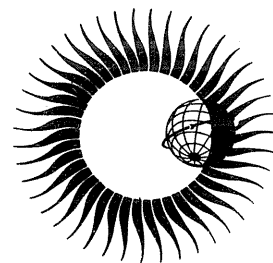


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**OBSERVATIONS OF JUPITER'S SPORADIC RADIO
EMISSION IN THE RANGE 7.6-41 MHz
9 SEPTEMBER 1968 THROUGH 9 DECEMBER 1971**



FEBRUARY 1973

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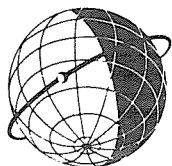
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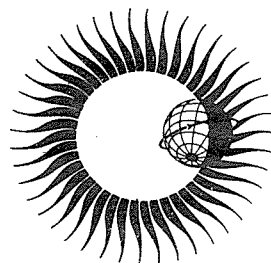


REPORT UAG - 25

OBSERVATIONS OF JUPITER'S SPORADIC RADIO EMISSION IN THE RANGE 7.6–41 MHz 9 SEPTEMBER 1968 THROUGH 9 DECEMBER 1971

by

James W. Warwick, George A. Dulk and David G. Swann
Department of Astro-Geophysics
University of Colorado
Boulder, Colorado



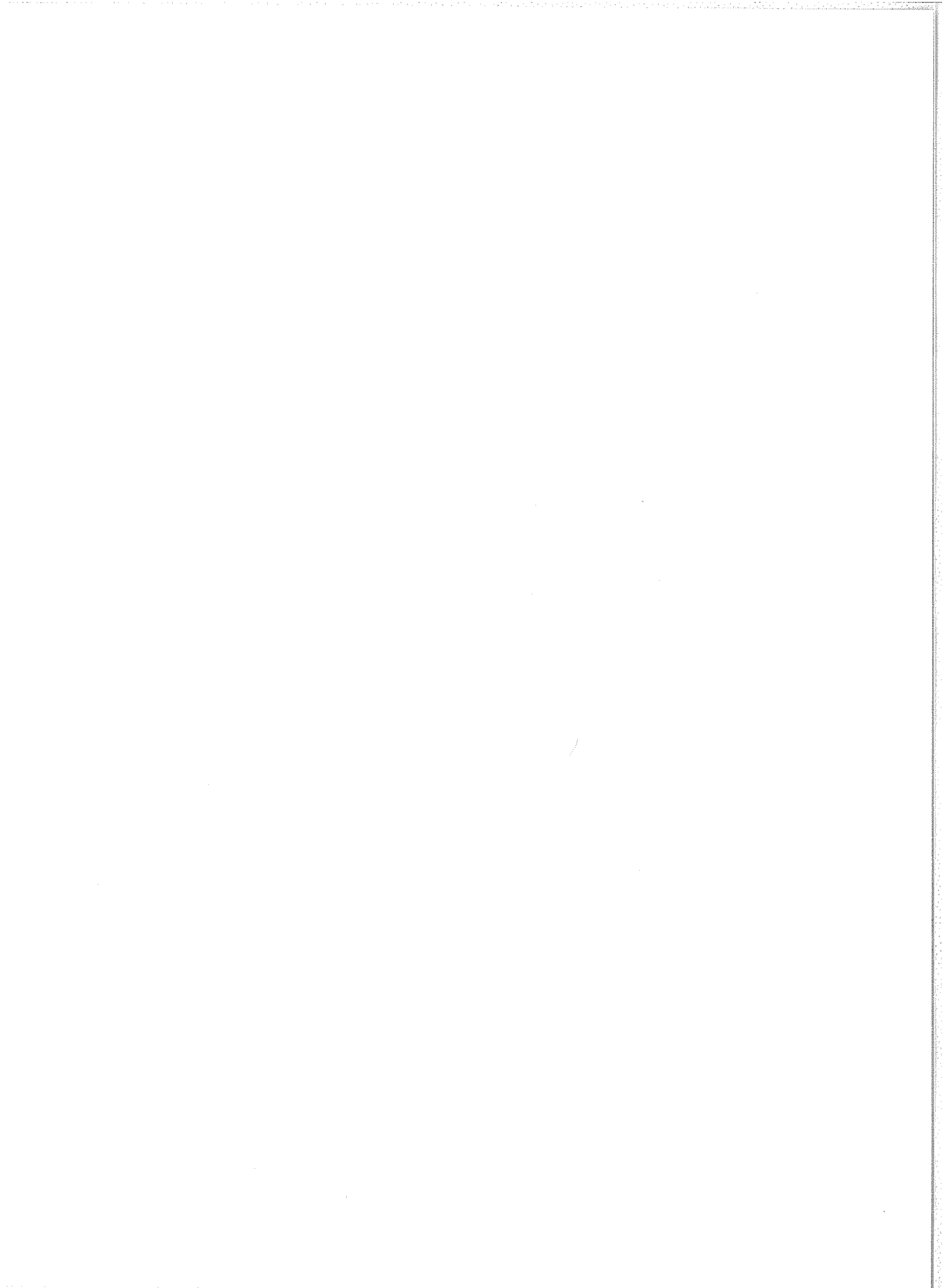
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Observations of Jupiter's Sporadic Radio Emission in the Range 7.6-41 MHz
9 September 1968 through 9 December 1971

by

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Department of Astro-Geophysics
University of Colorado
Boulder, Colorado 80302

This report extends the list of Jupiter's decametric emissions observed at Boulder through the Jupiter apparition of 1971. The data were recorded on the University of Colorado's radio spectrograph. Previous reports which covered the period from 1960 through September 1968 are found in Warwick and Kreiss [1964] and Warwick and Dulk [1965, 1966, 1968]. These reports cover the apparitions of 1960-63, 1964, 1965 and 1967-68, respectively.

We described the observing equipment and the data format in the previous reports. The present report uses the same scheme. Observing periods ± 30 days from conjunctions represent times when the antennas were tracking the sun; Jupiter was within 30° of the sun and therefore in the antenna beam. Observing periods and emission intervals which spanned 0000 UT are recorded with negative times and the later date or with times greater than 2400 UT and the earlier date.

During the period of 1 July 1970 through 28 October 1970, no observations were made because the observatory was being moved from a point 5 miles north of Boulder to a new and better site about 20 miles west of Boulder. Operation was sporadic during the first few months at the new site. These factors are reflected in the decreased observing times.

The overall emission probability was 0.016 for 1969, 0.002 for 1970 and 0.023 for 1971; these compare to an overall average emission probability of 0.077 for all apparitions from 1961 through 1968. Figure 1 is a histogram of emission probability vs. longitude of the central meridian (LCM) (System III (1957.0)) for the 1969 apparition. Figure 2 is a histogram of emission probability vs. Io's angle from superior geocentric conjunction ϕ_{IO} . These curves resemble curves of previous years, but the overall emission probability is much lower in 1969 than it was in 1968. Figure 3 shows the joint probability distribution as a function of the LCM and ϕ_{IO} . Note that the emission probability was greater than 40% near coordinate (LCM, ϕ_{IO}) = (150° , 90°).

Figure 4 is a plot of the (LCM, ϕ_{IO}) relation for the emissions recorded by us in 1969. Each sloped line represents one Jupiter event and is the path of the coordinate ϕ_{IO} from beginning to end of the emission. The line slope is equal to P_J/P_{IO} where Jupiter's rotational period $P_J \approx .413$ days and Io's period $P_{IO} \approx 1.77$ days. The uneven distribution of lines is due partly to Io's influence, partly to the near commensurabilities of the periods of Jupiter and Io, and partly to the 24 hour period of a single observer on the earth.

Figure 5 shows the (LCM, ϕ_{IO}) path from beginning to end of each observation interval (time when Jupiter was in the antenna beam). The uneven distribution of observations is evident, despite the fact that Jupiter was observed for 2417 hours (corresponding to an average of 239 rotations of Jupiter or 42 of Io).

Figures 6 through 10 and 11 through 15 are similar plots for the 1970 and 1971 apparitions, respectively. Figures 6 through 9 reflect the decreased emission probability in 1970 during which only 3 emissions were recorded.

Low emission probability is also evident in 1969 and 1971, compared with the previous years, 1961 through 1968.

Figure 16 shows the combined histograms of emission probability vs. longitude of central meridian LCM (System III (1957.0)) for all apparitions 1960 through 1971, a total of 11 curves. It shows the basic information from which the need for revision of P_{III} (1957.0) = 9 hr 55 min 29.37 sec is derived. The main peak of emission, after LCM (System III (1957.0)) = 200° , more or less steadily shifts towards later longitudes. It also shows some of the hazards in so doing, inasmuch as the early peak of emission, before LCM (System III (1957.0)) = 200° , appears currently to be shifting steadily towards earlier longitudes. A modification of P_{III} to 9 hr 55 min 29.72 sec would make the main peak fit on a vertical line on Figure 16, but would exaggerate the backwards motion of the early peak.

It will be of great interest to see the nature of these curves for the current and subsequent years, 1972 and later, as the earth's view of Jupiter essentially returns to the geometry of the years 1960 and later, shown in Figure 16.

REFERENCES

- | | | |
|------------------------------------|------|---|
| WARWICK, J. W. and
W. T. KREISS | 1964 | <u>IGY Solar Activity Report No. 28</u> , 2 November 1964,
National Academy of Sciences, IGY World Data Center A
at High Altitude Observatory, Boulder, Colorado 80302. |
| WARWICK, J. W. and
G. A. DULK | 1965 | <u>IGY Solar Activity Report No. 32</u> , 16 August 1965,
National Academy of Sciences, IGY World Data Center A
at High Altitude Observatory, Boulder, Colorado 80302. |
| WARWICK, J. W. and
G. A. DULK | 1966 | <u>IGY Solar Activity Report No. 34</u> , 1 November 1966,
National Academy of Sciences, IGY World Data Center A
at High Altitude Observatory, Boulder, Colorado 80302. |
| WARWICK, J. W. and
G. A. DULK | 1968 | <u>World Data Center A, Upper Atmosphere Geophysics
Report UAG-3</u> , ESSA Research Laboratories, Boulder,
Colorado 80302. |

DATE 1968	OBSERVING PERIOD	JUPITER OBSER- VATIONS	IN- TEN- SITY	BURSTI- NESS	FREQ. RANGE MHZ	JUPITER LONGITUDE	IO RANGE
9 9	1227 2545						
9 10	1224 2237						
9 10	2301 2309						
9 10	2322 2545						
9 11	1326 1407						
9 11	1415 2540						
9 12	1225 2025						
9 12	2039 2232						
9 12	2255 2538						
9 13	1221 2535						
9 14	1219 2531						
9 15	1215 2009						
9 15	2155 2528						
9 16	1217 1928						
9 16	2114 2525						
9 17	1207 2522						
9 18	1143 2436						
9 19	1140 2445						
9 20	1137 2512						
9 21	1134 2500						
9 22	1131 2433						
9 23	1128 2435						
9 24	1125 2436						
9 25	1122 2434						
9 26	1119 2026						
9 26	2121 2444						
9 27	1116 2430						
9 28	1118 2446						
9 29	1118 2442						
9 30	1118 2439						
10 1	1131 1450						
10 1	1506 2236						
10 1	2313 2436						
10 2	1118 2432						
10 3	1117 1915						
10 3	2230 2425						
10 4	1055 2423						
10 5	1052 1745						
10 5	1808 2422						
10 6	1049 2418						
10 7	1046 2415						
10 8	1043 1930						
10 8	1945 2411						
10 9	1040 2408						
10 10	1038 1230						
10 11	1035 1230						
10 12	1032 1230						
*10 12	1230 1500						
10 13	1029 1230						
10 14	1026 1230						
10 15	1023 1230						
10 16	1020 1307						
10 17	1017 1230						
10 18	1017 1230						
10 19	1012 1225						
10 20	1055 1230						
10 21	1018 1230						
10 22	1017 1230						

* DENOTES SPECIAL OBSERVING PERIOD WHEN IO-RELATED EMISSIONS WERE POSSIBLE.

