

2024 See <https://www.spaceweather.com>
<https://www.spaceweatherlive.com/en.html>
<https://www.nesdis.noaa.gov/news/time-lapse-of-solar-cycle-25-displays-increasing-activity-the-sun>

<ftp://ftp.swpc.noaa.gov/pub/warehouse/2024/>

1 Jan 08:54 – M2.3/1N flare in the same AR3536 (N004E70) and
12:25 – M4.7 flare

1-2 Jan **GEOSTORM** Kp=4 Dst=- 21 Bz~-11 Effects from CH1195; ESP J10~4.6

2-5 Jan

Anticipating Solar Flares

[Hugh S. Hudson](#)

Solar Phys. 2024

<https://arxiv.org/pdf/2407.04567>

4 Jan 01:55 - M3.8/2N flare, AR3536 (N004E39), 304 A
<https://www.spaceweather.com/images2024/04jan24/m4.gif>

4-5 Jan Плавный рост потока протонов до J10~17 с коротким возрастанием до J10~25

9 Jan ~16 UT – SE filament eruption, partial halo CME

Далее необычно длинный спокойный период без существенных вспышек

20 Jan ~08 UT – Эрупция волокна **erupted** южнее AR 3555 вблизи центрального сектора с возмущениями по всему диску, C3 LDE, 304 A, [halo CME](#) , [NASA model](#)

21-22 Jan - Повышение потока протонов до J10~7

22 Jan ~>09 UT – Ещё крупная эрупция южного волокна, **мощная 304 A**, [bright CME](#)
<https://www.spaceweather.com/images2024/22jan24/snap.gif>

The sun is crackling with solar flares from AR3361

<https://www.spaceweather.com/images2024/23jan24/doubleflare.gif>

23 Jan **A STRONG DOUBLE FLARE** "sympathetic solar flares." M5.1

<https://www.spaceweather.com/images2024/23jan24/doubleflare.gif>

Multiple partial halo CMEs were observed during the day due to flares in ARs S9346/13559 and S9357/13561.

29 Jan 04:38 – M6.7 LDE flare N25W70, radio S5~3200, type II/2, **Протоны SEP**
J10~25.8 →137, partial halo CME

https://www.spaceweather.com/images2024/29jan24/m7_teal_strip_opt.gif

<https://www.spaceweather.com/images2024/29jan24/halocmeSOHO.gif>

1 Feb >09 UT – N/central filament eruption, [CME](#)

6 Feb 03:30 – M4.0 LDE flare near SW limb, S3~400, II/1, IV/2, large [CME](#), SEP J10~ 1
<https://www.spaceweather.com/images2024/04feb24/martiansunspot2.gif>
>11 UT – **A remarkable symmetrical "FULL HALO" EXPLOSION ON THE FARSIDE**
<https://www.spaceweather.com/images2024/06feb24/haloCME.gif>
~13 UT – N filament eruption, 304 A

7 Feb 03:31 – M5.1 LDE flare, S40W78, coronal wave, S5~300

Since Feb. 7th, the sun has hurled multiple CMEs into space.

+ **9 Feb** 13:14 – [powerful SW-limb X3.4 flare](#) , AR3575, S15~5000, SEP J10~113→187, large CME, https://www.spaceweather.com/images2024/10feb24/radiationstorm_strip.jpg

Sympathetic solar eruption on 2024 February 9

[Shu-Yue Li](#), [Qing-Min Zhang](#), [Bei-Li Ying](#), [Li Feng](#), [Ying-Na Su](#), [Mu-Sheng Lin](#), [Yan-Jie Zhang](#)
Research in Astron. Astrophys. 2024
<https://arxiv.org/pdf/2412.01123>

Two successive EUV waves and a transverse oscillation of a quiescent prominence

Q. M. Zhang, [M. S. Lin](#), [X. L. Yan](#), [J. Dai](#), [Z. Y. Hou](#), [Y. Li](#), [Y. Qiu](#)
MNRAS 2024
<https://arxiv.org/pdf/2408.03634>

10 Feb ~03 UT– **E-limb eruption** and post-eruption arcade, large CME
~08 UT– **S central eruption** and large post-eruption arcade southward of AR3556,
[assymetric halo CME](#)
~23 UT – **M9 spike flare** in central AR3556 followed by **large N central filament eruption**,
https://www.spaceweather.com/images2024/10feb24/m9_teal_anim.gif

11 Feb **GEOSTORM Kp=4.5 Dst=(+43)-(−17) Bz~-14**

12 Feb 03:48 – M6.5 flare , S17W27, S9~110;
SEP J10~57→100 [it started](#) ~06 UT- **farside explosion on the SW limb**, large CME
~12 UT– significant NE limb eruption, large CME

14 Feb **GEOMAGNETIC STORM WATCH—CANCELED;**
~04 UT – **FARSIDE HALO CME** ~10 UT – **SEP, J10~47**
https://www.spaceweather.com/images2024/14feb24/farside_haloCME.gif

14-28 Feb

Global and local dynamics of X-flare-producing active regions during solar cycle 25 peak phase

B. [Raphaldini](#)^{1*}, M. [Dikpati](#)¹, A. S. W. [Teruya](#)², K. [Jain](#)³, A. A. [Norton](#)⁴ and S. W. [McIntosh](#)^{1,5}
A&A, 691, A3 (2024)
<https://www.aanda.org/articles/aa/pdf/2024/11/aa51428-24.pdf>

+ **16 Feb** 06:53 – brief but intense **X2.5 quasi-impulsive flare** S21W84, S15~570, II/3, IV/2 ,
SEP decay background plus J10<6 , CME
<https://www.spaceweather.com/images2024/16feb24/protonpulse.jpg>

+ **21 Feb** >17 UT – **NW filament eruption**, [a bright CME](#) partial halo
<https://www.spaceweather.com/images2024/21feb24/filament.gif>
23:07 – X1.8 spike+ flare, AR3590 N17E42

+ **22 Feb** **THREE X-FLARES, ZERO CMES**
06:32 – another **X1.7/2B** spike+ flare, AR3590 N16E35, S9~410
22:34 – **X6.3** flare, AR3590 N18E29, S9~1100
https://www.spaceweather.com/images2024/22feb24/x6_blue.jpg

Very Long-periodic Pulsations Detected Simultaneously in a White-light Flare and Sunspot Penumbra

Dong **Li**^{1,2}, Jincheng Wang^{2,3}, and Yu Huang¹
2024 ApJL 972 L2
<https://iopscience.iop.org/article/10.3847/2041-8213/ad6cde/pdf>

Localizing Quasiperiodic Pulsations in Hard X-Ray, Microwave, and Ly α Emissions of an X6.4 Flare

Dong **Li**^{1,2}, Zhenxiang Hong^{1,3}, Zhenyong Hou⁴, and Yang Su¹
2024 ApJ 970 77
<https://iopscience.iop.org/article/10.3847/1538-4357/ad566c/pdf>

24 Feb **06:34** – **M4.5** spike flare, AR3590, S9~770
11:18 – M3.6 flare, AR3590

25 Feb Near NW-limb filament eruption, CME
17:22 – **M2.0/1N** flare, AR3590 N17W10, CME?
[Weak geomag impact](#) of a CME from Feb. 21st filament eruption
AR3590 has [exploded often](#)

28 Feb Several (filament) eruptions and CMEs
A C5 flare in AR S9453 at **09:09** UT was associated with a **partial halo CME**
18:54 – very long **M1.5** LDE, AR3590 N14W48, CME

3 Mar An overdue **G2 GEOSTORM** **Kp=5.5** **Dst~ -115** **Bz~-18** The CME was hurled on Feb. 28th when a filament connected to AR3592 erupted.

