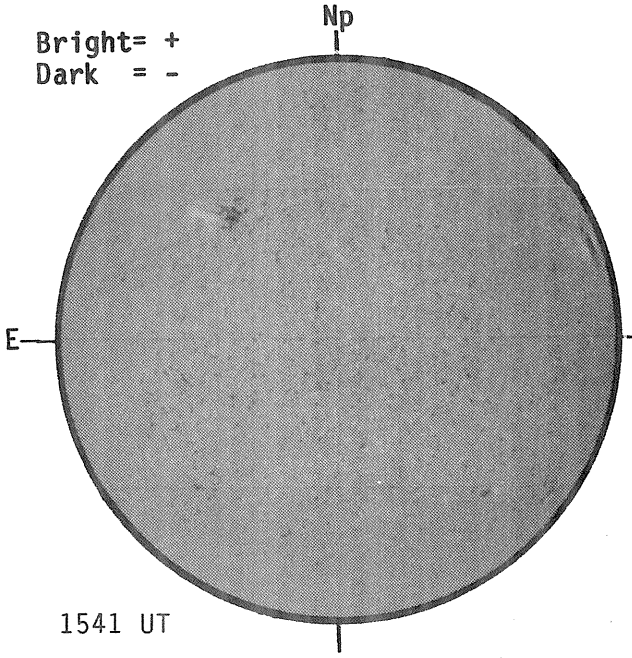


—— 5303A(x1) 1630 UT
xxxx 5694A(x6) 1646 UT
NO 5694A ACTIVITY TODAY

J U N E 29, 1 9 8 7 (P=- 3.76, B_0= 2.54, L_0= 193.77)

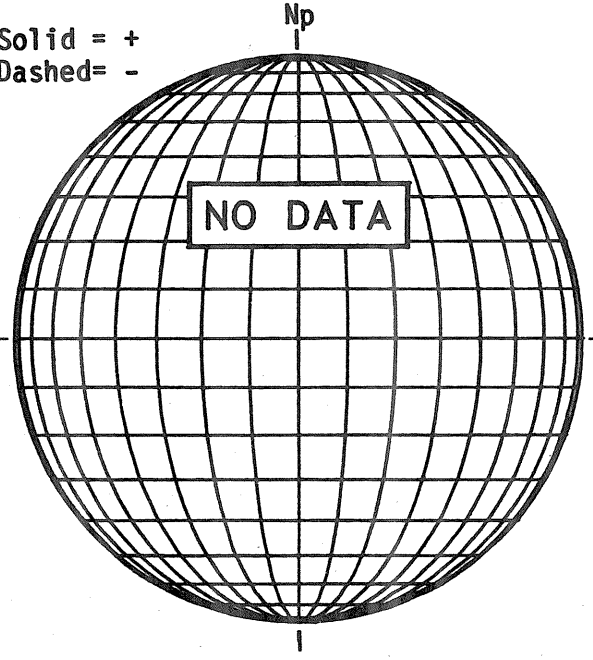
KITT PEAK MAGNETOGRAM

Bright= +
Dark = -



STANFORD MAGNETOGRAM

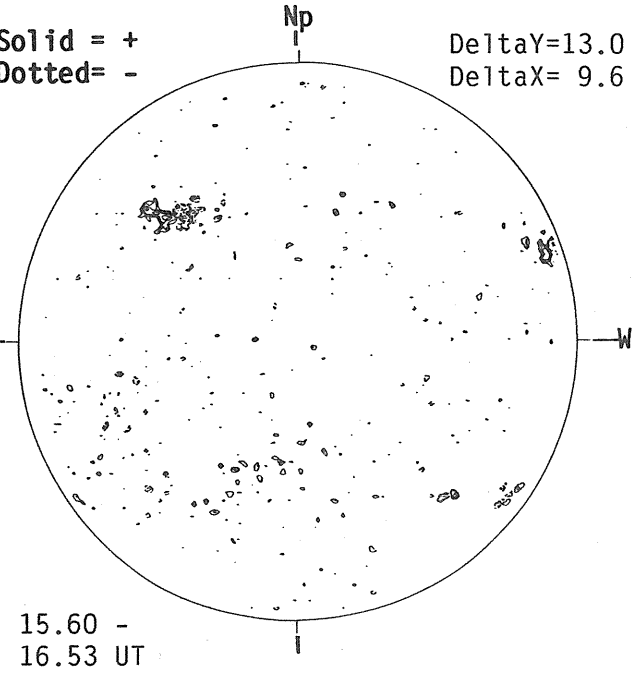
Solid = +
Dashed= -



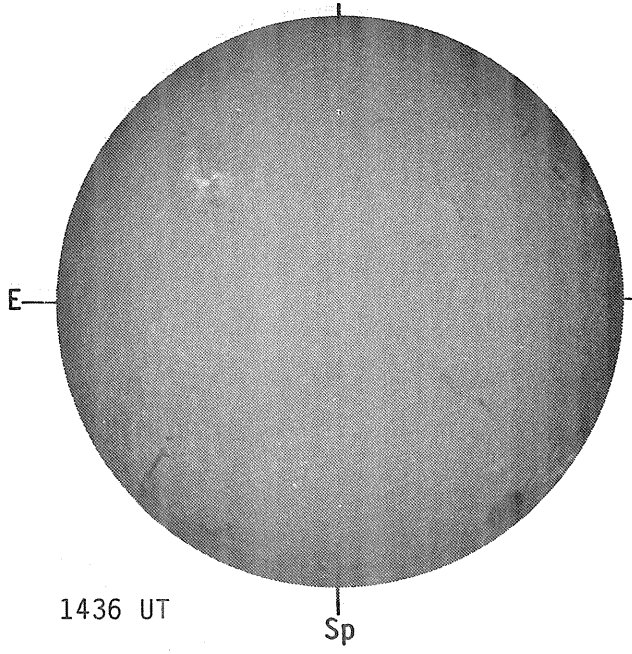
MT. WILSON MAGNETOGRAM

Solid = +
Dotted= -

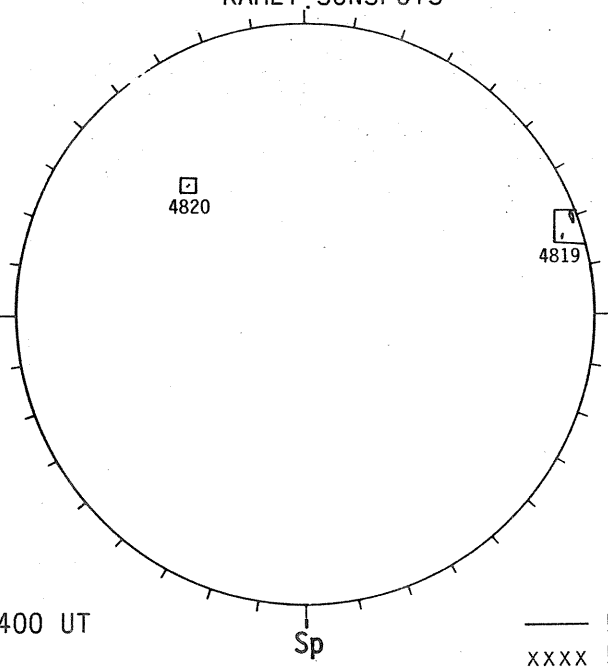
DeltaY=13.0
DeltaX= 9.6



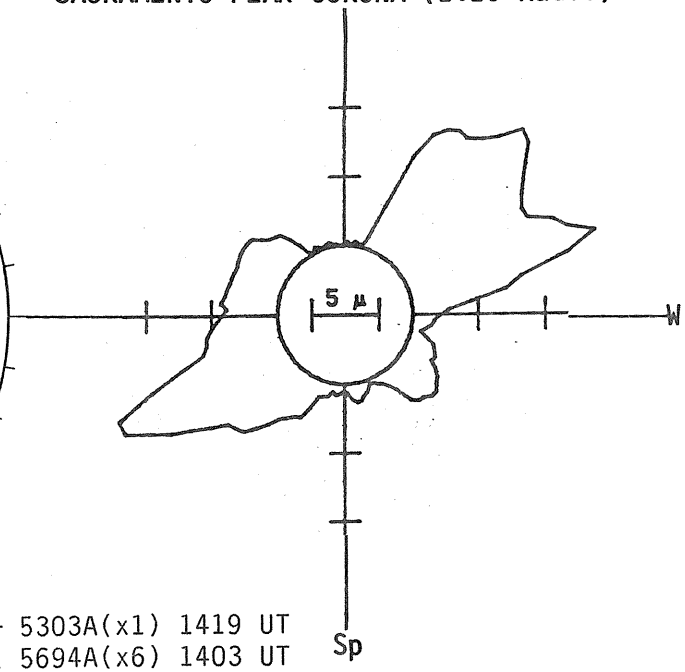
SACRAMENTO PEAK H-ALPHA



RAMEY SUNSPOTS



SACRAMENTO PEAK CORONA (1.15 Radii)

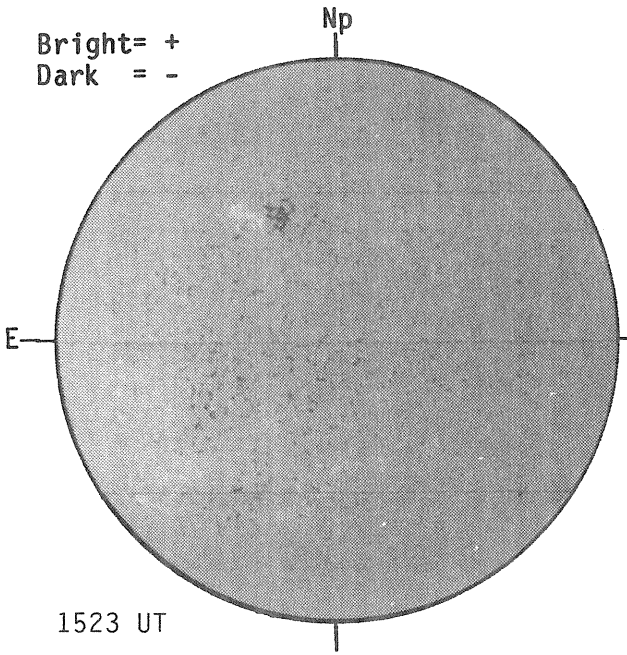


—— 5303A(x1) 1419 UT
xxxx 5694A(x6) 1403 UT
NO 5694A ACTIVITY TODAY

J U N E 30, 1 9 8 7 (P=- 3.31, B_o = 2.65, L_o = 180.53)

