Space Weather Highlights
11 March - 17 March 2024

SWPC PRF 2533
18 March 2024

Solar activity ranged from low to moderate levels. Moderate levels were reached on 14 Mar due to an M1.0/sf flare at 14/0604 UTC from Region 3599 (S12, L=065, class/area Dao/230 on 12 Mar). On 16 Mar, Moderate levels were once again seen as an M3.5 and an M1.1 occurred at 16/1635 UTC and 16/2155 UTC from a region just beyond the SE limb. Region 3599 was also responsible for a series of CMEs just beyond the SW limb which occurred at 15/0210 UTC and 15/0328 UTC. Modelling of the event indicated no Earth-directed component, however, an associated minor solar radiation storm (S1) was observed. Other activity included an approximate 35 degree filament channel eruption centered near S28W25 beginning at 17/0100 UTC. Two subsequent CMEs were observed in SOHO/LASCO C2 imagery off the SSE and SW limbs at 17/0312 UTC and 17/0336 UTC, respectively. Modelling indicated possible glancing blows late on 20 Mar to early on 21 Mar.

A greater than 10 MeV proton event above the 10 pfu (S1/Minor) threshold as a result of activity from Region 3599 beyond the SW limb early on 15 Mar. The event began at 15/2050 UTC, reached a peak flux of 16.7 pfu at 16/0635 UTC, and ended at 16/1505 UTC.

The greater than 2 MeV electron flux at geosynchronous orbit reached high levels on 11 Mar due to CH HSS influence. A peak of 1,420 pfu was observed at 11/1605 UTC.

Geomagnetic field activity ranged from quiet to active levels. Solar wind speed decreased on 11 Mar as weak negative polarity CH HSS influence diminished. A solar sector boundary crossing was observed midday on 11 Mar followed by another mild increase in solar wind speed and total field on 12-13 Mar. Solar wind speed reached a maximum around 484 km/s by 14/1350 UTC with total field near 9 nT early on 14 Mar due to positive polarity CH HSS influence. The geomagnetic field responded with unsettled periods on 12 and 14 Mar and an isolated active period early on 15 Mar. Solar wind speed slowly decreased around 290 km/s with total field values below 5 nT by the end of the period.

Space Weather Outlook
18 March - 13 April 2024

There is a chance for moderate (R1-R2/Minor-Moderate) levels through 31 Mar, mainly due to the flare potential of Region 3614 (N16, L=223, class/area Hax/080 on 17 Mar) and an unnumbered region rotating onto the SE limb. Low levels with a slight chance of M-class flares are likely on 01-13 Apr.

No proton events are expected at geosynchronous orbit.

The greater than 2 MeV electron flux at geosynchronous orbit is expected to reach high levels on 07-08 Apr due to recurrent CH HSS influence.

Geomagnetic field activity is expected to be at unsettled to active levels, with G1 (Minor)

storming likely, on 20-21 Mar due to activity from the 17 Mar CMEs. Unsettled levels are expected on 28-29 Mar, 03-05 Apr, and 09-11 Apr due to recurrent CH HSS activity.

Daily Solar Data

Date	Radio Flux 10.7cm	Sun spot No.	Sunspot Area (10^{-6} hemi.)	X-ray Background Flux	Flares							
					X-ray			Optical				
					C	M	X	S	1	2	3	4
11 March	127	56	190	B4.4	2	0	0	0	0	0	0	0
12 March	131	68	320	B4.8	14	0	0	6	0	0	0	0
13 March	128	86	320	B4.7	3	0	0	0	0	0	0	0
14 March	127	88	240	B8.0	6	1	0	1	0	0	0	0
15 March	129	49	80	C1.0	3	0	0	0	0	0	0	0
16 March	144	67	140	C1.0	4	2	0	1	0	0	0	0
17 March	151	86	290	C1.6	14	0	0	2	0	0	0	0

Daily Particle Data

Date	Proton Fluence (protons/cm ^{2} -day -sr)		Electron Fluence (electrons/cm^2 -day -sr)
	>1 MeV	>10 MeV	>2MeV
11 March	1.4e+06	2.0e+04	5.0e+07
12 March	5.8e+05	1.8e+04	2.5e+07
13 March	1.7e+05	1.8e+04	6.3e+06
14 March	9.6e+04	1.8e+04	3.8e+06
15 March	2.0e+06	3.8e+05	4.7e+06
16 March	4.9e+06	8.8e+05	5.2e+06
17 March	4.6e+06	1.7e+05	6.0e+06