5 Mar ~22 UT – SE filament eruption, bright CME

10 Mar **12:13** – **M7.3** spike impulsive flare, AR 3599, ~S17W35, S15~2400, type II/3, **very small** SEP, a faint CME https://www.spaceweather.com/images2024/10mar24/m7_teal.jpg

An impulsive geomagnetic effect from an early-impulsive flare

Hugh S. **Hudson**, [Edward. W. Cliver](#), [Lyndsay Fletcher](#), [Declan A. Diver](#), [Peter T. Gallagher](#), [Ying Li](#), [Christopher M.J. Osborne](#), [Craig Stark](#), [Yang Su](#)
MNRAS Volume 532, Issue 3, August 2024, Pages 3120–3125, 2024
<https://arxiv.org/abs/2407.09233>
<https://doi.org/10.1093/mnras/stae1720>
<https://watermark.silverchair.com/stae1720.pdf>

14 Mar ~09 UT – N filament eruption, CME

15 Mar Morning SW limb eruption in AR3599 (filament), very long LDE, **06:10** – C6.0, large PE arcade, bright CME, **soft spectrum** SEP J10~9→16

17 Mar ~07 UT – SSW large filament eruption, 304 A, a partial halo CME
https://www.spaceweather.com/images2024/17mar24/cof_anim.gif

https://www.spaceweather.com/images2024/17mar24/cme_anim.gif

19 Mar G1 **GEOSTORM** **Kp=3 Dst=-29 Bz~-10**

20 Mar 07:36 – M7.4 short-duration flare, AR3615, S15E53, S5~160, no discernible CME
https://www.spaceweather.com/images2024/20mar24/m7p4_teal.jpg

21 Mar G1 **GEOSTORM** **Kp=5 Dst=-77 Bz~-12** from 17 Mar eruption
<https://www.spaceweather.com/images2024/22mar24/cmeimpact2.jpg>
~19 UT – significant N **filament eruption**, CME

!!! Далее всплеск вспышечной и геомагнитной активности

+ **23 Mar** G1 **GEOSTORM** **Kp=5 Dst=-42 Bz~-10**
01:33 – **X1.1/2F-2N** LDE sympathetic flare with transequatorial loops in AR3614 (N27E08) and AR3615 (S15E15), S3~240, S9~170, type II/2, eruption, halo (mainly N) **a bright CME**, **soft spectrum SEP J10~ 119→685**
https://www.spaceweather.com/images2024/23mar24/doubleflare_teal_crop_strip.gif
14:02 – M5.3 flare , 15:13 – M3.8 flare, S9~110; 16:51 – M2.8 **SEP J10~ 204→396**
GEOSTORM Kp=5.5 Dst=-82 Bz~-13

24 Mar Flare 0051 0151 0415 LEA 3 FLA S14E00 2N 3615
01:25–M1.4, 01:54–M2.1, 02:05–M2.3, 02:18–M2.7 flares in AR3615
06:06 – M2.2/1B, S14W03, AR3615, S9~450 and other flares
Severe (G4) Geomagnetic Storm Kp=8 Dst=-130 Bz~-24 , ESP J10~714
Forbush ~14% https://www.spaceweather.com/images2024/23mar24/oulu_anim.gif
The 23 Mar CME reached Earth before 15h UT on March 24, a transition time of approx. 37 hours.

25 Mar 06:44 – spike M4.4, S15~390, AR3615, S13W02 без значительных CMEs
~07 UT – central N filament eruption

26 Mar Ряд вспышек M1.9-1.0, AR3615, включая spikes, без значительных CMEs
~14 UT – E filament eruption
<https://www.spaceweather.com/images2024/28mar24/multipleflares.jpg>

AR3615 is growing again

+ **28 Mar** 06:29 – M7.1/1N short-duration flare, AR3615, S16W65, S15~300
15:56 – M6.1 short-duration flare, AR3615, S15~140
20:56 – **X1.1/3B** short-duration flare, AR3615, S14W61, weak CME
https://www.spaceweather.com/images2024/28mar24/x1_teal.jpg

29 Mar 02:30 – M3.2 short-duration flare, AR3615, S5~200

30 Mar 21:16 – **M9.4** LDE flare, AR3615, SW limb, S9~300

1 Apr 01:32 – M3.2 short-duration flare, AR3625, N08W64

April 8, 2024 Great American Eclipse

Solar Orbiter Nugget #32 2024 Y. J. Rivera et al. <https://www.cosmos.esa.int/web/solar-orbiter/-/science-nugget-coordinated-observations-during-the-2024>

Constraining solar emission radius at 42 MHz during the 2024 total solar eclipse using a student-commissioned radio telescope

[Olivia R. Young](#), [Timothy E. Dolch](#), [Joseph F. Helmboldt](#), [Christopher Mentrek](#), +
ApJ 2025
<https://arxiv.org/pdf/2412.07034>

10 Apr 19:30 – N/central filament eruption

<https://www.spaceweather.com/images2024/10apr24/filament.gif>

11 Apr ~06 UT – N/central [beautiful filament eruption](#) ,
17:06 – [impulsive M5.4 flare](#) , plus ~C5 LDE, NE limb

14 Apr 02:32 –M4.2 spike flare, S11E67 AR3637, S15~500

15 Apr Several M-class impulsive flares from growing sunspot AR3639 near SE limb
<https://www.spaceweather.com/images2024/15apr24/crackling.jpg>

16-17 Apr **GEOSTORM Kp= 5 Dst=- 73 Bz~-12**

19 Apr **unexpectedly strong G3 GEOSTORM Kp= 7 Dst=- 122 Bz~-16**, [a CME strike](#)

21 Apr 21:52 – M3.4 spike flare, AR3638, S17W37, S9~140
https://www.spaceweather.com/images2024/21apr24/m3_teal.gif

22 Apr multiple jets and eruptions from the SW complex AR3638-47
<https://www.spaceweather.com/images2024/22apr24/southernjets.gif>

23 Apr 03:19 – short M3.6 flare, AR3644, N14W06, S5~290
A SUPER-SYMPATHETIC SOLAR FLARE: Four regions on the sun separated by hundreds of thousands of kilometers explode simultaneously. [Play the movie](#)

24 Apr **A SUNSPOT SUPER-GROUP**
https://spaceweathergallery2.com/indiv_upload.php?upload_id=206162

26 Apr **G1 GEOSTORM Kp= 5+ Dst=- 56 Bz~-11**
<https://www.spaceweather.com/images2024/26apr24/CMEimpact.jpg>

AR3654 is crackling with M-class flares

29 Apr **01:11 – M3.7 S08W40**
https://www.spaceweather.com/images2024/29apr24/m3_teal.gif

30 Apr >23 UT – **M9.5/2B quasy-spike flare**, AR3654, **S05W63**
https://www.spaceweather.com/images2024/30apr24/m9p5_teal.gif

1 May ~08 UT – eruption near AR3654, C5.8 LDE, bright CME ([movie](#))

2 May **G3 GEOSTORM Kp= 6.5 Dst=- 101 Bz~-20 DOUBLE CME STRIKE**,
[the impacts](#)

+ 3 May 02:22 – **X1.6/1B spike**, AR3663, N25E07, S15~800, type II, [a CME](#)
https://spaceweathergallery2.com/indiv_upload.php?upload_id=206283

08:11 – M4.4 spike, AR3663

4 May 06:19 – M9.1/1B spike, AR3663, S15~420
23:48 – M9.0/1B, N26W10

3-5 May AR3663 is crackling with multiple X and near-X near-spike flares:
<https://www.spaceweather.com/images2024/04may24/crackling.jpg>

4-14 May Outstanding Solar and Space Weather Activity

The extremely strong non-neutralized electric currents of the unique solar active region NOAA 13664

Ioannis **Kontogiannis** (Leibniz-Institut für Astrophysik Potsdam (AIP) Germany)
A&A 2024

Unveiling key factors in solar eruptions leading to the solar superstorm in 2024 May

Rui **Wang**^{1,2,3*}, Ying D. Liu^{1,2,3}, Xiaowei Zhao^{4,5} and Huidong Hu^{1,2}

A&A 692, A112 (2024)

<https://arxiv.org/pdf/2410.00891> File

<https://doi.org/10.1051/0004-6361/202452008>

<https://www.aanda.org/articles/aa/pdf/2024/12/aa52008-24.pdf>

Analyzing the Sequence of Phases Leading to the Formation of the Active Region 13664, with Potential Carrington-like Characteristics

Paolo Romano, [Abouazza Elmhamdi](#), [Alessandro Marassi](#), [Lidia Contarino](#)

