Monitoring aktywności słonecznej -użyteczne narzędzia

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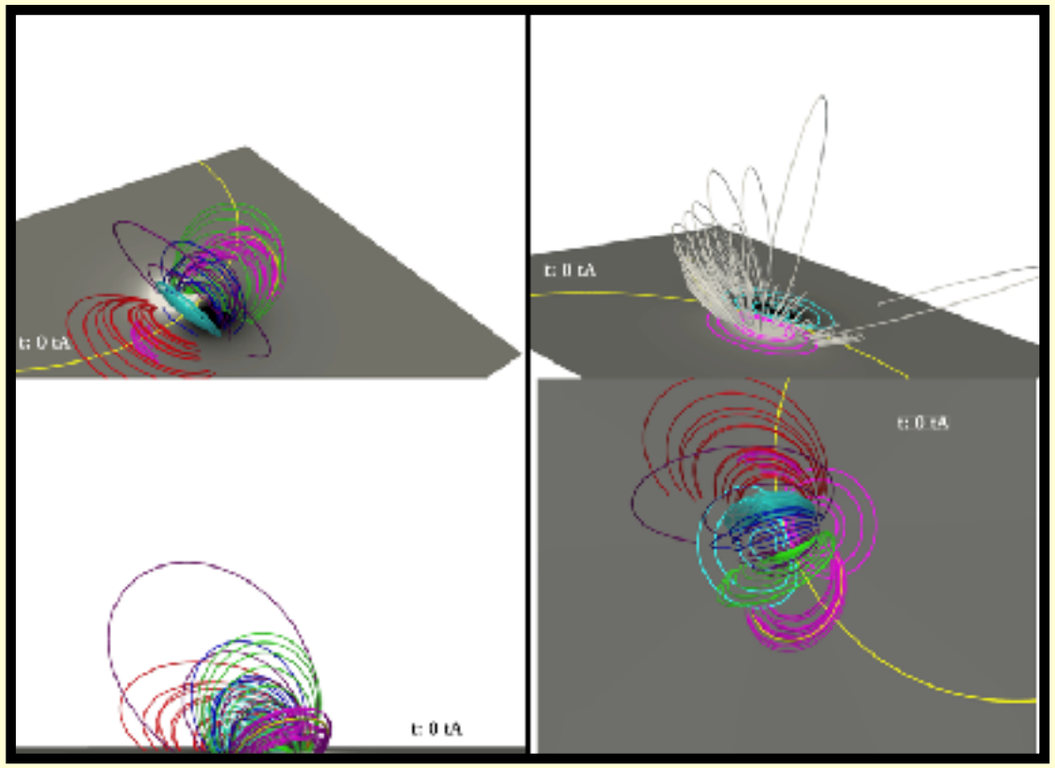
Sorbonne University, Paris Observatory, LESIA, Plas@Par, PSL, France

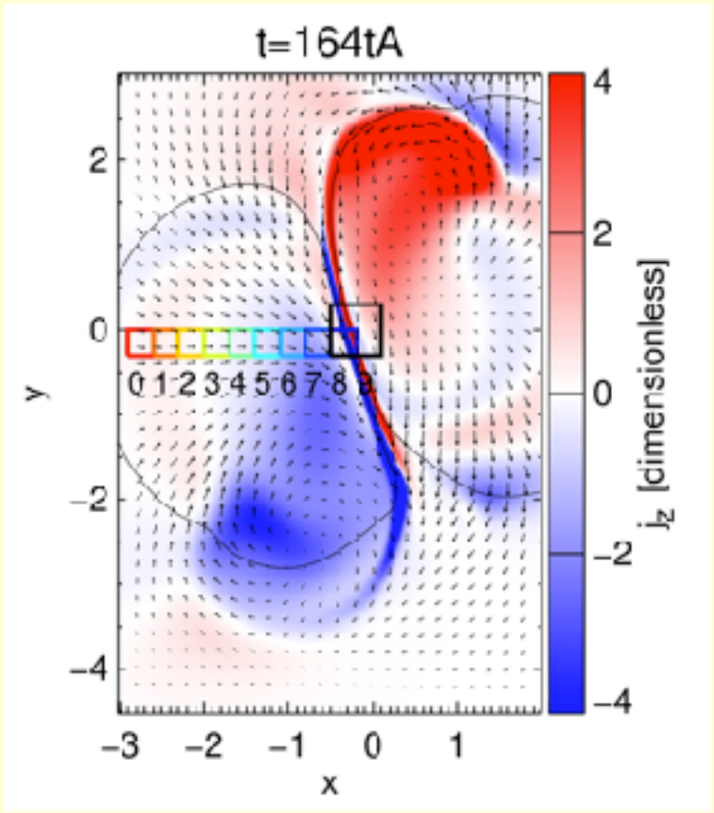
Warszawa, 04.07.2019

Moje badania

- **3D MHD simulation and observations of the solar flare -magnetic field, current and Lorentz force evolution**