DATE 1968	OBSERVING PERIOD	JUPITER OBSER- VATIONS	IN- TEN- SITY	BURSTI- NESS	FREQ. RANGE MHZ	JUPITER LONGITUDE	IO RANGE
10 23	0959 1300						
10 24	0956 1300						
10 25	0953 1300						
10 27	0948 1300						
10 28	1013 1151						
10 28	1206 1300						
10 29	0944 1300						
10 30	0948 1300						
*10 30	1300 1520						
10 31	1032 1300	1059 1140	2	WEAK	13-17	127.0-151.8	266.2-272.0
		1245 1300	2	WEAK	13-17	191.1-200.1	281.2-283.3
11 1	0942 1300						
11 2	0943 1300						
11 3	0942 1300						
11 4	0943 1300						
11 5	0942 1300						
11 6	0918 1330						
11 7	0914 1330						
11 8	0911 1330						
11 9	1018 1330						
11 10	0908 1400						
11 11	1022 1330						
11 12	0911 1330						
*11 12	1330 1500						
11 13	0924 1330						
*11 13	1500 1800						
11 14	0907 1330						
11 15	0908 1330						
11 16	0908 1330						
11 17	0908 1350						
11 18	0908 1330						
11 19	0907 1335						
11 20	0834 1330						
11 21	0907 1330						
11 22	0828 1334						
11 23	0825 1342						
11 24	0823 1330						
11 25	0819 1330						
11 26	0816 1330						
11 27	0812 1330						
11 28	0809 1330						
11 29	0808 1330						
12 1	0814 1330	1153 1256	3	MODERATE	16-36	143.4-181.5	97.6-106.5
12 2	0807 1330						
12 3	0808 1330						
*12 3	1330 1800						
12 4	0807 1330						
12 5	0945 1330						
12 6	0743 1330						
12 7	0739 1330						
12 8	0736 1330						
12 9	0732 1330						
12 10	0729 1330						
12 11	0911 1330						
12 12	0722 1329						
12 13	0718 1330						
12 14	0718 1330						
12 15	0726 1330						

DATE 1968	OBSERVING PERIOD		JUPITER OBSER- VATIONS		IN- TEN- SITY	BURSTI- NESS	FREQ. RANGE MHZ	JUPITER LONGITUDE	IO RANGE
12 16	0718	1330	1231	1301	1	WEAK	18-27	263.8-281.9	273.8-278.1
12 17	0723	1330							
12 18	0706	1330							
12 19	0723	1330							
12 20	0654	1330							
12 21	0650	1330							
12 22	0656	1332							
12 23	1017	1330							
12 24	0640	1330							
12 27	0635	1330							
12 28	0632	1330							
12 29	0627	1330							
12 30	0704	1330							
12 31	0633	1330							
1969									
1 2	1019	1330							
1 3	0628	1330							
1 4	0627	1330							
* 1 4	1330	1500							
1 5	0628	1330	1044	1131	1	WEAK	11-19	330.1-358.5	7.5- 14.1
1 6	0628	1330							
1 7	0550	1330							
1 10	0539	1330							
1 11	0535	1333							
1 12	0531	1330							
1 13	0527	1330							
1 14	0523	1330							
* 1 14	1558	1800							
1 15	0519	1330							
			0920	0930	2	MODERATE	15-21	345.2-351.3	230.4-231.8
			1108	1157	2	MODERATE	13-19	50.5- 80.2	245.7-252.6
1 16	0518	1500	0930	0948	1	SMOOTH	13-18	141.9-152.8	75.3- 77.8
1 17	0517	1330	1023	1128	2	MODERATE	12-19	324.5- 3.8	286.2-295.4
1 18	0518	1330							
1 19	0518	1330							
1 20	0518	1330							
1 21	0517	1330							
1 22	0517	1330	0902	1025	1	WEAK	13-20	308.7-358.8	212.4-224.2
1 23	0458	1330							
1 24	0517	1330							
			0808	1013	1	STRONG	13-26	217.2-292.8	251.8-269.4
			1103	1149	3	STRONG	13-19	323.0-350.8	276.5-283.0
1 25	0458	1337	0823	1049	2	MODERATE	12-18	16.9-105.1	97.4-118.0
1 26	0458	1330							
1 27	0458	1330							
1 28	0458	1330							
1 29	0426	1330							
1 30	0508	1330							
1 31	0509	1330	0826	1018	2	STRONG	13-28	202.6-270.3	239.0-254.8
2 1	0447	1330							
			0527	0544	1	WEAK	13-18	245.0-255.3	57.2- 59.6
			0740	0826	1	WEAK	13-18	325.4-353.2	76.0- 82.5
			1036	1129	1	SMOOTH	13-20	71.8-103.8	100.9-108.4
2 2	0444	1330	0437	0506	3	STRONG	11-20	5.5- 23.0	253.7-257.8
2 3	0458	1330	0931	1008	2	STRONG	12-20	333.8-356.2	138.9-144.1
2 4	0458	1330							
2 5	0457	1330							
2 6	0445	1330	0622	0719	2	MODERATE	15-20	311.5-346.0	2.8- 10.9
2 7	0458	1352	0937	1109	1	MODERATE	11-30	220.0-275.6	233.9-246.9

DATE 1969	OBSERVING PERIOD	JUPITER OBSER- VATIONS	IN- TEN- SITY	BURSTI- NESS	FREQ. RANGE MHZ	JUPITER LONGITUDE	IO RANGE
2 8	0458 1342	1139 1225	3	STRONG	12-18	84.5-112.3	94.7-101.2
2 9	0553 1330	0600 0631	3	MODERATE	11-19	30.2- 49.0	250.4-254.8
2 10	0447 1330	0520 0550	1	STRONG	18-29	156.7-174.8	88.3- 92.6
2 11	0513 1330						
2 12	0506 1330						
2 13	0453 1330						
2 14	0458 1330	1024 1115	1	MODERATE	14-34	223.1-254.0	225.6-232.8
		1201 1300	3	STRONG	13-18	281.8-317.4	239.3-247.6
2 15	0457 0612						
2 15	0708 1200						
* 2 15	1200 1504	1316 1458	3	STRONG	26-36	117.8-179.5	93.5-107.9
2 16	0457 1330	0707 0734	1	WEAK	15-18	45.3- 61.7	244.9-248.7
2 17	0458 1330	0808 0905	3	STRONG	11-24	232.9-267.4	97.1-105.2
2 18	0457 0504						
2 18	0520 0532						
2 18	0602 1330	0616 0625	2	MODERATE	15-20	315.9-321.3	284.8-286.1
2 19	0503 1330	1025 1104	3	STRONG	12-19	257.1-280.7	163.6-169.1
2 20	0458 1330						
2 21	0523 1330						
2 22	0458 1459						
2 23	0458 1330						
2 24	0458 1330	1001 1019	1	WEAK	16-22	276.0-286.9	98.2-100.8
2 25	0509 1330	0616 0633	2	MODERATE	16-20	290.7-301.0	270.0-272.4
2 26	0457 1330						
2 27	0457 1340						
2 28	0458 1330						
3 1	0458 1330						
3 2	0749 1330						
3 3	0548 1330						
3 4	0503 1330	0509 0535	2	MODERATE	20-28	225.0-240.7	245.8-249.4
3 5	0916 1330						
3 5	0507 1330						
3 7	0458 0658						
3 7	0812 1315						
3 8	0525 1332						
3 9	0458 1330						
3 10	0458 1330						
3 11	0457 1330	0608 0645	2	MODERATE	18-30	235.5-257.8	239.4-244.6
3 12	0515 1330						
3 13	0438 1330						
3 14	0457 1300						
3 15	0458 1300						
3 16	0458 1300						
3 17	0432 1300						
3 18	0458 1300	0516 0534	2	MODERATE	20-34	178.7-189.6	217.3-219.9
		0704 0728	1	STRONG	13-26	244.0-258.5	232.6-236.0
		0912 0933	2	STRONG	13-23	321.4-334.1	250.7-253.7
		0850 1036	3	STRONG	18-38	98.8-162.9	91.2-106.2
3 19	0457 1300						
3 20	0457 1300						
3 21	0458 1300						
3 22	0458 1300						
3 23	0458 1300						
3 24	0458 1300						
3 25	0454 1300	0958 1107	2	STRONG	19-24	324.0- 5.7	242.6-252.4
3 26	0459 1300	1025 1136	2	STRONG	18-37	130.9-173.9	90.1-100.1
3 27	0457 1300						
3 28	0458 0806						
3 28	0912 1300						

DATE 1969	OBSERVING PERIOD	JUPITER OBSER- VATIONS	IN- TEN- SITY	BURSTI- NESS	FREQ. RANGE MHZ	JUPITER LONGITUDE	IO RANGE
3 29	0214 1131						
3 30	0205 1131						
3 31	0205 1134						
4 1	0204 1133						
4 2	0231 0455						
4 2	0503 1157						
4 3	0215 1130						
4 4	0211 1100						
4 5	0220 0238						
4 5	0300 1129						
4 6	0215 0611						
4 6	0725 0935						
4 6	0945 1119						
4 7	0205 1134						
4 8	0206 1134						
4 9	0209 1028						
* 4 9	2300 2600						
4 10	0200 0940						
4 10	1000 1136						
4 11	0206 1134						
4 12	0213 1136						
4 13	0220 1137						
4 14	0205 1133						
4 15	0205 1128						
4 16	0205 1135						
* 4 17	0108 0300						
4 17	0317 1130						
4 18	0205 1138						
4 19	0220 1130						
4 20	0224 1134	06 07 0627	2	MODERATE	25-36	140.9-153.0	103.4-106.2
4 21	0205 1131						
4 22	0205 1127						
4 23	0205 1123						
4 24	0205 1119						
4 25	0205 1114						
4 26	0215 1110						
4 27	0205 1106	06 25 0758	2	STRONG	19-35	125.8-182.1	90.9-104.0
4 28	0305 0936						
4 29	0305 0956						
4 30	0311 0958						
5 1	0305 0956						
5 2	0305 1000						
5 3	0306 1001						
5 4	0306 1007						
5 5	0305 1003						
5 6	0305 0955						
5 7	0305 1007						
5 8	0305 0954						
5 9	0305 1000						
5 10	0305 1000						
5 11	0305 0955						
5 12	0305 1000						
5 13	0305 0930						
5 14	0305 0958						
5 15	0317 0933						
5 16	0305 0858						
5 17	0305 0900						

DATE 1969	OBSERVING PERIOD	JUPITER OBSER- VATIONS	IN- TEN- SITY	BURSTI- NESS	FREQ. RANGE MHZ	JUPITER LONGITUDE	IO RANGE
5 18	0305 0856						
* 5 18	2024 2700						
5 19	0300 0858						
5 20	0305 0933						
* 5 21	0019 0300						
5 21	0300 0858						
* 5 22	0017 0300	0203 0238	3	STRONG	25-35	130.6-151.7	101.7-106.7
5 22	0300 0914						
5 23	0305 0858						
5 24	0203 0732						
5 25	0200 0715						
5 26	0205 0715						
5 27	0204 0715						
5 28	0104 0715						
5 29	0204 0715						
5 30	0252 0715						
5 31	0203 0724						
6 1	0204 0715						
6 2	0205 0715						
6 3	0204 0715						
6 4	0206 0715						
6 5	0204 0715	0421 0458	1	MODERATE	20-32	160.4-182.8	89.4- 94.7
6 6	0204 0715						
6 7	0200 0715						
6 8	0200 0715						
6 9	0203 0715						
6 10	0204 0715						
6 11	0206 0715						
6 12	0204 0715						
6 13	0205 0505						
6 13	0530 0715						
6 14	0155 0715						
6 15	0204 0715						
6 16	0203 0715						
6 17	0201 0646						
6 18	0205 0640						
6 19	0205 0611						
6 20	0204 0715						
6 21	0205 0620						
6 22	0204 0600						
* 6 22	2003 2600	2236 2306	1	MODERATE	24-37	139.2-157.3	102.0-106.2
6 23	0200 0620						
6 24	0108 0619						
6 25	0206 0620						
6 26	0203 0600						
6 27	0204 0620						
6 28	0232 0610						
6 29	0231 0620						
* 6 29	2104 2600	2335 2400	2	STRONG	26-36	147.5-162.4	93.9- 97.4
6 30	0200 0620						
7 1	0249 0614						
7 2	0232 0620						
7 3	0247 0614						
7 4	0238 0515						
7 5	0233 0516						
7 6	0202 0515						
* 7 6	2205 2600						

DATE 1969	OBSERVING PERIOD	JUPITER OBSER- VATIONS	IN- TEN- SITY	BURSTI- NESS	FREQ. RANGE MHZ	JUPITER LONGITUDE	IO RANGE
7 7	0200 0514						
7 8	0303 0515						
7 9	0232 0515						
7 10	0234 0515						
7 11	0231 0515						
7 12	0232 0517						
7 13	0232 0515						
7 14	0231 0515						
7 15	0234 0515						
7 16	0232 0516						
7 17	0225 0517						
7 18	0230 0511						
7 19	0238 0515						
7 20	0255 0515						
7 21	0230 0534						
7 22	0200 0417						
7 23	0201 0415						
7 24	0200 0415						
* 7 24	1643 2000						
7 25	0200 0430						
7 26	0202 0415						
* 7 26	2215 2600						
7 27	0200 0432						
7 29	0203 0415						
7 30	0200 0414						
7 31	0203 0415						
8 1	0200 0415						
8 2	0203 0415						
* 8 2	2230 2600						
8 3	0200 0415						
8 4	0203 0415						
8 5	0245 0449						
8 6	0201 0315						
8 7	0204 0315						
8 8	0200 0315						
8 9	0204 0315						
8 10	0200 0315						
8 11	0203 0315						
8 12	0151 0315						
8 13	0205 0317						
8 14	0204 0315						
8 15	0158 0314						
8 16	0105 0315						
8 17	0203 0315						
8 18	0200 0315						
8 19	0206 0315						
8 20	0151 0315						
* 8 20	1630 2000						
8 21	0200 0344						
8 22	0148 0315						
8 23	0200 0315						
8 24	0157 0315						
8 25	0202 0238						
8 26	0200 0318						
8 27	0200 0315						
8 28	0200 0315						
8 29	0152 0315						
8 30	0200 0317						

