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Solar Division BULLETIN



HARRY L. BONDY, Editor

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MAY - JUNE 1956

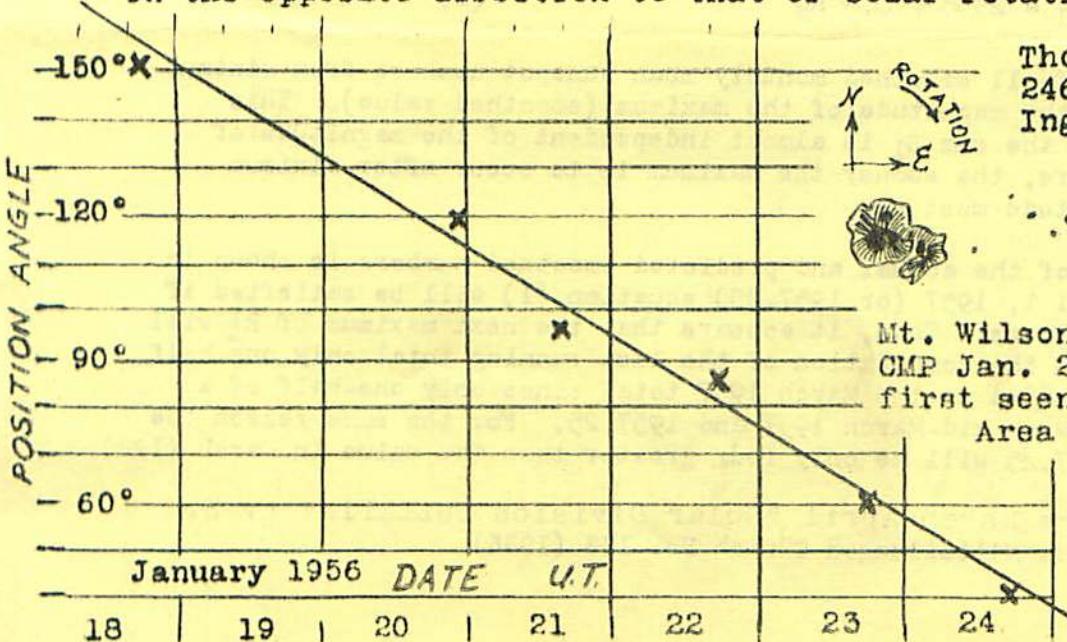
Numbers 117 - 118

ROTATION OBSERVED IN MT. WILSON 11443

Mr. Harry L. Bondy, chairman of the AAVSO-Solar Division, pointed out on photographs submitted him by Mr. Hans AREER, Manila, Philippines, that the leader of Mt. Wilson group 11443 showed good evidence of rotation. A small string of spots adjacent to the leader or an extention appeared to change position angle from day to day. Measures were made on plates taken at Mt. Wilson Observatory to check the rotation and determine the rate.

The rectangular coordinates of the leader spot and the end of the projection were measured for each day. These coordinates were then transferred to latitude and longitude on the sun by the standard transformation equations. The differences in heliographic position between the leader spot and the extention were used to compute the position angles of the extention from the leader spot with respect to the sun's north pole.

The resulting position angles are plotted in the accompanying diagram. The dates are all UT. The rotation was reasonably constant and in the opposite direction to that of solar rotation.



Thomas A. Cragg
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from Hans AREER's
photograph
22 January 1956 0615 UT

Mt. Wilson group 11443
CMP Jan. 23.9 N25° 33H
first seen Jan. 17; last Jan. 29
Area approx. 650 x 10° hem.

PREDICTION OF THE NEXT SUNSPOT MAXIMUM

It was noted that straight lines can be fitted to the smoothed monthly mean Zürich sunspot numbers for the pre-maximum phases of the last two sunspot cycles plotted on the cover of the January 1956 issue of the Solar Division Bulletin. These lines fit the data rather well if the first 15 to 18 months of the cycle are neglected. If these lines are extended downward to the time axis, they each intersect this axis at 11 months after minimum. The slope of the line for the 17th cycle is about 3.7 sunspot numbers per month; and for the 18th cycle, 5.4 sunspot numbers per month. Notice that at the beginning of each cycle the slope of the smoothed sunspot numbers is much less than these values.