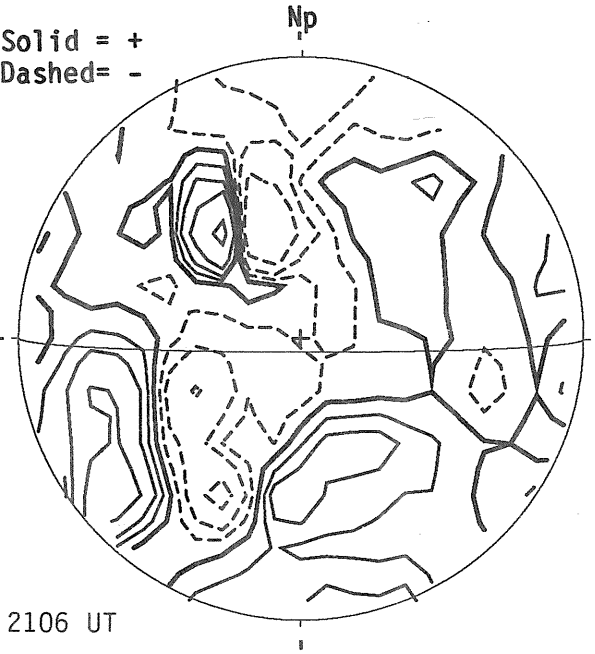
KITT PEAK MAGNETOGRAM

Bright= +
Dark = -



STANFORD MAGNETOGRAM

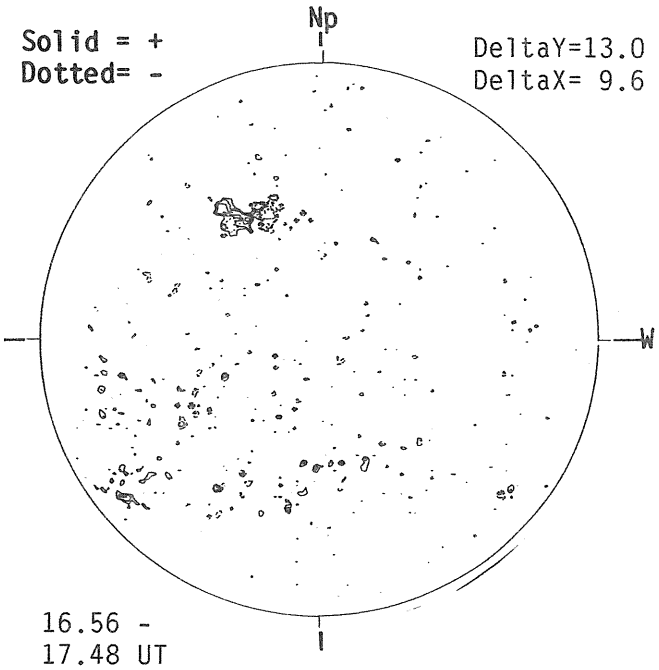
Solid = +
Dashed= -



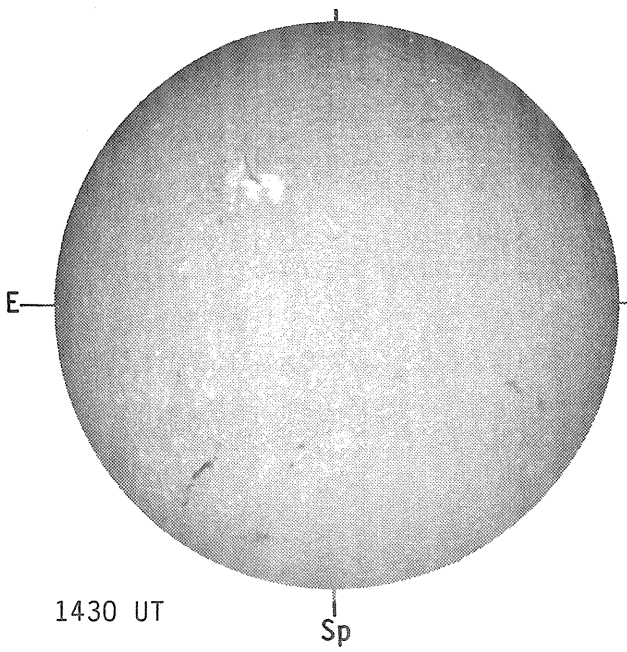
MT. WILSON MAGNETOGRAM

Solid = +
Dotted= -

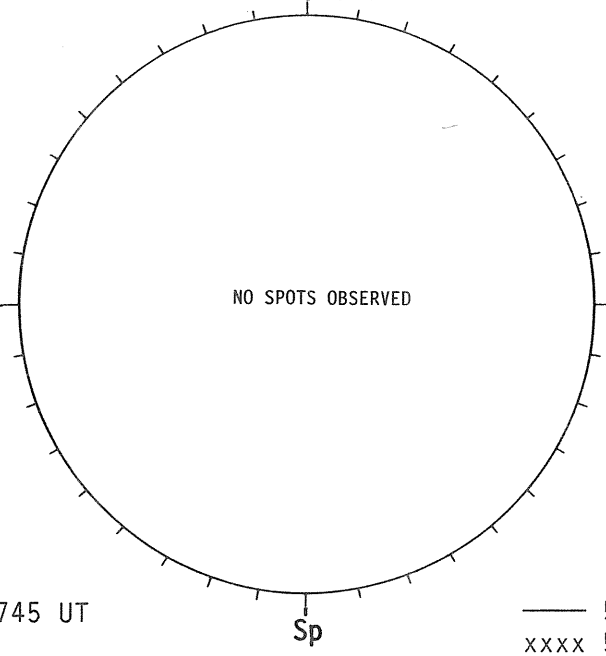
DeltaY=13.0
DeltaX= 9.6



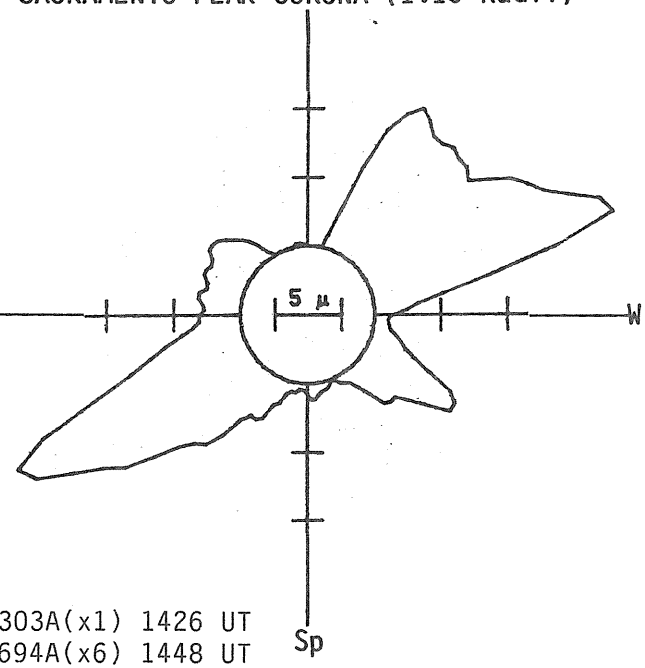
SACRAMENTO PEAK H-ALPHA



RAMEY SUNSPOTS



SACRAMENTO PEAK CORONA (1.15 Radii)



—— 5303A(x1) 1426 UT
xxxx 5694A(x6) 1448 UT
NO 5694A ACTIVITY TODAY

S U N S P O T G R O U P S
(ORDERED BY CENTRAL MERIDIAN PASSAGE DATE)

JUNE 1987

NOAA/ USAF Group	Mt Wilson Group	Sta	Observation Mo	Day	Time (UT)	Lat	CMD	CMP Mo	Day	Max H	Mag Class	Spot Class	Corrected Area (10^{-6} Hemi)	Spot Count	Long. Extent (Deg)	Qual
4814	24403	MWIL	06	11	0100	S19	W15	06	9.9	4	(B)					
4814		SVTO	06	12	0717	S19	W29	06	10.1		B	BXO	20	5	2	3
4814		LEAR	06	12	0736	S19	W29	06	10.1		B	BXO	10	3	3	3
4814		RAMY	06	12	1247	S19	W32	06	10.1		B	BXO	20	3	3	4
4814		BOUL	06	12	1325	S18	W32	06	10.1		B	BXO	20	2	3	3
4814	24403	MWIL	06	12	1400	S20	W33	06	10.1	3	(B)					
4814		HOLL	06	12	1540	S20	W32	06	10.2		B	BXO	20	2	3	3
4814		LEAR	06	13	0328	S20	W38	06	10.2		A	AX	10	1	1	3
4814		SVTO	06	13	0709	S19	W41	06	10.2		A	AX	10	2		4
4813	24404	MWIL	06	11	0100	S11	E06	06	11.5	4	(B)					
4813		HOLL	06	11	1605	S11	W02	06	11.5		B	BXO	10	2	2	3
4813		PALE	06	11	1756	S11	W02	06	11.6		B	BXO	10	2	3	3
4813		RAMY	06	11	2025	S11	W03	06	11.6		B	BXO	10	5	5	3
4813		SVTO	06	12	0717	S10	W09	06	11.6		B	BXO	10	3	3	3
4813		LEAR	06	12	0736	S11	W11	06	11.5		A	AX	10	1	1	3
4813		RAMY	06	12	1247	S12	W15	06	11.4		B	BXO	10	4	3	4
4813		BOUL	06	12	1325	S12	W14	06	11.5		A	AX	10	1	1	3
4813	24404	MWIL	06	12	1400	S12	W14	06	11.5	4	(AF)					
4813		HOLL	06	12	1540	S12	W14	06	11.6		A	AX	10	2	1	3
4813		SVTO	06	13	0709	S12	W24	06	11.5		A	AX		1		4
4813A	24402	MWIL	06	10	1400	S12	E26	06	12.5	3	(AF)					
4816		SVTO	06	17	0553	S05	W02	06	17.1		B	BXO	10	2	2	3
4816		BOUL	06	17	1316	S05	W04	06	17.2		B	BXO	10	5	4	2
4816	24406	MWIL	06	17	1345	S04	W06	06	17.1	3	(B)					
4816		RAMY	06	17	1515	S05	W06	06	17.2		B	BXO	10	3	3	4
4816		HOLL	06	17	1525	S04	W06	06	17.2		B	BXO	10	3	2	4
4816		PALE	06	17	1802	S04	W08	06	17.1		B	BXO	10	2	3	3
4816		LEAR	06	18	0040	S03	W11	06	17.2		B	BXO	10	3	2	3
4816		SVTO	06	18	0544	S06	W13	06	17.3		B	BXO	10	3	2	3
4816	24406	MWIL	06	18	1400	S03	W18	06	17.2	3	(AP)					
4816		HOLL	06	18	1459	S04	W19	06	17.2		A	AX	10	2	1	3
4816		RAMY	06	18	1545	S04	W19	06	17.2		A	AX	10	2	2	3
4815		SVTO	06	12	0717	N27	E84	06	18.8		A	AX		1		3
4815		LEAR	06	12	0736	N28	E79	06	18.5		A	AX	10	1	1	3
4815		RAMY	06	12	1247	N28	E79	06	18.7		A	AX	10	1	1	4
4815	24405	MWIL	06	12	1400	N27	E76	06	18.5	3	(AP)					
4815		HOLL	06	12	1540	N26	E78	06	18.7		A	AX	30	1	1	3
4815		LEAR	06	13	0328	N28	E70	06	18.6		A	AX	10	1	1	3
4815		SVTO	06	13	0709	N28	E68	06	18.6		A	AX	10	1		4
4815		BOUL	06	13	1309	N28	E60	06	18.2		A	AX	20	1	1	2
4815		RAMY	06	13	1310	N27	E64	06	18.5		A	AX	10	1	1	4
4815		HOLL	06	13	1315	N27	E65	06	18.6		A	AX	10	1	1	3
4815	24405	MWIL	06	13	1330	N28	E64	06	18.6	3	(AP)					
4815		PALE	06	13	1955	N28	E60	06	18.5		A	AX	20	1	1	3
4815		LEAR	06	14	0244	N28	E57	06	18.6		A	AX	10	1	1	3
4815		CULG	06	14	0515	N28	E56	06	18.6		A	AX	10	1	1	3
4815		SVTO	06	14	0730	N27	E54	06	18.5		A	AX	10	2	1	2
4815		BOUL	06	14	1306	N27	E49	06	18.4		A	AX	10	1	1	2
4815		RAMY	06	14	1315	N28	E52	06	18.6		A	AX	10	1	1	3
4815	24405	MWIL	06	14	1345	N27	E51	06	18.5	4	(AP)					
4815		HOLL	06	14	1654	N28	E50	06	18.6		A	AX	10	1	1	3
4815		PALE	06	14	2005	N28	E49	06	18.7		A	AX		1		2
4815		LEAR	06	15	0528	N28	E45	06	18.7		A	AX	10	1	1	3
4815		RAMY	06	15	1330	N27	E40	06	18.7		A	AX	10	1	1	3
4815		BOUL	06	15	1421	N25	E38	06	18.5		A	AX		1	1	2
4815		HOLL	06	15	1440	N26	E40	06	18.7		A	AX	10	1	1	3
4815		RAMY	06	17	1515	N25	E10	06	18.4		A	AX	10	2	1	4
4815		HOLL	06	17	1525	N25	E11	06	18.5		A	AX		2	1	4
4815		LEAR	06	18	0040	N25	E05	06	18.4		A	AX	10	2	1	3
4815		SVTO	06	18	0544	N28	E02	06	18.4		B	BXO	10	3	3	3
4815		RAMY	06	18	1545	N30	W06	06	18.2		A	AX	10	1	1	3
4815		PALE	06	18	1726	N30	W05	06	18.3		A	AX	20	1	1	3
4815		CULG	06	19	0405	N31	W14	06	18.1		B	BXO	10	3	3	1
4815		LEAR	06	19	0615	N31	W12	06	18.3		A	AX	10	3	2	3
4815		RAMY	06	19	1520	N31	W17	06	18.3		A	AX	10	2	2	2

