Observations of Sunspot Groups with Solar Optical Telescope (SOT)

SOT による黒点群の観測

Takako T. ISHII
(石井 貴子)

Kwasan and Hida Observatories, Kyoto-U., JAPAN
京都大学大学院 理学研究科 附属天文台

ishii@kwasan.kyoto-u.ac.jp

Subject:

Flare energy storage and release.

Question:

What is the common magnetic field configuration to flare-productive active regions ?

Method:

Study the evolution of active regions.

Birth, growth, and decay.

Photospheric vector-magnetic field (helicity).

Corona (XRT), chromosphere (H-alpha).

Previous works:

Schematic model of emerging flux bundles.

- Hida Domeless Solar Telescope (DST)

  e.g. Kurokawa 1987 Sol. Phys.

  Ishii et al. 1998 ApJ, 2000 PASJ.

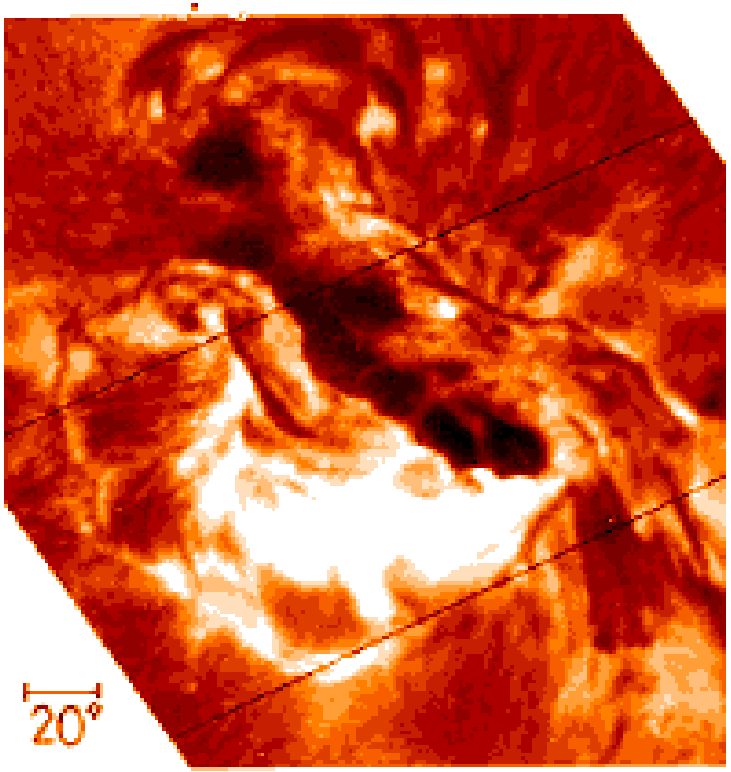
- NOAA 9026 (2000 June)

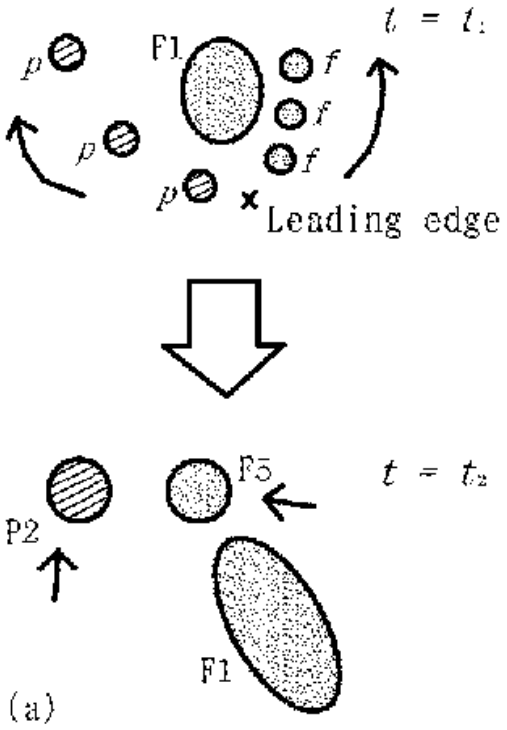
  DST/ LaPalma H-alpha

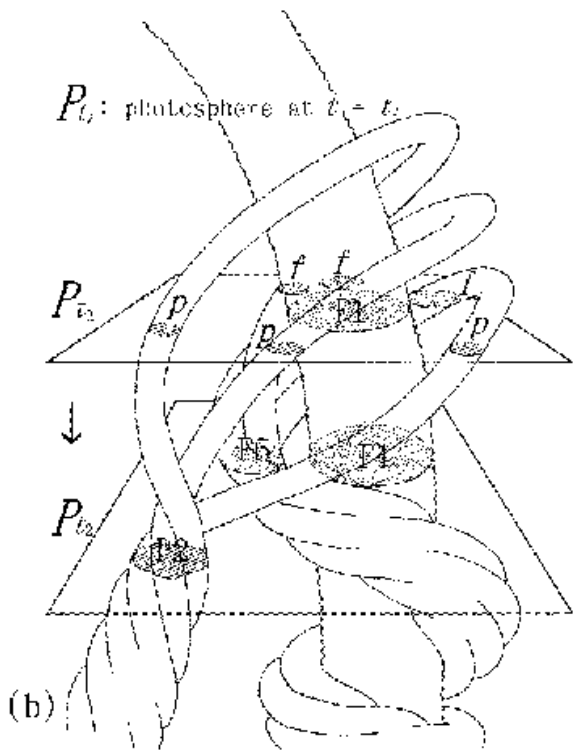
  TRACE white light, SOHO MDI

  Kurokawa et al. 2002 ApJ.