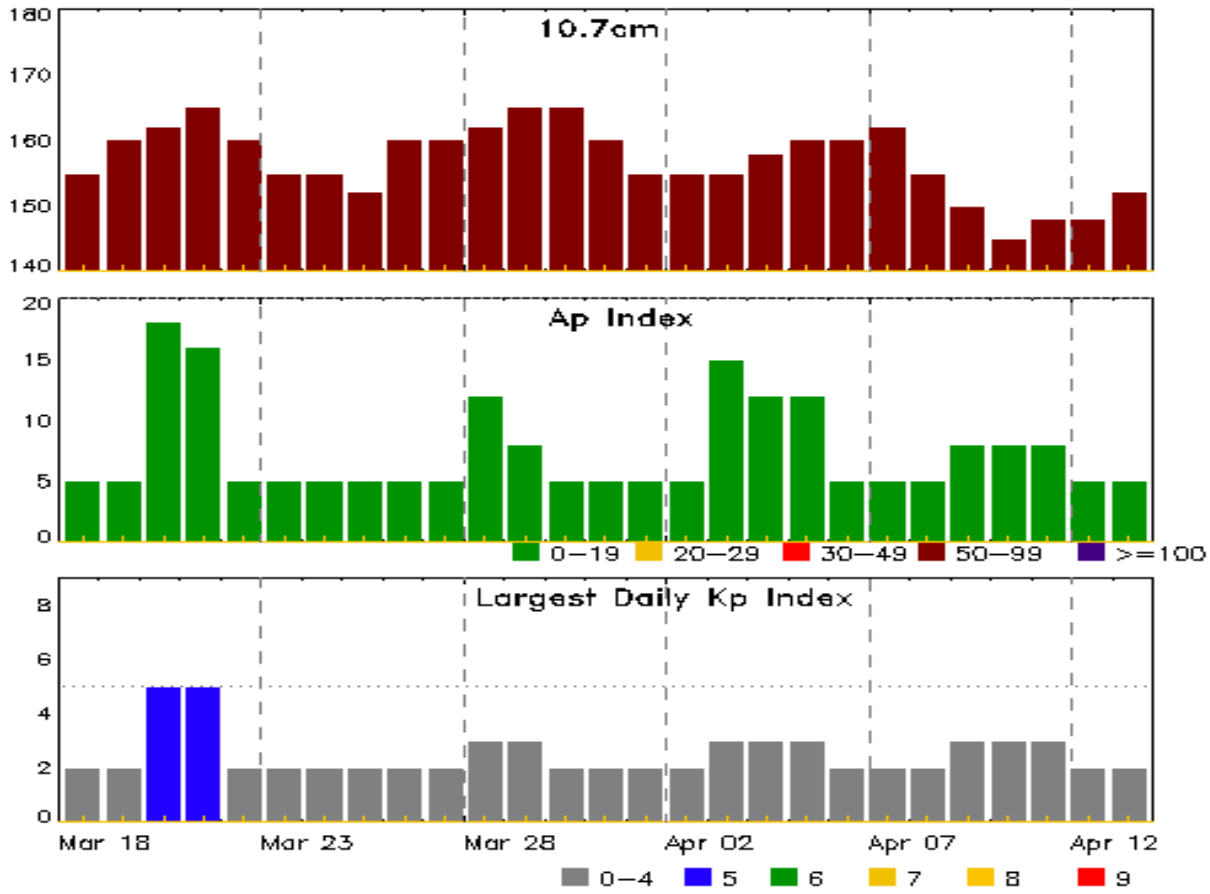
Daily Geomagnetic Data

Date	Middle Latitude Fredericksburg		High Latitude College		Estimated Planetary	
	A	K-indices	A	K-indices	A	K-indices
11 March	4	1-1-2-2-2-1-1-0	4	0-1-2-3-2-1-0-0	4	1-1-2-2-1-1-0-1
12 March	4	2-0-0-2-2-2-1-0	9	1-0-0-5-2-3-0-0	6	3-1-1-2-1-2-1-0
13 March	7	0-0-3-2-3-3-1-1	20	0-0-4-5-4-5-2-0	9	1-1-3-3-2-3-2-1
14 March	7	1-2-1-2-2-2-2-3	4	1-2-0-3-0-1-1-1	8	1-3-2-2-2-2-2-3
15 March	8	3-2-2-2-2-2-2-1	6	1-2-3-3-1-0-1-0	8	4-2-2-2-1-1-1-1
16 March	3	0-0-0-1-2-2-1-0	0	0-0-0-0-0-0-0-0	3	0-0-1-1-1-0-0-1
17 March	2	0-0-0-1-2-1-1-0	0	0-0-0-0-0-0-0-0	2	0-1-1-1-1-1-0-0

Alerts and Warnings Issued

Date & Time of Issue UTC	Type of Alert or Warning	Date & Time of Event UTC
11 Mar 0917	ALERT: Type II Radio Emission	11/0853
11 Mar 1403	ALERT: Electron 2MeV Integral Flux >= 1000pfu	11/1345
13 Mar 0739	WARNING: Geomagnetic K = 4	13/0738 - 2359
15 Mar 0055	WARNING: Geomagnetic K = 4	15/0055 - 1200
15 Mar 0301	ALERT: Geomagnetic K = 4	
15 Mar 1544	WARNING: Proton 10MeV Integral Flux > 10pfu	15/1545 - 16/0600
15 Mar 2106	ALERT: Proton Event 10MeV Integral Flux >= 10pfu	15/2050
16 Mar 0555	EXTENDED WARNING: Proton 10MeV Integral Flux > 10pfu	15/1545 - 16/2359
16 Mar 2020	SUMMARY: Proton Event 10MeV Integral Flux >= 10pfu	15/2050 - 16/1505
16 Mar 2020	CANCELLATION: Proton 10MeV Integral Flux > 10pfu	

Twenty-seven Day Outlook



Date	Radio Flux 10.7cm	Planetary A Index	Largest Kp Index	Date	Radio Flux 10.7cm	Planetary A Index	Largest Kp Index
18 Mar	155	5	2	01 Apr	155	5	2
19	160	5	2	02	155	5	2
20	162	18	5	03	155	15	3
21	165	16	5	04	158	12	3