2024 *ApJL* 973 L31

<https://arxiv.org/pdf/2409.04408>

<https://iopscience.iop.org/article/10.3847/2041-8213/ad77cb/pdf>

The Solar and Geomagnetic Storms in May 2024: A Flash Data Report

Hisashi **Hayakawa**, [Yusuke Ebihara](#), [Alexander Mishev](#), [Sergey Koldobskiy](#), [Kanya Kusano](#), [Sabrina Bechet](#), [Seiji Yashiro](#), [Kazumasa Iwai](#), [Atsuki Shinbori](#), [Kalevi Mursula](#), [Fusa Miyake](#), [Daikou Shiota](#), [Marcos V. D. Silveira](#), [Robert Stuart](#), [Denny M. Oliveira](#), [Sachiko Akiyama](#), [Kouji Ohnishi](#), [Yoshizumi Miyoshi](#)

2024

<https://arxiv.org/pdf/2407.07665>

+ **5 May** AR3663 01:27 – M8.4/1B short flare, N26W10, S9~180

06:01 – X1.3/1B short flare, N26W10, S9~230

10:00 – M7.4/1B short flare, S9~320

11:54 – X1.2/1B short flare, N26W22

https://www.spaceweather.com/images2024/05may24/acticity_teal.gif

5-6 May G1 GEOSTORM Kp= 5 Dst=- 50 Bz~-12

5-11 May

The extremely strong non-neutralized electric currents of the unique solar active region NOAA 13664

Ioannis **Kontogiannis** (Leibniz-Institut für Astrophysik Potsdam (AIP) Germany)
A&A 2024

Magnetic Field Evolution of the Solar Active Region 13664

[Robert Jarolim](#), [Astrid Veronig](#), [Stefan Purkhart](#), [Peijin Zhang](#), [Matthias Rempel](#)

ApJ 2024

<https://arxiv.org/pdf/2409.08124>

+ **6 May** 06:35 – **X4.5/3B** flare, AR3663, N24W35, S15~220

https://www.spaceweather.com/images2024/06may24/m4p5_anim_opt.gif

6-12 May

Extraordinary Magnetic Flux Emergence Rate Preceding the May 2024 Extreme Geomagnetic Disturbances

Xudong Sun¹, Aimee Norton², Shin Toriumi³, Peter Schuck⁴, Jie Zhang

[HMI Science Nuggets](#) #4216 June 2024

<http://hmi.stanford.edu/hminuggets/?p=4216>

Evolution of AR3664 [movie of NOAA 13664/8 flux emergence](#)

7 May 16:30 – **M8.2** spike, AR3663, N25W55, S9~230

AR3663 – X-FLARE CHAMPION OF SOLAR CYCLE 25;

AR3664 – X-FLARE CHAMPION OF SOLAR CYCLE 25;

+ **8 May** 01:41 – **X1.0/1B** spike flare, AR3663, N26W58, S9~130

https://www.spaceweather.com/images2024/07may24/x1p0_teal.gif

05:09 – **X1.0** short flare, N26W61, S5~570

06:43 – **M7.1/3B** longer flare, **AR3664, S21W15**, S9~570, haloCME

https://www.spaceweather.com/images2024/08may24/roiling_crop_opt.gif

<https://www.spaceweather.com/images2024/08may24/halocme.gif>

12:01 – **M8.7** Castelli longer flare, **AR3664, S20W15**, S5~1000,

17:53 – **M7.9/2N**, **AR3664, S18W18**, S9~160

~18:30 – significant NE eruption

21:40 – **X1.0**, S5~3200, **AR3664**

22:27 – **M9.8**, **AR3664**

U23:29 – 2N, ERU, **S18W23, AR3664**

https://www.spaceweather.com/images2024/09may24/lots_of_cmes.gif

See https://en.wikipedia.org/wiki/May_2024_solar_storms

Estimating early coronal mass ejection propagation direction with DIRECD during the severe May 8 and follow-up June 8, 2024 events

[Shantanu Jain](#), [Tatiana Podladchikova](#), [Astrid M. Veronig](#), [Galina Chikunova](#), [Karin Dissauer](#), [Mateja Dumbovic](#), [Amaia Razquin](#)

A&A 2024

<https://arxiv.org/pdf/2410.18549>

Unveiling key factors in solar eruptions leading to the solar superstorm in 2024 May

Rui Wang^{1,2,3*}, Ying D. Liu^{1,2,3}, Xiaowei Zhao^{4,5} and Huidong Hu^{1,2}

A&A 692, A112 (2024)

<https://arxiv.org/pdf/2410.00891> File

<https://doi.org/10.1051/0004-6361/202452008>

<https://www.aanda.org/articles/aa/pdf/2024/12/aa52008-24.pdf>

The magnetic topology of AR13664 leading to its first halo CME

[David MacTaggart](#), [Tom Williams](#), [OPM Aslam](#)

JGR 2024

<https://arxiv.org/pdf/2410.15964>

Magnetic Field Evolution of the Solar Active Region 13664

[Robert Jarolim](#), [Astrid Veronig](#), [Stefan Purkhart](#), [Peijin Zhang](#), [Matthias Rempel](#)

ApJ 2024

<https://arxiv.org/pdf/2409.08124>

Various Features of the X-class White-light Flares in Super Active Region NOAA 13664

[Ying Li](#), [Xiaofeng Liu](#), [Zhichen Jing](#), [Wei Chen](#), [Qiao Li](#), [Yang Su](#), [De-Chao Song](#), [M. D. Ding](#), [Li Feng](#), [Hui Li](#), [Weiqun Gan](#)

ApJL 972 L1 2024

<https://arxiv.org/pdf/2408.05725> File

<https://iopscience.iop.org/article/10.3847/2041-8213/ad6d6c/pdf>

Extraordinary Magnetic Flux Emergence Rate Preceding the May 2024 Extreme Geomagnetic Disturbances

Xudong Sun¹, Aimee Norton², Shin Toriumi³, Peter Schuck⁴, Jie Zhang

[HMI Science Nuggets](#) #4216 June 2024

<http://hmi.stanford.edu/hminuggets/?p=4216>

Evolution of AR3664 [movie of NOAA 13664/8 flux emergence](#)

8-10 May

HOPE (hot onset precursor event) during high activity

Hugh HUDSON, Alphonse STERLING

RHESSI Nuggets #475 2024

https://heliowiki.smce.nasa.gov/wiki/index.php/HOPE_during_high_activity

8-15 May

Deconstructing Solar Super Active Region 13664 in the Context of the Historic Geomagnetic Storm of 2024 May 10-11

[Priyansh Jaswal](#), [Suvadip Sinha](#), [Dibyendu Nandy](#)

ApJ 2024

<https://arxiv.org/pdf/2409.14752>

A Pileup of Coronal Mass Ejections Produced the Largest Geomagnetic Storm in Two Decades

Ying D. Liu, [Huidong Hu](#), [Xiaowei Zhao](#), [Chong Chen](#), [Rui Wang](#)

ApJL 2024

<https://arxiv.org/pdf/2409.11492>

Unveiling key factors in solar eruptions leading to the solar superstorm in 2024 May

Rui Wang^{1,2,3*}, Ying D. Liu^{1,2,3}, Xiaowei Zhao^{4,5} and Huidong Hu^{1,2}

A&A 692, A112 (2024)

<https://arxiv.org/pdf/2410.00891> File

<https://doi.org/10.1051/0004-6361/202452008>

<https://www.aanda.org/articles/aa/pdf/2024/12/aa52008-24.pdf>

Various Features of the X-class White-light Flares in Super Active Region NOAA 13664

[Ying Li](#), [Xiaofeng Liu](#), [Zhichen Jing](#), [Wei Chen](#), [Qiao Li](#), [Yang Su](#), [De-Chao Song](#), [M. D. Ding](#), [Li Feng](#), [Hui Li](#), [Weiqun Gan](#)

ApJL 972 L1 2024

<https://arxiv.org/pdf/2408.05725> File

<https://iopscience.iop.org/article/10.3847/2041-8213/ad6d6c/pdf>

Unveiling the Interplanetary Solar Radio Bursts of the 2024 Mother's Day Solar Storm
Oksana **Kruparova**^{1,2}, Vratislav Krupar^{1,2}, Adam Szabo², David Lario², Teresa Nieves-Chinchilla²,
and Juan Carlos Martinez Oliveros³
2024 ApJL 970 L13
<https://iopscience.iop.org/article/10.3847/2041-8213/ad5da6/pdf>