Active Region NOAA 5395 *(1989 March)*







The most flare-productive region during the last solar cycle 22

Twisted magnetic flux bundle model

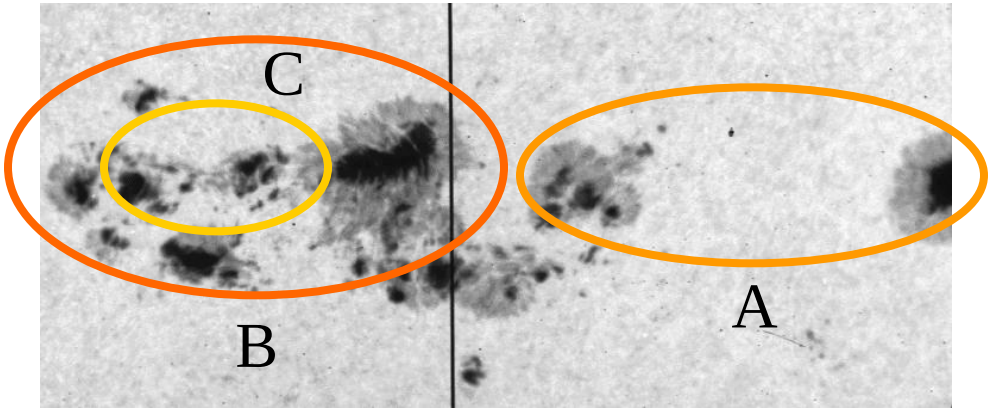
Ishii et al. (1998) ApJ, 499, 898

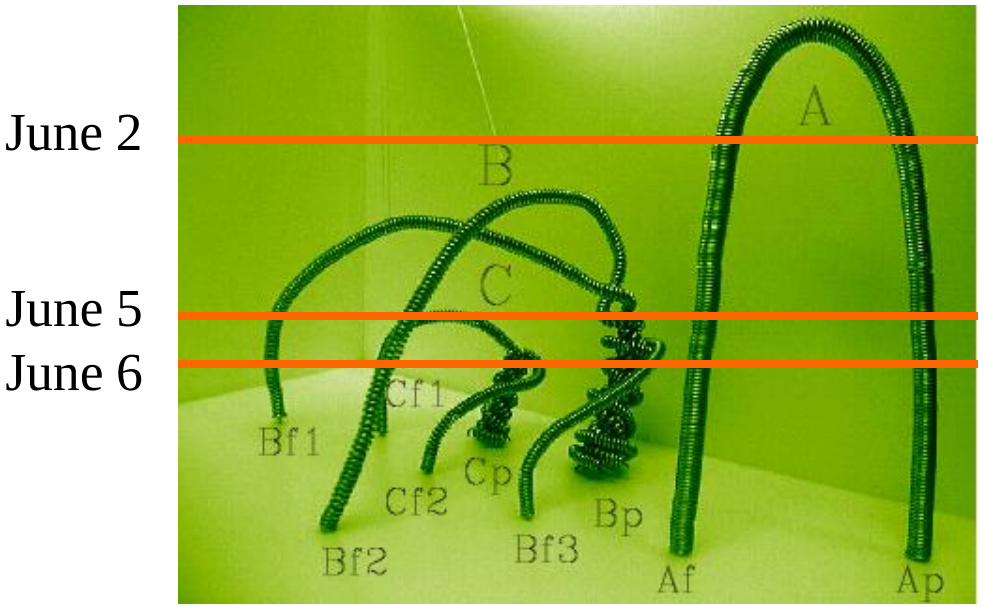
Active Region NOAA 4201 *(1983 June)*

Observations by DST have performed for ten days running.

High flare activity has been found when (June 5-6) and where the twisted magnetic flux bundles (B, C) emerged.

In region A, no flares have occurred.





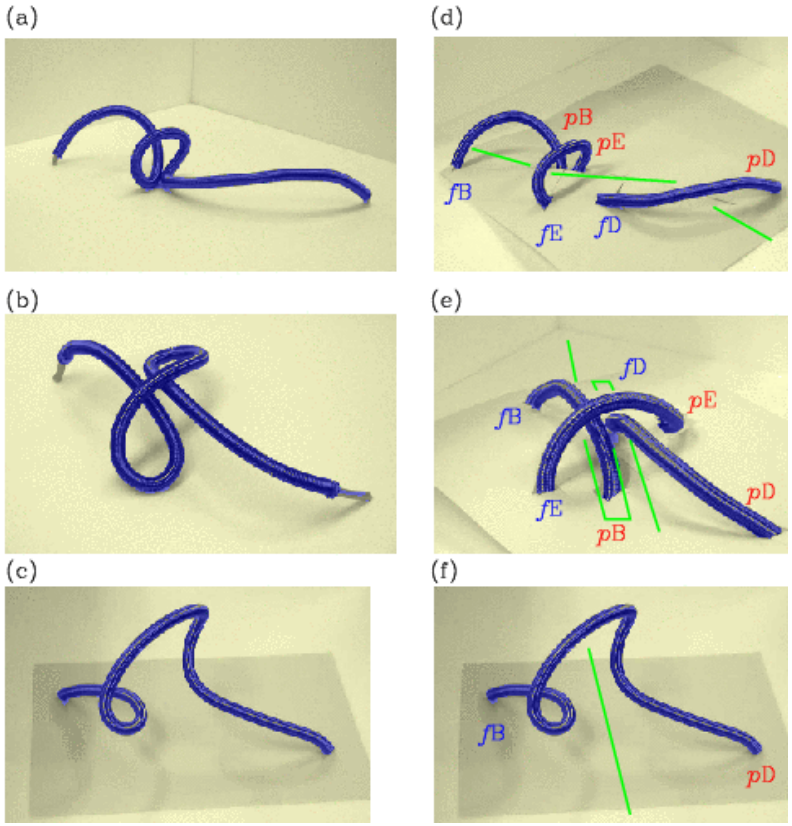
Ishii et al. (2000) PASJ, 52, 337

MDI magnetograms

NOAA 9026 (2000 June)

Twisted magnetic knot

(Kurokawa et al. 2002
ApJ 572, 598)



TRACE white light

On going:

Active regions with X-class flares (about 30 ARs)

SOHO MDI full disk → daily evolution movies

(1996 – 2001 done. 2002 in prep.)

East-limb → West-limb 11 days

Cadence:

- Magnetograms

  15 images / day (one image / 90 min.)

  OK.

- Intensitygrams

  4 images / day (one image / 6 hours)

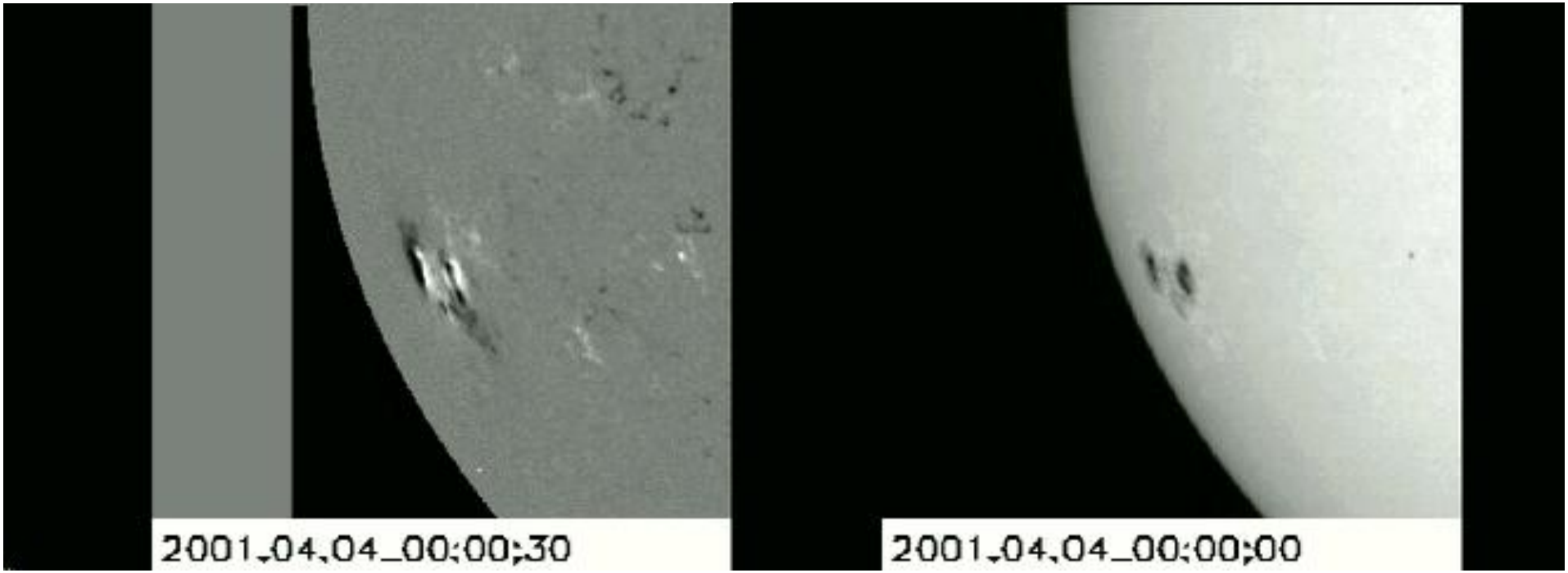
  a little bit poor.

NOAA 9415 (2001 Apr.)