DATE 1969	OBSERVING PERIOD	JUPITER OBSER- VATIONS	IN- TEN- SITY	BURSTI- NESS	FREQ. RANGE MHZ	JUPITER LONGITUDE	IO RANGE
8 31	0200 0315						
9 1	0204 0314						
* 9 1	1428 1700						
9 2	0200 0314						
9 3	0151 0311						
9 4	0200 0307						
9 5	0200 0304						
9 6	0115 0220						
9 6	1433 2615						
9 7	1429 2608						
9 8	1427 2145						
9 9	1721 2156						
9 10	1522 1534						
9 10	1627 2158						
9 11	1617 2157						
9 12	1617 2200						
9 13	1619 2200						
9 14	1622 2300						
9 15	1615 2201						
9 16	1615 2159						
9 17	1702 2257						
9 18	1619 2304						
9 19	1615 2257						
9 20	1614 2306						
9 21	1509 1700						
9 21	1734 2303						
9 22	1615 2305						
9 23	1616 2300						
9 24	1615 2303						
9 25	1620 2300						
9 26	1615 1718						
9 26	1822 2304						
9 27	1614 2308						
9 28	1502 1800						
9 28	1834 2301						
9 29	1615 2303						
9 30	1615 1956						
9 30	2019 2300						
10 1	1617 2301						
10 3	1615 2304						
10 4	1650 2300						
10 5	1548 2301						
10 6	1615 2305						
10 7	1617 2302						
10 8	1615 2305						
10 9	1615 2230						
10 10	1609 2305						
10 11	1548 2311						
10 12	1555 2258						
10 13	1556 2306						
10 14	1612 2259						
10 15	1701 2232						
10 17	1615 2303						
10 18	1614 2302						
10 19	1626 2258						
10 20	1615 2215						
10 21	1605 2258						

DATE 1969	OBSERVING PERIOD	JUPITER OBSER- VATIONS	IN- TEN- SITY	BURSTI- NESS	FREQ. RANGE MHZ	JUPITER LONGITUDE	IO RANGE
10 22	1616 2302						
10 23	1615 2124						
10 24	1515 2300						
10 25	1614 2303						
10 26	1734 2358						
10 27	1648 2301						
10 28	1609 2240						
10 29	1615 2300						
10 30	1715 2253						
10 31	1617 2258						
11 1	1556 1830						
11 2	1511 2259						
11 3	1617 2302						
11 4	1627 2330						
11 5	1616 2300						
11 6	1615 2301						
11 7	1615 2258						
11 8	1615 2305						
11 9	1555 2259						
*11 29	1615 1900						
*12 4	1058 1400						
*12 9	2100 2147						
1970							
1 9	1120 1500						
1 10	1100 1457						
1 11	1125 1459						
1 13	1125 1500						
1 14	1047 1500						
1 15	1104 1500						
1 16	1112 1500						
1 17	1101 1503						
1 18	1114 1500						
1 19	1104 1500						
1 20	1102 1500						
1 21	1058 1500						
1 22	1058 1500						
1 23	1118 1500						
1 24	0907 1500						
1 26	1351 1500						
1 27	1221 1500						
1 28	0834 1400						
1 29	1219 1400						
1 30	0830 1400						
1 31	0818 1400						
2 1	0753 1402						
2 3	0901 1400	1110 1200	1	WEAK	20-31	230.2-260.5	235.7-242.7
2 4	0733 1430						
2 5	0830 1400						
2 6	1025 1400						
2 7	0818 1400						
2 8	0759 1417						
2 9	0850 1400						
2 10	0825 1506						
2 11	0828 1400						

DATE 1970	OBSERVING PERIOD	JUPITER OBSER- VATIONS	IN- TEN- SITY	BURSTI- NESS	FREQ. RANGE MHZ	JUPITER LONGITUDE	IO RANGE
2 12	0822 1400						
2 13	0854 1400						
2 14	0818 1359						
2 15	0826 1400						
2 16	0818 1400						
2 17	0818 1400						
2 18	0718 1400						
* 2 18	1400 1700						
2 19	0725 1400						
2 20	0720 1400						
2 21	0717 1400						
2 22	0734 1400						
2 23	0718 1400						
2 24	0718 1400						
2 25	0724 1330						
2 26	0530 1300						
2 27	0719 1312						
2 28	0718 1235						
3 1	0718 1300						
3 2	0718 1300						
3 3	0718 1300						
3 4	0718 1306						
3 6	0842 1300						
3 7	0720 1300						
3 8	0719 1324						
3 9	0718 1300						
3 10	0718 1300						
3 11	0718 1230						
3 12	0718 1300						
3 13	0718 1300						
3 14	0718 1300						
3 15	0718 1300						
3 16	0718 1300						
3 17	0718 1300						
3 18	0810 1300						
3 19	0718 1300						
3 20	0718 1300						
3 21	0718 1300						
3 22	0754 1300						
3 23	0718 1300						
3 24	0518 1300						
3 25	0620 1300						
3 26	0535 1300						
3 27	0518 1200						
3 28	0527 1300						
3 29	0518 1400						
3 30	0638 1300						
4 1	0518 1300						
4 2	0518 1300						
4 3	0518 1300						
4 4	0623 1300						
4 5	0518 1300						
4 6	0518 1300						
4 7	0600 1300						
4 8	0518 1300						
4 9	0518 1300						
4 10	0529 1300						

DATE 1970	OBSERVING PERIOD	JUPITER OBSER- VATIONS	IN- TEN- SITY	BURSTI- NESS	FREQ. RANGE MHZ	JUPITER LONGITUDE	IO RANGE
4 11	0516 1241	0712 0755	1	WEAK	24-37	133.2-159.2	98.3-104.4
4 12	0518 1240						
4 13	0615 1300						
4 14	0519 1300						
4 15	0418 1300						
4 16	0418 1300						
4 17	0438 1300						
4 18	0418 1231						
4 19	0418 1300						
4 20	0418 1300						
4 21	0418 1200	0814 0905	1	MODERATE	20-35	145.4-176.3	92.3- 99.5
4 22	0418 1200						
4 23	0418 1200						
4 24	0418 1200						
4 25	0418 1200						
4 26	0418 1200						
4 27	0418 1200						
4 28	0428 1200						
4 29	0418 1200						
4 30	0418 1200						
5 1	0418 1200						
5 2	0418 1200						
5 3	0418 1200						
5 4	0418 1128						
5 5	0303 0657						
5 6	0316 0700						
5 7	0400 0713						
5 8	0319 0658						
5 9	0302 0737						
5 10	0346 0735						
5 11	0332 0731						
5 12	0324 0735						
5 13	0333 0729						
5 14	0323 0736						
5 15	0323 0732						
5 16	0317 0731						
5 17	0316 0734						
5 18	0316 0718						
5 19	0324 0727						
5 20	0333 0730						
5 21	0330 0730						
5 22	0316 0734						
5 23	0149 1000						
5 24	0118 0634						
5 25	0051 1000						
5 26	0033 0900						
5 27	0021 0955						
5 28	0018 0958						
5 29	0018 0958						
5 30	0027 1000						
5 31	0016 1000						
6 2	0019 1003						
6 3	0015 1003						
6 4	0017 0900						
6 5	0227 0856						
6 6	0230 0900						
6 7	0227 0857						

DATE 1970	OBSERVING PERIOD	JUPITER OBSER- VATIONS	IN- TEN- SITY	BURSTI- NESS	FREQ. RANGE MHZ	JUPITER LONGITUDE	IO RANGE
6 8	0229 0857						
6 9	0225 0858						
6 10	0225 0939						
6 11	0227 0856						
6 12	0225 0856						
6 13	0224 0857						
6 14	0223 0915						
6 15	0224 0858						
6 16	0244 0849						
6 17	0220 0857						
6 18	0229 0857						
* 6 19	-0235 0220						
6 19	0220 0828						
6 19	0009 0500						
* 6 25	-0242 0302						
6 28	0120 0600						
11 1	1712 2200						
11 2	1803 2233						
11 3	1930 2225						
11 4	1634 2400						
11 5	1635 2250						
11 6	1643 2230						
11 7	1712 2230						
11 8	1645 2230						
11 9	1648 2237						
11 10	1702 2228						
11 11	1651 2400						
11 12	1637 2400						
11 13	1732 2330						
11 14	1705 2330						
11 15	1701 2330						
11 16	1628 2330						
11 17	1652 2300						
11 18	1642 2300						
11 19	1630 2300						
11 20	1652 2300						
11 21	1710 2230						
11 22	1630 2230						
11 23	1752 2230						
11 24	1631 2158						
11 25	1616 2230						
11 26	1636 2230						
11 27	1734 2228						
11 29	1643 2230						
11 30	1626 2230						
12 1	1649 2230						
12 2	1606 2230						
12 3	1634 2230						
12 4	1644 2230						
12 5	1643 2230						
12 6	1700 2230						
12 7	1247 1636						
12 8	1716 2230						
1971							
2 13	1115 1300						

DATE 1971	OBSERVING PERIOD	JUPITER OBSER- VATIONS	IN- TEN- SITY	BURSTI- NESS	FREQ. RANGE MHZ	JUPITER LONGITUDE	IO RANGE
* 2 14	1434 1755						
2 15	1115 1300						
2 16	1044 1300						
2 17	1044 1300						
2 18	1049 1300						
2 19	1140 1300						
2 20	1202 1259						
2 21	0959 1330						
2 23	0944 1300						
2 24	0944 1300						
2 25	1221 1300						
2 26	0944 1300	0935 1100	1	WEAK	14-20	233.7-285.1	305.6-317.6
3 1	0944 1300						
3 2	1035 1300						
3 3	0748 1315	1059 1115	1	MODERATE	14-16	317.2-326.9	254.6-256.9
3 4	0954 1315	1033 1213	2	MODERATE	16-36	92.1-152.5	94.4-108.5
3 5	1047 1300						
3 8	0949 1652	1001 1126	1	WEAK	16-19	315.0- 6.4	183.7-195.8
3 9	0949 1310						
3 10	0004 1310	1030 1230	2	MODERATE	13-19	273.7-346.2	234.8-251.8
3 11	0934 1150	1112 1315	3	WEAK	14-37	89.7-164.0	84.2-101.6
3 12	0949 1310						
3 13	1024 1259						
3 14	0958 1300						
3 15	0949 1300						
* 3 18	1039 1655	1340 1418	2	WEAK	24-34	153.3-176.3	89.5- 94.8
3 19	0949 1300						
3 20	1029 1330						
3 21	1018 1330						
3 22	0959 1350						
3 23	1002 1351						
3 24	0944 1350						
3 25	0945 1350						
* 3 25	1350 1625						
3 26	0949 1350						
3 26	0949 1350						
3 27	1020 1330						
3 28	1030 1330						
3 29	0959 1350						
3 30	0954 1350						
3 31	0950 1350						
4 1	0959 1351						
4 2	0949 1350						
4 3	0933 1258						
4 5	0954 1350						
4 6	1001 1350						
4 7	1003 1350						
4 8	0949 1351						
4 9	1005 1300						
4 10	1004 1230						
* 4 11	0502 1200	0634 0930	3	MODERATE	17-22	271.0- 17.4	234.1-258.9
* 4 12	0646 1300	0834 0914	2	MODERATE	16-37	134.2-158.4	94.6-100.3
4 14	1003 1300						
4 15	1023 1301						
4 16	0955 1213						
4 24	0902 1350						
4 25	0953 1230						

DATE 1971	OBSERVING PERIOD	JUPITER OBSER- VATIONS	IN- TEN- SITY	BURSTI- NESS	FREQ. RANGE MHZ	JUPITER LONGITUDE	IO RANGE
4 26	0859 1307						
4 27	1146 1250						
4 28	0855 1250						
4 29	0855 1250						
4 30	0855 1249						
5 1	0644 1250						
5 2	0739 1245						
5 3	0805 1250						
5 4	0905 1251						
5 5	1016 1200						
5 6	0900 1250						
5 7	0910 1252						
5 8	0901 1250						
5 9	0845 1250						
5 10	0920 1235						
5 11	0855 1200	10 11 1028	2	WEAK	13-25	242.5-252.8	252.7-255.1
5 12	0855 1200						
5 13	0855 1200						
* 5 14	0257 1200	04 20 0553	2	STRONG	18-39	122.4-178.6	93.9-107.0
5 15	0905 1200						
5 16	0851 1200						
5 17	0845 1200						
5 19	1006 1200						
5 20	0900 1150						
* 5 21	0358 1145	05 35 0654	2	STRONG	19-36	142.4-190.2	89.9-101.1
5 22	0845 1145						
5 23	0855 1200						
5 24	0343 0800						
5 25	0344 0758						
5 26	0344 0800						
5 27	0337 0800						
5 28	0349 0850						
5 29	0404 0802						
5 30	0346 0800						
5 31	0338 0730						
6 1	0344 0800						
6 2	0339 0929	07 52 0838	1	MODERATE	19-22	233.2-261.1	32.7- 39.2
6 3	0344 0930	03 57 0425	2	MODERATE	16-24	241.9-258.8	203.0-207.0
		06 42 0653	1	WEAK	14-21	341.6-348.3	226.4-227.9
		08 19 0925	1	MODERATE	11-18	40.3- 80.2	240.1-249.4**
6 4	0344 0930	07 00 0807	1	MODERATE	18-28	143.2-183.7	72.5- 82.0
6 5	0357 0800	05 45 0645	2	WEAK	17-29	248.5-284.7	265.5-274.0
6 6	0402 0800						
6 7	0354 0934						
6 8	0346 0800						
6 9	0354 0918						
6 10	0255 0652						
6 12	0304 0700						
6 13	0254 0700						
6 14	0331 0848						
6 15	0257 0842						
6 16	0254 0900						
6 17	0255 0900	05 17 0619	1	WEAK	18-30	239.1-276.6	184.8-193.6
6 18	0255 0657						
6 19	0259 0902	06 35 0735	1	WEAK	18-26	227.5-263.8	243.0-251.4
6 20	0318 0908						
6 21	-0003 0701						

* DENOTES SPECIAL OBSERVING PERIOD WHEN IO-RELATED EMISSIONS WERE POSSIBLE.

** EMISSION OCCURRED WHEN ANTENNAS WERE TRACKING SUN. JUPITER WAS ABOUT 40 DEG. FROM SUN AND OUTSIDE THE NOMINAL BEAMWIDTH OF THE ANTENNAS.