+ **9 May** 09:13 – X2.2/3B LDE , S20W26, AR3664, S5~3100, type II/2, halo CME,
Protons J10~1
https://www.spaceweather.com/images2024/09may24/x2_teal_opt.gif
https://www.spaceweather.com/images2024/09may24/so_many_cmes.gif
17:44 – X1.1 , AR3664, S9~870, type II/3

Various Features of the X-class White-light Flares in Super Active Region NOAA 13664
[Ying Li](#), [Xiaofeng Liu](#), [Zhichen Jing](#), [Wei Chen](#), [Qiao Li](#), [Yang Su](#), [De-Chao Song](#), [M. D. Ding](#), [Li Feng](#), [Hui Li](#), [Weiqun Gan](#)
ApJL 972 L1 2024
<https://arxiv.org/pdf/2408.05725> File
<https://iopscience.iop.org/article/10.3847/2041-8213/ad6d6c/pdf>

+ **10 May** 06:54 – X3.9/2B, AR3664, S20W26, coronal wave, S3~900, type II/2, halo CME
14:11–M5.9/1N, AR3664, S14W39, S9~110
Soft ESP protons J10→207 Много SEP из-за G5 бури
>19 UT – long-duration SE filament eruption

HOPE (hot onset precursor event) during high activity

Hugh HUDSON, Alphonse STERLING
RHESSI Nuggets #475 2024
https://heliowiki.smce.nasa.gov/wiki/index.php/HOPE_during_high_activity

Various Features of the X-class White-light Flares in Super Active Region NOAA 13664
[Ying Li](#), [Xiaofeng Liu](#), [Zhichen Jing](#), [Wei Chen](#), [Qiao Li](#), [Yang Su](#), [De-Chao Song](#), [M. D. Ding](#), [Li Feng](#), [Hui Li](#), [Weiqun Gan](#)
ApJL 972 L1 2024
<https://arxiv.org/pdf/2408.05725> File
<https://iopscience.iop.org/article/10.3847/2041-8213/ad6d6c/pdf>

Stellar flares, superflares and coronal mass ejections -- entering the Big data era **Review**
[Krisztián Vida](#), [Zsolt Kövári](#), [Martin Leitzinger](#), [Petra Odert](#), [Katalin Oláh](#), [Bálint Seli](#), [Levente Kriskovics](#), [Robert Greimel](#), [Anna Görgei](#)
Universe 2024
<https://arxiv.org/pdf/2407.16446>

Unveiling the Interplanetary Solar Radio Bursts of the 2024 Mother's Day Solar Storm
Oksana **Kruparova**^{1,2}, Vratislav Krupar^{1,2}, Adam Szabo², David Lario², Teresa Nieves-Chinchilla²,
and Juan Carlos Martinez Oliveros³
2024 ApJL 970 L13
<https://iopscience.iop.org/article/10.3847/2041-8213/ad5da6/pdf>

10-11 May EXTREME G5 GEOMAGNETIC STORM
Kp= 9 Dst=- 412 Bz~-48

The Probability of the May 2024 Geomagnetic Superstorm
S. Elvidge, [D. R. Themens](#)
Space Weather [Volume23, Issue1](#) January 2025 e2024SW004113
<https://doi.org/10.1029/2024SW004113>

<https://agupubs.onlinelibrary.wiley.com/doi/epdf/10.1029/2024SW004113>

Super-Intense Geomagnetic Storm on 10–11 May 2024: Possible Mechanisms and Impacts

S. Tulasi **Ram**, [B. Veenadhari](#), [A. P. Dimri](#), [J. Bulusu](#), [M. Bagiya](#), [S. Gurubaran](#), [N. Parihar](#), [B. Remya](#), [G. Seemala](#), [Rajesh Singh](#), [S. Sripathi](#), [S. V. Singh](#), [G. Vichare](#)

Space Weather [Volume22, Issue12](#) December 2024 e2024SW004126

<https://doi.org/10.1029/2024SW004126>

<https://agupubs.onlinelibrary.wiley.com/doi/epdf/10.1029/2024SW004126>

Unveiling key factors in solar eruptions leading to the solar superstorm in 2024 May

Rui **Wang**^{1,2,3*}, Ying D. Liu^{1,2,3}, Xiaowei Zhao^{4,5} and Huidong Hu^{1,2}

A&A 692, A112 (2024)

<https://arxiv.org/pdf/2410.00891> File

<https://doi.org/10.1051/0004-6361/202452008>

<https://www.aanda.org/articles/aa/pdf/2024/12/aa52008-24.pdf>

Deconstructing Solar Super Active Region 13664 in the Context of the Historic Geomagnetic Storm of 2024 May 10-11

[Priyansh Jaswal](#), [Suvadip Sinha](#), [Dibyendu Nandy](#)

ApJ 2024

<https://arxiv.org/pdf/2409.14752>

A Pileup of Coronal Mass Ejections Produced the Largest Geomagnetic Storm in Two Decades

Ying D. **Liu**, [Huidong Hu](#), [Xiaowei Zhao](#), [Chong Chen](#), [Rui Wang](#)

ApJL 2024

<https://arxiv.org/pdf/2409.11492>

Magnetic Field Evolution of the Solar Active Region 13664

[Robert Jarolim](#), [Astrid Veronig](#), [Stefan Purkhart](#), [Peijin Zhang](#), [Matthias Rempel](#)

ApJ 2024

<https://arxiv.org/pdf/2409.08124>

Analyzing the Sequence of Phases Leading to the Formation of the Active Region 13664, with Potential Carrington-like Characteristics

[Paolo Romano](#), [Abouazza Elmhamdi](#), [Alessandro Marassi](#), [Lidia Contarino](#)

2024 ApJL 973 L31

<https://arxiv.org/pdf/2409.04408>

<https://iopscience.iop.org/article/10.3847/2041-8213/ad77cb/pdf>

Interplanetary Causes and Impacts of the 2024 May Superstorm on the Geosphere: An Overview

Rajkumar **Hajra**, [Bruce Tsatnam Tsurutani](#), [Gurbax Singh Lakhina](#), [Quanming Lu](#), [Aimin Du](#)

ApJ 2024

<https://arxiv.org/pdf/2408.14799>

The Solar and Geomagnetic Storms in May 2024: A Flash Data Report

Hisashi **Hayakawa**, [Yusuke Ebihara](#), [Alexander Mishev](#), [Sergey Koldobskiy](#), [Kanya Kusano](#), [Sabrina Bechet](#), [Seiji Yashiro](#), [Kazumasa Iwai](#), [Atsuki Shinbori](#), [Kalevi Mursula](#), [Fusa Miyake](#), [Daikou Shiota](#), [Marcos V. D. Silveira](#), [Robert Stuart](#), [Denny M. Oliveira](#), [Sachiko Akiyama](#), [Kouji Ohnishi](#), [Yoshizumi Miyoshi](#)

2024

<https://arxiv.org/pdf/2407.07665>

Satellite Drag Analysis During the May 2024 Geomagnetic Storm

William E. **Parker**¹ and Richard Linares²

JGR 2024

<https://arxiv.org/html/2406.08617v1>

SUPERSTORM ZAPS GLOBAL ELECTRIC CIRCUIT

See <https://www.spaceweather.com> for 18 Jun 2024

Extraordinary Magnetic Flux Emergence Rate Preceding the May 2024 Extreme Geomagnetic Disturbances

Xudong Sun¹, Aimee Norton², Shin Toriumi³, Peter Schuck⁴, Jie Zhang

[HMI Science Nuggets](#) #4216 June 2024

<http://hmi.stanford.edu/hminuggets/?p=4216>

Assessment of Geomagnetic Activity for the Kp=9 “Gannon Storm” in May 2024 Based on Version 3.0 Hpo Indices

Yosuke Yamazaki, Jürgen Matzka, Marcos Vinicius Siqueira da Silva, Guram N Kervalishvili, ++
ESS Open Archive . June 14, 2024.