5 X-class flares

(e.g. 2001-Apr-10 *Asasi-flare*)

600 arcsec



SOHO / MDI
magnetograms

SOHO / MDI
intensitygrams

20 degrees
in heliographic coordinate

NOAA 9415
(Face-on movie)

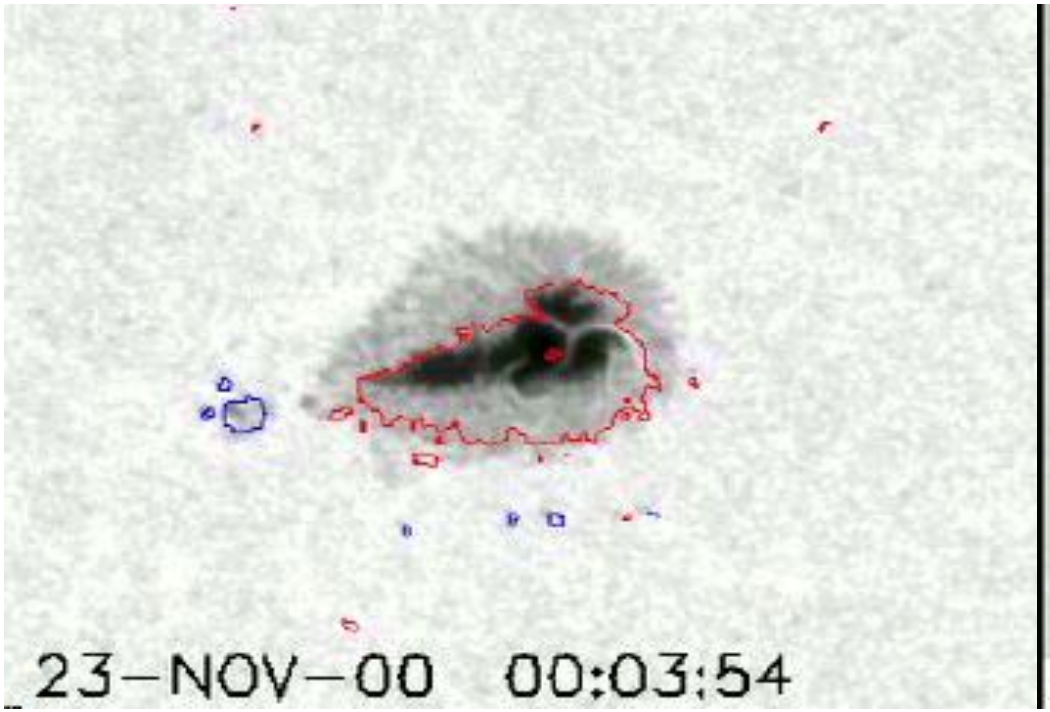
gray scale: intensitygram
contour: magnetogram
level: 500 Gauss
red: positive
blue: negative

SOHO / MDI Full disk
Longitudinal magnetogram
1 pixel = about 2 arcsec

Solar-B / SOT
Vector-magnetogram
High resolution

NOAA 9236 (2000 Nov.)