DATE 1971	OBSERVING PERIOD	JUPITER OBSER- VATIONS	IN- TEN- SITY	BURSTI- NESS	FREQ. RANGE MHZ	JUPITER LONGITUDE	IO RANGE
* 6 22	0000 0800	0154 0302	1	STRONG	22-36	149.4-190.5	94.0-103.6**
6 23	0250 0908						
6 24	0255 0701						
6 25	0245 0800						
6 26	0304 0932	0725 0809	1	MODERATE	17-33	231.9-258.5	235.1-241.3
6 27	0428 0700						
6 28	0155 0801						
6 29	0055 0818						
6 30	0200 0810						
7 1	0155 0810	0630 0745	1	STRONG	23-29	231.5-276.8	165.1-175.7
7 2	0201 0800						
7 3	0234 0930						
7 4	0234 0930						
7 5	0148 0900						
7 11	0232 0830						
7 12	0200 0730						
7 14	0200 0730						
7 15	0200 0730						
7 16	0200 0730						
7 17	0200 0730						
7 18	0200 0730						
7 20	0200 0730						
7 21	0200 0730	0203 0322	1	WEAK	20-29	200.7-248.4	237.7-248.9**
7 22	0230 0730						
7 24	0230 0700						
7 25	0230 0700						
7 26	0230 0700						
7 27	0230 0700						
7 30	0230 0700						
* 7 30	2200 2400	2318 2350	2	MODERATE	28-31	165.7-185.0	89.2- 93.7**
8 1	0230 0630						
8 2	0230 0630	0300 0326	1	MODERATE	22-27	240.7-256.4	167.4-171.1
8 4	0230 0630						
8 5	0230 0630						
8 6	0230 0630						
8 7	0230 0630						
8 8	0230 0600						
8 9	0200 0600						
8 10	0200 0600						
8 11	0200 0600						
8 12	0200 0600						
8 13	0200 0600						
8 14	0200 0600						
8 15	0200 0600						
8 16	0200 0530						
8 17	0200 0530						
8 18	0200 0530						
8 19	0200 0530						
8 20	0200 0530						
8 21	0200 0530						
8 22	0200 0530						
8 23	0200 0530						
8 24	0200 0500						
8 25	0200 0500						
8 26	0200 0500						
8 27	0200 0500						
8 28	0200 0500						

DATE 1971	OBSERVING PERIOD	JUPITER OBSER- VATIONS	IN- TEN- SITY	BURSTI- NESS	FREQ. RANGE MHZ	JUPITER LONGITUDE	IO RANGE
8 29	0200 0500	0300 0332	2	MODERATE	31-36	132.0-151.4	102.8-107.3
8 30	0200 0500						
8 31	0130 0500						
9 1	0130 0430						
9 2	0130 0430						
9 3	0130 0430						
9 4	0130 0430						
9 5	0000 0430						
9 6	0130 0430						
9 7	0130 0430						
9 8	0130 0430						
9 9	0130 0400						
9 10	0130 0400						
9 11	0130 0400						
9 12	0130 0400						
9 13	0130 0400						
9 14	0130 0400						
9 15	0130 0400						
9 16	0130 0400						
9 17	0130 0400						
9 18	0100 0330						
9 19	0100 0330						
9 20	0100 0330						
9 21	1900 2220						
9 21	0100 0330						
* 9 22	1900 2330						
9 23	0000 0330						
9 24	0100 0330						
9 25	0100 0330						
9 26	0100 0330						
9 27	0100 0300						
9 28	0100 0300						
* 9 29	2000 2330						
9 30	0000 0300						
10 1	0100 0300						
10 2	0100 0300						
10 3	0100 0300						
10 4	0100 0300						
10 5	0100 0300						
10 6	0100 0230						
10 7	2300 2330						
10 8	0000 0300						
10 9	0030 0230						
10 10	0030 0230						
10 11	0030 0230						
10 12	0030 0230						
10 13	0030 0230						
10 14	0030 0230						
10 15	0030 0200						
10 16	0030 0200						
10 17	0030 0200						
10 18"	0030 0200						
10 19	0030 0200						
10 20	0030 0200						
10 21	0030 0200						
10 22	0030 0200						
10 23	0030 0200						

DATE 1971	OBSERVING PERIOD	JUPITER OBSER- VATIONS	IN- TEN- SITY	BURSTI- NESS	FREQ. RANGE MHZ	JUPITER LONGITUDE	IO RANGE
10 24	0030 0130						
10 25	0030 0130						
10 26	0030 0130						
10 27	0000 0130						
10 28	0000 0130						
10 29	1600 2600						
10 30	1600 2600						
10 31	1600 2600						
11 1	1600 2530						
11 2	1610 2530						
11 3	1600 2530						
11 4	1600 2530						
11 5	1530 2530						
11 6	1530 2530						
11 7	1530 2530						
11 8	1530 2530						
11 9	1530 2530						
11 10	1530 2530						
11 11	1530 2530						
11 12	1530 2500						
11 13	1530 2500						
11 14	1530 2500						
11 15	1500 2500						
11 16	1500 2500						
11 17	1500 2500						
11 18	1500 2500						
11 19	1500 2500						
11 20	1500 2500						
11 21	1500 2430						
11 22	1500 2430						
11 23	1500 2430						
11 24	1500 2430						
11 25	1500 2430						
11 26	1430 2430						
11 27	1430 2430						
11 28	1430 2430						
11 29	1430 2430						
11 30	1430 2430						
12 1	1430 2400						
12 2	1430 2400						
12 3	1430 2400						
12 4	1430 2400						
12 5	1430 2400						
12 6	1400 2400						
12 7	1400 2400						
12 8	1400 2400						
12 9	1400 2400						

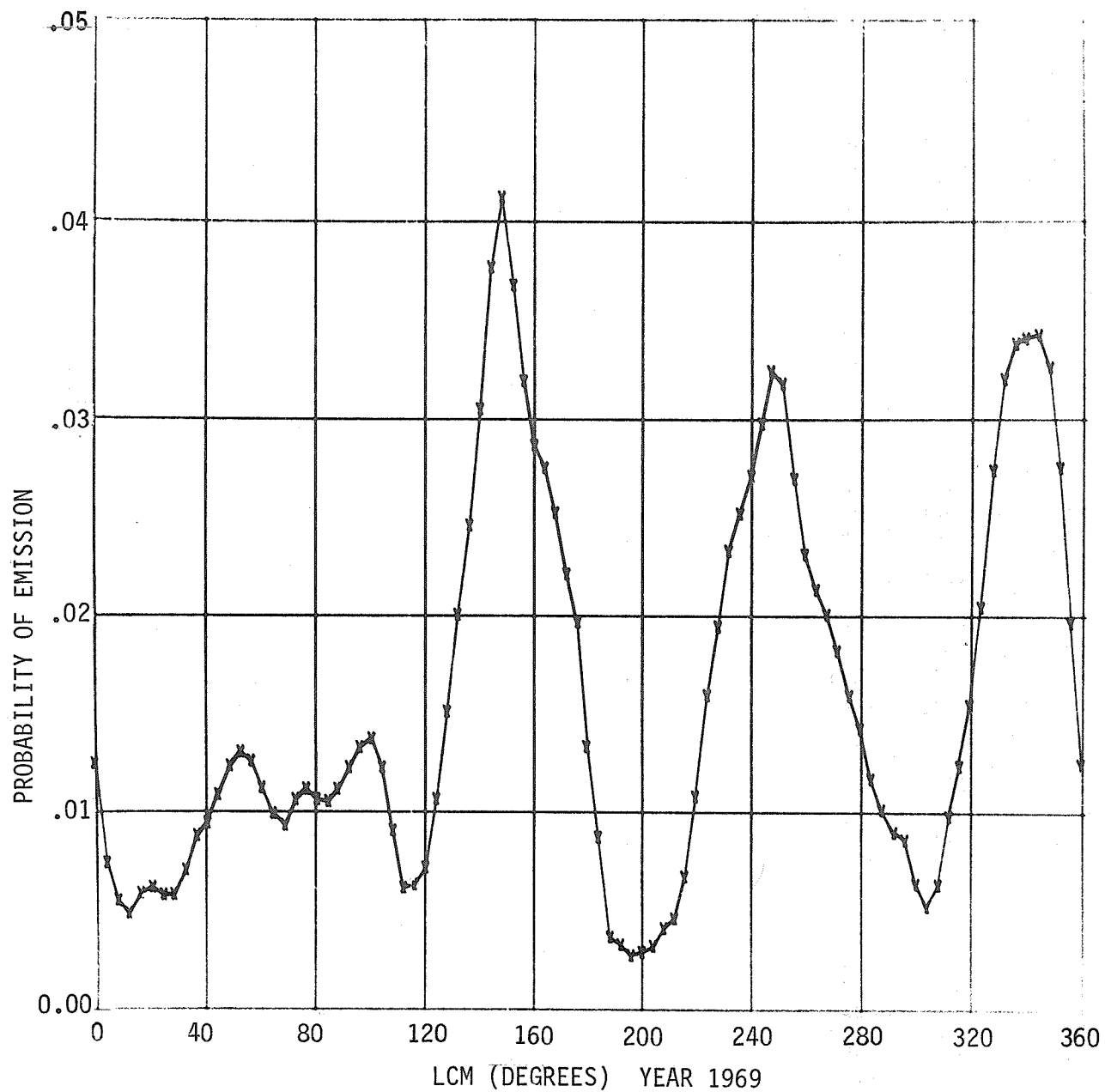


Fig. 1.

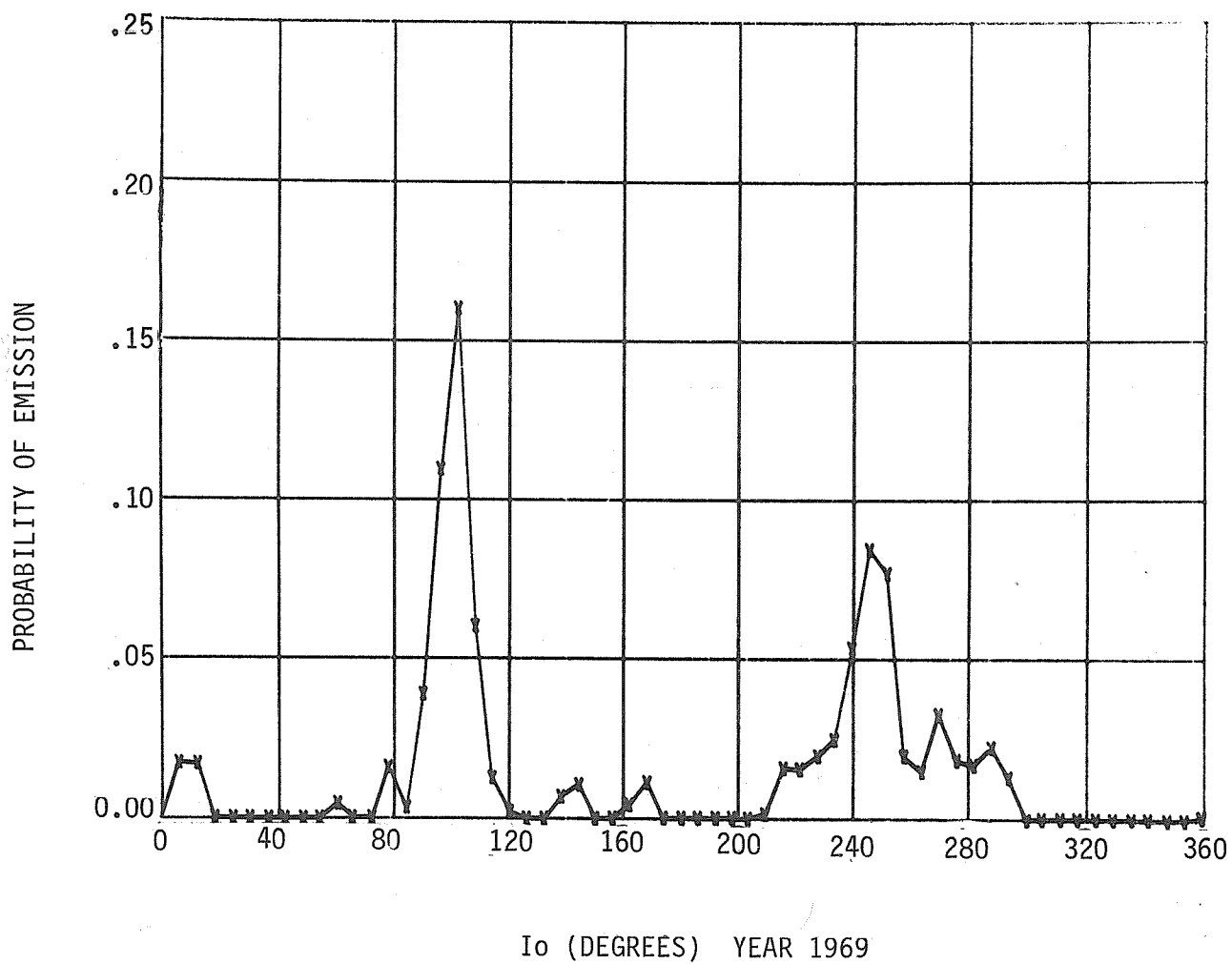


Fig. 2.