<https://essopenarchive.org/doi/full/10.22541/essoar.171838396.68563140/v1>

DOI: [10.22541/essoar.171838396.68563140/v1](https://doi.org/10.22541/essoar.171838396.68563140/v1)

+ **11 May** 01:23–X5.8/2B, AR3664, S15W45, S15~3600, halo CME type II/3
Hard protons J10→116

<https://www.spaceweather.com/images2024/11may24/x6.gif>

<https://www.spaceweather.com/images2024/11may24/newcme.gif>

11:44 – X1.5, S9~620

15:25– M8.8/2N, S15W49, S9~230

AR 3664 https://spaceweathergallery2.com/indiv_upload.php?upload_id=208190

Various Features of the X-class White-light Flares in Super Active Region NOAA 13664

[Ying Li](#), [Xiaofeng Liu](#), [Zhichen Jing](#), [Wei Chen](#), [Qiao Li](#), [Yang Su](#), [De-Chao Song](#), [M. D. Ding](#), [Li Feng](#), [Hui Li](#), [Weiqun Gan](#)

ApJL 972 L1 2024

<https://arxiv.org/pdf/2408.05725> File

<https://iopscience.iop.org/article/10.3847/2041-8213/ad6d6c/pdf>

Unveiling key factors in solar eruptions leading to the solar superstorm in 2024 May

Rui Wang^{1,2,3*}, Ying D. Liu^{1,2,3}, Xiaowei Zhao^{4,5} and Huidong Hu^{1,2}

A&A 692, A112 (2024)

<https://arxiv.org/pdf/2410.00891> File

<https://doi.org/10.1051/0004-6361/202452008>

<https://www.aanda.org/articles/aa/pdf/2024/12/aa52008-24.pdf>

+ **12 May** 16:26 – X1.0/1F, S18W72, radio spike S15~1400

Various Features of the X-class White-light Flares in Super Active Region NOAA 13664

[Ying Li](#), [Xiaofeng Liu](#), [Zhichen Jing](#), [Wei Chen](#), [Qiao Li](#), [Yang Su](#), [De-Chao Song](#), [M. D. Ding](#), [Li Feng](#), [Hui Li](#), [Weiqun Gan](#)

ApJL 972 L1 2024

<https://arxiv.org/pdf/2408.05725> File

<https://iopscience.iop.org/article/10.3847/2041-8213/ad6d6c/pdf>

13 May 09:44 – M6.6/SF LDE, S20W81, S5~1400, type II/2, CME,

https://www.spaceweather.com/images2024/13may24/lopsided_cme.gif

Soft protons J10→59→121

+ **14 May** 02:09– X1.7 spike, AR3664, S5~440, type II/2, small CME

https://www.spaceweather.com/images2024/14may24/xflare_crop.gif

12:25–X1.2 quasi-spike, AR3664, S15~4200, type II/2, small CME
STRONGEST FLARE OF THE CYCLE 16:51–X8.7 quasi-spike,
S18W89,AR3664, S15~1200, type II/2, CME

https://www.spaceweather.com/images2024/14may24/xflare_crop.gif

Softer protons

Another source 17:38–M4.4/2N impressive LDE, AR3682 N19E72, S9~720, type II/2, CME

Various Features of the X-class White-light Flares in Super Active Region NOAA 13664

[Ying Li](#), [Xiaofeng Liu](#), [Zhichen Jing](#), [Wei Chen](#), [Qiao Li](#), [Yang Su](#), [De-Chao Song](#), [M. D. Ding](#), [Li Feng](#), [Hui Li](#), [Weiqun Gan](#)

ApJL 972 L1 2024

<https://arxiv.org/pdf/2408.05725> File

<https://iopscience.iop.org/article/10.3847/2041-8213/ad6d6c/pdf>

Unveiling the Interplanetary Solar Radio Bursts of the 2024 Mother's Day Solar Storm

Oksana **Kruparova**^{1,2}, Vratislav Krupar^{1,2}, Adam Szabo², David Lario², Teresa Nieves-Chinchilla², and Juan Carlos Martinez Oliveros³

2024 ApJL 970 L13

<https://iopscience.iop.org/article/10.3847/2041-8213/ad5da6/pdf>

The Solar and Geomagnetic Storms in May 2024: A Flash Data Report

Hisashi **Hayakawa**, [Yusuke Ebihara](#), [Alexander Mishev](#), [Sergey Koldobskiy](#), [Kanya Kusano](#), [Sabrina Bechet](#), [Seiji Yashiro](#), [Kazumasa Iwai](#), [Atsuki Shinbori](#), [Kalevi Mursula](#), [Fusa Miyake](#), [Daikou Shiota](#), [Marcos V. D. Silveira](#), [Robert Stuart](#), [Denny M. Oliveira](#), [Sachiko Akiyama](#), [Kouji Ohnishi](#), [Yoshizumi Miyoshi](#)

2024

<https://arxiv.org/pdf/2407.07665>

Observations of the 2024 May 14 X8.7 Solar Flare with the Goldstone-Apple Valley Radio Telescope (GAVRT)

Thangasamy **Velusamy**¹, Ryan Dorcsey², Nancy Kreuser-Jenkins², Lisa Nichole Lamb², Erica Pagano², Marin M. Anderson¹, Joseph Lazio¹, and Steven Levin¹

2024 Res. Notes AAS 8 163

<https://iopscience.iop.org/article/10.3847/2515-5172/ad5a0d>

AR3664 – X-FLARE CHAMPION OF SOLAR CYCLE 25;

Historical Comparison of May 2024 Solar Storms

+ **15 May** 08:37– X3.4, AR3664, W>90, S15~2000, CME

Another source 14:38–X2.9, SE-limb AR3685, S5~180, type II/1, CME

<https://www.swpc.noaa.gov/news/another-x-flare-another-region>

<https://www.spaceweather.com/images2024/15may24/newssourceofflares.gif>

Various Features of the X-class White-light Flares in Super Active Region NOAA 13664

[Ying Li](#), [Xiaofeng Liu](#), [Zhichen Jing](#), [Wei Chen](#), [Qiao Li](#), [Yang Su](#), [De-Chao Song](#), [M. D. Ding](#), [Li Feng](#), [Hui Li](#), [Weiqun Gan](#)

ApJL 972 L1 2024

<https://arxiv.org/pdf/2408.05725> File

<https://iopscience.iop.org/article/10.3847/2041-8213/ad6d6c/pdf>

16 May a short-lived **G1 GEOSTORM** Kp= 6 Dst=- 83 Bz~-11

- 17 May** a short-lived **G1 GEOSTORM Kp= 6 Dst=- 106 Bz~-15**
<https://www.spaceweather.com/images2024/17may24/cmeimpact.jpg>
 21:08–M7.2/2B LDE, **AR3685**, S12E62, type II/2
- 20 May** >06 UT– **Significant farsidem (X12) SoLO flare**, [bright full-halo CME](#)
Mars Got Cooked by a Recent Solar Storm
 See <https://www.nytimes.com/2024/06/13/science/mars-aurora-solar-storm.html>
- 23 May** 02:16– M4.2/1N short flare, AR3679, S08W63, S15~210, CME
 >04 UT– SE filament eruption and AR3685, M1.7 LDE, CME
<https://www.spaceweather.com/images2024/23may24/filament.gif>
- + **27 May** 07:08–**X2.8 LDE** flare beyond the SE limb (**farside AR3664**), **impulsive S5~320**,
 type II/3, large [bright CME](#)
<https://www.spaceweather.com/images2024/27may24/x2p8.gif>
- + **29 May** 14:37–**X1.4/2B LDE, AR3697 (old AR3664)**, S21E66, S9~320, [bright CME](#)
https://www.spaceweather.com/images2024/29may24/xflare_anim.gif
- + **31 May** 22:03–**X1.1/2B impulsive flare**, AR3697, no CME,
https://www.spaceweather.com/images2024/31may24/x1_teal_movie.jpg
THE HIGHEST SUNSPOT NUMBER IN 22 YEARS See <https://www.spaceweather.com>, **6 Jun**
- + **1 Jun** 08:48–**X1.4**, AR3697, S18E31, no CME, S15~660
 18:36–**X1.0 impulsive**, AR3697, S16E24, imp S15~840
 19:39–M7.3 LDE, AR3697, imp S8~1100, type II/2, [a halo CME](#)
https://www.spaceweather.com/images2024/01jun24/doubleflare_crop_opt.gif
- 3 Jun** 11:55–M3.2/1N impulsive flare, AR3697, S19W01, imp S9~3000
 12:28–M2.8 impulsive flare, AR3697,
 14:11–M4.8/2N eruption, AR3695, N28W42
<https://www.spaceweather.com/images2024/03jun24/newplume.gif>
- 4 Jun** 06:31–M2.4/1N short LDE, AR3697, S20W09
- 5 Jun** 08:56–M3.4 and 10:07–M2.6 short flares, AR3697, S21W25
 >15:30–NE filament eruption, CME
- 6 Jun** 15:06–M6.1/2B short flare, AR3697, S20W41, imp S3~350
- 7 Jun** **UNEXPECTED 6-hour GEOMAGNETIC STORM: Kp= 6 Dst=- 24 Bz~-14**
 09:13–M4.0 short flare, AR3709, S10E84
- 8 Jun** **SOLAR FLARE AND HARD RADIATION STORM**
 00:51–M3.3/1F imp, AR3697, S18W53
 01:49–M9.7/1F short LDE, AR3697, S18W53, S9~640, type II/3, large [CME](#),
hard SEP J10~1000
https://www.spaceweather.com/images2024/08jun24/almostx_teal.gif
<https://www.spaceweather.com/images2024/08jun24/redflare.gif>
The strongest solar radiation or "S" storm since September 2017