S U N S P O T G R O U P S
(ORDERED BY CENTRAL MERIDIAN PASSAGE DATE)

JUNE 1987

NOAA/ USAF Group	Mt Wilson Group	Sta	Observation Mo	Day	Time (UT)	Lat	CMP	Mo	Day	Max H	Mag Class	Spot Class	Corrected Area (10^{-6} Hemi)	Spot Count	Long. Extent (Deg)	Qual
4815A	24407	MWIL	06	18	1400	N32	E07	06	19.1	3	(AF)					
4818		RAMY	06	19	1520	S19	E03	06	19.9		B	BXO	10	2	2	2
4818		LEAR	06	20	0038	S20	W03	06	19.8		B	BXO	10	3	3	4
4818		BOUL	06	20	1308	S20	W12	06	19.6		A	AX		1	1	2
4818	24409	MWIL	06	20	1345	S20	W13	06	19.6	4	(AP)					
4818		PALE	06	20	1815	S20	W15	06	19.6		A	AX		1		3
4818		HOLL	06	20	2020	S20	W16	06	19.6		A	AX		1		3
4819		PALE	06	20	1815	N19	E45	06	24.2		A	AX		1		3
4819		HOLL	06	20	2020	N19	E42	06	24.0		B	BXO	10	2	2	3
4819		LEAR	06	21	0729	N20	E35	06	24.0		B	CRO	30	10	5	3
4819		SVTO	06	21	1100	N19	E34	06	24.0		B	BXO	40	11	6	3
4819		BOUL	06	21	1308	N18	E30	06	23.8		B	CAO	30	10	9	1
4819	24410	MWIL	06	21	1400	N19	E31	06	23.9	5	(B)					
4819		HOLL	06	21	1533	N20	E31	06	24.0		B	DSO	80	11	7	3
4819		PALE	06	21	1836	N19	E29	06	24.0		B	DSO	70	12	6	3
4819		LEAR	06	22	0100	N20	E25	06	23.9		B	DSO	150	15	7	4
4819		CULG	06	22	0430	N19	E24	06	24.0		B	DAI	190	19	8	4
4819		SVTO	06	22	0720	N18	E24	06	24.1		B	DSO	110	19	7	3
4819	24410	MWIL	06	22	1415	N19	E17	06	23.9	5	(B)					
4819		BOUL	06	22	1419	N18	E17	06	23.9		B	DAI	190	12	8	2
4819		HOLL	06	22	1650	N19	E18	06	24.1		B	DSO	180	23	9	3
4819		PALE	06	22	1754	N19	E17	06	24.0		B	DSI	200	25	8	3
4819		LEAR	06	23	0001	N20	E14	06	24.1		B	DSO	170	21	8	4
4819		CULG	06	23	0500	N19	E09	06	23.9		B	DSO	230	14	8	1
4819		SVTO	06	23	0540	N19	E09	06	23.9		B	DSO	130	18	8	3
4819	24410	MWIL	06	23	1400	N19	E03	06	23.8	6	(B)					
4819		HOLL	06	23	1515	N19	E05	06	24.0		B	DSO	170	20	8	3
4819		BOUL	06	23	1618	N18	E03	06	23.9		B	CAO	140	13	8	2
4819		RAMY	06	23	1710	N20	E03	06	23.9		B	DHO	260	18	9	3
4819		PALE	06	23	1757	N19	E02	06	23.9		B	DSI	200	22	8	3
4819		LEAR	06	24	0021	N18	W02	06	23.9		B	CSO	120	18	8	3
4819		CULG	06	24	0300	N19	W01	06	24.0		B	DSO	110	10	9	1
4819		SVTO	06	24	0618	N19	W06	06	23.8		B	DSI	240	22	9	4
4819		BOUL	06	24	1325	N19	W11	06	23.7		B	CAO	130	13	8	2
4819	24410	MWIL	06	24	1400	N20	W08	06	24.0	5	(B)					
4819		RAMY	06	24	1414	N19	W08	06	24.0		B	CSI	220	22	8	3
4819		HOLL	06	24	1445	N20	W09	06	23.9		B	DSO	160	21	9	3
4819		PALE	06	24	1726	N20	W10	06	24.0		B	DSO	210	21	9	4
4819		LEAR	06	25	0456	N20	W17	06	23.9		B	CSO	90	12	8	4
4819		SVTO	06	25	0549	N20	W19	06	23.8		B	CSO	200	16	9	4
4819		BOUL	06	25	1343	N18	W20	06	24.0		B	CAO	220	8	9	4
4819	24410	MWIL	06	25	1345	N20	W22	06	23.9	5	(B)					
4819		RAMY	06	25	1445	N19	W22	06	23.9		B	CSO	190	9	8	2
4819		HOLL	06	25	1520	N19	W22	06	23.9		B	CSO	160	10	9	3
4819		PALE	06	25	1658	N19	W23	06	23.9		B	CSO	200	12	10	4
4819		LEAR	06	26	0051	N20	W27	06	24.0		B	CSO	140	7	9	3
4819		CULG	06	26	0405	N19	W29	06	23.9		B	CSO	90	8	9	2
4819		SVTO	06	26	0545	N20	W28	06	24.1		B	CSO	160	12	10	4
4819		BOUL	06	26	1330	N19	W35	06	23.9		B	CAO	180	6	6	3
4819		RAMY	06	26	1340	N19	W35	06	23.9		B	CSO	170	5	7	3
4819	24410	MWIL	06	26	1345	N20	W38	06	23.7	4	(BP)					
4819		HOLL	06	26	1745	N20	W36	06	24.0		B	CSO	170	7	7	2
4819		PALE	06	26	1850	N20	W38	06	23.9		B	CSO	140	6	6	3
4819		LEAR	06	27	0005	N20	W39	06	24.0		B	CHO	130	6	10	3
4819		CULG	06	27	0355	N21	W47	06	23.5		A	HS	120	1	1	1
4819		BOUL	06	27	1302	N21	W49	06	23.8		A	HA	150	2	2	1
4819	24410	MWIL	06	27	1345	N20	W50	06	23.7	5	(BP)					
4819		RAMY	06	27	1415	N20	W52	06	23.6		A	HS	140	1	3	4
4819		HOLL	06	27	1550	N19	W53	06	23.6		A	HS	170	1	2	3
4819		PALE	06	27	1920	N16	W51	06	23.9		B	CSO	110	2	7	1
4819		LEAR	06	28	0008	N19	W52	06	24.0		B	CHO	140	2	9	2
4819		SVTO	06	28	0540	N19	W55	06	24.0		B	CSO	120	2	7	3
4819		BOUL	06	28	1310	N21	W62	06	23.8		A	HA	100	2	2	2
4819	24410	MWIL	06	28	1345	N20	W64	06	23.7	5	(BP)					
4819		RAMY	06	28	1430	N21	W65	06	23.6		A	HS	100	1	3	4
4819		HOLL	06	28	1445	N19	W63	06	23.8		A	HA	90	1	1	2
4819		PALE	06	28	1900	N21	W68	06	23.6		A	HS	100	2	2	2

S U N S P O T G R O U P S
(ORDERED BY CENTRAL MERIDIAN PASSAGE DATE)