I_o , LCM PROBABILITY CONTOUR MAP, YEAR 1969, CONTOUR INTERVAL .10

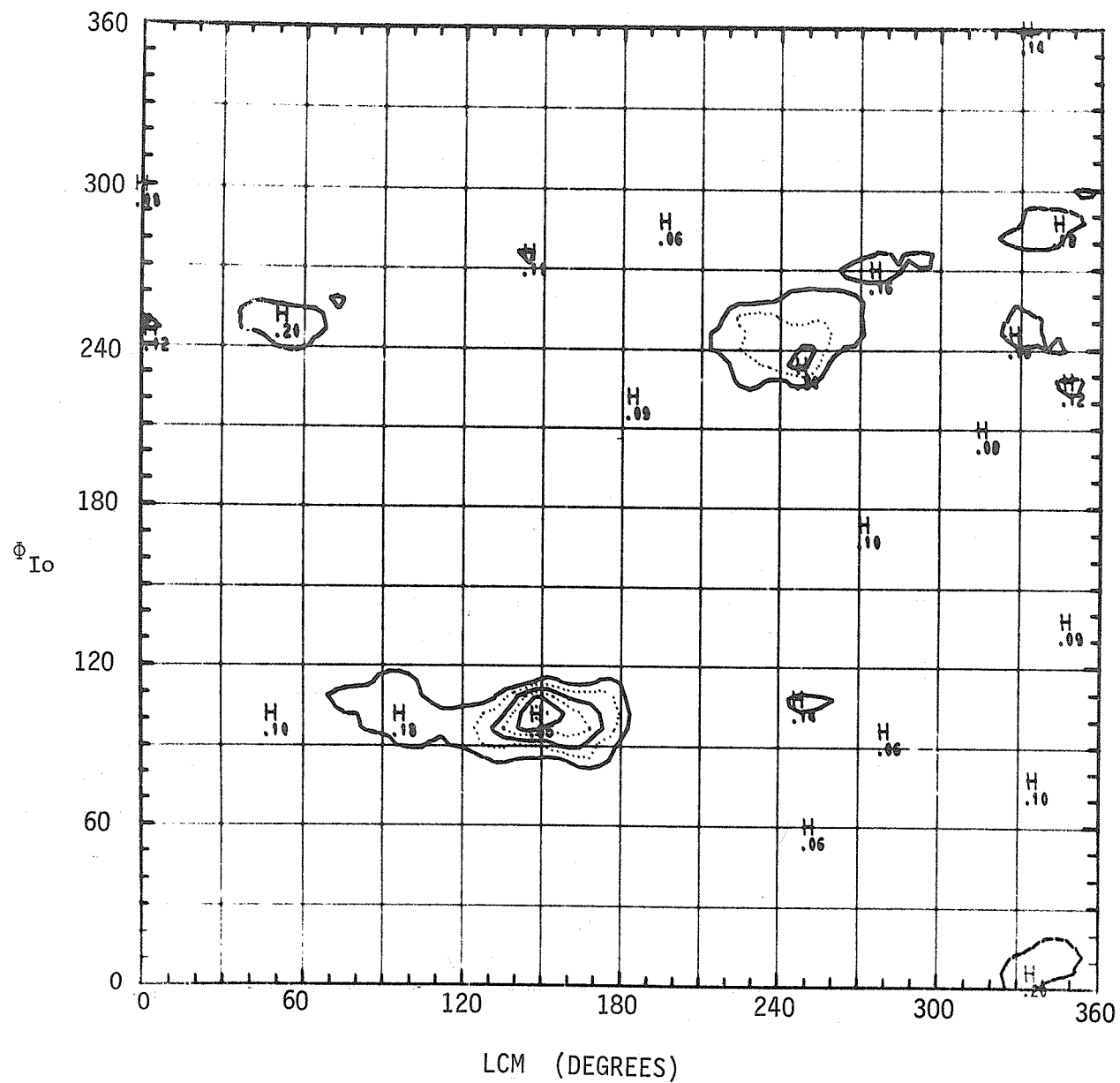


Fig. 3.

EMISSION PLOT FOR THE APPARITION OF 1969

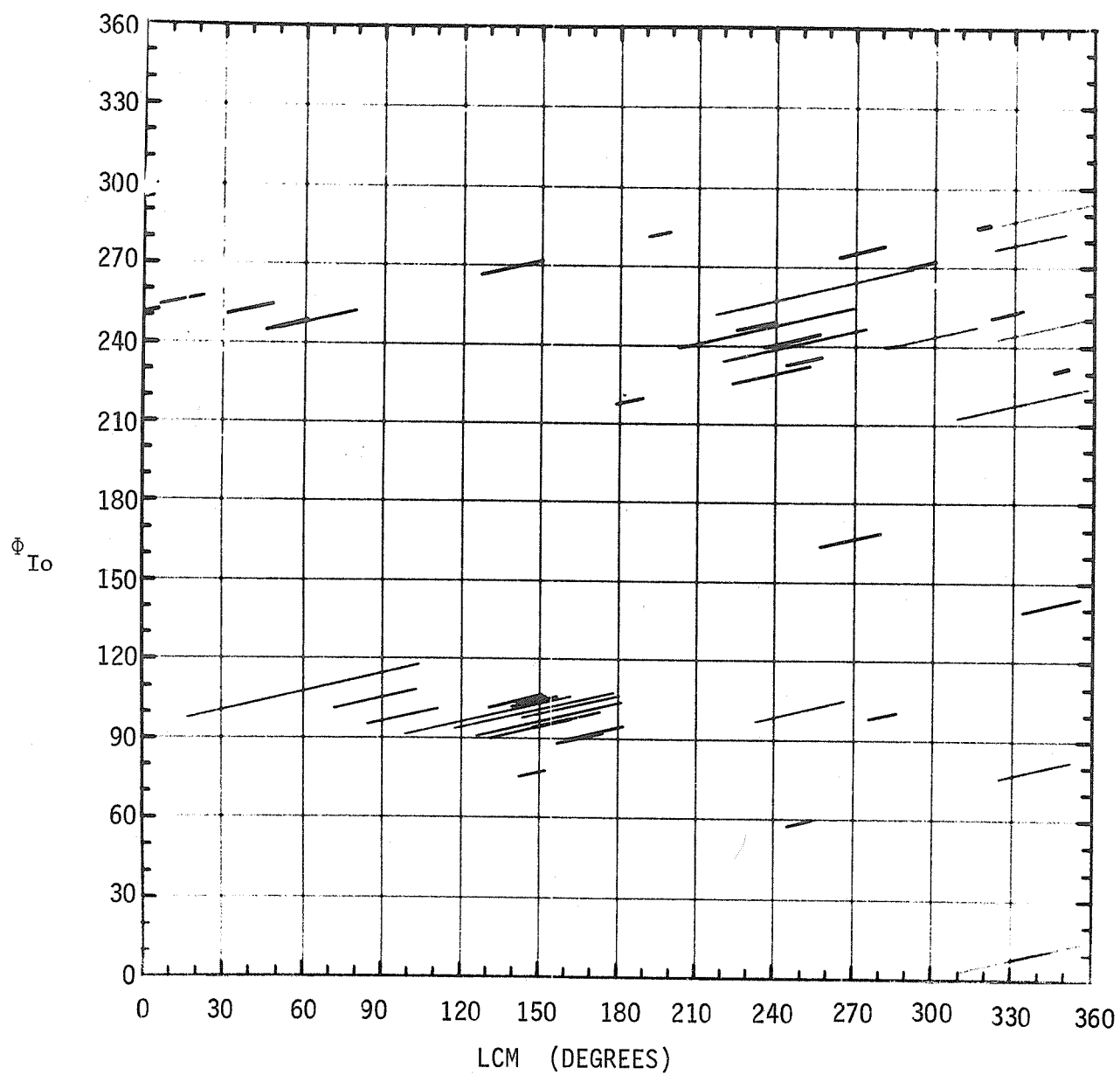


Fig. 4.

OBSERVATION PLOT FOR THE APPARITION OF 1969

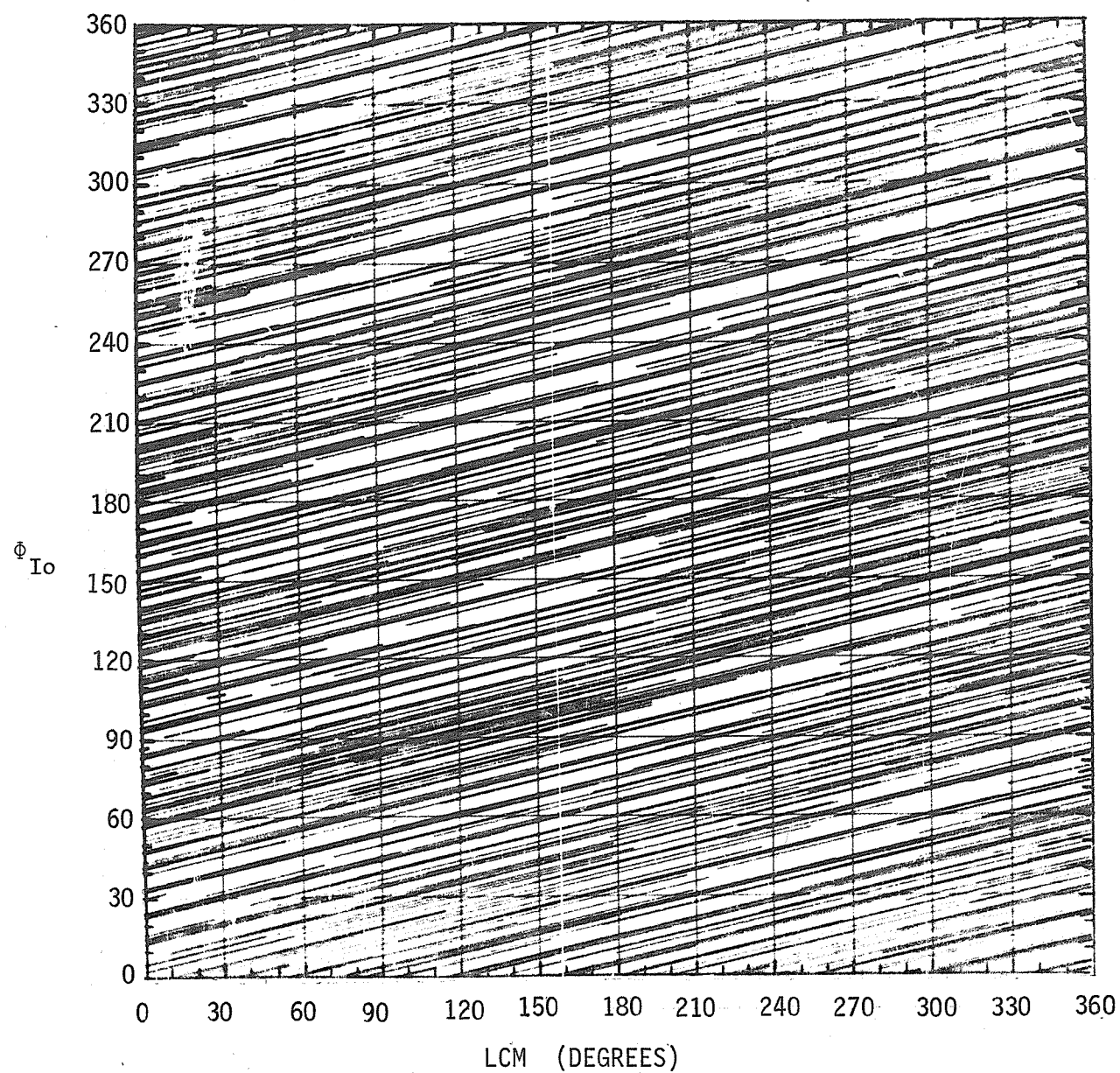


Fig. 5.