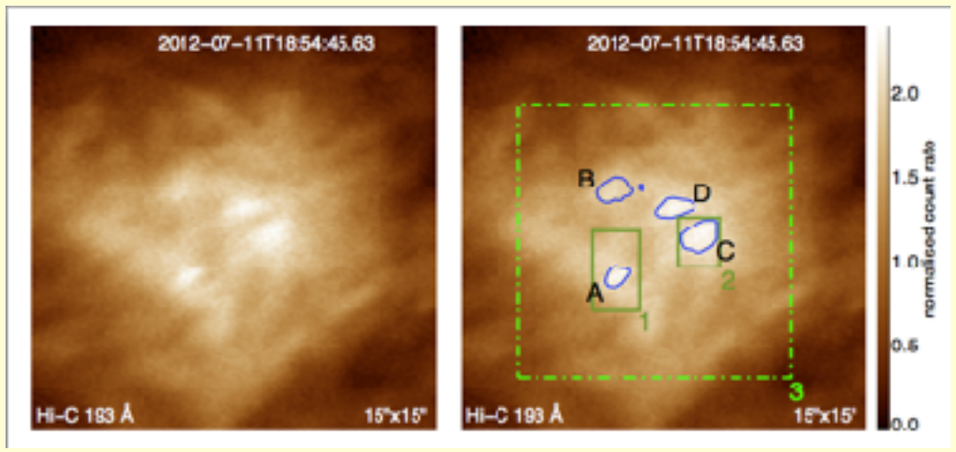


Zuccarello et al. 2015 (ApJ, 814, 126)



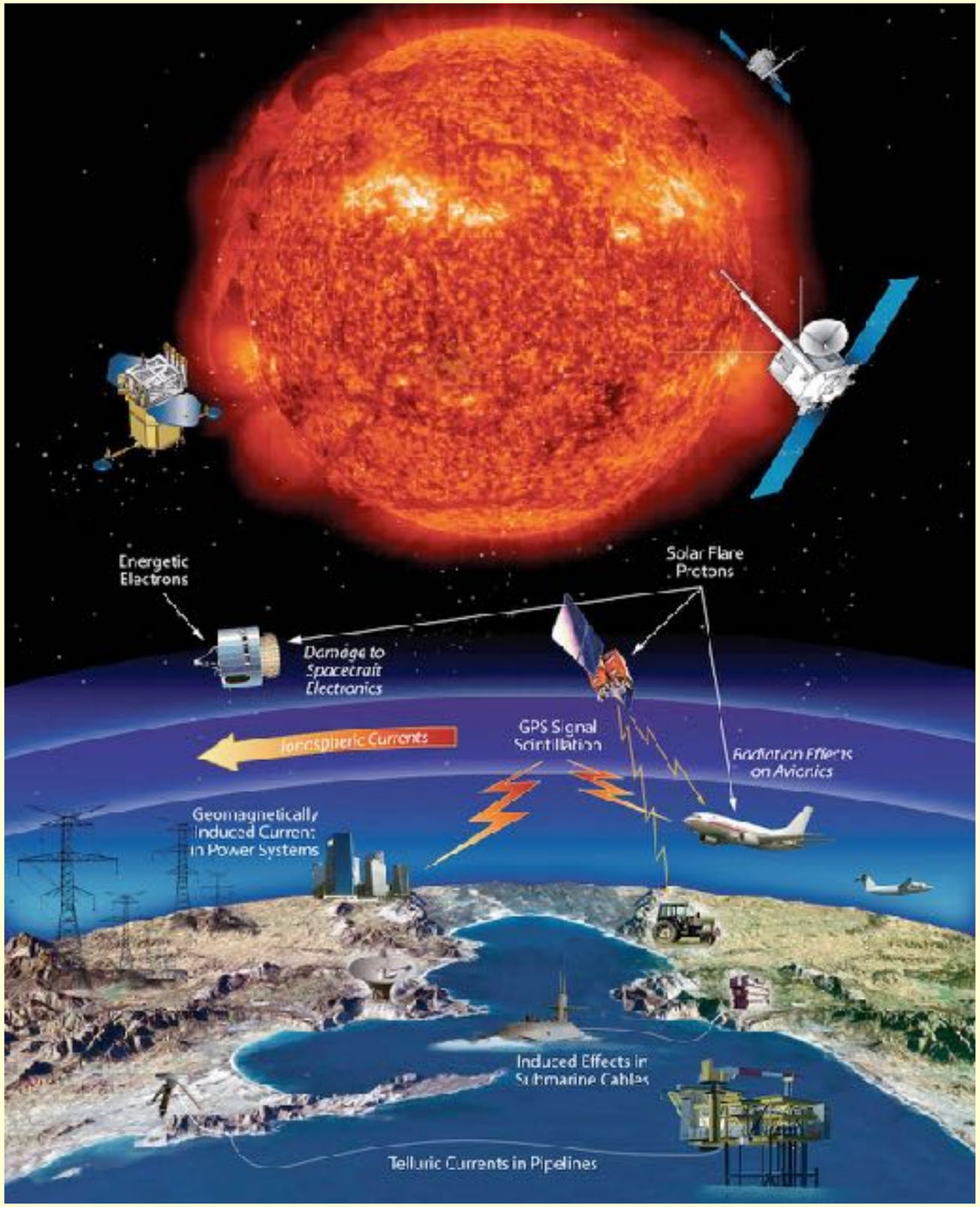
Barczynski et al. 2019 (ApJ, 877, 67)