Estimating early coronal mass ejection propagation direction with DIRECD during the severe May 8 and follow-up June 8, 2024 events

[Shantanu Jain](#), [Tatiana Podladchikova](#), [Astrid M. Veronig](#), [Galina Chikunova](#), [Karin Dissauer](#), [Mateja Dumbovic](#), [Amaia Razquin](#)

A&A 2024

<https://arxiv.org/pdf/2410.18549>

- + **10 Jun** 06:09–M3.3 spike, AR3697, S19W90
11:08–**X1.5** short flare, AR3697, S19W85, imp S15~170, CME
18:40–M9.5 short LDE, AR3697, S18W88, imp S9~140, type II/1, CME

AR3697 (former AR3664) produced 28 M-class flares and 6 X-class flares in its last rotation

10-11 Jun **INEFFECTIVE CME** [weak impact](#) **Kp= 4+** **Dst=-45** **Bz~-9**

11-12 Jun **FARSIDE EXPLOSION**, AR3697 (old AR3664), large CME, SEP J10~10
https://www.spaceweather.com/images2024/12jun24/farside_cme.gif

17 Jun A flurry of CMEs due to farside activity

20 Jun 23:16 – [brief but intense](#) **M5.7/1B** spike, AR3719, S14E57, S9~200

23 Jun 13:01–**M9.3/1N** short flare, AR3723 (Old AR3664 and 3697), S17E74, imp S9~190
<https://www.spaceweather.com/images2024/23jun24/returning.jpg>

24-25 Jun Large SW [erupting filament](#) , a [large CME](#), ~M1 long SXR gradual rise and fall

28 Jun **G3 GEOMAGNETIC STORM: Kp= 7.5** [storm](#) **Dst=- 105** **Bz~-25**

29 Jun ~15 UT – large SW filament eruption, [CME](#)
https://www.spaceweather.com/images2024/29jun24/cof_strip_opt.gif

13 Jul 12:42– short-term M5.3/1N flare, AR3738 , S08W42, imp S9~250
23:01–short-term M5.0 flare, AR3738 , S08W46, no CME

+ **14 Jul** 02:34– short-term **X1.2** flare, AR3738 , imp S9~1000
https://www.spaceweather.com/images2024/14jul24/x1p2_teal.jpg

+ **16 Jul** 13:26– short-term **X1.9** flare ([movie](#)), AR3738 , S06W85, imp S15~6500, narrow CME, type II/3, **no SEP**

New Results on the Onset of a Coronal Mass Ejection from 5303 Å Emission Line Observations with VELC/ADITYA-L1

R. **Ramesh**¹, V. Muthu Priyal¹, Jagdev Singh¹, K. Sasikumar Raja¹, P. Savarimuthu¹, and Priya Gavshinde¹

2024 ApJL 976 L6

<https://iopscience.iop.org/article/10.3847/2041-8213/ad8c45/pdf>

17 Jul 06:39–M5.0/2B, AR3743 , S10W31, imp S5~770, II/1
07:09–M3.4, AR3743 , N09W39, II/1

21 Jul >16:30–NE filament eruption and M1.0 flare connected to AR3757, Two dark plumes **304 A**, type II/2, **a halo CME**
https://www.spaceweather.com/images2024/21jul24/doubleplume_strip_opt.gif

22 Jul 04:04–M3.9 flare, AR3762, S15E56

22-23 Jul SolO: **MAJOR FARSIDE X14 FLARE**. The biggest flare of Solar Cycle 25
https://www.spaceweather.com/images2024/25jul24/x14_stix.jpg
FARSIDE(?) CME PEPPERS EARTH WITH HARD PROTONS, J10~24, a full halo CME
<https://www.spaceweather.com/images2024/23jul24/farsideCME.gif>
morning S filament eruption observed with STEREO-A;
14:28–LDE M2.4, AR3754, S10E77, type II/2

24 Jul 07:42– spike M3.6/2B flare, AR3759?, S06W81, imp S15~360, type II/2
17:21– spike 2.9/1F flare, AR3751, S07W71, imp S9~280, type II/2

26 Jul **GEOMAGNETIC STORM: Kp= 4.5 Dst=- 51 Bz~-12**

27 Jul 02:37 –spike M4.2/1N, AR3766, S09E24
05:46–quasi M3.1/SF, AR3762, S10W25, imp S5~330, coronal wave
AR3762 and AR3766 produced a series of M-class flares, a mash-up of at least two halo CMEs
https://www.spaceweather.com/images2024/27jul24/interest_compressed.gif
<https://www.spaceweather.com/images2024/27jul24/doublehalo.gif>

28 Jul 01:51– **short-term M9.9/2B flare, AR3765, S16E16, imp S15~480, type II/3, faint halo CME**
https://www.spaceweather.com/images2024/28jul24/m9p9_teal.gif

10:42– **short-term M7.7/SF, AR3762, S10W39, imp S9~170, halo CME**
https://www.spaceweather.com/images2024/28jul24/additional_CMEs.gif
<https://www.spaceweather.com/images2024/28jul24/wagontrain.gif>
A [series of M-class flares](#) over the weekend hurled multiple CMEs toward Earth, as many as four or five

+ **29 Jul** 02:37 – spike **X1.5/2B, impulsive X1.5 flare**, AR3764, S05W04, imp S9~1000
12:55 – spike M8.7, AR3762, S16W43, imp S9~1020, type II/2
14:46– M4.2/1N LDE, AR3765, S16W04
19:57–short-term M6.4, AR3766?, S05W10?

Over the weekend, the sun hurled [Multiple CMEs](#) directly toward Earth. Individually, none of the CMEs was particularly impressive, but together they joined forces to form a potentially-potent "Cannibal CME."
[NOAA model](#)

30 Jul **GEOMAGNETIC STORM: Kp= 5 Dst=(+32) -28 Bz~-11**
19:38–mini LDE **M9.4/2N exploded today**, AR3772, S24E64, imp S9~210
almost-X-class flare

31 Jul 05:23– short-term M4.7 , AR3774
06:46– short-term M7.7, AR3768, S16W61, imp S9~420
13:32–spike+LDE M4.4/1F+SN, AR: 3764, 3768, 3772, S05W38, S15W65, S23E53, imp S9~150

31 Jul- 1 Aug **GEOMAGNETIC STORM: Kp= 5 Dst= -34 Bz~-13**

1 Aug 01:50 –spike M6.6, AR3773, S06W62, imp S9~240
04:41–M4.4, AR3765, S12W35, imp S15~1100
07:09–LDE M8.2/1N, AR3768, S16W74, imp S5~610, [CME](#) , [M8 flare](#)

11:38– LDE M4.1, AR3768, S16W80, imp S3~110

2 Aug 04:55–LDE M7.4, AR3774, S04E56, S3~440

3 Aug 18:39–spike M7.3, AR3775, S11W70, imp S15~540
19:30– short-term M5.4, E limb

https://www.spaceweather.com/images2024/04aug24/m_and_m.gif

4 Aug **G3 GEOMAGNETIC STORM: Kp= 6.5 Dst=- 116 Bz~-18**

+ **5 Aug** 05:23 –spike M6.1, AR3780, S11E63, imp S5~420, type II/3
13:40– **X1.7**, departing W-limb AR3767, imp S9~420, type II/2, SEP J10~3
15:26–**X1.1/2B**, [giant new sunspot](#) AR3780 near the eastern limb, imp S9~340, type II/2