5 X-class flares



TRACE White light

SOHO / MDI high-resolution

1 pixel = 0.5 arcsec

20 degrees

in heliographic coordinate

SOHO / MDI

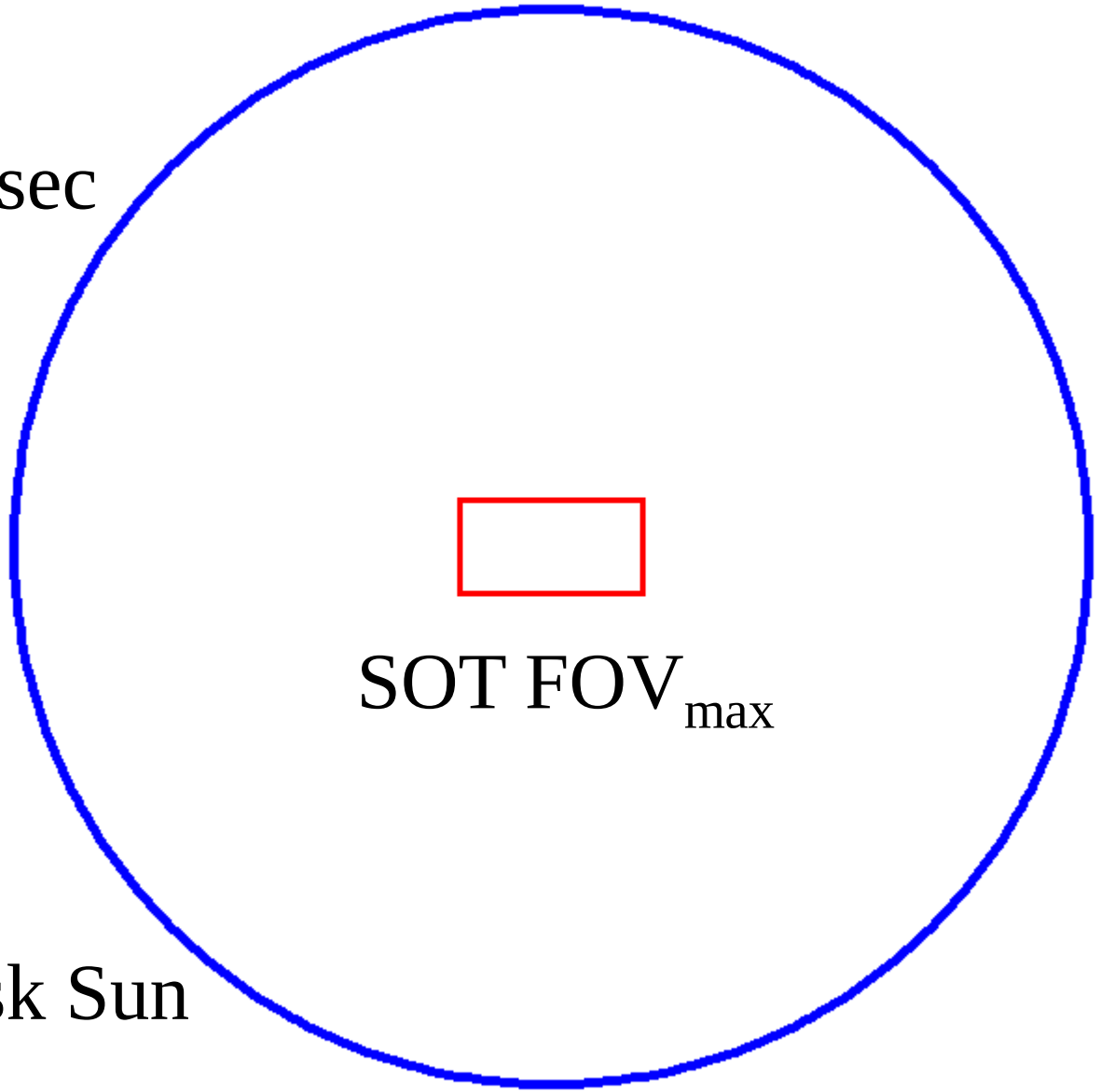
Full disk

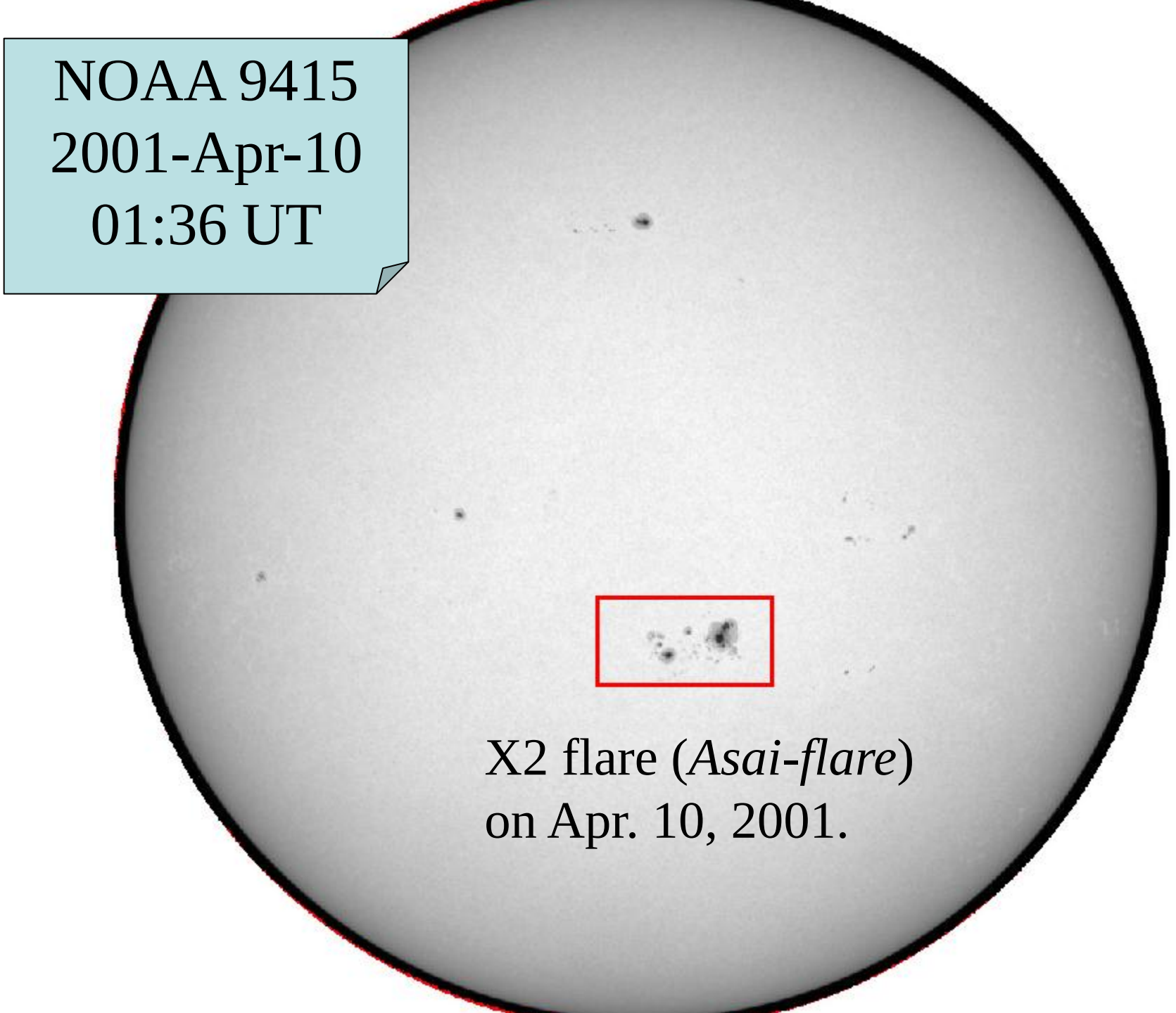
contour: magnetic field (500 Gauss, red: positive, blue: negative)

Solar-B SOT

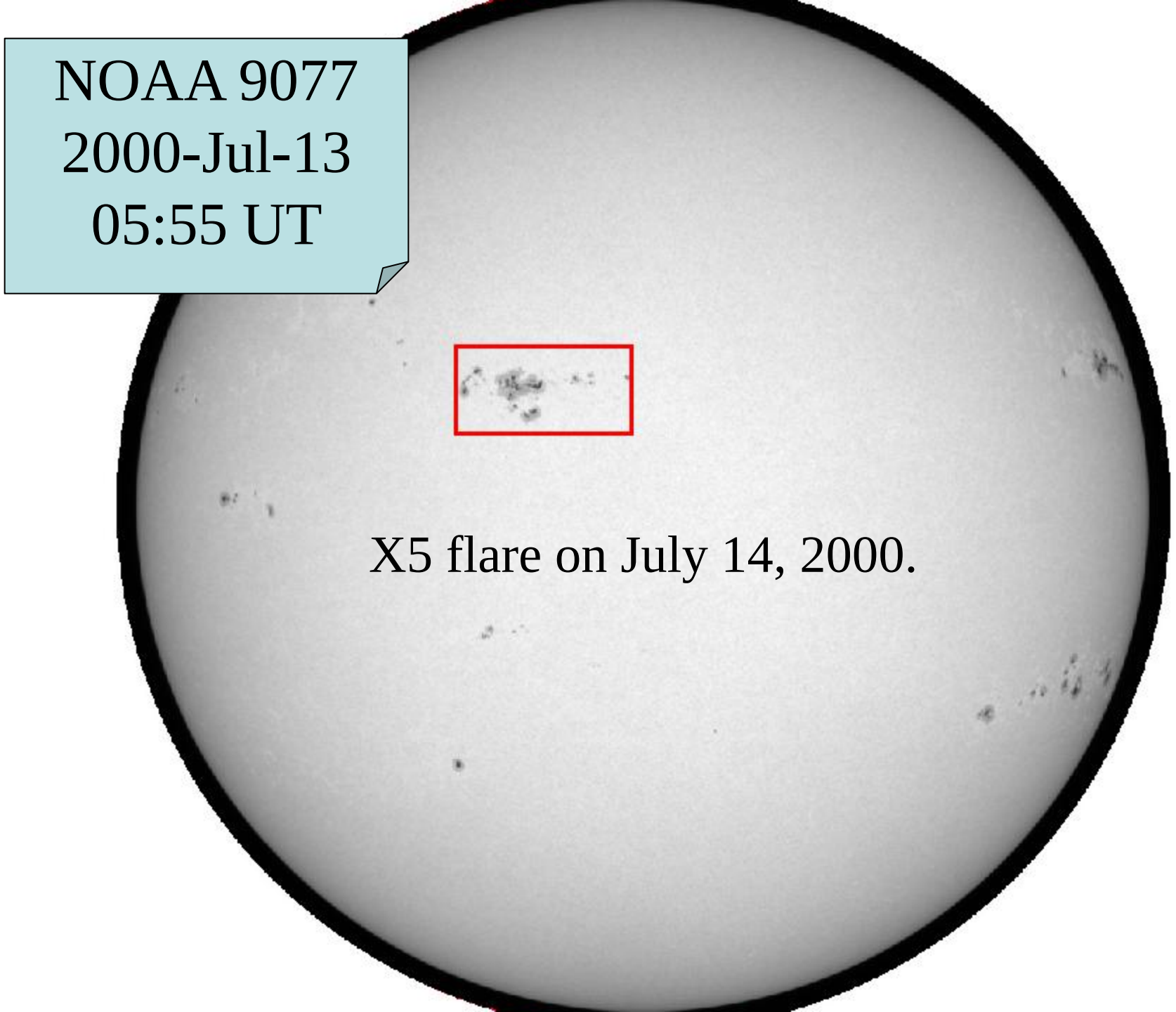
1 pixel = 0.08 arcsec

Field of View
(FOV)
⇒max:
328”×164”