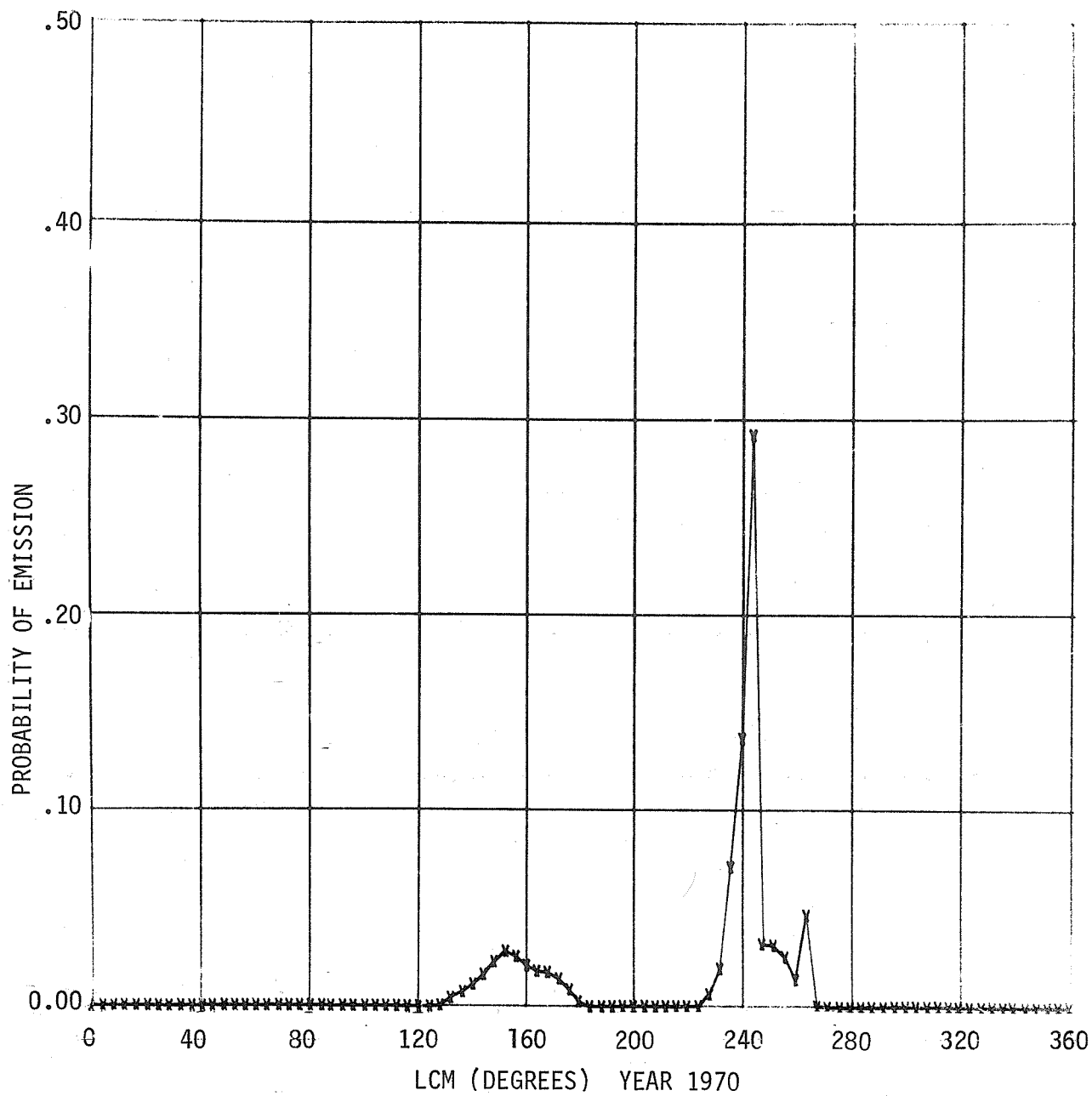


Fig. 6.

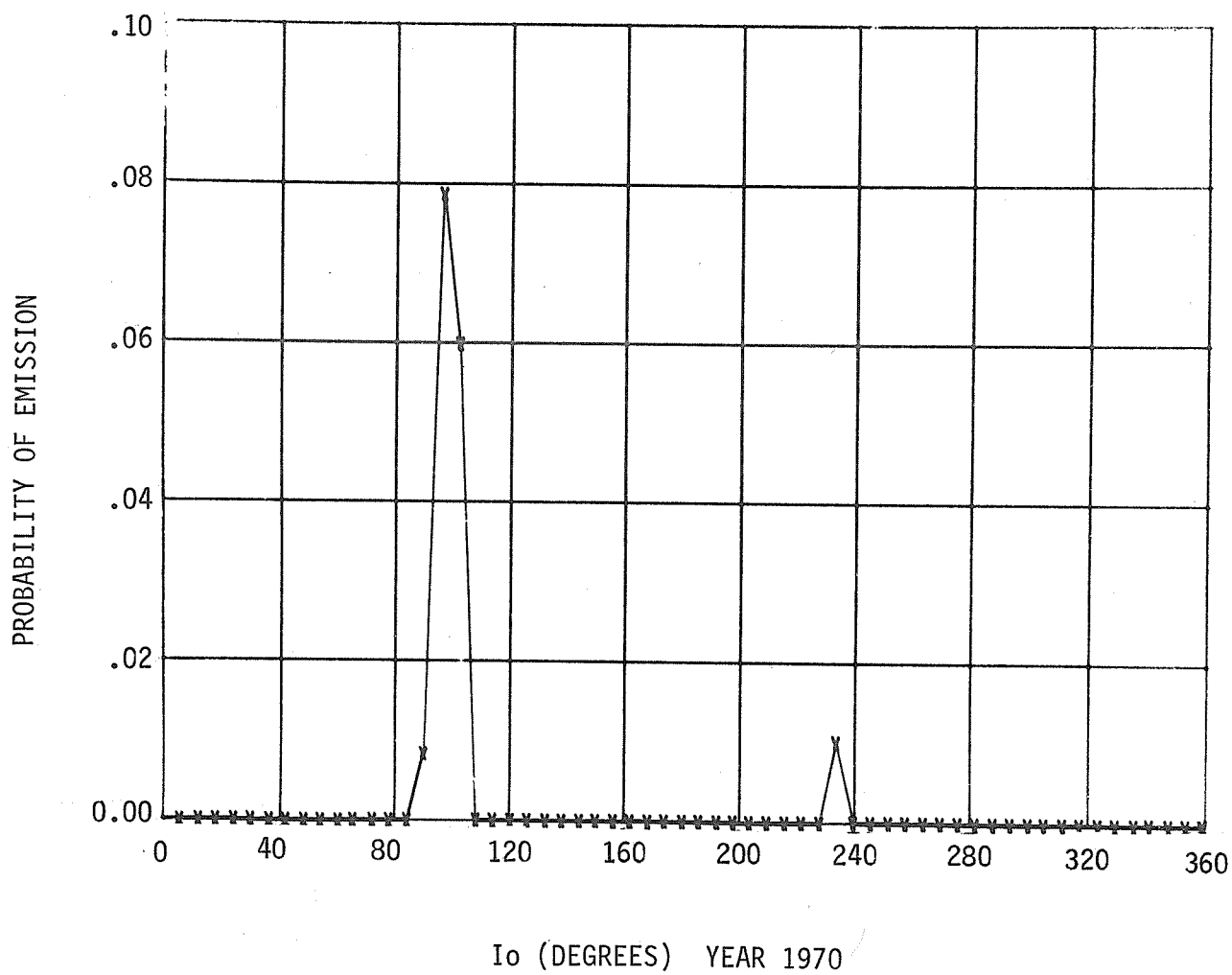


Fig. 7

I_0 , LCM PROBABILITY CONTOUR MAP, YEAR 1970, CONTOUR INTERVAL .10

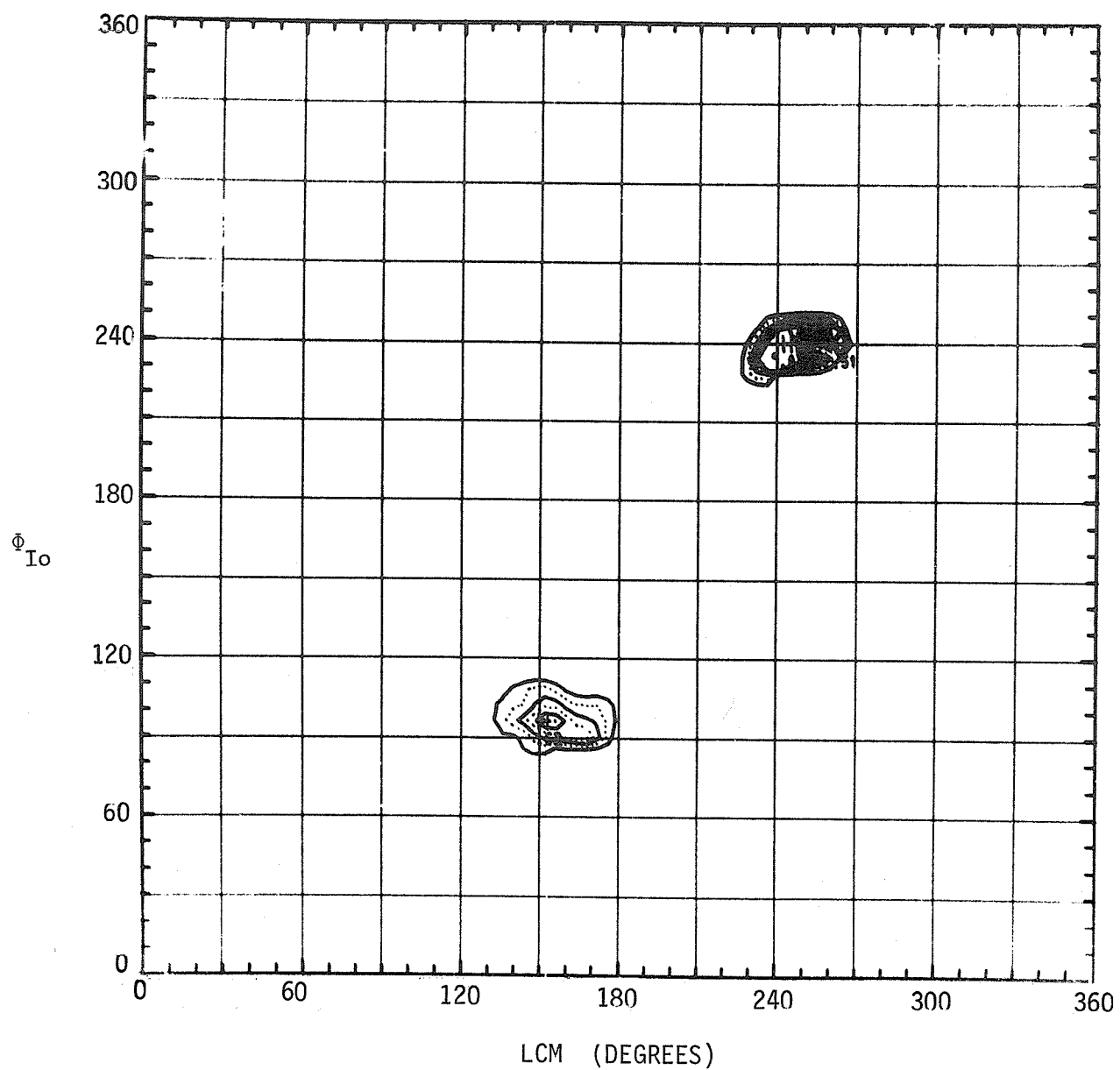


Fig. 8.

EMISSION PLOT FOR THE APPARITION OF 1970

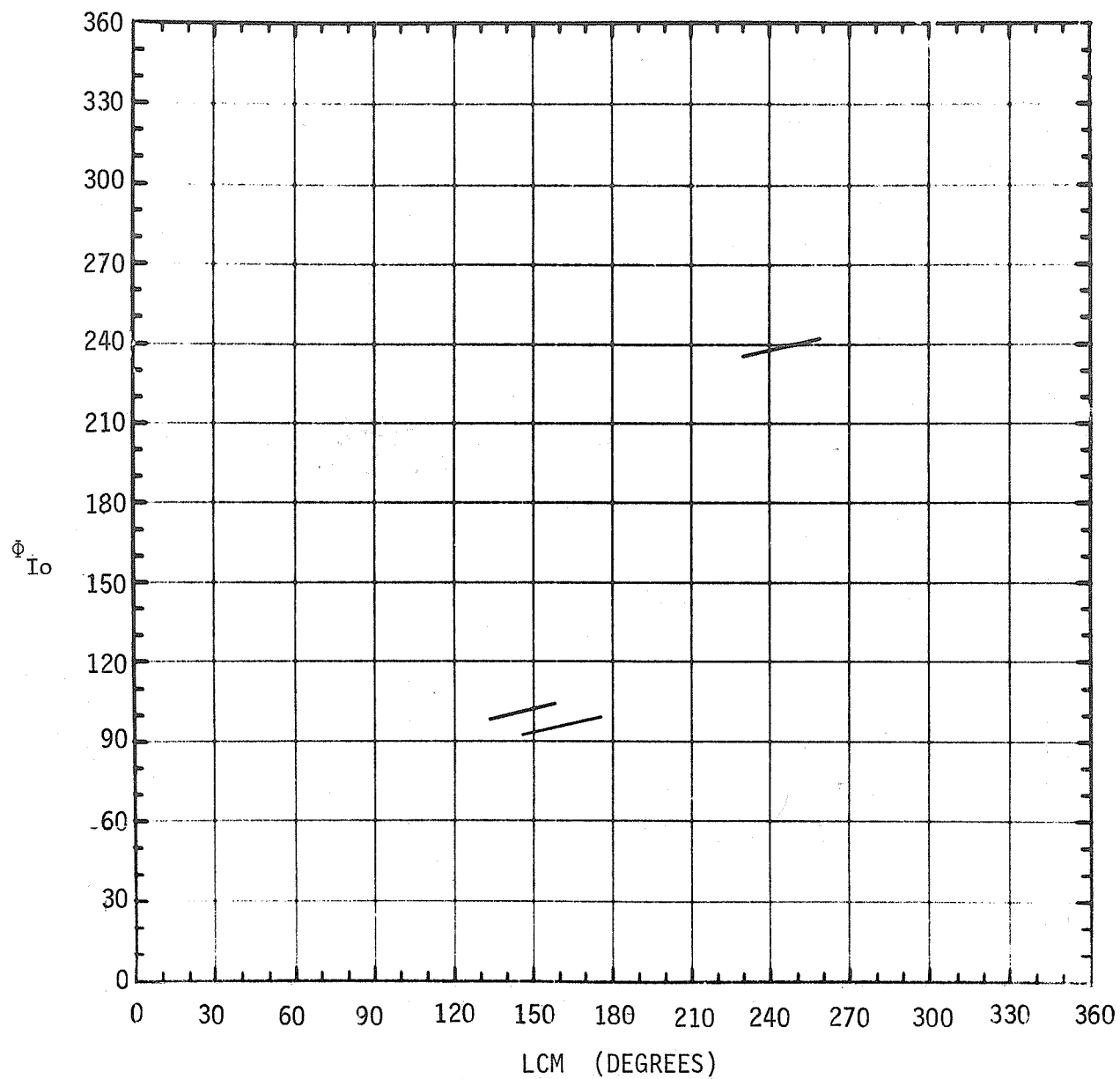


Fig. 9.