22	160	5	2	05	160	12	3
23	155	5	2	06	160	5	2
24	155	5	2	07	162	5	2
25	152	5	2	08	155	5	2
26	160	5	2	09	150	8	3
27	160	5	2	10	145	8	3
28	162	12	3	11	148	8	3
29	165	8	3	12	148	5	2
30	165	5	2	13	152	5	2
31	160	5	2				

Energetic Events

	Time			X-ray		Optical Information			Peak Radio Flux		Sweep Freq Intensity	
Date	Begin	Max	Half Max	Class	Integ Flux	Imp/ Brtns	Location Lat	CMD	Rgn #	245	2695	II	IV
14 Mar	0552	0604	0611	M1.0	0.005	SF	S11W82		3599				
16 Mar	1622	1635	1644	M3.5	0.025								
16 Mar	2127	2155	2211	M1.1	0.021								

Flare List

	Time			Optical			
Date	Begin	Max	End	X-ray Class	Imp/ Brtns	Location Lat CMD	Rgn #
11 Mar	0223	0232	0244	B7.3			3599
11 Mar	0301	0306	0311	B9.1			3599
11 Mar	0836	0850	0859	C5.8			3599
11 Mar	1139	1157	1208	C1.6			3599
11 Mar	2211	2221	2227	B9.0			3599
12 Mar	0244	0251	0302	C1.5			3599
12 Mar	0401	0408	0415	C2.6			3599
12 Mar	0448	0453	0459	C1.1			3599
12 Mar	0719	0725	0731	C1.1			3599
12 Mar	0818	0818	0822		SF	S20E55	3607
12 Mar	0825	U0825	0833		SF	S20E55	3607
12 Mar	0855	0858	0925		SF	S20E57	3607
12 Mar	0936	0948	0957	C2.5			3599
12 Mar	1006	1018	1026	C3.3	SF	S11W61	3599
12 Mar	1114	1135	1145	C3.9	SF	S11W59	3599
12 Mar	1145	1149	1154	C3.3			3599
12 Mar	1416	1433	1437	C1.1			3599
12 Mar	1437	1455	1500	C1.4			3599
12 Mar	1500	1509	1511	C1.6			
12 Mar	1511	1517	1527	C1.6			3599
12 Mar	1735	1815	1837	C2.7			3599
12 Mar	2204	2208	2212	C1.0	SF	S18E47	3607
13 Mar	0052	0059	0107	B8.0			3607
13 Mar	0549	0558	0605	C1.0			3599
13 Mar	0810	0822	0833	B8.4			3610
13 Mar	2004	2013	2030	B9.0			3599
13 Mar	2151	2205	2234	C1.8			3605
13 Mar	2324	2349	0016	C6.2			3599