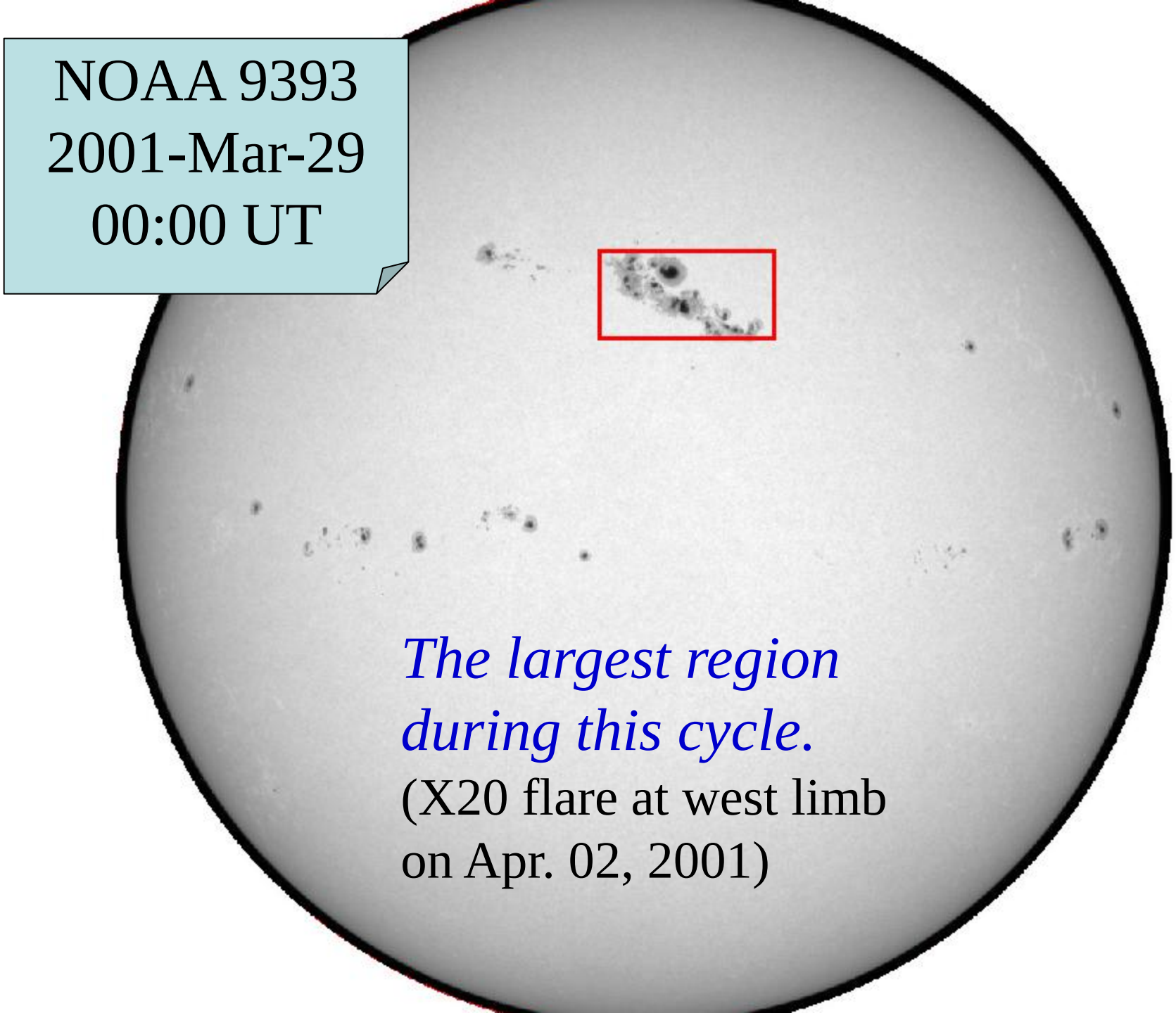




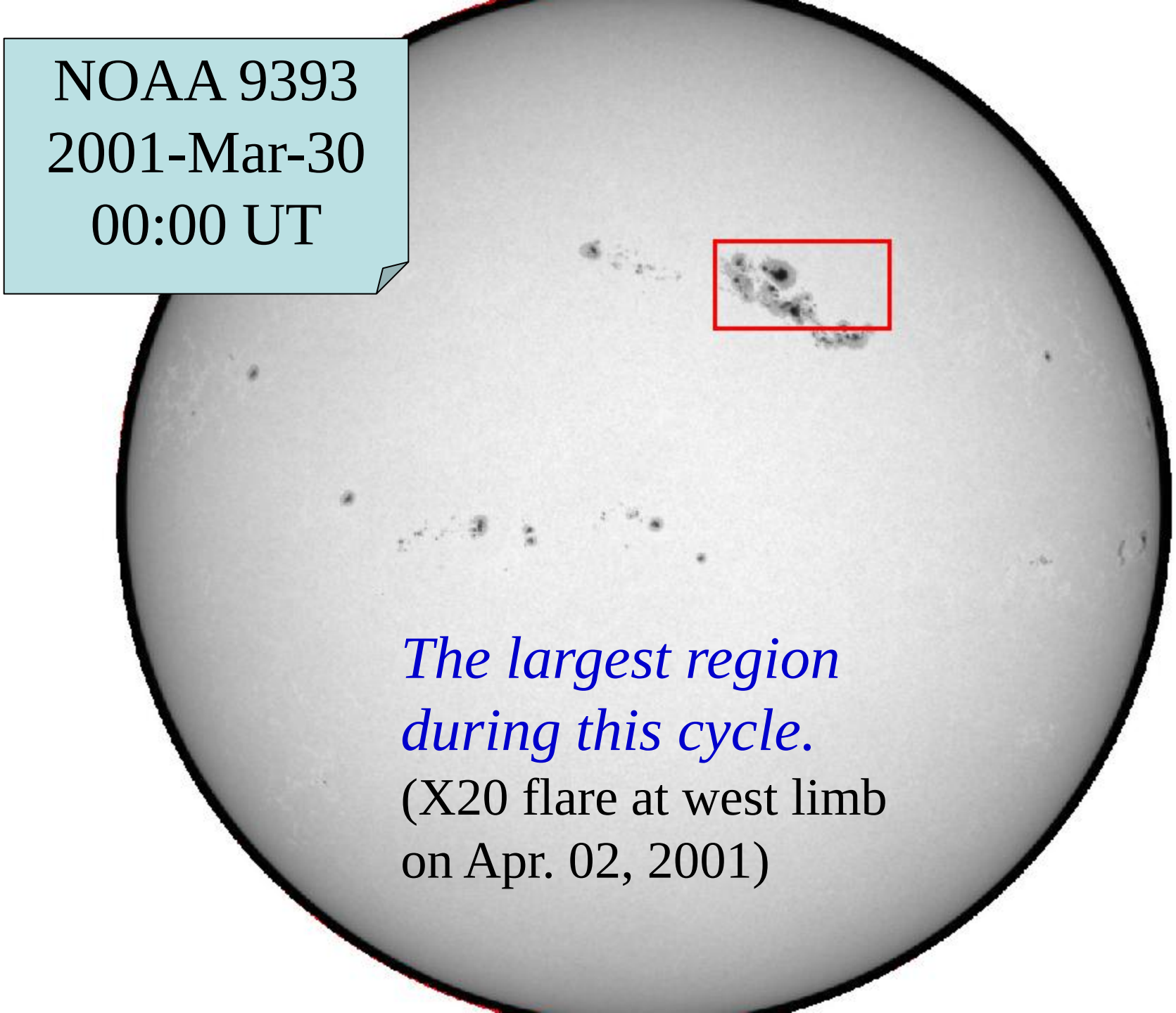
X2 flare (*Asai-flare*)
on Apr. 10, 2001.