OBSERVATION PLOT FOR THE APPARITION OF 1970

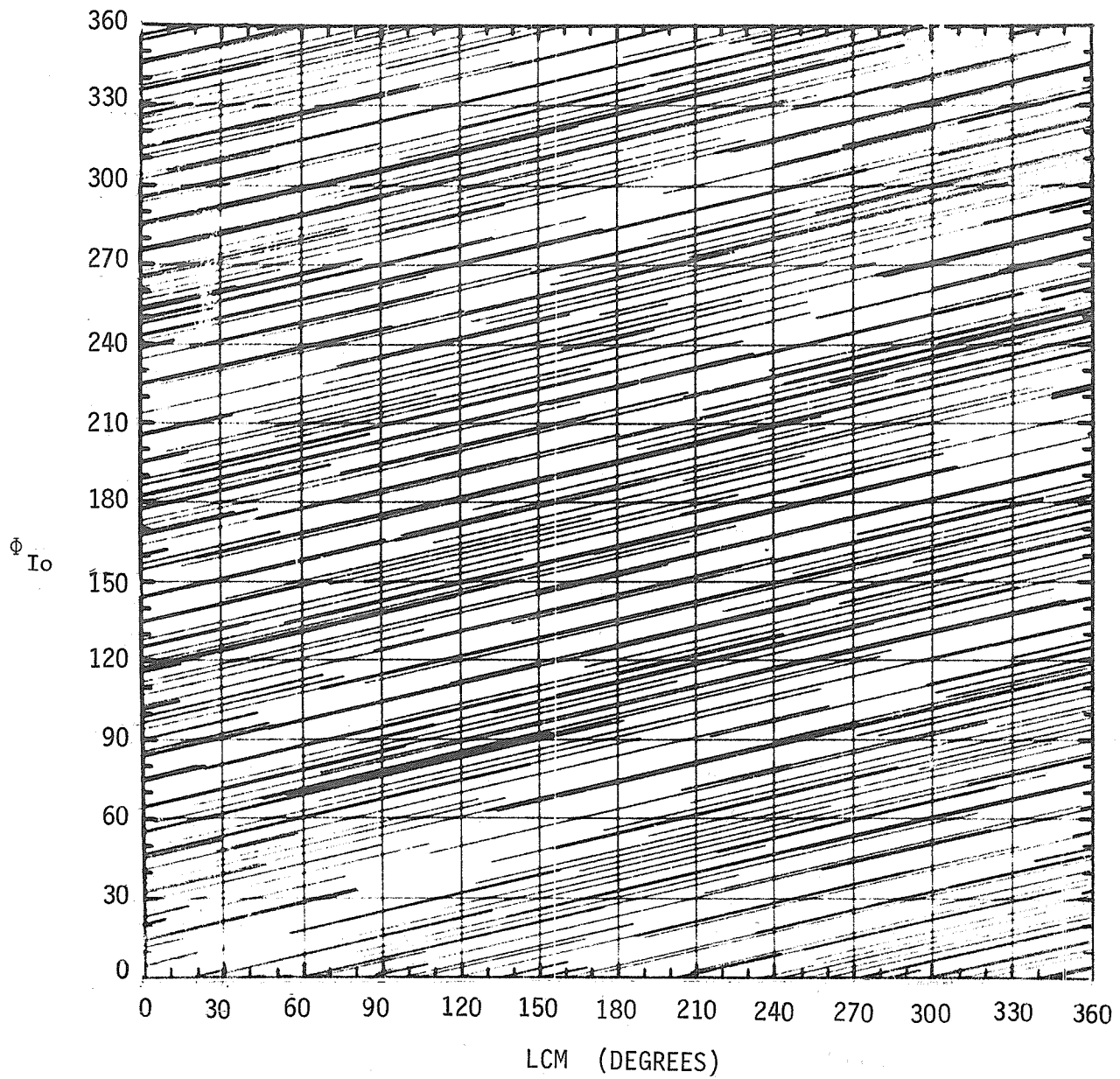


Fig. 10.

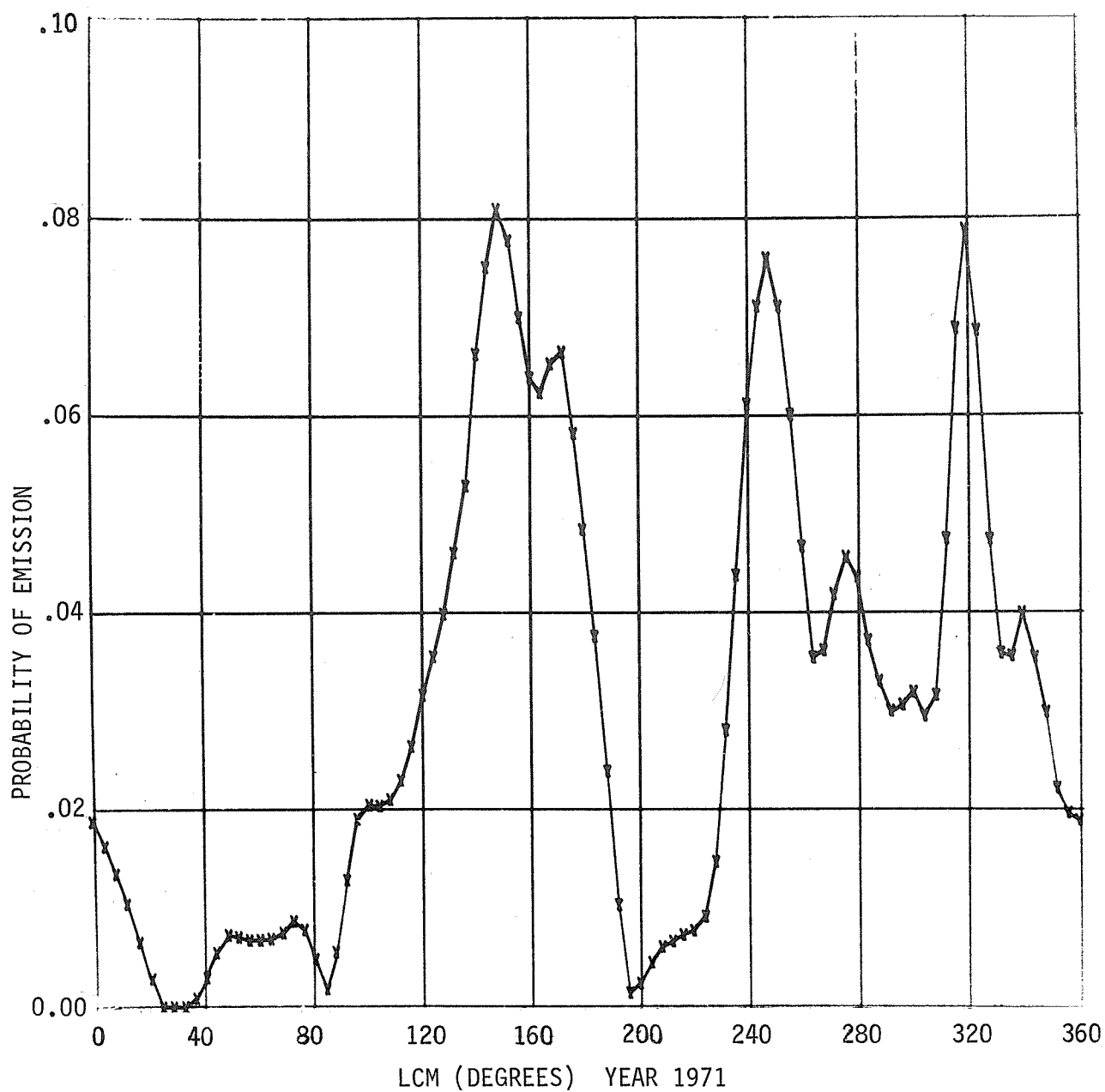


Fig. 11.

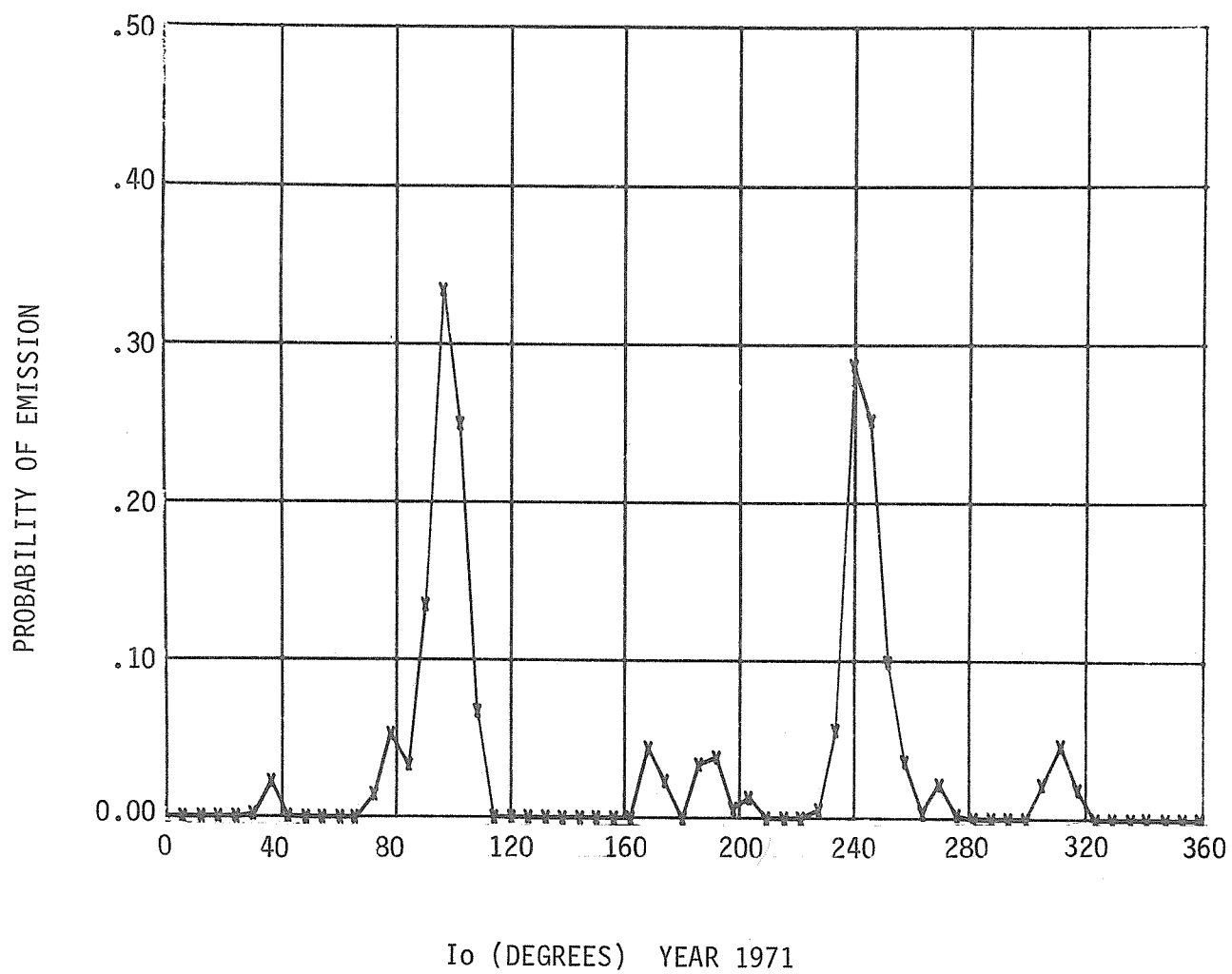


Fig. 12.