A study of the monthly mean American Relative sunspot numbers of the current cycle (both raw, R_A , and smoothed, \bar{R}_A) indicates that the slope of the smoothed numbers to the next maximum will be about 8.0 sunspot numbers per month. A line of this slope and crossing the time axis at 11 months after minimum can be drawn on a graph of the smoothed monthly mean American sunspot numbers. See the graph in Figure 1. The smoothed American numbers are expected join this sloping line at a value of about 56 at 18 months after minimum (October 1955), and rise along it to maximum. Assuming that this will happen, one can predict smoothed sunspot numbers for the coming months by reading them off this sloping line on the graph. These predictions are entered in Table I with slants around them. This table also gives observed and smoothed monthly mean American Relative sunspot numbers for each month since minimum where available. The smoothed values in parentheses are estimates based on incomplete data.

Therefore, the magnitude and time of the next sunspot maximum could be predicted if it were known when to stop this upward trend. Waldmeier provides a method for deciding when to stop in a paper of his.* He gives the following equation in this paper:

$$S_1 = 2538 + 0.4 R_M \quad (1)$$

where S_1 is the sum of all smoothed monthly mean sunspot numbers from minimum to maximum and R_M is the magnitude of the maximum (smoothed value). This equation implies that the sum S_1 is almost independent of the magnitude of the maximum. Therefore, the sooner the maximum is to occur after minimum the greater its magnitude must be.

A running total of the actual and predicted smoothed numbers is shown in Table I.* Around April 1, 1957 (or 1957.25) equation (1) will be satisfied if the predicted trend occurs. Thus, it appears that the next maximum of \bar{R}_A will be 196 at 1957.25. In the computation of the last running total only one-half of the value 196 was added to the March 1957 total since only one-half of a month will elapse between mid-March 1957 and 1957.25. For the same reason the sunspot number at 1957.25 will be only four greater than the value in March (192).

*) published in the March-April "Solar Division BULLETIN" p. 3.

**) M. Waldmeier, Astr. Mitteilungen Zürich No. 133 (1935)

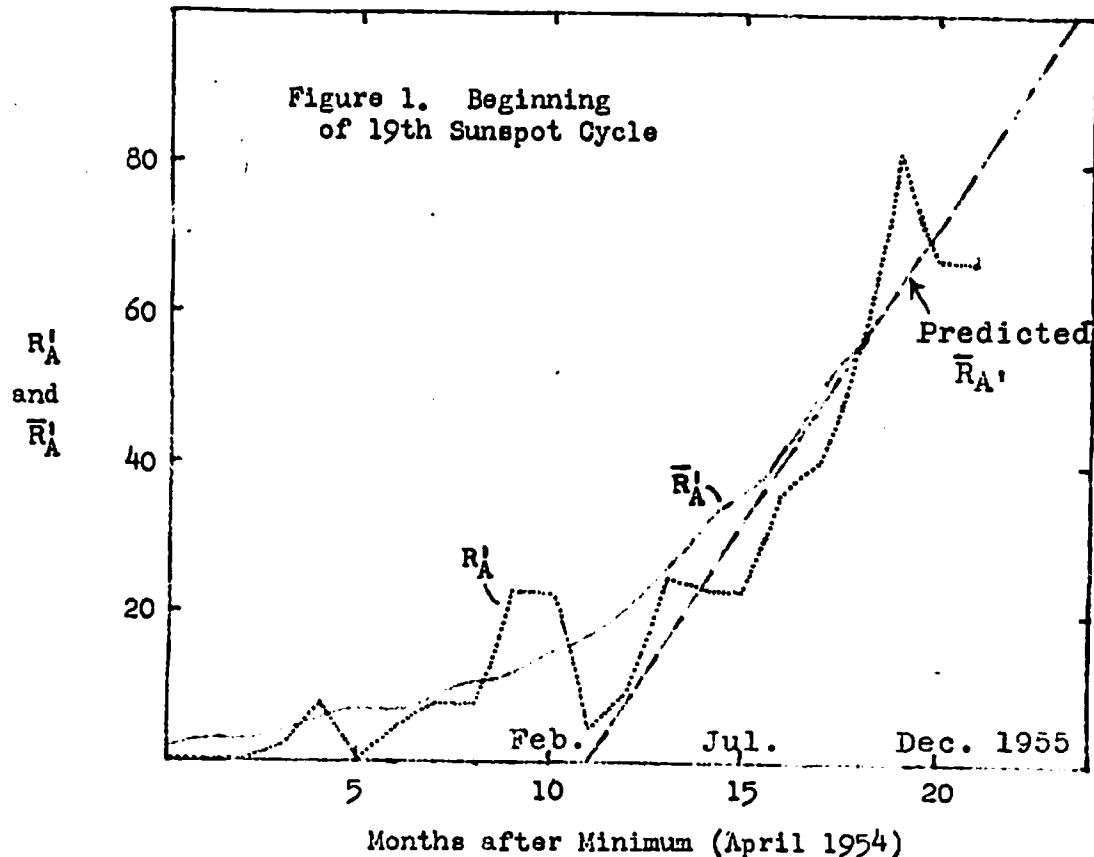
In his paper Waldmeier also gives the following equation:

$$R_5 = 0.29 R_M - 11.4 \quad (2)$$

where R_5 is the smoothed sunspot number five years after maximum. Under the assumption that the above prediction of the magnitude and time of R_M is correct, equation (2) gives a value of 45 for R_5 occurring at 1962.25 (five years after 1957.25). If a linear decrease of smoothed monthly mean sunspot numbers is assumed after maximum, the predicted values of \bar{R}_A' will be 188 at the beginning of IGY and 143 when IGY ends in December 1958. The fact that the sunspot maximum may occur before the beginning of IGY should not affect the IGY program because, as the above prediction indicates, the sunspot numbers will still remain high for several years after maximum. Furthermore, the graph on page 169 of Ellison's recent book, The Sun and its Influence, indicates that the time of maximum aurora occurrence tends to lag behind the sunspot maximum. Perhaps, because of their lower latitude the sunspots after maximum, though less numerous, affect terrestrial phenomena more than those at maximum; the particles ejected from these low latitude spots are no doubt more closely directed toward the Earth than those from spots at higher latitudes.

The prediction of the sunspot maximum by Waldmeier himself is similar to the one above. He predicts that the smoothed monthly mean Zürich sunspot numbers will reach a maximum of 170 at 1957.1. Thus, according to either Waldmeier's prediction or the one here, the coming sunspot maximum will be higher than any one previously recorded!

Leith Holloway
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Washington 8, D. C.



Rapid changes in a sunspot group - 18 March 1956

Mr. ADRIEN EMOND, Sainte Therese de Blainville, Que., Canada, uses a 75mm refractor with 105x for his solar observations. Being not only a very able observer, Mr. Emond has also the ability to draw and paint with great skill what he sees.

The following pictures show in fine detail what Mr. Emond observed on 18th March 1956. Note the wealth of detail in penumbra, the bright bridges as well as very fine detail in the very umbra. Detailed structure and shading is rarely seen in even the finest solar photographs. Congratulations to Mr. Adrien Emond for his excellent work.

18 March 1956.



1530 U.T.

1830 U.T.

2200 U.T.

This beautifully depicted H-type group crossed the central meridian on 16.6 March 1956 in latitude 20° South and had an area of a little over 500 millionths of the solar hemisphere.

* * * * *

Correction:

In our February issue /p.2/ it was stated that the velocity of cosmic ray-particles associated with the unusual flare of 23 February 1956 was of the order of one half the speed of light. This is erroneous, as was pointed out to me by Dr. Peter Millman, since my estimate did not take into consideration that it takes about 8 minutes of time for light to reach us from the sun and thus to reveal a flare. Thus the cosmic particles traveled "only" at a velocity of one third (1/3) the speed of light, still faster than any other previously recorded particles. hlb

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The SOLAR DIVISION had an excellent representation at the AAVSO spring convention at Cornell University. We were able to present not only a number of very interesting papers but also to exhibit fine photographs, drawings as well as Mt. David Warshaw's "transistorized" receiver for "Sudden Enhancement of Atmospherics" (SEA's) due to solar flares.