JUNE 1987

NOAA/ USAF Group	Mt Wilson Group	Sta	Observation Time Mo	Day	(UT)	Lat	CMD	CMP Mo	Day	Max H	Mag Class	Spot Class	Corrected Area (10^{-6} Hemi)	Spot Count	Long. Extent (Deg)	Qual
4819		LEAR	06	29	0135	N21	W72	06	23.5		B	CAO	110	2	3	3
4819		CULG	06	29	0525	N21	W73	06	23.6		A	HS	120	1	3	2
4819		SVTO	06	29	0850	N20	W70	06	24.0		B	CSO	140	2	6	3
4819		HOLL	06	29	1315	N20	W75	06	23.8		A	HA	80	2	1	4
4819	24410	MWIL	06	29	1345	N20	W76	06	23.8	4	(BP)					
4819		RAMY	06	29	1400	N19	W75	06	23.8		A	HS	90	1	2	1
4819		PALE	06	29	1733	N21	W80	06	23.6		A	HS	100	1	2	3
4819		LEAR	06	30	0350	N21	W89	06	23.3		A	HA	30	1	1	2
4819		CULG	06	30	0445	N23	W85	06	23.6		A	HS	120	1	1	2
4817		LEAR	06	18	0040	S32	E78	06	24.2		A	HS	10	1	1	3
4817		SVTO	06	18	0544	S31	E77	06	24.3		A	HA	30	1	2	3
4817	24408	MWIL	06	18	1400	S32	E73	06	24.4	5	(AP)					
4817		HOLL	06	18	1459	S31	E73	06	24.4		A	HS	120	1	2	3
4817		RAMY	06	18	1545	S28	E71	06	24.2		A	HH	20	1	3	3
4817		PALE	06	18	1726	S31	E72	06	24.4		A	HS	120	1	2	3
4817		BOUL	06	18	1940	S31	E68	06	24.2		A	HS	80	1	2	3
4817		CULG	06	19	0405	S33	E70	06	24.7				60	1	2	1
4817		LEAR	06	19	0615	S32	E66	06	24.5		A	HH	140	2	3	3
4817		SVTO	06	19	0753	S31	E66	06	24.5		B	CHO	110	2	4	3
4817		HOLL	06	19	1343	S31	E59	06	24.2		A	HS	70	2	2	3
4817	24408	MWIL	06	19	1345	S30	E60	06	24.3	5	(AP)					
4817		BOUL	06	19	1345	S31	E61	06	24.4		A	HS	100	2	2	3
4817		RAMY	06	19	1520	S30	E61	06	24.4		B	CSO	20	2	3	2
4817		PALE	06	19	1701	S31	E58	06	24.3		A	HS	110	2	3	3
4817		LEAR	06	20	0038	S30	E56	06	24.4		A	HS	140	2	2	4
4817		BOUL	06	20	1308	S31	E48	06	24.3		A	HS	60	2	3	2
4817	24408	MWIL	06	20	1345	S30	E49	06	24.4	5	(BP)					
4817		PALE	06	20	1815	S31	E47	06	24.5		A	HS	90	2	2	3
4817		HOLL	06	20	2020	S30	E45	06	24.4		A	HS	50	2	2	3
4817		LEAR	06	21	0729	S31	E40	06	24.5		A	HS	90	2	2	3
4817		SVTO	06	21	1100	S30	E36	06	24.3		B	DSO	90	2	3	3
4817		BOUL	06	21	1308	S30	E34	06	24.2		A	HS	40	2	3	1
4817	24408	MWIL	06	21	1400	S31	E35	06	24.3	5	(AP)					
4817		HOLL	06	21	1533	S31	E35	06	24.4		A	HS	90	4	3	3
4817		PALE	06	21	1836	S31	E34	06	24.4		A	HS	50	2	2	3
4817		LEAR	06	22	0100	S31	E30	06	24.4		A	HS	90	3	3	4
4817		CULG	06	22	0430	S31	E28	06	24.4		B	DRO	80	3	3	4
4817		SVTO	06	22	0720	S31	E27	06	24.4		B	DSO	70	3	3	3
4817	24408	MWIL	06	22	1415	S31	E22	06	24.3	4	(AP)					
4817		BOUL	06	22	1419	S30	E22	06	24.3		B	CAO	30	3	3	2
4817		HOLL	06	22	1650	S31	E22	06	24.4		A	HS	30	3	2	3
4817		PALE	06	22	1754	S31	E21	06	24.4		A	HS	40	3	2	3
4817		LEAR	06	23	0001	S31	E18	06	24.4		A	HS	40	3	2	4
4817		CULG	06	23	0500	S32	E13	06	24.2		B	CSO	50	3	3	1
4817		SVTO	06	23	0540	S31	E15	06	24.4		B	CSO	40	3	2	3
4817	24408	MWIL	06	23	1400	S31	E10	06	24.4	5	(AP)					
4817		HOLL	06	23	1515	S31	E09	06	24.3		A	HS	40	2	2	3
4817		BOUL	06	23	1618	S30	E20	06	24.2		A	HS	70	1	2	2
4817		RAMY	06	23	1710	S31	E08	06	24.3		A	HS	50	1	2	3
4817		PALE	06	23	1757	S32	E07	06	24.3		A	HS	50	1	2	3
4817		LEAR	06	24	0021	S30	E05	06	24.4		A	HS	20	1	1	3
4817		CULG	06	24	0300	S31	E02	06	24.3		A	HS	10	1	1	1
4817		SVTO	06	24	0618	S31	E01	06	24.3		A	HS	50	1	1	4
4817		BOUL	06	24	1325	S30	W04	06	24.2		A	AX	10	1	1	2
4817	24408	MWIL	06	24	1400	S31	W02	06	24.4	5	(AP)					
4817		RAMY	06	24	1414	S32	W03	06	24.3		A	HS	50	2	2	3
4817		HOLL	06	24	1445	S31	W03	06	24.4		A	HS	30	1	1	3
4817		PALE	06	24	1726	S32	W05	06	24.3		A	HS	50	1	1	4
4817		LEAR	06	25	0001	S31	W07	06	24.4		A	HS	10	1	1	4
4817		SVTO	06	25	0549	S31	W11	06	24.4		A	HS	40	1	1	4
4817		BOUL	06	25	1343	S30	W15	06	24.4		A	AX	10	1	1	4
4817	24408	MWIL	06	25	1345	S32	W15	06	24.4	4	(AP)					
4817		RAMY	06	25	1445	S32	W14	06	24.5		A	HA	30	1	2	2
4817		HOLL	06	25	1520	S31	W15	06	24.4		A	HS	30	1	1	3
4817		PALE	06	25	1658	S32	W18	06	24.3		A	HS	30	1	1	4
4817		LEAR	06	26	0051	S32	W22	06	24.3		A	AX	10	2	1	3
4817		CULG	06	26	0405	S31	W21	06	24.5		A	HS	10	1	1	2
4817		SVTO	06	26	0545	S31	W23	06	24.4		A	HS	10	1	1	4

S U N S P O T G R O U P S
(ORDERED BY CENTRAL MERIDIAN PASSAGE DATE)

JUNE 1987

NOAA/ USAF Group	Mt Wilson Group	Sta	Observation Mo	Day	Time (UT)	Lat	CMD	CMP Mo	Day	Max H	Mag Class	Spot Class	Corrected Area (10^{-6} Hemi)	Spot Count	Long. Extent (Deg)	Qual
4817		BOUL	06	26	1330	S30	W28	06	24.4		A	AX	10	1	1	3
4817		RAMY	06	26	1340	S31	W28	06	24.4		A	HA	20	1	1	3
4817	24408	MWIL	06	26	1345	S32	W28	06	24.4	4	(AP)					
4817		HOLL	06	26	1745	S31	W29	06	24.4		A	HS	20	1	1	2
4817		PALE	06	26	1850	S33	W30	06	24.4		A	HA	10	1	1	3
4817		LEAR	06	27	0005	S32	W33	06	24.4		A	AX	10	1	1	3
4817		CULG	06	27	0355	S30	W38	06	24.2		A	AX	10	1		1
4817		BOUL	06	27	1302	S29	W39	06	24.5		A	AX	10	1	1	1
4817	24408	MWIL	06	27	1345	S32	W40	06	24.4	4	(AP)					
4817		RAMY	06	27	1415	S32	W41	06	24.3		A	AX	10	1	1	4
4817		HOLL	06	27	1550	S32	W42	06	24.3		A	AX	10	1	1	3
4817		PALE	06	27	1920	S32	W43	06	24.4		A	AX	10	1	1	1
4817		LEAR	06	28	0008	S32	W44	06	24.5		A	AX	10	1	1	2
4817		SVTO	06	28	0540	S32	W46	06	24.6		B	BXO	10	3	1	3
4817		BOUL	06	28	1310	S30	W52	06	24.4		B	BXO	10	2	5	2
4817	24408	MWIL	06	28	1345	S33	W52	06	24.4	3	(BP)					
4817		RAMY	06	28	1430	S33	W52	06	24.5		B	BXO	10	2	4	4
4817		HOLL	06	28	1445	S33	W51	06	24.6		B	BXO	10	2	5	2
4821		PALE	06	27	1920	S32	W17	06	26.4		B	BXO	10	2	3	1
4821		LEAR	06	28	0008	S32	W17	06	26.6		B	BXO	10	2	3	2
4821		SVTO	06	28	0540	S31	W20	06	26.6		A	AX	10	1	3	3
4821		BOUL	06	28	1310	S29	W26	06	26.5		B	BXO	10	3	2	2
4821	24412	MWIL	06	28	1345	S31	W26	06	26.5	4	(B)					
4821		RAMY	06	28	1430	S32	W27	06	26.5		B	BXO	10	4	4	4
4821		HOLL	06	28	1445	S31	W28	06	26.4		B	BXO	10	2	2	2
4821		PALE	06	28	1900	S32	W31	06	26.3		A	AX		2	1	2

Stations reporting:

BOUL = Boulder
CULG = Culgoora
HOLL = Holloman
LEAR = Learmonth
MWIL = Mt. Wilson
PALE = Palehua
RAMY = Ramey
SVTO = San Vito

SUDDEN IONOSPHERIC DISTURBANCES

JUNE 1987

Day	Start (UT)	Max (UT)	End (UT)	Imp	Wide-spread Index	Number of Station Reports by Type SWF	SEA	SPA	LF-SPA	SES	Known Flare	X-ray Class	NOAA/SESC Region
02	0827	0837	0840	1-	1		1				No flare		
02	1934	1936	1958	1	1	1					No flare		
03	1245	1250	1256	1-	1		1				No flare		
05	0334	0348	0515	1	1		1				No flare		
05	1358	1416	1455	1	1		1				No flare		
05	1633	1635	1640	1-	1	1					No flare		
05	1951	1951	2001	1-	1	1					No flare		
08	0937	0950U	1040U	1	1		1				No flare		
08	1050	1100	1120	1	3		2				No flare		
08	1505	1514	1528	1	1	1					No flare		
09	1902	1909	1916	1-	1	1					No flare		
10	0922	1025	1110	1	3		2				No flare		
10	1629	1635	1640	1-	1	1					No flare		
11	0156	0246	0447	1-	1			1			No flare		
11	0926	0928	0947	1	1		1				No flare		
11	1300	1319	1356	1	3		2				No flare		
12	1110	1145	1207	1	3		2				No flare		
12	1404	1417	1450	1	1		1				No flare		
13	0952	1036	1101	1	3		2				No flare		
15	1444	1453	1509	1-	1	1					No flare		
16	0603	0620	0644	1	1		1				No flare		
16	0707	0720	0738	1	3		2				0710 UT		No data
16	0809	0820	0843	1	3		2				No flare		
16	0931	0950	1014	1-	1		1				No flare		
17	1637	1648	1702	1	1	1					No flare		
18	0738	0749	0816	1	3		2				No flare		
22	1218	1223	1230	1-	1		1				1217 UT		No data
22	1616	1621	1644	1	1	1					No flare		
22	2022	2033	2036	1-	1	1					2018 UT		4819
23	1224	1234	1340	1-	1	1					1227 UT		No data
24	1354	1359	1407	1-	3	1	3				1356 UT		No data
25	1005	1042	1053	1	3		2				No flare		
25	1551	1632	1658	1	1	1					No flare		
26	0311	0330	0356	1-	1			1			0309 UT		No data
29	1315	1356	1419	1-	1		1				No flare		
29	1712	1723	1736	1	1	1					No flare		
29	1809	1816	1827	1	1	1					No flare		

SUDDEN IONOSPHERIC DISTURBANCES

JUNE 1987

OBSERVATORIES REPORTING FOR JUNE 1987**

Ayrshire, Scotland	SES	Maui, Hawaii, USA	SWF
Darmstadt, German Federal Republic	SWF	Panska Ves, Czechoslovakia	SEA, SWF, SES
Edenvale, Republic of S. Africa	SES	Paterson, New Jersey, USA (A03)	SES
Farsta, Sweden	SES	Paterson, New Jersey, USA (A46)	SES
Hiraiso, Japan	SWF	Rimavska Sobota, Czechoslovakia	SEA
Houston, Texas, USA	SES	Sofia, Bulgaria	SES
Huancayo, Peru	SWF	Somesworth, New Hampshire, USA	SES
Inubo, Japan	SPA	Tavares, Florida, USA	SES
Kandilli, Turkey	SEA	Tucson, Arizona, USA	SES
Latrobe, Pennsylvania, USA	SES	Upice, Czechoslovakia	SEA
Lintong, Peoples Republic of China	SPA	Valley Cottage, New York, USA	SES
Louisville, Kentucky, USA	SES	Zilina, Czechoslovakia	SEA

**Observations are not necessarily continuous.

SIDs by NOAA/SESC REGIONS

JUNE 1987

Day:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
Region No.	Number of events in active regions																														
4819																						1									
	Number of events with X-ray flares																														
	Number of events with no flare reported																														
		2	1		4			3	1	2	3	2	1		1	4	1	1				1		1	2				3		
	Number of events with no flare patrol																														
	Number of events with flare but no active region																														
																1						1	1	1		1					
Event Totals		2	1		4			3	1	2	3	2	1		1	5	1	1				3	1	2	2	1			3		