Flare List

Date	Time			Optical			
	Begin	Max	End	X-ray Class	Imp/ Brtns	Location Lat CMD	Rgn #
14 Mar	0204	0215	0222	C3.7			3599
14 Mar	0355	0404	0410	C1.7			3599
14 Mar	0511	0516	0522	C1.0			3599
14 Mar	0552	0604	0611	M1.0	SF	S11W82	3599
14 Mar	1041	1059	1118	C4.0			3599
14 Mar	1747	1758	1809	C3.0			3599
14 Mar	2048	2057	2103	C1.8			3599
15 Mar	0059	0145	0208	C1.9			3599
15 Mar	0209	0405	0436	C4.9			3599
15 Mar	0532	0610	0659	C6.0			3599
16 Mar	1411	1416	1423	C1.6			3613
16 Mar	1524	1534	1541	C1.6			
16 Mar	1622	1635	1644	M3.5			
16 Mar	1904	1916	1926	C8.2			
16 Mar	2127	2155	2211	M1.1			
16 Mar	2318	2326	2332	C2.1	SF	N23W70	3612
17 Mar	0031	0042	0055	C2.9			
17 Mar	0353	0359	0417	C6.6			
17 Mar	0532	0547	0605	C3.8			3614
17 Mar	0645	0652	0702	C2.4			3614
17 Mar	0733	0741	0758	C2.8			
17 Mar	1035	1043	1048	C4.3			
17 Mar	1203	1213	1219	C5.5			
17 Mar	1255	1259	1305	C2.3			
17 Mar	1311	1323	1329	C3.1			3614
17 Mar	1336	1344	1352	C2.7			
17 Mar	1513	U1513	1540		SF	S18W15	3607
17 Mar	1527	1543	1552	C4.9	SF	N22W73	3612
17 Mar	1552	1558	1612	C3.3			3612
17 Mar	1939	1944	1954	C2.6			
17 Mar	2054	2112	2138	C4.9			3612

Region Summary

	Location		Sunspot Characteristics					Flares							
		Helio	Area	Extent	Spot	Spot	Mag	X-ray			Optical				
Date	Lat CMD	Lon	10^{-6} hemi.	(helio)	Class	Count	Class	C	M	X	S	1	2	3	4
			Region 3599												
01 Mar	S13E75	69	40	2	Hax	1	A	1							
02 Mar	S13E60	71	30	7	Cro	4	B								
03 Mar	S13E48	70	30	9	Cro	3	B	1							
04 Mar	S14E38	67	30	3	Cso	3	B	2							
05 Mar	S13E25	66	70	4	Dsi	6	BG	1			1				
06 Mar	S12E13	64	130	6	Dsi	12	BG	2			1				
07 Mar	S12W02	66	140	6	Dai	16	BGD	9			10				
08 Mar	S12W15	67	150	7	Dai	18	BG	3	1		2				
09 Mar	S13W28	67	220	7	Dai	25	BGD	6			2				
10 Mar	S13W41	67	210	8	Dai	15	BGD	5	1		2	1			
11 Mar	S12W55	67	160	7	Dai	13	BGD	2							
12 Mar	S12W67	65	230	7	Dao	7	BG	12			2				
13 Mar	S14W81	67	140	7	Cao	2	B	2							
14 Mar	S13W94	67	70	5	Cao	2	B	6	1		1				
								52	3	0	21	1	0	0	0