The next issue will carry some of the papers presented to the Spring convention. hlb

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AMERICAN RELATIVE SUNSPOT NUMBERS R_A, APRIL and MAY 1956

Day	Apr.	May	Day	Apr.	May	Day	Apr.	May	Day	Apr.	May
1.....	79...101		9.....	107..154		17.....	188...107		25.....	91...95	
2.....	49...96		10.....	134..146		18.....	173...131		26.....	82...94	
3.....	37...107		11.....	140..143		19.....	161...119		27.....	78...105	
4.....	22...134		12.....	169..134		20.....	139...131		28.....	57...119	
5.....	31...138		13.....	170..118		21.....	135...117		29.....	57...125	
6.....	36...118		14.....	147..110		22.....	124...108		30.....	77...121	
7.....	53...155		15.....	161.. 95		23.....	86... 75		31.....	111	
8.....	84...166		16.....	130.. 86		24.....	76... 80				

Monthly mean - APRIL R_A = 102.4 - MAY R_A = 117.3

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ZURICH PROVISIONAL SUNSPOT NUMBERS for APRIL and MAY 1956

Dependent on observations at Zürich Observatory and its stations in Locarno and Arosa.

Day.	Apr.	May	Day	Apr.	May	Day	Apr.	May	Day	Apr.	May
1.....	60...78		9.....	103...180		17.....	130...132		25.....	104...103	
2.....	69...93		10.....	145...178		18.....	140...144		26.....	88...120	
3.....	66..138		11.....	144...175		19.....	130...136		27.....	94...115	
4.....	66..169		12.....	160...163		20.....	140...127		28.....	67...137	
5.....	50..158		13.....	178...142		21.....	140...144		29.....	32...136	
6.....	45..162		14.....	164...133		22.....	120...119		30.....	70...146	
7.....	63..162		15.....	150...110		23.....	115... 82		31.....	123	
8.....	86..186		16.....	120...122		24.....	96...102				

Monthly mean - APRIL R_Z = 104.5 -- MAY R_Z = 136.0

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NUMBER OF SUNSPOT GROUPS OBSERVED DAILY AT MOUNT WILSON OBSERVATORY 1956

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
<hr/>																															
JAN	7	4	6	5	7	8	8	8	3	4	5	8	8	7	7	8	7	6	5	6	6	5	7	-	-	7	6	-	-		
FEB	6	6	5	4	3	2	3	3	5	6	7	10	11	13	11	11	13	14	14	16	-	-	14	14	14	15	14	12			
MAR	11	9	8	9	6	6	7	9	8	11	8	9	13	11	12	12	15	14	10	11	13	14	11	13	15	11	10	10	10	13	
APR.	8	10	9	6	4	5	6	6	11	10	-	-	-	12	16	17	18	18	21	18	14	13	9	9	-	-	8	5	7		
MAY	6	9	12	13	12	12	11	14	-	14	14	9	10	8	9	9	11	11	11	12	12	8	7	8	6	6	7	9	8	10	10

Monthly mean - JANUARY 6.4 FEBRUARY 9.3 MARCH 10.6 APRIL 10.8 MAY 9.9

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At Mount Wilson Observatory sunspot groups are classified according their magnetic polarities. This method permits the most accurate determination of individual groups. The Solar Division BULLETIN will publish regularly the daily number of groups observed at Mt. Wilson Observatory.

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AMERICAN SUNSPOT NUMBER OBSERVATIONS

AAVSO

MONTHLY MEANS $R_A = 105.9$

March 1956

SOLAR DIVISION

MONTHLY MEANS R₂-153

-1*- REVIEWED BY

R_{A'} 127 113 104 98 86 94 102 103 83 80 77 77 85 103 111 123 102 116 118 118 114 146 123 134 110 123 103 105 104 116 88
 R_Z 152 120 115 90 112 110 107 104 102 97 84 80 97 122 114 120 138 122 120 118 115 103 120 136 138 140 106 115 122 113 118