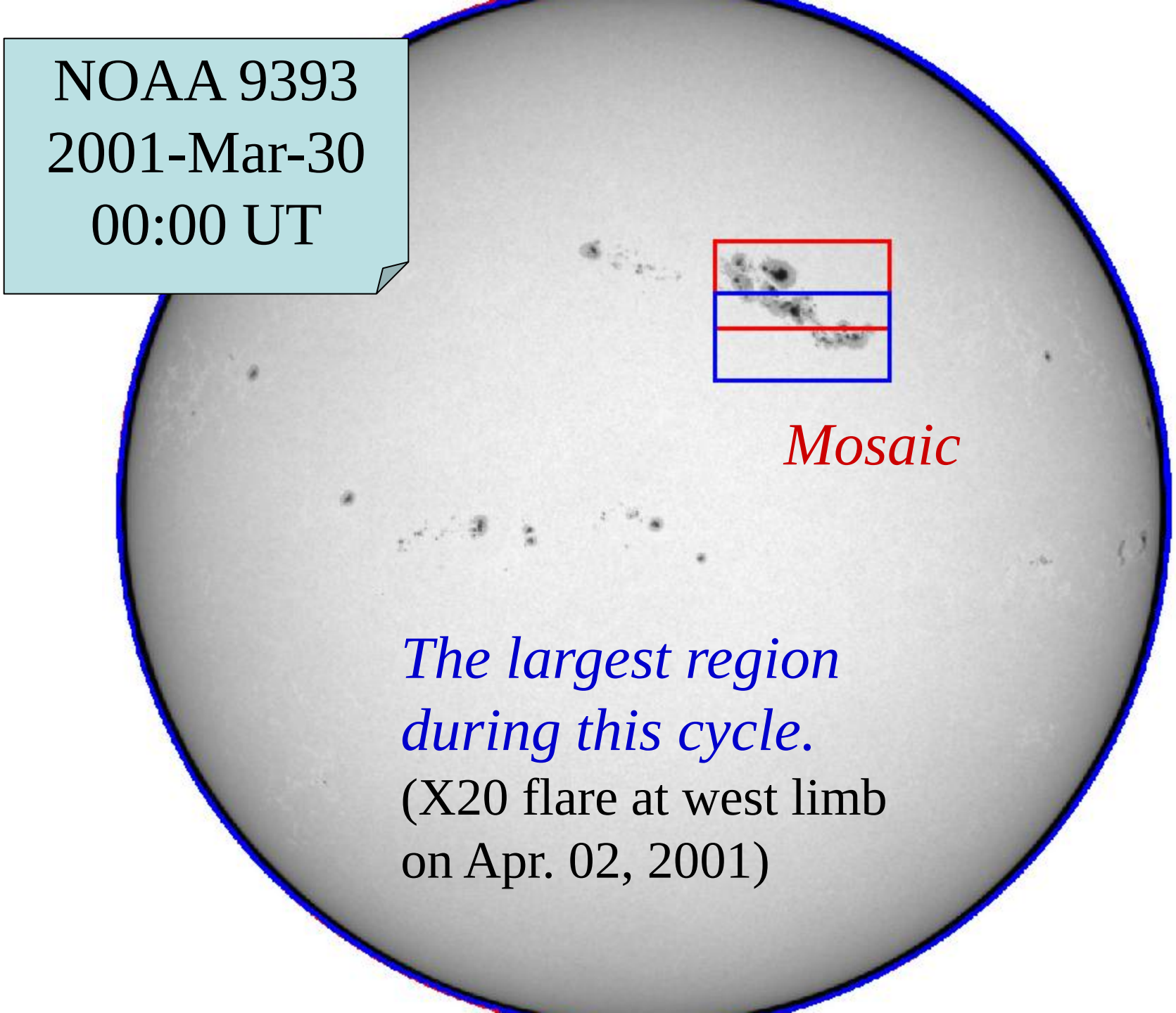
X5 flare on July 14, 2000.