Crossed West Limb.
Absolute heliographic longitude: 66

			Region 3600												
02 Mar	S18E73	58	80	2	Hsx	1	A								
03 Mar	S18E59	59	80	2	Hsx	1	A								
04 Mar	S18E46	59	80	3	Hsx	1	A								
05 Mar	S18E33	57	70	2	Hsx	1	A	2			1				
06 Mar	S18E21	55	70	2	Hsx	2	A								
07 Mar	S18E08	55	70	2	Hsx	3	A								
08 Mar	S18W04	56	40	2	Hsx	3	A								
09 Mar	S18W18	57	30	2	Hsx	2	A								
10 Mar	S19W31	57	20	2	Hrx	3	A								
11 Mar	S17W44	56	10	1	Axx	1	A								
12 Mar	S17W57	56	10	2	Axx	2	A								
13 Mar	S17W71	57	plage												
14 Mar	S17W85	58	plage												
								2	0	0	1	0	0	0	0

Crossed West Limb.
Absolute heliographic longitude: 56

Region Summary - continued

	Location		Sunspot Characteristics					Flares							
		Helio	Area	Extent	Spot	Spot	Mag	X-ray			Optical				
Date	Lat CMD	Lon	10^{-6} hemi.	(helio)	Class	Count	Class	C	M	X	S	1	2	3	4
		Region 3602													
03 Mar	N18E42	75	plage					3							
04 Mar	N19E29	76	30	4	Dao	8	B	4			1				
05 Mar	N20E16	74	50	7	Cso	4	B								
06 Mar	N17E01	75	40	2	Cso	3	B								
07 Mar	N17W13	77	30	3	Cso	2	B								
08 Mar	N16W26	78	20	1	Hax	2	A								
09 Mar	N16W41	80	10	1	Hax	1	A								
10 Mar	N15W53	79	10	1	Hrx	1	A								
11 Mar	N16W66	78	10	1	Axx	1	A								
12 Mar	N17W79	77	plage												
								7	0	0	1	0	0	0	0

Crossed West Limb.
Absolute heliographic longitude: 75

		Region 3603													
04 Mar	N14E53	52	10	1	Axx	1	A								
05 Mar	N14E40	50	40	3	Hsx	1	A								
06 Mar	N13E28	49	60	6	Cso	3	B								
07 Mar	N14E13	51	60	2	Hax	2	A								
08 Mar	N14W01	53	20	1	Hsx	1	A								
09 Mar	N13W16	55	10	1	Hrx	2	A								
10 Mar	N13W30	56	plage					1			1				
11 Mar	N13W44	56	plage												
12 Mar	N13W58	57	plage												
13 Mar	N13W72	58	plage												
14 Mar	N13W86	59	plage												
								1	0	0	1	0	0	0	0

Crossed West Limb.
Absolute heliographic longitude: 53

Region Summary - continued

	Location		Sunspot Characteristics					Flares							
		Helio	Area	Extent	Spot	Spot	Mag	X-ray			Optical				
Date	Lat CMD	Lon	10^{-6} hemi.	(helio)	Class	Count	Class	C	M	X	S	1	2	3	4
			Region 3604												
05 Mar	N08E71	20	70	2	Hax	1	A								
06 Mar	N08E65	13	30	2	Hsx	1	A								
07 Mar	N08E43	21	20	1	Hsx	1	A	1			1				
08 Mar	N07E29	23	10	2	Bxo	3	B				1				
09 Mar	N08E15	24	20	2	Cro	4	B								
10 Mar	N08E01	25	10	3	Bxo	3	B								
11 Mar	N08W13	25	plage												
12 Mar	N08W27	26	plage												
13 Mar	N08W41	27	plage												
14 Mar	N08W55	28	plage												
15 Mar	N08W69	29	plage												
16 Mar	N08W83	30	plage												
								1	0	0	2	0	0	0	0

Crossed West Limb.
Absolute heliographic longitude: 25

			Region 3605												
07 Mar	S15E26	38	20	3	Dao	4	B								
08 Mar	S15E13	39	20	6	Cro	4	B								
09 Mar	S15W01	40	20	7	Cro	5	B								
10 Mar	S15W14	40	30	5	Cro	5	B								
11 Mar	S15W31	42	10	1	Bxo	1	B								
12 Mar	S14W46	44	10		Axx	1	A								
13 Mar	S13W58	44	10	1	Axx	1	A	1							
14 Mar	S13W72	45	plage												
15 Mar	S13W86	46	plage												
								1	0	0	0	0	0	0	0