SOLAR RADIO EMISSION
SPECTRAL OBSERVATIONS

JUNE 1987

Day	Observation Start (UT)	Observation End (UT)	Sta	Decimetric Band Start (UT)	Decimetric Band End (UT)	Decimetric Band Int (1-3)	Metric Band Start (UT)	Metric Band End (UT)	Metric Band Int (1-3)	Dekametric Band Start (UT)	Dekametric Band End (UT)	Dekametric Band Int (1-3)	Spectral Type
01	0413	1847	WEIS										
02			PALE				0001.0	0002.0	1				III
	0411	0517	WEIS										
	0555	1146	WEIS										
	1251	1848	WEIS										
03	0410	0825	WEIS										
	0848	1849	WEIS										
04	0410	1849	WEIS										
05	0410	1609	WEIS										
	1756	1850	WEIS										
			PALE				2011.0	2011.0	1				III
06	0409	1850	WEIS										
07	0410	0835	WEIS										
08	0408	1851	WEIS										
09	0410	0928	WEIS										
	0952	1853	WEIS										
10			SVTO				1247.0	1247.0	2				III
	0408	1449	WEIS				1247.2	1249.3	2				IIIB
	1505	1853	WEIS										
11	0410	1634	WEIS										
			SVTO				0559.0	0600.0	2				III
			SVTO				1351.0	1352.0	1				III
	1636	1854	WEIS										
			PALE				1939.0	1939.0	1				III
12	0407	1854	WEIS										
13	0409	0711	WEIS										
	1006	1855	WEIS										
14	0407	1429	WEIS										
	1432	1854	WEIS										
15	0409	1856	WEIS										
16	0407	0515	WEIS										
	0600	1856	WEIS										
17	0409	1856	WEIS										
18	0408	1231	WEIS										
	1322	1855	WEIS										
19	0410	1842	WEIS										
20			SVTO				0428.0	0428.0	2				III
	0848	1857	WEIS										
21	0410	1858	WEIS										
			PALE				1757.0	1758.0	1				III
			SVTO				1757.0	1757.0	2				III
22	0408	1554	WEIS										
	1557	1857	WEIS										
			PALE				2118.0	2125.0	1				V
23	0410	1858	WEIS										
24	0409	0620	WEIS										
	0647	1300	WEIS										
	1322	1857	WEIS										

SOLAR RADIO EMISSION SPECTRAL OBSERVATIONS

JUNE 1987

Day	Observation Start (UT)	Observation End (UT)	Sta	Decimetric Band Start (UT)	Decimetric Band End (UT)	Decimetric Band Int (1-3)	Metric Band Start (UT)	Metric Band End (UT)	Metric Band Int (1-3)	Dekametric Band Start (UT)	Dekametric Band End (UT)	Dekametric Band Int (1-3)	Spectral Type
24			CULG				2209.0	2209.0	1				III
25	0410	1858	WEIS										
26	0410	1428	WEIS										
	1444	1857	WEIS										
27	0411	0906	WEIS										
	1031	1858	WEIS										
			SVTO				1035.0	1035.0	2				III
28	0410	0642	WEIS										
	1536	1857	WEIS										
29	0635	1715	WEIS										
30			LEAR				0213.0	0214.0	1				V
			PALE				0213.0	0213.0	1				III
			CULG				0214.0	0215.0	1				III
	0537	1857	WEIS										

The symbols used under the column heading SPECTRAL TYPE have the following definitions:

B = Single burst
G = Small group (< 10) of bursts
GG = Large group (> 10) of burst
C = Underlying continuum (particularly with Type I)
S = Storm in the sense of intermittent but apparently connected activity
N = Intermittent activity in this period
U = U-shaped burst of Type III

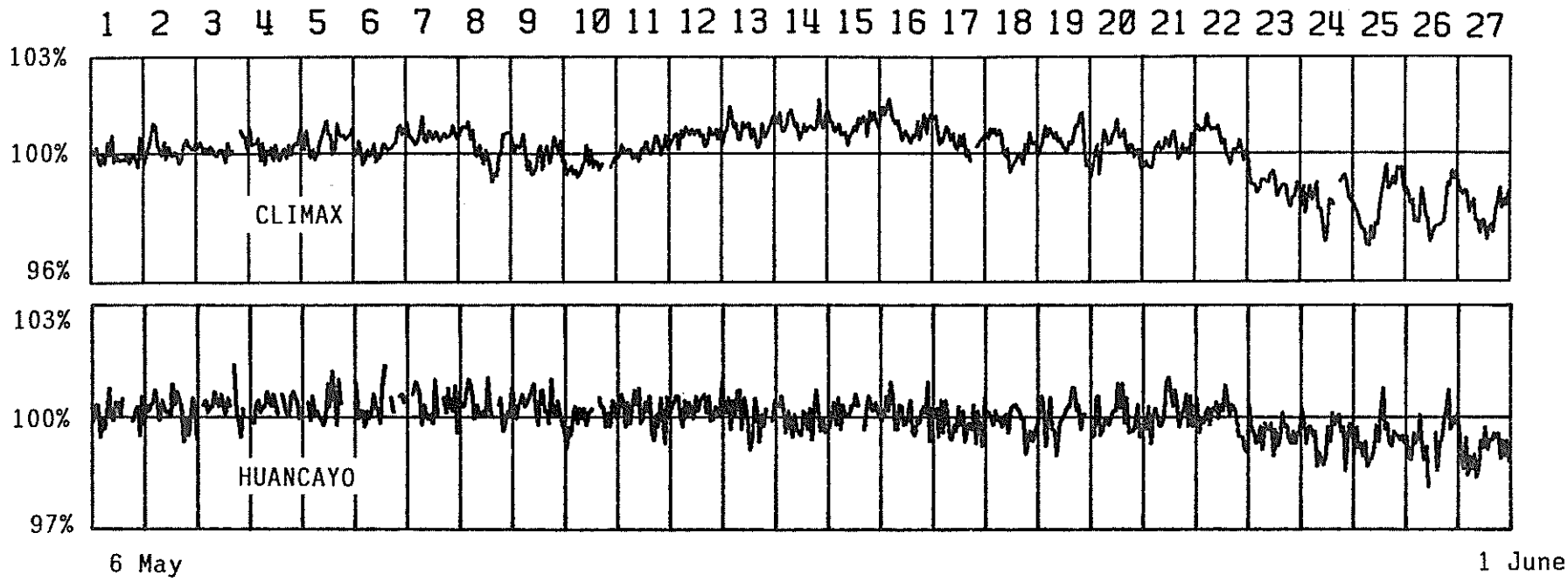
RS = Reverse slope burst
DP = Drifting pairs
DC = Drifting Chains
H = Herringbone
W = Weak
P = Pulsations
CONT = Continuum
UNCLF = Unclassified activity
DCIM = Fast drift

Stations Reporting:

CULG = Culgoora
LEAR = Learmonth
PALE = Palehua
SGMR = Sagamore Hill
SVTO = San Vito
WEIS = Weissenau

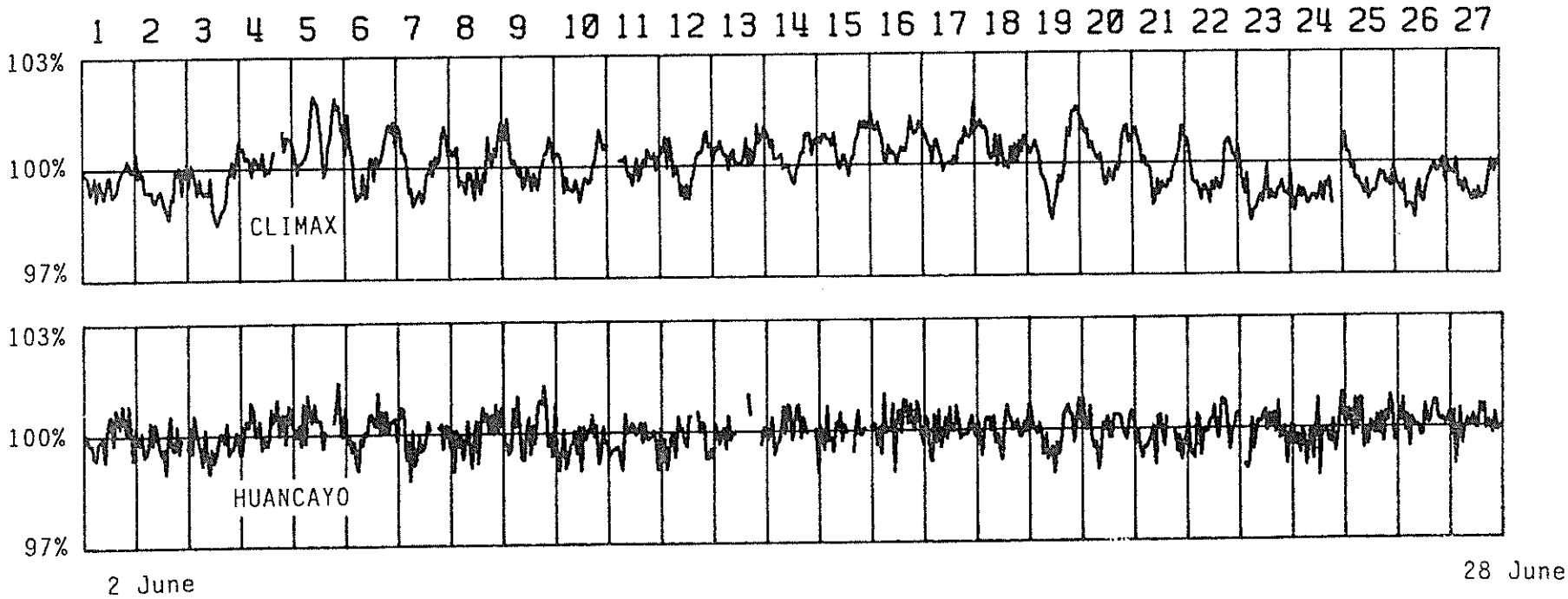
COSMIC RAY INDICES
(Neutron Monitors)

Bartels Rotation 2101 (6 May - 1 June 1987)



COSMIC RAY INDICES
(Neutron Monitors)

Bartels Rotation 2102 (2-28 June 1987)



77
Jun 87

COSMIC RAY INDICES
(Neutron Monitor)

JUNE 1987

Day	THULE Average (cts/h)/100	ALERT Average (cts/h)/100	DEEP RIVER Average (cts/h)/300	KIEL Average (cts/h)/100	CLIMAX Average (cts/h)/100	PREDIGTSTUHL Average (cts/h)/100	TOKYO Average (cts/h)/256	HUANCAYO Average (cts/h)/100
1				6299.3	4193.1			1781.7
2				6309.1	4192.0			1783.3
3				6327.9	4184.2			1779.0
4				6321.1	4183.6			1778.1
5				6347.3	4219.0			1786.8
6				6385.4	4241.4			1788.7
7				6358.0	4214.3			1783.7
8				6341.4	4205.7			1780.4
9				6336.7	4206.2			1782.9
10				6338.3	4210.4			1784.3
11				6314.0	4200.8			1777.3
12				6332.4	4207.9			1778.9
13				6337.3	4208.7			1778.8
14				6347.6	4220.8			1783.7(32)
15				6351.7	4217.8			1783.3
16				6360.0	4228.7			1781.9
17				6365.3	4233.3			1785.5
18				6350.3	4225.0			1782.6
19				6336.9	4225.2			1783.0
20				6318.2	4208.5			1781.4
21				6315.9	4217.9			1782.9
22				6295.2	4202.3			1777.2
23				6300.7	4194.4			1783.1
24				6301.8	4172.5			1780.5
25				6276.1	4171.6			1779.0
26				6289.1	4189.8			1784.7
27				6267.6	4178.7			1786.2
28				6247.5	4183.0			1783.1
29				6240.7	4180.7			1783.9
30				6260.8	4184.0			1783.9
Mean				6319.1	4203.5			1782.3

For less than 24-hour coverage, parentheses enclose the number of hours for which data are available.
For Climax and Huancayo, parentheses enclose the number of section hours whenever the sum of both sections falls below 40 hours.