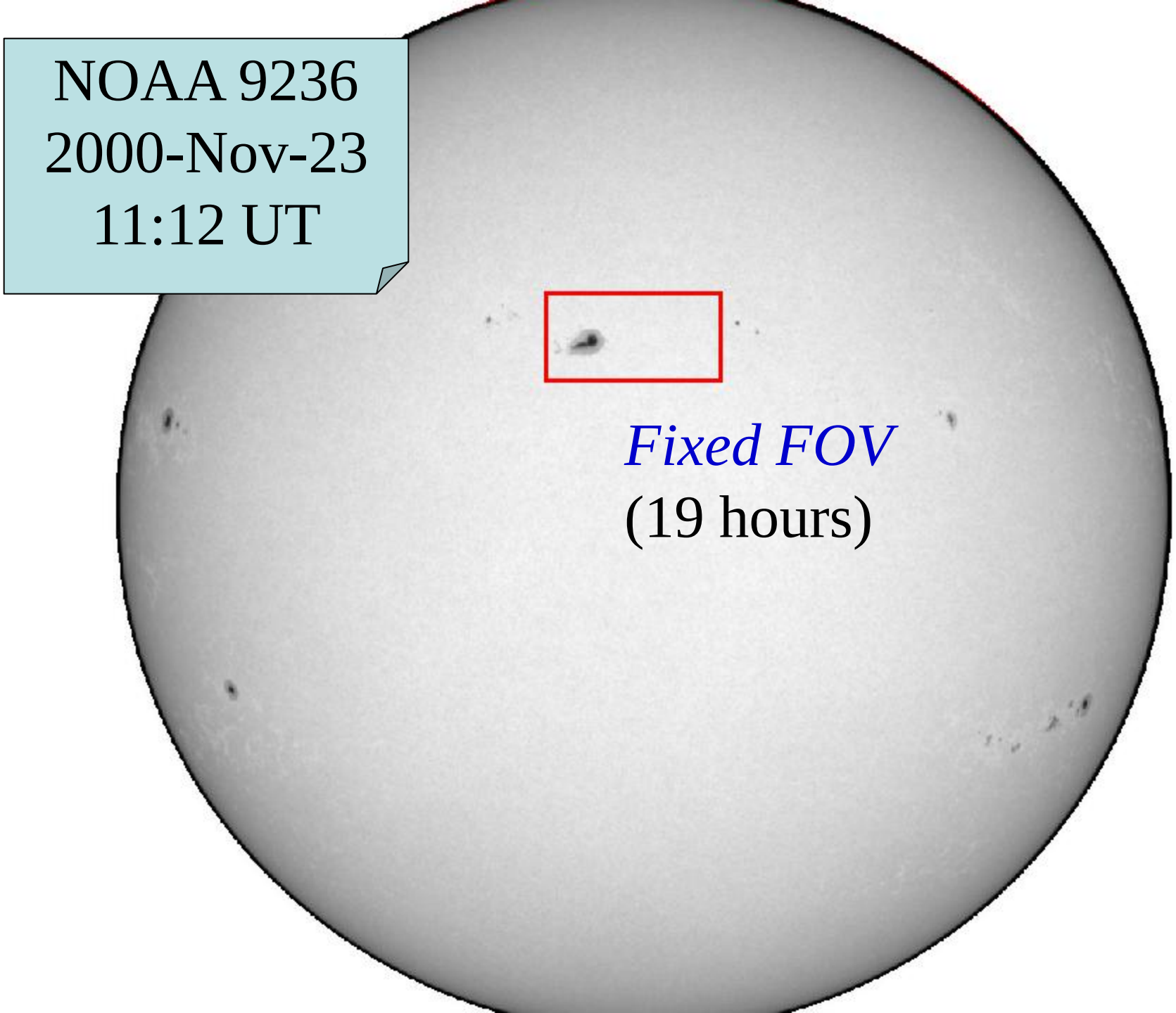


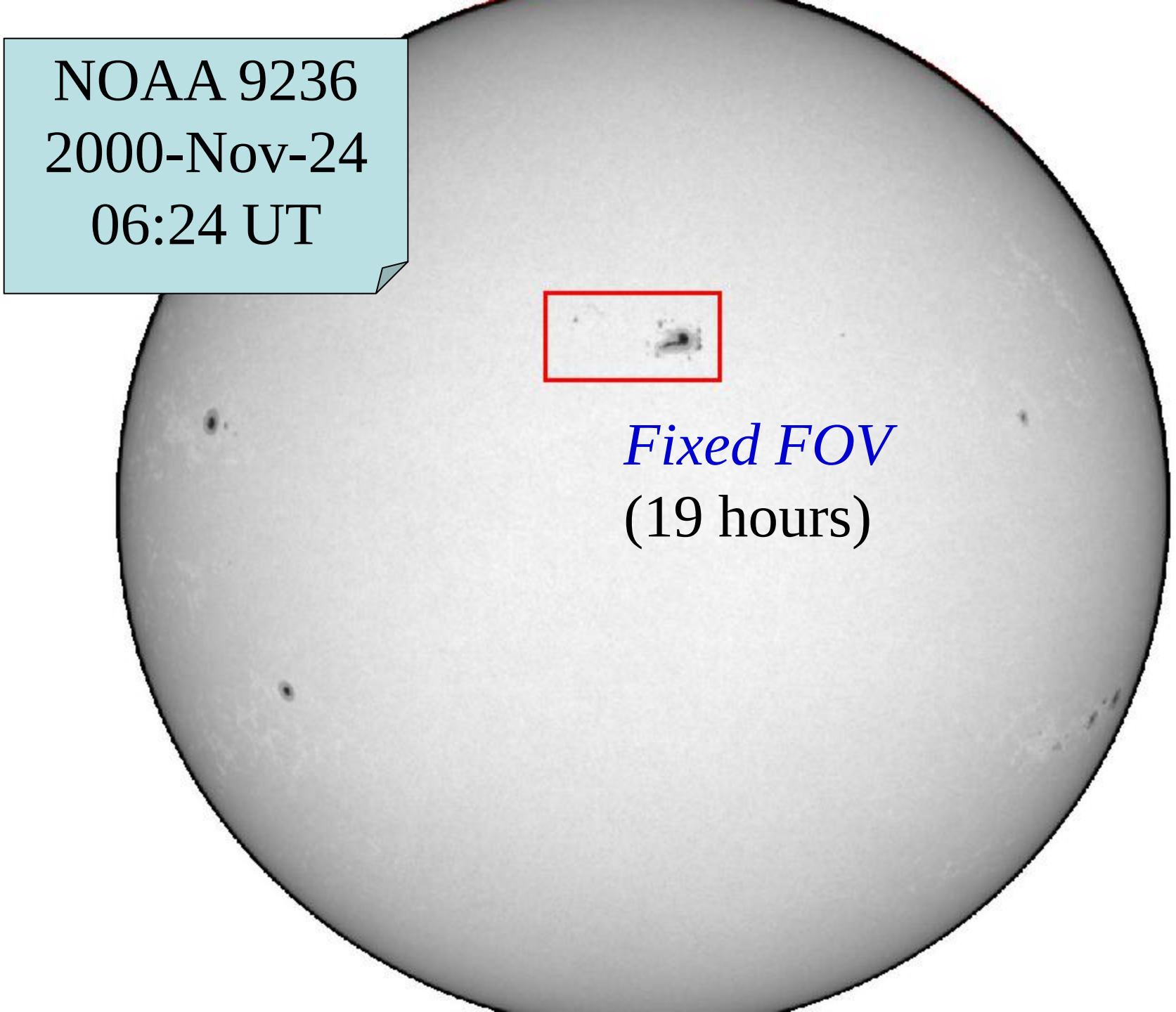
The largest region during this cycle.
(X20 flare at west limb on Apr. 02, 2001)

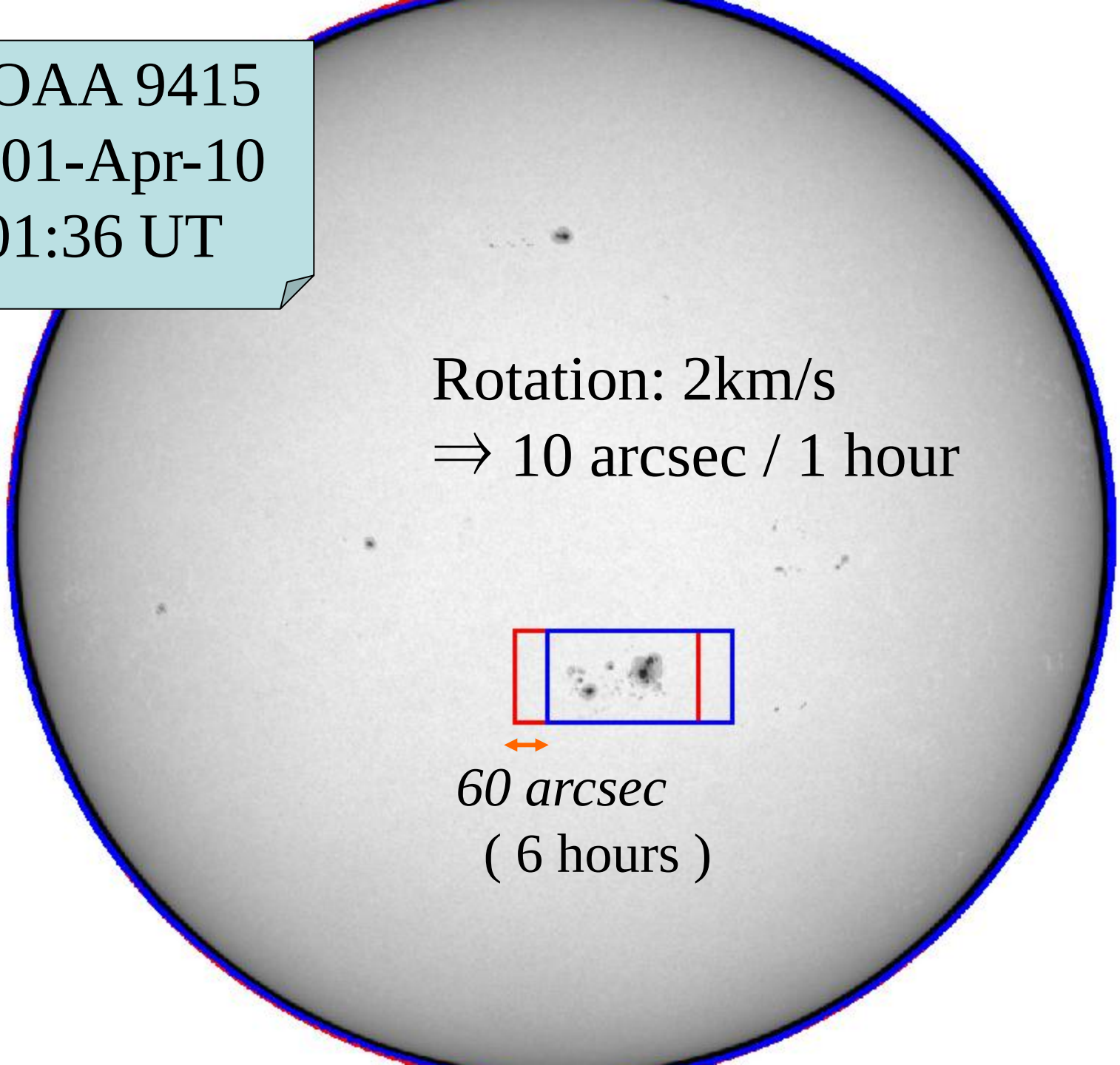


The largest region during this cycle.
(X20 flare at west limb on Apr. 02, 2001)


NOAA 9393
2001-Mar-30
00:00 UT
Mosaic
The largest region
during this cycle.
(X20 flare at west limb
on Apr. 02, 2001)