Crossed West Limb.
Absolute heliographic longitude: 40

			Region 3606												
12 Mar	N08E27	330	40	4	Dao	5	B								
13 Mar	N09E13	331	30	5	Dao	5	B								
14 Mar	N09E01	332	20	6	Cro	3	B								
15 Mar	N09W13	333	plage												
16 Mar	N09W26	332	10	1	Axx	2	A								
17 Mar	N09W40	333	plage												
								0	0	0	0	0	0	0	0

Still on Disk.
Absolute heliographic longitude: 332

Region Summary - continued

	Location		Sunspot Characteristics					Flares							
		Helio	Area	Extent	Spot	Spot	Mag	X-ray			Optical				
Date	Lat CMD	Lon	10^{-6} hemi.	(helio)	Class	Count	Class	C	M	X	S	1	2	3	4
			Region 3607												
12 Mar	S18E44	314	30	2	Dso	3	B	1			4				
13 Mar	S17E32	313	110	6	Dao	5	B								
14 Mar	S18E19	314	80	7	Dao	8	B								
15 Mar	S17E06	314	40	8	Dro	6	B								
16 Mar	S17W08	314	20	9	Cro	6	B								
17 Mar	S17W21	314	20	9	Bxo	5	B				1				
								1	0	0	5	0	0	0	0
Still on Disk. Absolute heliographic longitude: 314															
			Region 3608												
13 Mar	N12E40	305	10		Axx	1	A								
14 Mar	N11E28	305	10	1	Axx	1	A								
15 Mar	N11E14	306	plage												
16 Mar	N11W00	307	plage												
17 Mar	N11W10	303	30	5	Dro	10	B								
								0	0	0	0	0	0	0	0
Still on Disk. Absolute heliographic longitude: 307															
			Region 3609												
13 Mar	N07E48	298	10	1	Axx	1	A								
14 Mar	N06E37	296	10	1	Axx	1	A								
15 Mar	N06E22	298	plage												
16 Mar	N06E07	300	plage												
17 Mar	N06W08	301	plage												
								0	0	0	0	0	0	0	0
Still on Disk. Absolute heliographic longitude: 300															
			Region 3610												
13 Mar	S16E68	278	10	1	Hax	1	A								
14 Mar	S16E55	278	20	1	Hrx	2	A								
15 Mar	S16E42	278	10	1	Axx	1	A								
16 Mar	S16E28	279	plage												
17 Mar	S16E14	279	plage												
								0	0	0	0	0	0	0	0
Still on Disk. Absolute heliographic longitude: 279															

Region Summary - continued

	Location		Sunspot Characteristics					Flares							
		Helio	Area	Extent	Spot	Spot	Mag	X-ray			Optical				
Date	Lat CMD	Lon	10^{-6} hemi.	(helio)	Class	Count	Class	C	M	X	S	1	2	3	4
			Region 3611												
14 Mar	N26E59	274	30	1	Hsx	1	A								
15 Mar	N28E48	272	20	1	Hrx	1	A								
16 Mar	N28E35	271	30	1	Hrx	1	A								
17 Mar	N28E21	272	20	1	Hrx	1	A								
								0	0	0	0	0	0	0	0

Still on Disk.
Absolute heliographic longitude: 272

			Region 3612												
15 Mar	N23W57	17	10	1	Axx	1	A								
16 Mar	N23W68	15	10	1	Axx	1	A	1			1				
17 Mar	N22W80	13	10	2	Axx	2	A	3			1				
								4	0	0	2	0	0	0	0

Still on Disk.
Absolute heliographic longitude: 17

			Region 3613												
16 Mar	S23W17	323	70	6	Cao	7	B	1							
17 Mar	S22W30	323	130	6	Dai	7	B								
								1	0	0	0	0	0	0	0

Still on Disk.
Absolute heliographic longitude: 323

			Region 3614												
17 Mar	N16E70	223	80	2	Hax	1	A	3							
								3	0	0	0	0	0	0	0

Still on Disk.
Absolute heliographic longitude: 223

Preliminary Report and Forecast of Solar Geophysical Data (The Weekly)

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Notice: The 27-day Outlook, Satellite Environment, X-ray and Proton plots have been redesigned. Comments and suggestions are welcome SWPC.Webmaster@noaa.gov

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