7 Aug 13:50– spike M4.1, AR3774, S03W24, imp S9~2300, type II/2
18:54–LDE M5.0/2B, AR3777, S07W07, imp S3~290, type II/2

+ **8 Aug** 19:35–LDE **X1.3/1N**, AR3777, S10W09, imp S9~110, halo CME, type II/2
https://www.spaceweather.com/images2024/08aug24/x1p3_teal.gif
https://www.spaceweather.com/images2024/08aug24/halo_cme.gif
21:23–LDE M4.5, AR , imp S5~160

**SOLAR CYCLE 25 LIKELY REACHED THE HIGHEST SUNSPOT NUMBER
IN OVER 20 YEARS**

<https://www.swpc.noaa.gov/news/solar-cycle-25-likely-reached-highest-sunspot-number-over-20-years>

9 Aug 21:23–LDE M4.5, AR , imp S5~1600

10 Aug 02:37–LDE M5.3/2N/ AR3780, S10E01, imp S9~780,

11 Aug **GEOMAGNETIC STORM: Kp= 4.5 Dst= >0 Bz~ >0**

12 Aug **G3-G4 GEOMAGNETIC STORM: Kp= 8 Dst= -203 Bz~ -20**
response to multiple CME impacts

13 Aug 23:44–short LDE M4.2/1N, AR3784, N14E10, imp S5~130

14 Aug 04:02–LDE M4.4, AR3777, W-limb
06:40–LDE **X1**, **strangely-magnetized sunspot** AR3784, N14E03, imp S3~500, large CME
15:49–spike+PLDE M5.9, AR3784, N14W01, imp S9~220

17 Aug **a brief but strong (G3)? geomagnetic storm. Kp= 6.5 Dst= -36 Bz~ -21**

19 Aug 21:52–spike+PLDE M3.7, imp S9~100

21 Aug 22:08–spike? M5.1/2N, AR3796 , S03E31, imp S9~250

23 Aug 03:41–spike M3.4, AR3801 , N09E66, imp S15~580
20:12–double short M5.1/1N, high latitude AR3800, **S25E22**

26 Aug >17 UT– significant ESS filament eruption, large CME

28 Aug G2 **geomagnetic storm. Kp= 5.5 Dst= -92 Bz~ -15**
PLASMA FALLS ON THE SUN
https://spaceweathergallery2.com/indiv_upload.php?upload_id=212182

30 Aug 12:20–spike M3.8, AR3806, S10E59

30-31 Aug G2 **geomagnetic storm. Kp= 4.5 Dst= -88 Bz~ -13**

1 Sep 13:22– behind the SE-limb LDE M5.5, large CME, post-eruptive arcade, slow growing SEP up to J10~5.5 on 3 Sep
https://www.spaceweather.com/images2024/02sep24/venus_cme.gif

3 Sep ~07:50–W farside eruption, type II, large halo CME, hard SEP of J10~2
<https://www.spaceweather.com/images2024/03sep24/farsidecme.gif>
~ simultaneously 07:22–M1.4 E flare, AR3813, S20E57
16:02 –M3.3, AR3813, S20E57

4 Sep **UNEXPECTED CME IMPACT: at 10:30**

SOLAR CYCLE 25 CONTINUES TO SURGE

<https://www.spaceweather.com/images2024/04sep24/sunspotnumbers.jpg>

5 Sep ~07 UT– A **magnificent farside halo CME** , the second time this week

8 Sep Several eruptions (filament), ~00 UT- [dark plasma explosion](#) NW-central M1, **304 A**

9 Sep Large W-limb (AR3806) and E-limb (farside) halo CMEs. **Soft SEP J10~10 →35**
<https://www.spaceweather.com/images2024/09sep24/halocme.gif>
17:08 –spike M3.4/2N, AR3814, N15E15, imp S3~170

10 Sep 00:30– LDE C1.05, one more N halo CME, N-central AR3814
<https://www.spaceweather.com/images2024/10sep24/halocme.gif>

11 Sep NW AR3814 is crackling with M-class flares.

12 Sep 00:12–short-term LDE M5.0, N-central AR3814, N13W01?
A 24 HOUR G3 geomagnetic storm. Kp=7 Dst= -114 Bz~ -22
09:43– ~spike X1.3, E-limb, imp S9~660
https://www.spaceweather.com/images2024/12sep24/x1p3_crop.jpg
14:43–spike+PE M6.8, AR3811, S15W84

13 Sep 06:56 –short LDE M5.4, SW-limb, significant CME

+ **14 Sep** 15:29–real LDE X4.5/2B, AR3825, S15E56, **S15~8800, significant CME**
https://www.spaceweather.com/images2024/14sep24/xflare_anim_opt.gif

14-15 Sep hard-spectrum SEP, J10~3.5 → 6.2

17 Sep **G4 geomagnetic storm Kp=7.5 Dst= -116 Bz~ -17**
Associated Energetic Storm Particles (ESP) J10~34

19 Sep ~10 UT – slow N filament eruption, CME

22 Sep 21:39– short LDE **M3.7 flare hurled a massive plume of plasma**, AR3834, S14E37, imp S3~540, [partial lopsided halo CME](#)
<https://www.spaceweather.com/images2024/22sep24/plume.jpg>

23-26... Sep G1 geomagnetic disturbances **Kp=5 Dst= -47**

29 Sep CME <https://www.swpc.noaa.gov/news/noaa-shares-imagery-goes-19-ccor-1>

30 Sep 23:59–short **M7.6**, ([movie](#)) , AR3842, S18E30, imp S15~160

+ **1 Oct** 22:20–almost spike+short **X7.1/2B**, AR3842, S16E17, S15~3200, type II/3, [a quite faint CME](#)
https://www.spaceweather.com/images2024/01oct24/x_seven.gif

2 Oct 05:38–spike M3.6, AR3842 , S15E20, imp S9~250
13:38–short M3.2/1N, AR3842 , S19E07, imp
20:51–short M3.1, AR3842

+ **3 Oct** >06 UT...–several near NE-limb filament eruptions, CMEs
12: 18 – the **strongest flare of Cycle 25**, short **X9.05**, AR3842 **large-scale coronal wave, dimming, radio S15~5900, type II/2, a halo CME**
20:28–short **M7.6/2B**, AR3843, S09W47, radio imp S9~110, type II/2, faint CME, no SEP

The Evolution of Photospheric Current Density During an X9.3-Class Solar Flare

Li, HL (Li, Hai-Li) ; Liang, HF (Liang, Hong-Fei) ; Zhou, XP (Zhou, Xin-Ping) ; Liu, Y (Liu, Yu) ; Meng, N (Meng, Ni) ; Feng, YL (Feng, Yu-Long)

RESEARCH IN ASTRONOMY AND ASTROPHYSICS Volume 24 Issue 10 105013 2024
DOI 10.1088/1674-4527/ad709d

An X9 flare and its huge crochet (SFE)

Hugh HUDSON

RHESSI Science Nuggets #472 2024

[https://sprg.ssl.berkeley.edu/~tohban/wiki/index.php/An_X9_flare_and_its_huge_crochet_\(SFE\)](https://sprg.ssl.berkeley.edu/~tohban/wiki/index.php/An_X9_flare_and_its_huge_crochet_(SFE))

4 Oct short 04:55 –M4.0/1N, AR3843, S16W17, imp S9~150

6-7-8 Oct G1-G2→G3 **geomagnetic storm Kp=5+ Dst= -46 Bz~ -13**
Kp=7+ Dst= -153 Bz~ -16

+ **7 Oct** 19:13 – short **X2.3/2B**, ([movie](#)), AR3842, S19W63, S3~640
followed by 20:59– clear LDE X1.0, AR3842, S9~130, type II, IV, large CME
<https://www.spaceweather.com/images2024/08oct24/twocmes.gif>

8 Oct addition: Soft ESP, J10~2.3;
>03 UT–**large SW filament eruption** 06 UT–SW CME ; 14 UT – E CME

+ **9 Oct** **01:56–LDE X1.8, AR3848, N11W10?, S5~2800, type II/3 (5176), IV/3**
https://www.spaceweather.com/images2024/09oct24/x1p8_tea_crop_strip_opt.gif
massive halo CME <https://www.spaceweather.com/images2024/09oct24/halocme.gif>
S3 (Strong) solar radiation storm SEP, J10~1000, This explosions lasted more than 4 hours

15:47–spike **X1.4/1N**, AR3842, S12W87, imp S15~2900, small CME
23:12– spike **M7.7**, AR3842, S12W87, imp S5~ 240

Comet Tsuchinshan-ATLAS is passing almost directly between Earth and the sun.