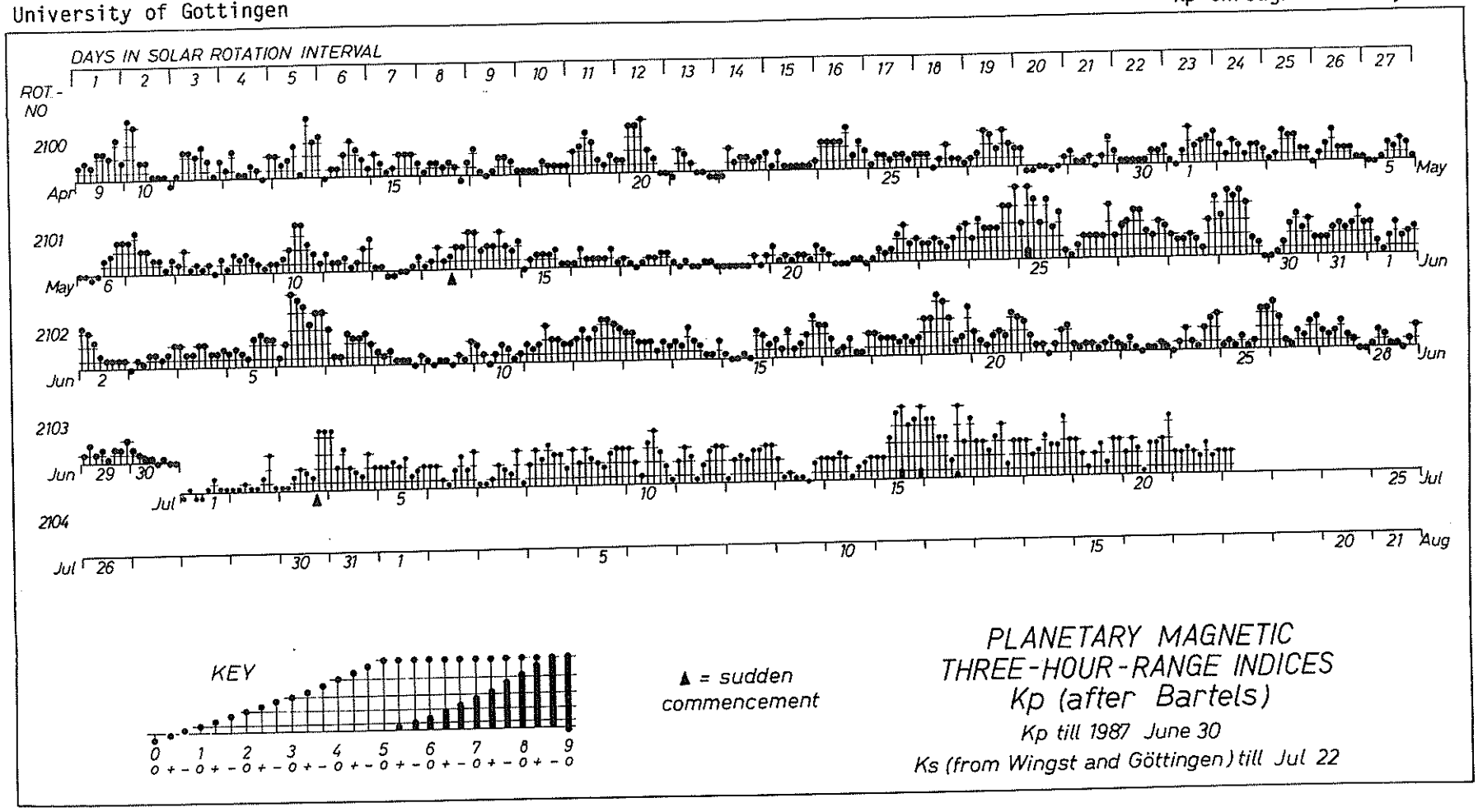
DAILY AVERAGE INDICES Ap

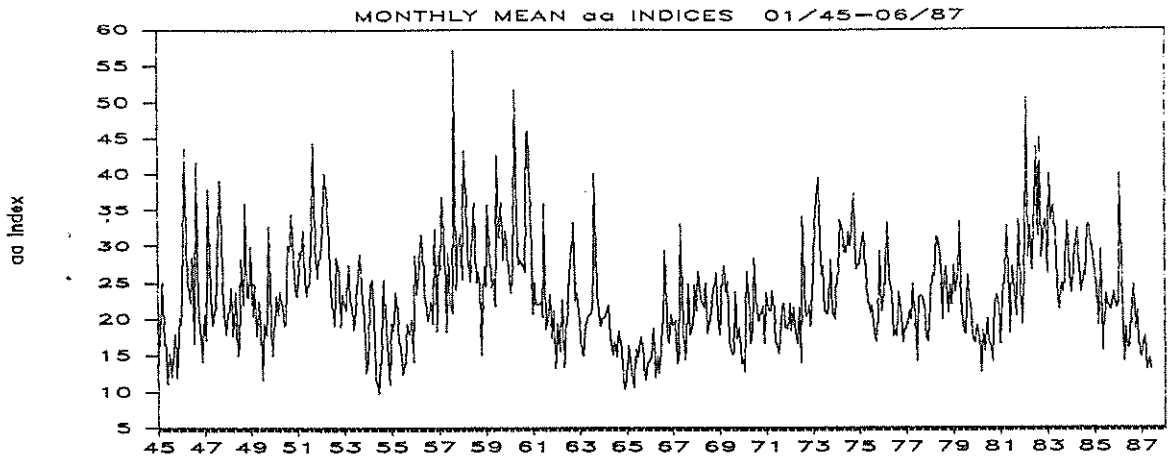
Day	Jul 86	Aug	Sep	Oct	Nov	Dec	Jan 87	Feb	Mar	Apr	May	Jun
1	7	6	9	7	13	13	18	7	9	10	7	8
2	13	5	16	23	6	8	10	4	3	4	6	8
3	8	19	7	9	16	6	6	4	6	2	6	4
4	7	20	7	7	67	7	3	4	10	16	5	6
5	7	9	9	19	20	4	3	4	21	12	4	7
6	5	6	8	12	12	4	3	7	10	7	5	25
7	4	4	5	5	6	6	5	9	21	13	8	9
8	6	7	5	6	4	4	7	14	12	11	4	4
9	6	10	6	6	3	6	10	11	9	8	4	3
10	6	6	6	3	5	12	6	8	11	10	10	4
11	4	7	16	4	14	8	5	7	8	7	6	7
12	6	10	89	2	9	4	10	18	14	5	2	13
13	7	10	22	28	5	12	6	4	8	12	6	6
14	4	5	12	31	5	20	5	5	8	6	9	6
15	4	6	18	14	12	4	5	6	10	6	4	4
16	5	4	7	6	11	12	12	12	12	4	4	8
17	8	5	14	6	8	5	10	9	10	5	4	6
18	6	3	20	13	6	6	8	7	12	4	2	6
19	4	4	21	21	4	6	7	5	11	8	2	17
20	3	15	18	14	5	7	18	29	4	12	4	8
21	6	29	11	11	3	11	10	19	18	3	3	6
22	7	29	4	6	2	14	10	18	15	4	7	4
23	5	25	43	5	12	22	11	14	6	4	8	3
24	15	22	22	2	46	10	7	12	5	9	20	7
25	17	17	26	4	49	11	7	7	6	4	25	7
26	20	12	27	3	17	14	7	6	13	4	9	9
27	16	13	20	16	9	9	7	12	26	9	14	5
28	9	12	13	9	5	3	11	13	12	2	10	4
29	17	22	13	15	10	3	10		5	4	21	5
30	11	27	5	14	14	4	4		4	4	9	3
31	12	16		6		7	8		4		11	
Mean	8	12	17	11	13	8	8	10	10	7	8	7