AMERICAN SUNSPOT NUMBER OBSERVATIONS

MONTHLY MEANS RA'-102.4

April

56

SOLAR DIVISION

MONTHLY MEANS R_Z-104.5

OBSERVER	KL	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		
Adams	70	9.21	3.14	2.8	2.15	2.22		3.27			4.65	4.62		4.70		6.40	6.52	5.97		5.54	5.12		3.11											
Bartley	724	8.57								8.36	9.49	10.52	11.71	12.50		16.96								8.52										
Bowles	705																																	
Bundy	128	7.22																																
Cochran	700																																	
Dickinson	5.10																																	
Dunn	7.22																																	
Eustis	111		1.2	1.7	1.14	2.18		2.20	4.24	16.38	16.20	16.28	16.35	16.43		16.28	16.20	16.26	16.27	2.23	6.25	6.27												
Garrison	720	9.12																																
Griggs	7.20	4.10	4.9	3.9	3.22	4.23	4.48	6.60	7.41	9.60																								
Hess	700	5.15																																
Elias	7.44	8.27	5.18	5.18	3.29	4.27	4.65	4.69	5.32	10.82	10.64	10.53	10.42	10.31		10.20	10.10	10.00	10.17	10.74	3.66	4.70	3.93	7.45	6.66	4.77	4.16	7.48						
Estramadura	7.21	4.10	2.20	5.10	2.20	4.23	5.27	9.48	9.53	10.63	10.74	10.66	10.59	10.52		10.70	10.60	10.57	10.64	10.74	4.46	4.47	5.17	5.10	4.20	4.10	3.10	3.10	3.10	3.10				
Evans																																		
Fernald	702	8.28	3.10																															
Itayaishi	3.5	4.14																																
Lachute	8.46	5.11																																
Lusk	700	7.67																																
Maher	7.20	7.28																																
Mandrusik	7.21	7.26																																
Moore	7.21																																	
Nicolini	7.19	5.7	4.10	1.13	4.17	3.22	6.22	10.25			8.24	9.48		10.25	10.22	10.27	10.29	10.31	10.37	10.45	10.47	10.49	10.51	10.53	10.55	10.57	10.59	10.61	10.63	10.65	10.67	10.69	10.71	
Pilsworth	700	5.29																																
Rastrough	6.60	5.21	4.11		1.9	8.29		8.44	10.52	11.19	11.51	11.52	11.54	11.55		11.68																		
Luge																																		
Thomas	7.21	5.10	3.12	3.6	5.13	4.19	4.65	5.63		10.67	10.63	10.62	10.61	10.60		10.78	10.74	10.70	10.66	10.62	10.58	10.54	10.50	10.46	10.42	10.38	10.34	10.30	10.26	10.22	10.18	10.14	10.10	
Thomasson	7.21	4.9	3.9							2.8	4.20	4.23	6.19	8.26		9.24	10.26	10.24	10.22	10.20	10.18	10.16	10.14	10.12	10.10	10.08	10.06	10.04	10.02	10.00	10.08	10.06	10.04	10.02
Trathen	7.20	5.9	5.7	4.1	1.2	4.7	5.8	6.11	5.15	6.14	6.17	6.19	6.17		10.26	10.24	10.22	10.20	10.18	10.16	10.14	10.12	10.10	10.08	10.06	10.04	10.02	10.00	10.08	10.06	10.04	10.02		
Venter	7.22	4.14	4.27	3.7	6.7	6.6	6.21	6.24	6.21	6.55	6.57		9.30	9.46		10.20	10.18	10.16	10.14	10.12	10.10	10.08	10.06	10.04	10.02	10.00	10.08	10.06	10.04	10.02	10.00			
Warren	7.18																																	
Wells	7.2																																	
Wentzel																																		
LOENHICK																																		
KOYAMA	7																																	
Received 1962																																		
Re	79	49	37	22	31	36	53	84	107	134	140	163	170	147	161	170	188	173	161	139	135	124	86	76	51	82	78	57	57	77				

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<i>Ra</i>	79	49	37	22	31	36	53	84	107	134	140	162	170	147	161	130	168	173	161	139	135	124	86	76	31	86	70	57	57	77
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OBSERVATIONS MADE UNDER ADVERSE SEEING CONDITIONS