10 Oct 22:30–**M3.0** LDE, AR, S24W40

10-11 Oct SEVERE (G4) GEOMAGNETIC STORM Kp=8.5 Dst= -335 Bz~ -46
Supplemented soft ESP J10~1000→1800

14 Oct 00:17– short/spike **M3.4**, AR3848, N10W78, imp S5~160, type II(3), narrow CME

16 Oct ~24 UT – halo CME

18 Oct 19:38–spike **M4.8/SN**, AR3854, S08W76,
23:28–spike **M4.7/SF**, AR3852, S11W80, type II/1

19 Oct geomagnetic storm Kp=4.5 Dst= -45 Bz~ -9
06:56–spike **M6.5**, AR3854, S08W76

23 Oct ~11:30– SE central eruption

+ **24 Oct** 03:37– LDE **X3.3/SF**, AR3869, S05E86, imp S5~12000, type II(1),IV(3),
a large CME https://www.spaceweather.com/images2024/24oct24/x3p3_teal.gif

+ **26 Oct BIG DOUBLE SOLAR FLARE:** AR3873 erupted twice producing pair of closely-spaced flares
06:23–short **M9.5** , AR3873,
07:19 – LDE **X1.8/3N**, AR3872, S11E56, S3~4200, type II(2),IV(3), **impressive CME**
https://www.spaceweather.com/images2024/26oct24/euv_xflare.gif

26-28 Oct **a CME** grazed Earth on Oct. 26th (1600 UT) ; **SEP/ESP J10→364**

28 Oct 16:28–LDE **M4.2/1F**, AR3878, N16E67; **central filament eruption**

29 Oct >12 UT–SW **an erupting filament** , **initial stages of the explosion** , **large CME**

30 Oct 20:53–short LDE **M7.2/2N**, AR3878, N16E37, imp S15~100, without CME
<https://www.spaceweather.com/images2024/30oct24/allflare.gif>

+ **31 Oct** 21:20– spike + short LDE **X2.0/3B**, AR3878, N18E24, imp S5~2600,
without CME, https://www.spaceweather.com/images2024/31oct24/euv_anim.gif

2, 4, 6 Nov Небольшие геомагнитные возмущения Dst~ -36

4 Nov 01:40– LDE **M3.8 flare**, AR3883, S09E43, type II(1), large **CME**
15:41–spike **M5.5**, AR3883

5 Nov 15:26–short **M4.1**, AR3878, N16W42, type II(1),

+ **6 Nov** 08:50–spike **M5.8/SF** на спаде **M2.9 LDE**
13:40–spike **X2.3** + 14:38–LDE **M5.3**, AR3883, 3886
<https://www.spaceweather.com/images2024/06nov24/crackling2.jpg>

multiple [M-class](#) flares, none of the explosions has produced a significant CME

7 Nov >04 UT–SW-limb **filament/prominence eruption**, significant CME

8-9 Nov **GEOMAGNETIC STORM: Kp= 5 Dst= -96 Bz~ -13**
<https://www.spaceweather.com/images2024/08nov24/thedata.jpg>

10 Nov 00:15–spike **M4.2/1B**, AR3889, S08E33
12:06–spike **M9.4/2B**, AR3889, S08E26, imp S15~520, type II(3), **puny** CME
https://www.spaceweather.com/images2024/10nov24/m9_teal.gif
20:21–short LDE **M4.9/2N**, AR3889, S12E30, imp S3~370

11 Nov >14 UT– **large S-central filament eruption**; bright CME
https://sdo.gsfc.nasa.gov/assets/img/dailymov/2024/11/11/20241111_1024_0193.mp4

18 Nov [M-class flares](#) from new AR3901, S07E76 ; 12:53–spike M3.7

21-22 Nov [SEP, J10~110](#) following an explosion behind the sun's western limb, large CME
https://www.spaceweather.com/images2024/21nov24/farside_cme.gif

25 Nov >02 UT- significant S-central filament eruption, significant [CME](#)
07:42–short LDE **M9.3**, AR hidden behind NE limb , imp S3~210
https://www.spaceweather.com/images2024/26nov24/20241125_074610_1024_0131.jpg

Solar activity has been low for more than a week.

New SDO imagery is unavailable due to severe damage after flooding (broken pipe) at the processing facility on November 26, 2024. Reports from November 27 onwards will be updated when images become available in 2025.

GOES-16 X-ray imagery <https://lasp.colorado.edu/space-weather-portal/now/sun>

1 Dec Note: **A flood at Stanford University has damaged a number of important SDO data servers. Repairs may not be completed until 2025.** [Extensive damage to many SDO data servers.](#)

7 Dec 22:15–short **M3.2/SN**, AR3917, S08E28

8 Dec 09:06–spike **X2.2/2B**, AR3912, S08W54, imp S15~6800 , small CME

10 Dec 06:48–spike+short PE **M6.2**, AR 3922 near the east limb

11 Dec 15:49–spike **M6.7**,

14-15 Dec Filament eruptions and CMEs

15 Dec Over the past week, **three halo CMEs** have exploded from the farside. [Here is the latest](#)

17 Dec Short-term Kp-index geomagnetic storm Kp~ 5+ . Dst>0 [The CME impact](#)
Magnificent halo [CME](#) from farside

19 Dec 15:34–**spike+ M3.8**, AR9328

19- Dec Медленно нарастающие протоны J10~ 4.5 , скорее всего, от залимбовой активности

23 Dec 11:12 –**clear spike M8.9**, AR3932, S12E39, imp S9~370, noticeable CME

24 Dec 00:19- **clear spike M4.7**, AR3932, S17E24, imp S3~140

25 Dec 04:30+04:49–**doubled spike M2.8+M4.9**, AR3938+3932, N17E64+S17E10, imp S9~330, <https://www.spaceweather.com/images2024/25dec24/christmasflare.gif>

26 Dec 03:15–**short M7.3**, AR3933, S09W20, imp S5~270
Four M-class [sympathetic flares](https://www.spaceweather.com/images2024/26dec24/3m_teal.gif) within a 2 1/2 hour period
https://www.spaceweather.com/images2024/26dec24/3m_teal.gif

28 Dec 11:21– **short M4.5**, AR3932, S09W55, imp S9~680

+29 Dec 07:18–**gradual flux rise plus short X1.1/1N**, AR3936, N15W30, imp S9~320
<https://www.swpc.noaa.gov/news/r3-strong-hf-radio-blackout-event-29-dec-2024>

15:09 –**short M7.1**, AR3936, N15W37, imp S9~260

17:08–**short M3.3/1B**, AR3939, S18E26 ; AR3938, N19E01, imp S9~600

18:41–**short M3.3/1N**, AR3934, N13W40, imp S5~140

[The SE CME](#) was hurled into space by the eruption of a magnetic filament connected to sunspot 3939

A score of M-class flares

+30 Dec 04:14–**X1.5**, AR3936, N11W47, imp **S9~2800**

04:31–**X1.1/1N**, AR3932, S19W50, imp S3~430 *a double X-flare, faint CME*

https://www.spaceweather.com/images2024/30dec24/x1.5_teal.gif

<https://www.swpc.noaa.gov/news/pair-r3-strong-hf-radio-blackout-events-30-dec-2024>

<https://www.spaceweather.com/images2024/30dec24/crackling.png>

06:25–**short M3.5**, AR3936, N11W47, imp S9~140

14:46–**spike M3.5/1N**, AR3936, N11W51

16:54–**spike M5.0**, AR3936, imp S9~110

31 Dec- 1 Jan Moderate ([G2](#)) to severe ([G4](#)) **GEOMAGNETIC STORM: Kp=8 Dst= -214 Bz~ -22**