PLANETARY 3-HOUR-RANGE INDICES (Kp) BY 27-DAY SOLAR ROTATION INTERVAL

University of Gottingen

Kp through June 30, 1987





Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Mean
1945	16.1	16.4	25.0	19.1	15.4	11.1	15.3	12.1	15.6	17.9	12.0	20.2	16.3
1946	19.2	30.2	43.5	25.0	24.1	22.3	28.6	16.7	41.7	19.6	19.3	14.3	25.4
1947	20.6	17.1	37.9	23.3	19.1	21.1	21.4	32.9	39.1	31.3	20.7	17.9	25.2
1948	20.8	21.0	24.2	17.7	23.7	15.0	16.2	28.3	22.0	36.1	23.1	23.0	22.6
1949	29.8	20.4	24.7	17.6	22.4	17.9	11.8	19.2	17.8	32.7	24.6	15.1	21.2
1950	19.5	23.2	20.6	23.8	21.7	19.0	19.5	30.2	29.3	34.5	28.0	24.0	24.4
1951	23.1	29.2	28.5	32.1	25.5	23.2	25.2	29.7	44.4	30.3	25.7	28.2	28.8
1952	28.5	34.3	40.1	38.0	33.1	23.8	20.7	19.0	28.5	26.4	18.9	23.4	27.9
1953	22.3	21.2	27.4	22.7	21.4	18.4	22.5	26.1	29.0	22.4	20.2	12.6	22.2
1954	13.9	24.5	25.5	20.6	12.0	9.7	13.1	16.5	25.4	21.1	14.5	10.9	17.3
1955	19.3	18.2	23.6	21.1	16.7	15.1	12.3	14.3	19.1	17.8	19.9	14.1	17.6
1956	28.7	23.3	27.6	31.7	29.3	23.5	19.8	20.7	22.4	19.3	32.3	18.2	24.7
1957	28.7	26.8	36.7	28.8	18.1	29.1	21.7	20.7	57.0	24.0	29.5	31.7	29.4
1958	25.5	43.2	36.1	27.6	25.2	29.7	36.0	25.1	26.5	24.7	15.0	27.2	28.5
1959	24.3	35.9	29.9	24.2	25.7	21.6	42.5	31.2	36.1	28.2	32.1	30.8	30.2
1960	25.2	23.5	27.6	51.5	31.6	27.6	28.1	27.2	26.4	45.6	45.9	34.5	32.9
1961	20.6	25.1	22.0	21.8	22.3	20.1	36.0	18.5	20.7	23.3	17.3	21.1	22.4
1962	13.2	19.2	15.5	22.6	13.4	18.1	21.0	26.2	29.8	33.3	22.5	23.5	21.5
1963	19.3	15.3	14.9	18.2	20.4	20.5	20.8	22.5	40.2	23.5	20.7	18.9	21.3
1964	20.1	20.1	21.0	21.7	17.5	15.1	16.9	14.8	18.2	16.9	13.8	10.3	17.2
1965	11.8	16.3	14.3	12.6	10.5	15.7	14.7	16.8	17.5	13.1	11.7	13.8	14.1
1966	14.2	14.8	18.6	12.0	14.8	12.5	17.1	20.0	29.4	17.5	16.8	20.5	17.3
1967	18.9	19.8	13.8	15.5	33.1	18.6	14.4	17.5	24.7	17.8	18.9	24.5	19.8
1968	21.1	26.5	23.3	22.2	21.4	24.9	18.0	20.1	22.0	24.8	26.2	20.3	22.6
1969	17.8	25.8	27.3	23.6	25.2	16.7	15.0	15.3	23.8	17.2	18.7	13.8	20.0
1970	14.4	12.7	26.4	23.1	16.6	18.3	28.4	21.0	19.7	20.6	21.6	16.5	19.9
1971	23.5	21.2	21.1	23.9	21.1	17.0	15.2	17.1	21.4	22.2	18.8	18.6	20.1
1972	21.9	18.3	21.5	18.1	16.6	21.5	14.0	34.2	20.4	20.4	21.8	18.9	20.6
1973	26.1	32.7	36.9	39.6	26.1	27.3	20.9	20.6	22.8	28.2	20.7	19.9	26.8
1974	25.8	26.4	33.7	32.9	29.2	29.2	32.0	30.2	33.7	37.3	26.8	27.5	30.4
1975	27.6	31.1	32.0	24.3	22.7	20.7	21.7	18.1	16.9	20.2	29.3	21.1	23.8
1976	23.3	28.5	33.4	25.4	23.7	17.5	18.4	17.7	23.7	20.4	16.9	18.6	22.3
1977	18.7	21.0	19.9	24.9	20.1	14.2	22.9	23.2	23.0	20.9	17.3	17.0	20.3
1978	24.6	26.2	25.9	31.3	31.2	28.3	19.9	25.6	27.0	20.8	24.6	22.0	25.6
1979	27.3	23.7	26.9	33.5	21.0	18.3	17.9	26.0	22.0	19.3	17.1	16.8	22.5
1980	19.0	17.3	12.7	18.4	15.6	20.0	17.0	15.9	14.2	21.9	23.3	21.7	18.1
1981	16.5	23.1	26.6	32.8	26.9	18.0	27.2	24.0	20.4	33.7	24.1	19.3	24.4
1982	24.2	50.6	28.5	32.9	26.7	32.1	43.9	31.4	45.1	28.5	33.0	33.8	34.2
1983	26.2	40.0	33.6	35.7	31.6	24.9	21.3	24.9	23.7	28.3	33.5	26.0	29.1
1984	23.5	26.7	30.7	32.5	27.2	23.7	26.4	25.8	32.6	33.1	31.0	29.0	28.5
1985	25.7	24.1	19.0	29.5	15.6	19.9	23.4	22.0	21.2	22.2	23.7	21.4	22.3
1986	22.4	40.0	21.1	14.3	18.8	15.9	16.3	22.3	24.7	18.6	21.2	15.3	20.9
1987	14.8	16.6	17.6	12.9	14.7	13.2							15.0

PRINCIPAL MAGNETIC STORMS

JUNE 1987

Sta	Geomag Lat	Commencement Day	Commencement Time (UT)	Type	SC Amplitudes D (Min)	SC Amplitudes H (Gamma)	SC Amplitudes Z (Gamma)	Maximum 3-Hour K Index Day(3-Hour Periods)	K	Ranges D (Min)	Ranges H (Gamma)	Ranges Z (Gamma)	End Day	End Hour (UT)
HYB	07.6N	05	1100	..	..	..	..	06(3,4,5)	5	7	153	23	07	22
SIT	60.0N	06	06--	..	..	..	..	06(5)	7	--	560	380	06	15
BJI	28.5N	06	0600	..	..	..	..	06(3)	5	11	95	37	06	21
JAI	17.3N	06	0100	..	..	..	..		-	9	130	43	07	04
KRC	16.4N	06	03--	..	..	..	..	06(4,5)	5	4	110	60	08	13
SHL	14.7N	06	0100	..	..	..	..		-	8	117	30	07	04
UJJ	13.5N	06	0100	..	..	..	..		-	7	167	32	07	04
ABG	09.5N	06	0100	..	..	..	..	06(5)	5	7	146	41	07	04
GUA	04.0N	06	0700	..	..	..	..	06(4)	5	--	100	10	06	20
ETT	00.6S	06	0430	..	..	..	..		-	-5	145	54	07	24
PMG	18.6S	06	0600	..	..	..	..	06(3)	6	5	130	80	07	00
CNB	43.9S	06	06--	..	..	..	..	06(3,4,5)	5	17	145	40	06	20
HYB	07.6N	18	2300	..	..	..	..	19(4)	5	6	108	26	20	02
HYB	07.6N	25	1700	..	..	..	..	25(7,8) 26(7,8) 27(1,4)	3	5	75	22	27	14

Stations Reporting:

ABG = ALIBAG
BJI = BEIJING
CNB = CANBERRA
COL = COLLEGE
ETT = ETAIYAPURAM
FRD = FREDERICKSBURG
GNA = GNANGARA
GUA = GUAM
HER = HERMANUS
HYD = HYDERABAD
JAI = JAIPUR
KRC = KARACHI
KGL = KERGUELEN
PMG = PORT MORESBY
SHL = SHILLONG
SIT = SITKA
UJJ = UJJAIN
WIT = WITTEVEEN

RADIO PROPAGATION QUALITY INDICES

JUNE 1987

Day	Bracknell	Teheran	New York	Tokyo	Johannesburg	Canberra
	For Circuits from Norddeich to:					
1	4.8	4.0	5.0	3.3	2.6	3.1
2	4.5	3.4	4.6	3.6	5.5	3.8
3	5.5	6.2	6.1	6.2	5.1	4.6
4	5.5	6.7	6.1	6.9	5.4	4.1
5	5.9	5.8	5.7	5.0	5.8	5.0
6	5.7	4.8	3.6	3.9	5.9	4.1
7	5.7	4.8	4.4	4.9	5.0	3.9
8	6.1	4.6	5.3	6.0	4.6	3.7
9	5.7	5.5	6.4	7.3	6.0	4.8
10	5.1	6.2	6.9	7.7	5.1	6.5
11	7.2	6.4	6.2	7.3	6.4	6.5
12	6.5	6.3	5.8	6.2	6.5	6.7
13	7.2	5.9	5.5	6.2	6.1	6.8
14	6.3	6.0	5.7	6.9	5.8	5.1
15	6.8	6.6	6.5	8.7	6.1	6.6
16	7.6	5.1	6.6	7.5	5.9	6.9
17	6.4	5.5	6.6	7.8	4.8	5.9
18	7.5	5.6	6.9	7.7	5.1	6.1
19	7.3	5.3	5.4	6.7	5.7	6.2
20	6.7	5.4	6.1	6.2	5.0	5.1
21	6.1	5.2	6.0	7.2	2.6	5.4
22	6.0	6.3	6.4	7.2	5.3	6.0
23	7.4	5.7	6.0	7.7	5.2	5.9
24	6.3	6.3	6.8	7.4	4.0	6.7
25	6.0	5.6	6.7	7.0	3.4	6.3
26	5.1	6.1	5.3	6.1	4.7	6.4
27	5.3	6.1	5.9	6.9	4.6	5.9
28	6.5	7.2	6.3	6.8	5.1	5.3
29	5.9	5.9	6.0	7.2	5.0	6.3
30	5.2	6.1	5.8	6.0	4.4	4.8
Mean	6.1	5.7	5.9	6.5	5.1	5.5

CALCULATION OF QUALITY INDICES (Q)

From all 24 hourly field strength values and from all frequencies of the same circuit a median field strength value is calculated (FD). This daily value is compared with the average value (FA) of the preceeding 27 days (1 sun rotation).

$$Q = 6.0 + 20 \log(FD/FA)/3.0$$

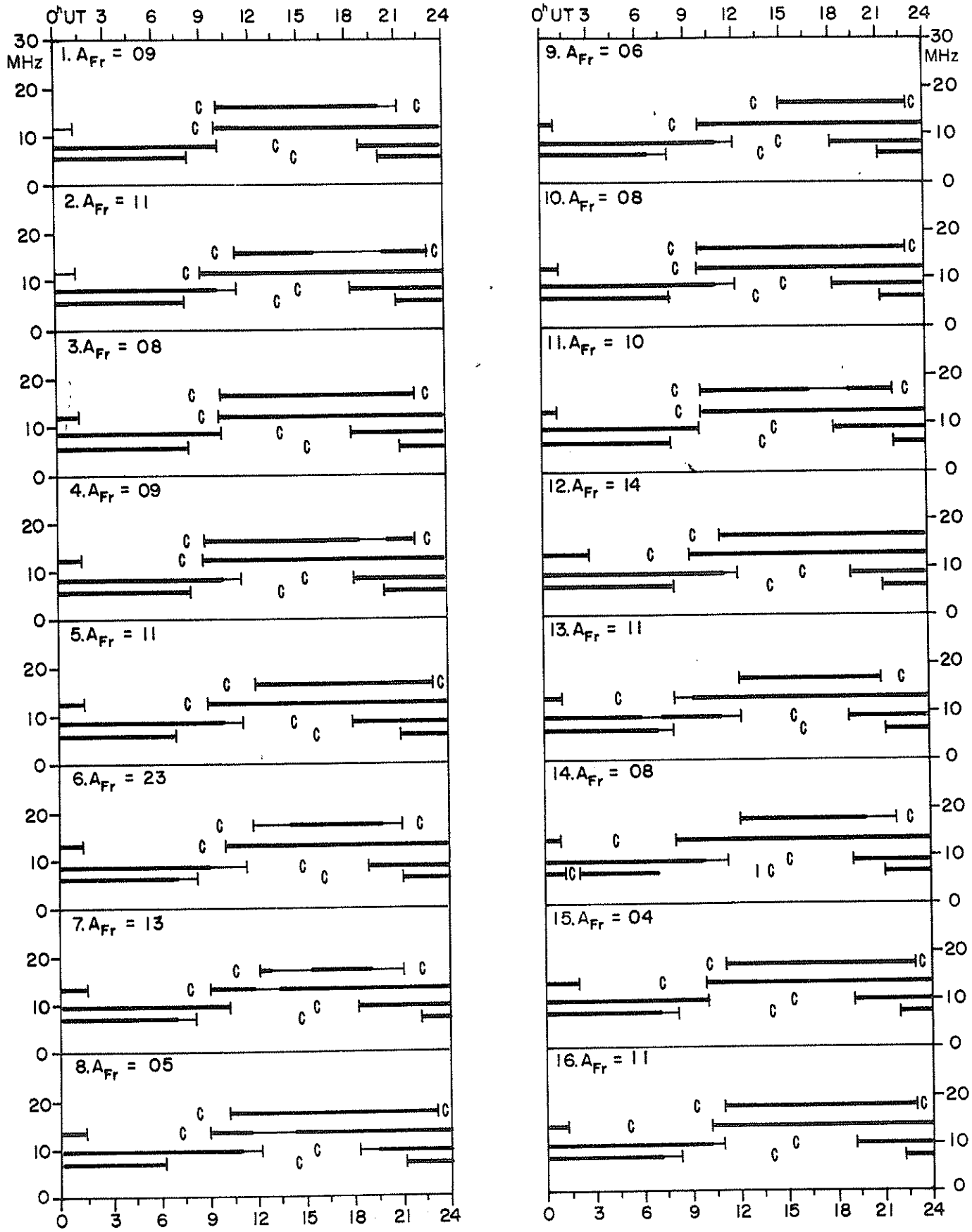
The quality indices vary from 0.0 to 9.9 where 6.0 is normal. Conditions are "normal" (index = 6.0), if they correspond to the average of the preceeding 27 days.