NOAA 9236
2000-Nov-23
11:12 UT
Fixed FOV
(19 hours)

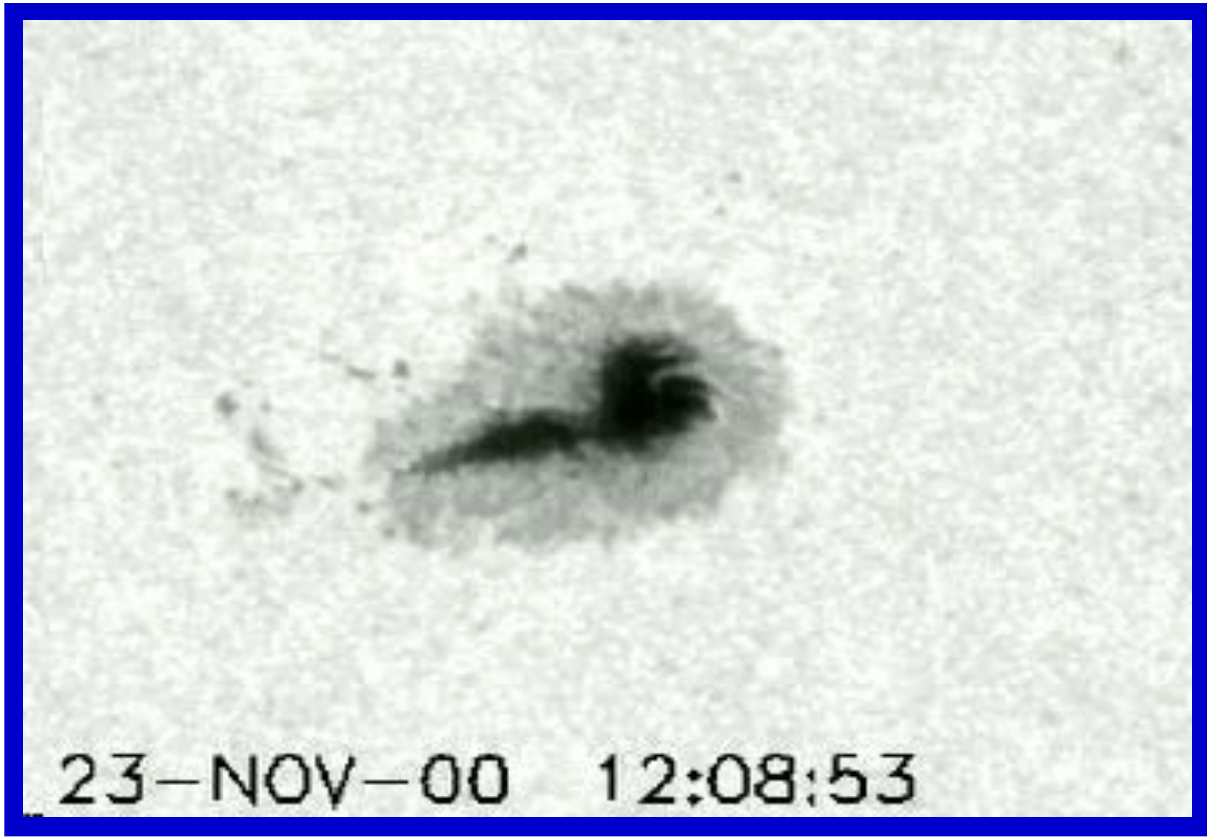

NOAA 9236
2000-Nov-24
06:24 UT
Fixed FOV
(19 hours)

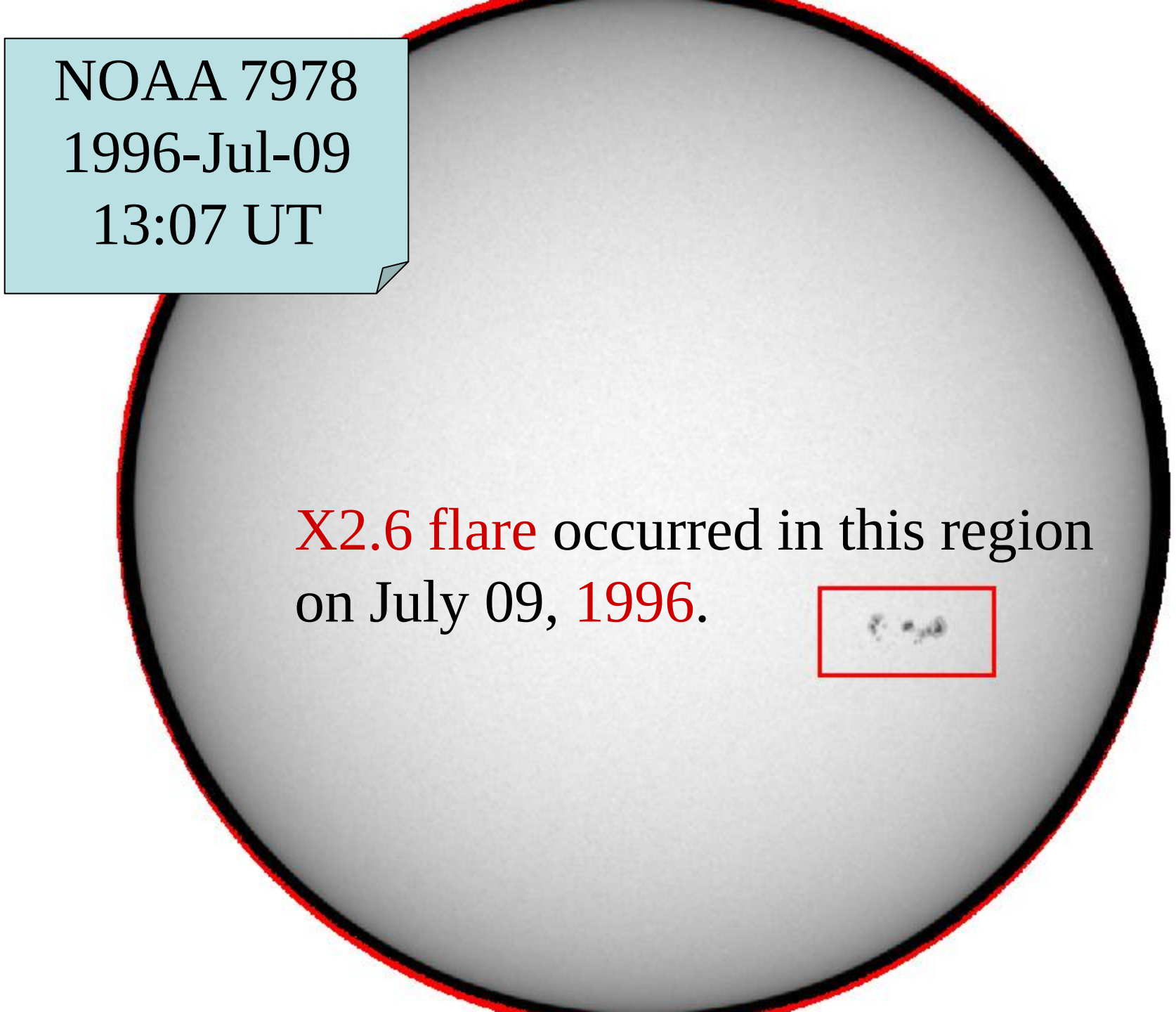

NOAA 9415
2001-Apr-10
01:36 UT
Rotation: 2km/s
⇒ 10 arcsec / 1 hour
60 arcsec
(6 hours)

Summary

FOV can cover whole active region.

We need fine pointing management (by OP).




NOAA 7978
1996-Jul-09
13:07 UT
X2.6 flare occurred in this region
on July 09, 1996.