I_0 , LCM PROBABILITY CONTOUR MAP, YEAR 1971, CONTOUR INTERVAL .10

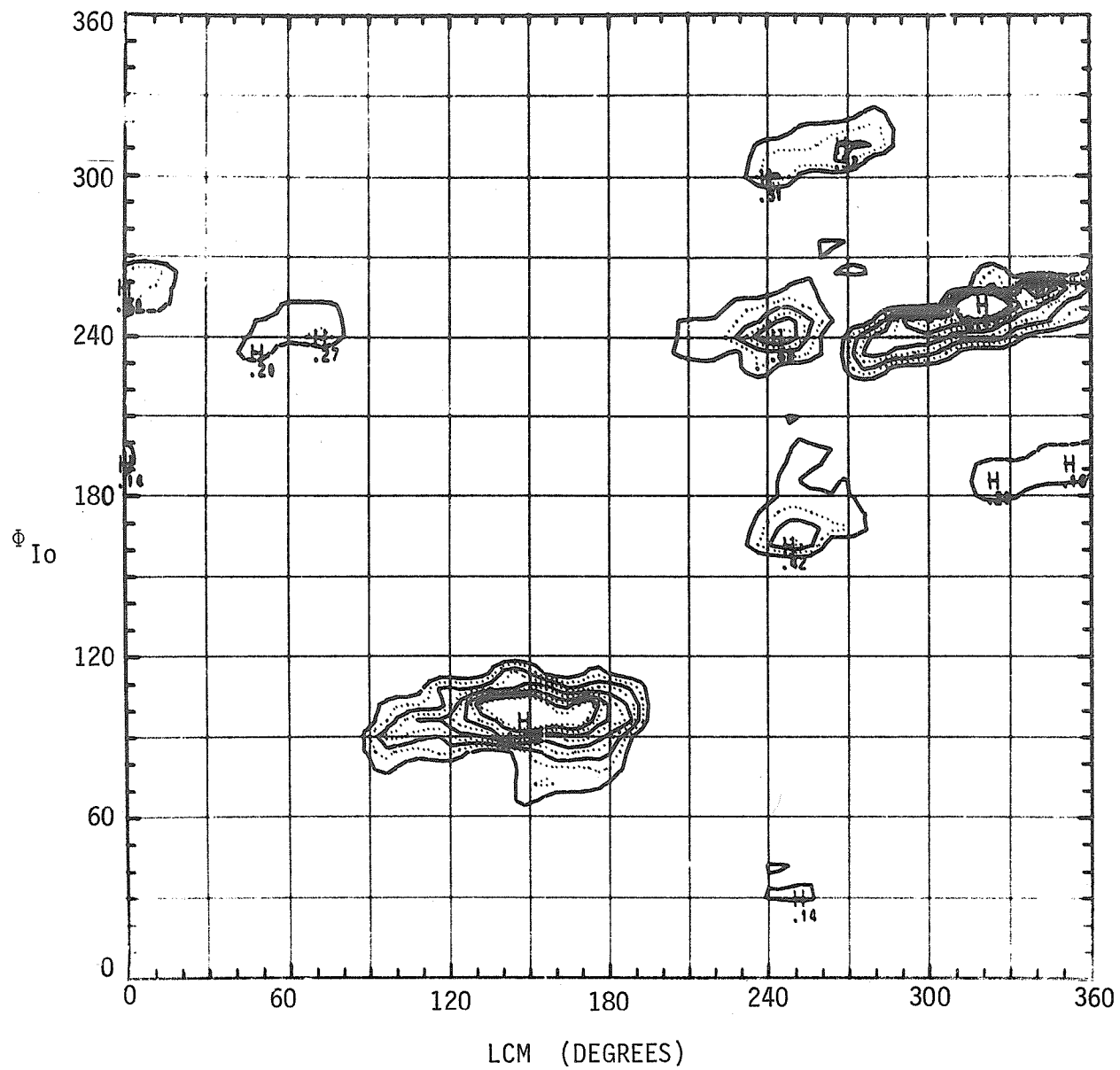


Fig. 13.

EMISSION PLOT FOR THE APPARITION OF 1971

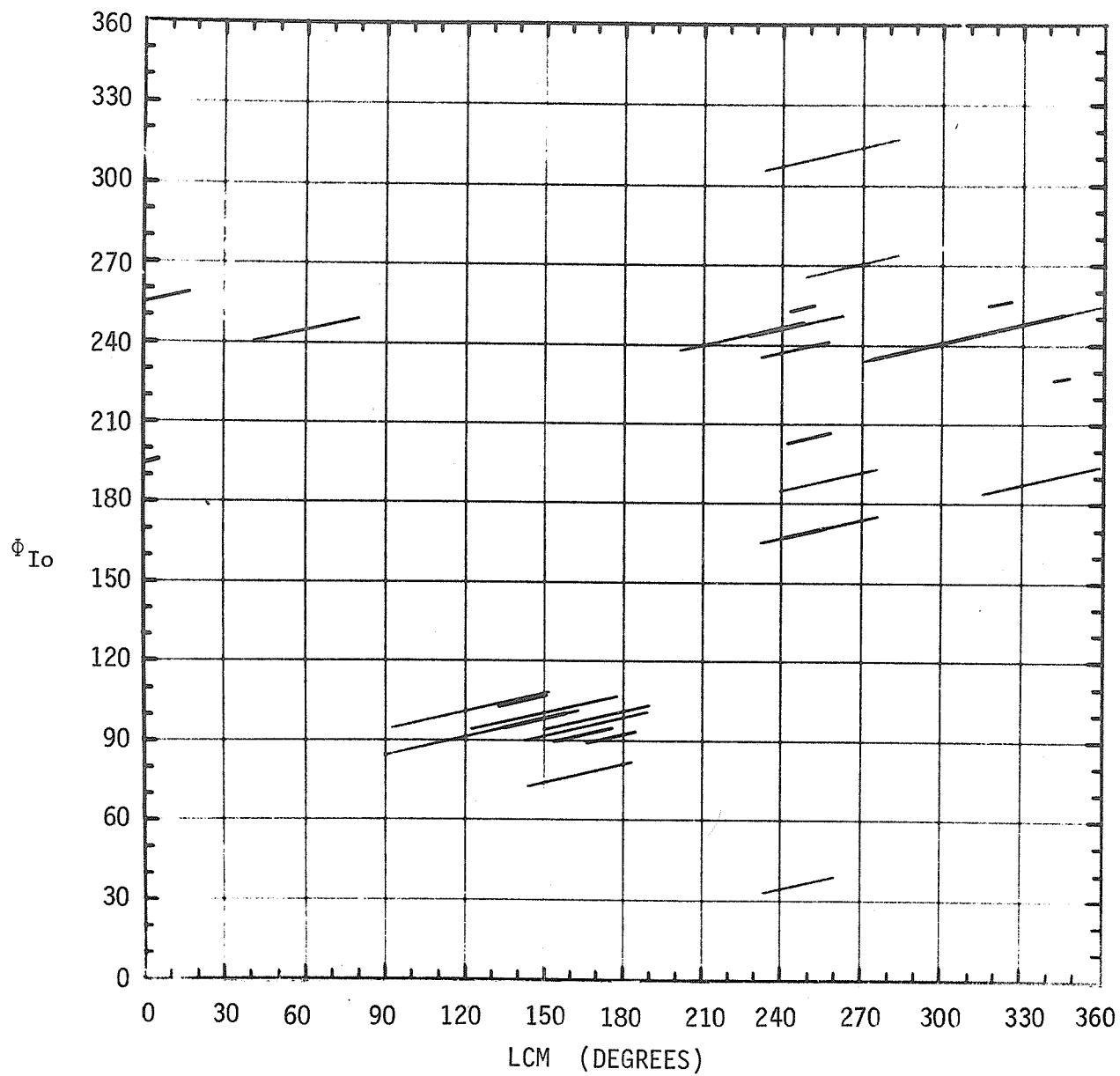


Fig. 14.

OBSERVATION PLOT FOR THE APPARITION OF 1971

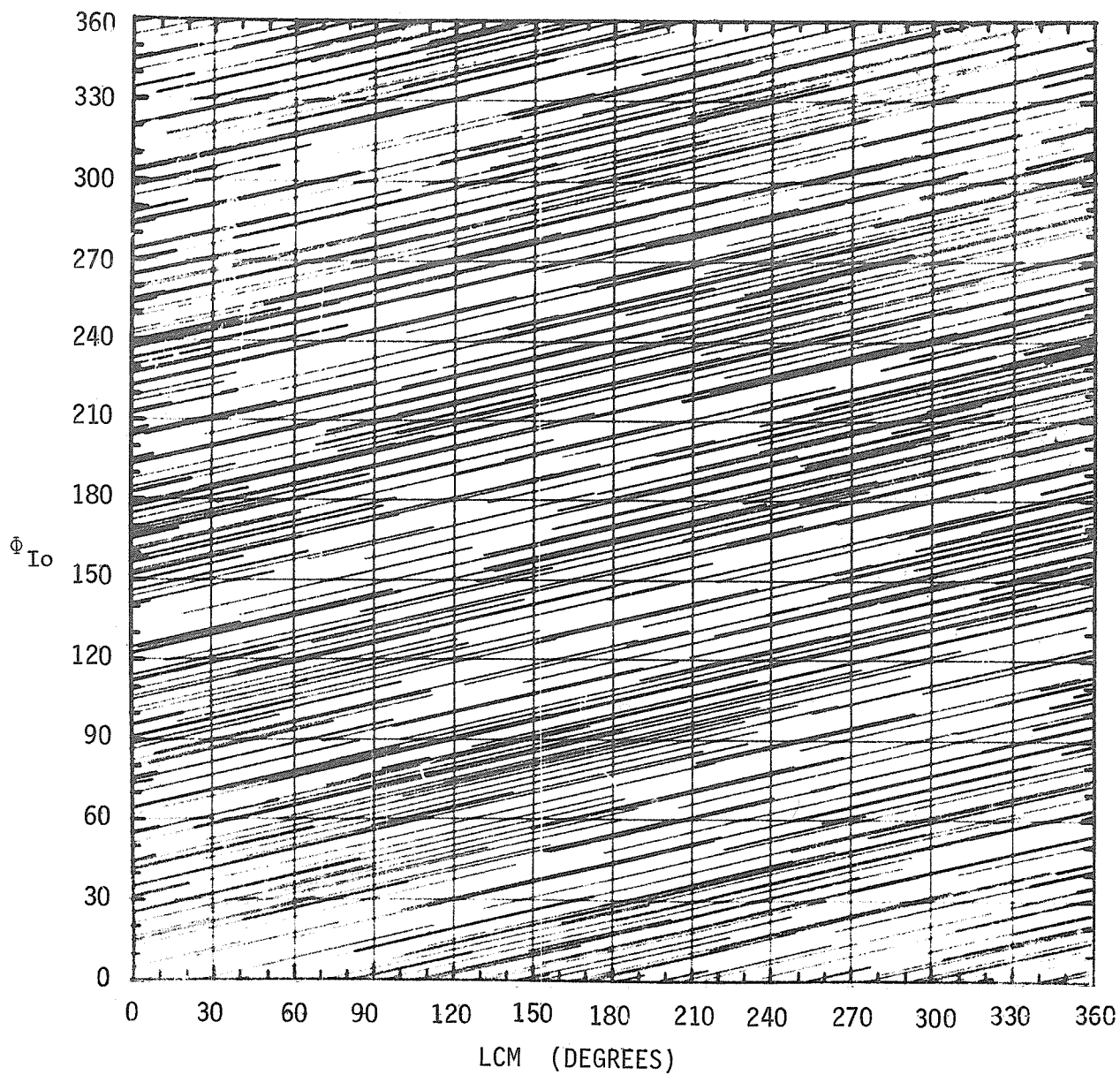


Fig. 15.

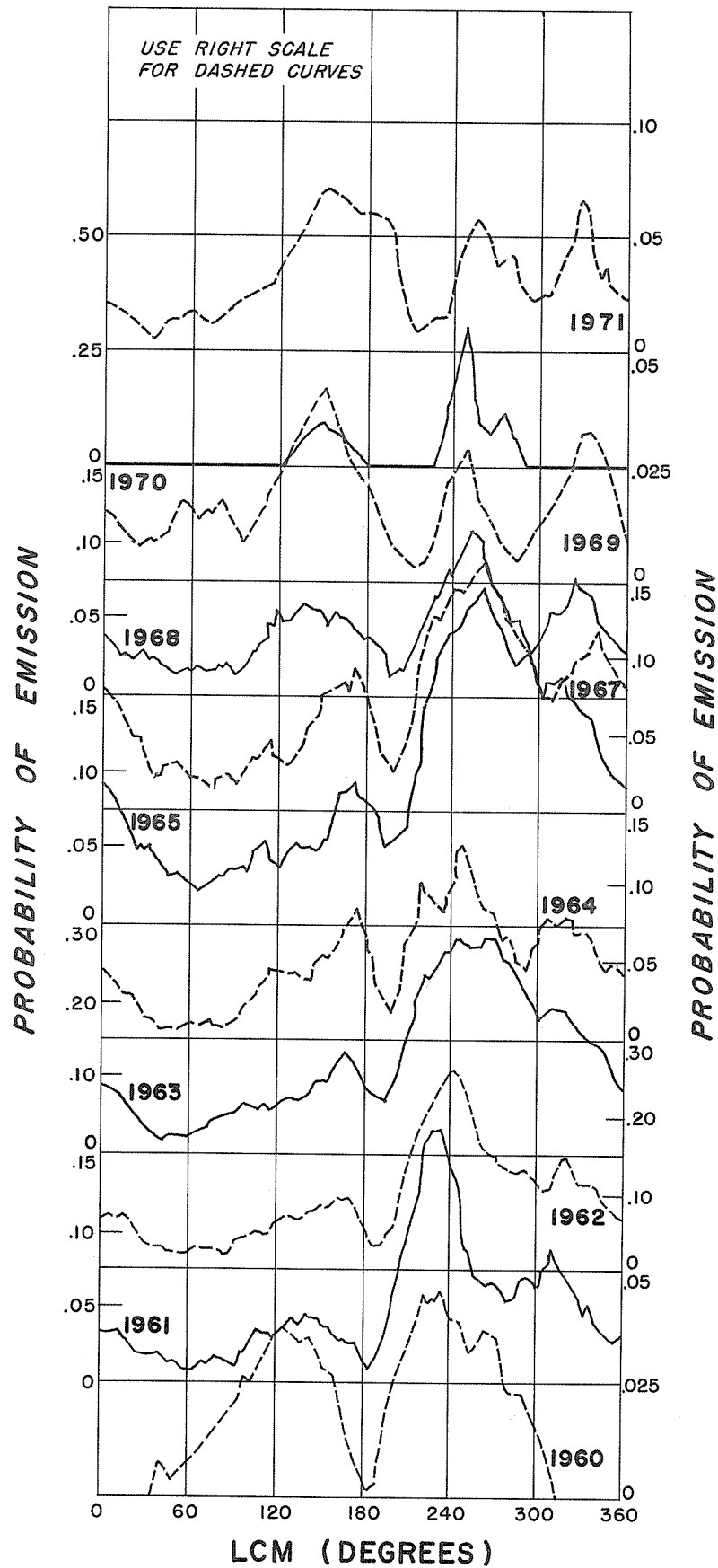


Fig. 16

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