SCALE FOR QUALITY INDICES

0.0 - 1.0 = very poor
1.1 - 3.0 = poor
3.1 - 5.0 = fair
5.1 - 7.0 - normal
7.1 - 9.0 = good
9.1 - 9.9 = very good

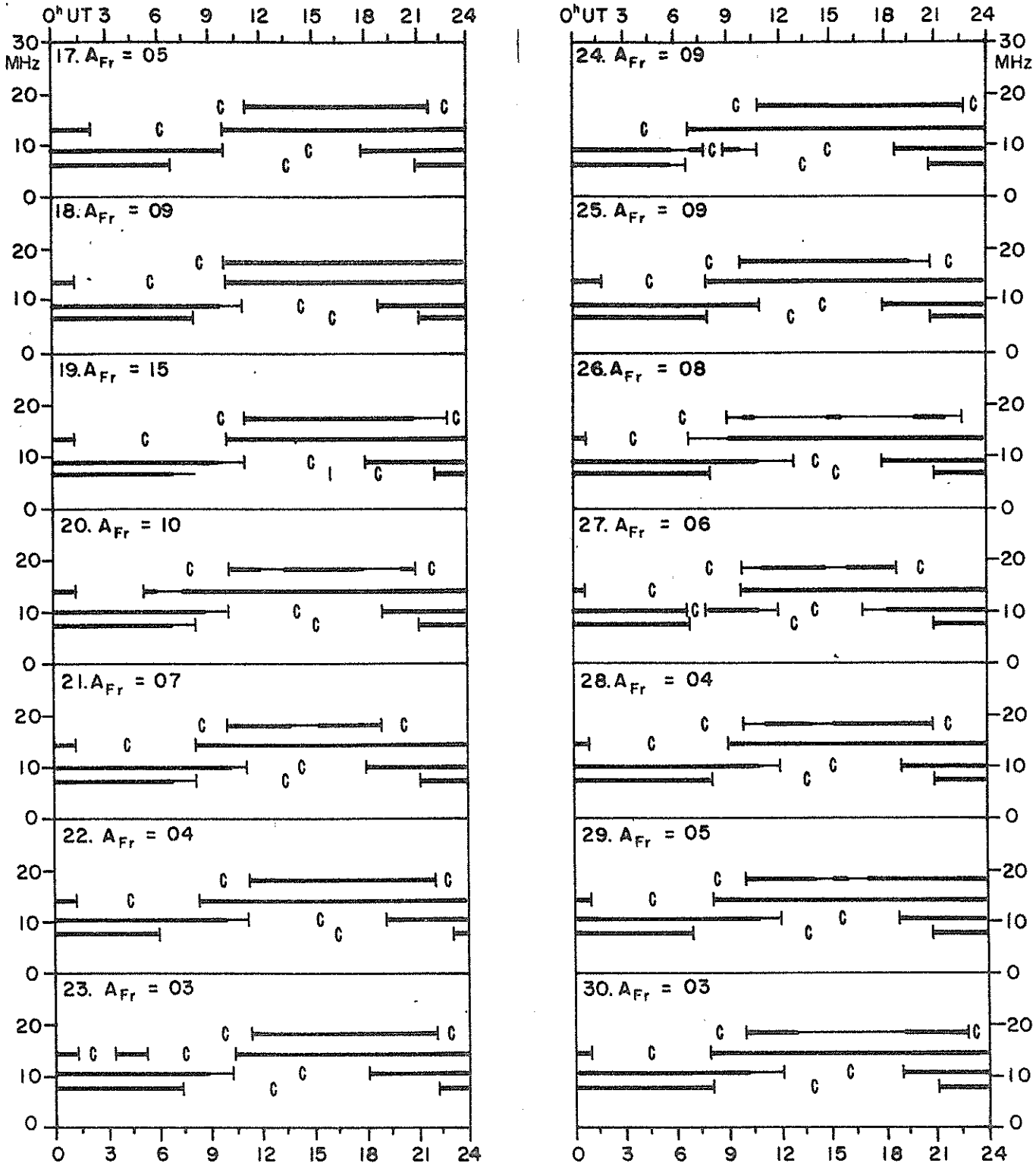
TRANSMISSION FREQUENCY RANGES -- NORTH ATLANTIC PATH

JUNE 1987



TRANSMISSION FREQUENCY RANGES -- NORTH ATLANTIC PATH

JUNE 1987



Field strengths from four frequencies, 6.4, 8.6, 13.0, and 17.0 MHz, observed on a Norddeich-New York circuit are represented above. Heavy solid lines represent field strengths $\geq$ -12 dB above 1 μV/m (transmitter power reduced to 1 kW). Observed field strengths between -12 dB and -40 dB above 1 μV/m are represented by the fine line.

C O N T E N T S

Prompt Reports LATE DATA Number 516 Part I

88
Late
Nov 86

PIONEER VENUS ORBITER
ONE HOUR MAGNETIC FIELD AVERAGES AT APOAPSIS
VENUS SOLAR ORBITAL COORDINATES

UNIVERSAL TIME					NANOTESLAS BXvso	BYvso	BZvso	BT	REGION W=WAKE
86	305	NOV	1	11:50:00	-13.22	4.53	-2.61	14.45	W
86	306	NOV	2	11:50:00					
86	307	NOV	3	11:50:00	-34.07	-.01	-30.38	46.42	W
86	308	NOV	4	11:50:00					
86	309	NOV	5	11:50:00	7.28	-5.94	3.87	10.93	W
86	310	NOV	6	11:50:00	4.47	-3.43	6.62	9.88	W
86	311	NOV	7	11:50:00					
86	312	NOV	8	11:50:00	6.57	-7.10	.18	9.98	W
86	313	NOV	9	11:50:00	1.87	-6.87	.35	8.55	W
86	314	NOV	10	11:50:00					
86	315	NOV	11	11:50:00					
86	316	NOV	12	11:50:00					
86	317	NOV	13	11:50:00	-.69	-2.76	.39	7.18	W
86	318	NOV	14	11:50:00					
86	319	NOV	15	11:50:00	12.97	-4.92	1.66	14.34	W
86	320	NOV	16	11:50:00					
86	321	NOV	17	11:50:00	8.60	-6.24	4.86	11.94	W
86	322	NOV	18	11:50:00					
86	323	NOV	19	11:50:00					
86	324	NOV	20	11:50:00	3.71	.54	.01	4.07	W
86	325	NOV	21	11:50:00					
86	326	NOV	22	11:50:00	-8.37	-2.99	6.31	11.22	
86	327	NOV	23	11:50:00	7.64	-29.61	16.09	34.91	
86	328	NOV	24	11:50:00					
86	329	NOV	25	11:50:00					
86	330	NOV	26	11:50:00	-7.48	3.15	-.46	8.17	
86	331	NOV	27	11:50:00	-.13	8.39	1.56	9.60	
86	332	NOV	28	11:50:00	3.77	9.18	1.05	10.67	
86	333	NOV	29	11:50:00					
86	334	NOV	30	11:50:00	-8.23	4.46	-2.82	10.23	

Source: Institute of Geophysics and Planetary Physics, UCLA

WDC-C2 FOR GEOMAGNETISM, KYOTO UNIVERSITY

HOURLY EQUATORIAL DST VALUES(PROVISIONAL)

APRIL 1987

UNIT=NT

DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24 (U.T.)
1	-4	-15	-20	-29	-37	-41	-44	-44	-44	-46	-46	-39	-34	-31	-31	-31	-31	-33	-33	-32	-29	-26	-25	-24
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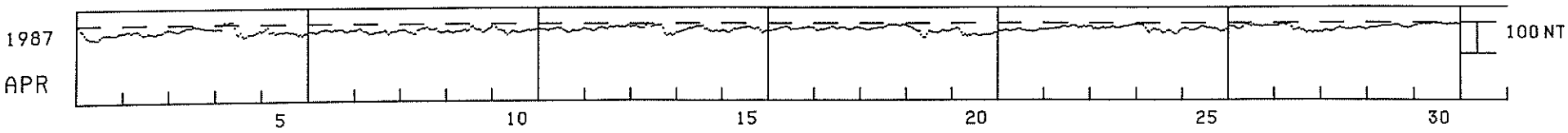

89
Late
Apr 87

WDC-C2 FOR GEOMAGNETISM, KYOTO UNIVERSITY

HOURLY EQUATORIAL DST VALUES(PROVISIONAL)

MAY 1987

UNIT=NT

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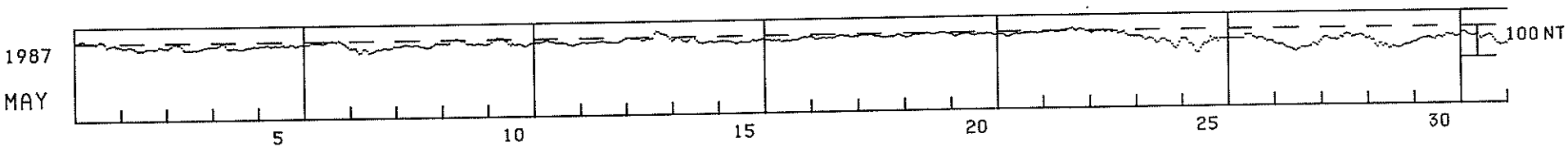

MAGNETIC STORM SUDDEN COMMENCEMENTS AND SOLAR FLARE EFFECTS
(PRELIMINARY REPORT ON RAPID MAGNETIC VARIATIONS)

MAY 1987

Storm Sudden Commencements (ssc)			Solar Flare Effects (sfe)		
Day	Time	Quality: Station Group*	Day	Begin-End	Station(s)
13	1404	B: WNG COI QUE MPO	05	1006-1016	MPO
		C: WIT BDV CLF GCK SPT EBR(sfe?)	10	1125-1132	NCK
		LNP AMS CZT	16	1027-1033	MPO
		sfe: NCK (ssc?) AQU	21	0315-0350	MMB KAK KNY
			25	0342-0348	LNP
			25	1442-1449	NCK
			25	1803-1815	NCK
			28	1051-1063	NCK

Reporting Observatories:

SOD COL DOB NUR WNG WIT NGK BDV CLF NCK GCK MMB AQU EBR COI
SPT FRD KAK HTY KNY QUE TEN LNP MPO GNA AMS CZT KGL DUM

*Three-letter codes identify each observatory. Reporting stations have been grouped by the character of the observed event. The letter A means very remarkable; B means fair, ordinary, but unmistakable; and C means very poor, doubtful.

WORLD DATA CENTER A
FOR
SOLAR-TERRESTRIAL PHYSICS

The ICSU Panel on WDCs has recommended that it would be appropriate courtesy to acknowledge in publications that data were obtained from the originating station or investigator through the intermediary of the WDCs. The following statement is suggested:

"Data used in this study were provided by WDC-A for Solar-Terrestrial Physics, NOAA E/GC2, 325 Broadway, Boulder Colorado 80303, USA."