- **Small-scale structure in the upper atmosphere of the Sun**



Barczynski et al. 2017 (A&A, 599, 137)

Słońce - Ziemia



NASA

Zjawiska geofizyczne

↓

Pogoda kosmiczna

↓

Aktywność Słońca

↓

Fizyka Słońca (Heliofizyka)

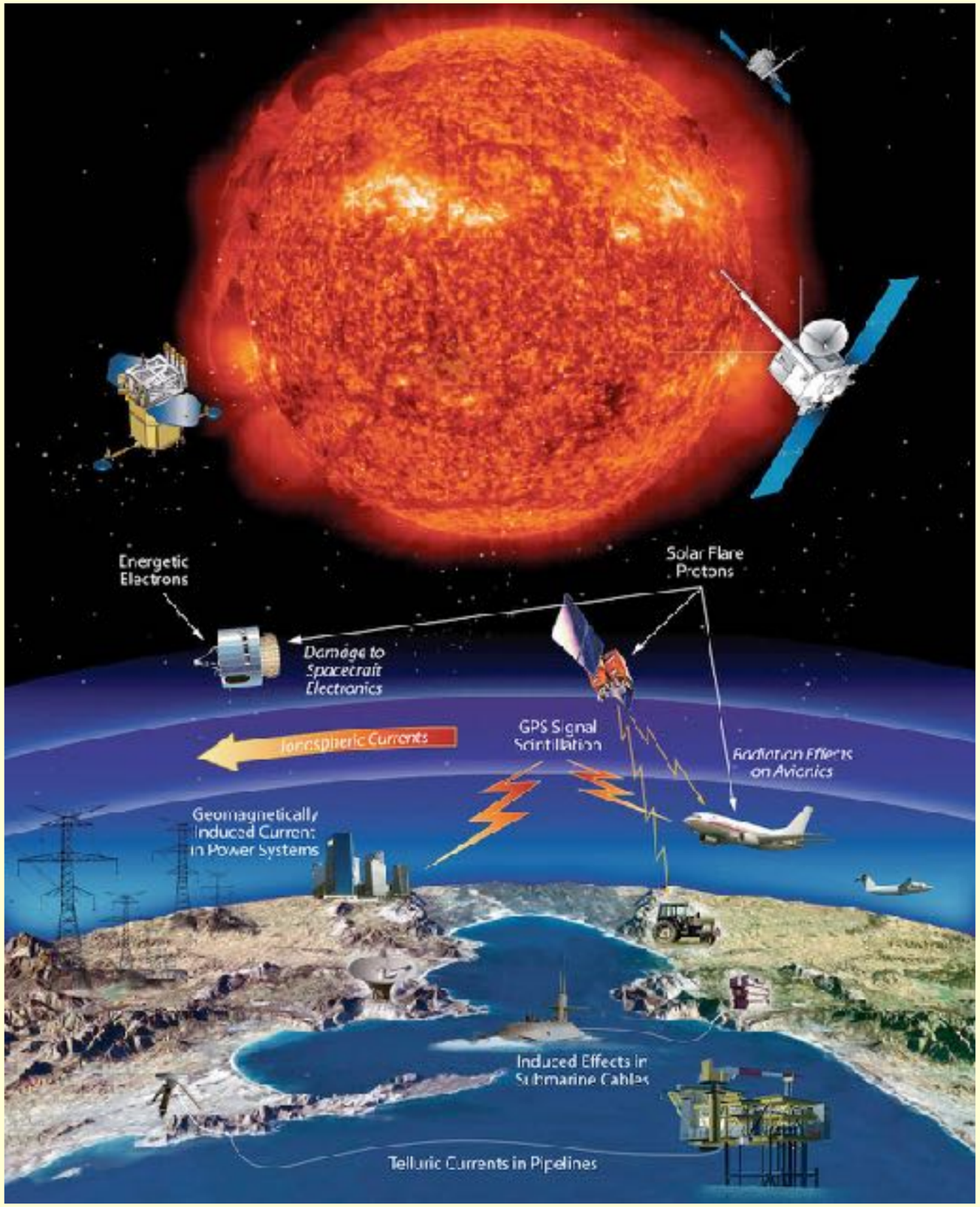
↓

Obserwacje/symulacje atmosfery Słońca

↓

Narzędzia do analizy danych

Słońce - Ziemia



NASA

Zjawiska geofizyczne

↓

Pogoda kosmiczna

↓

Aktywność Słońca

↓

Fizyka Słońca (Heliofizyka)

↓

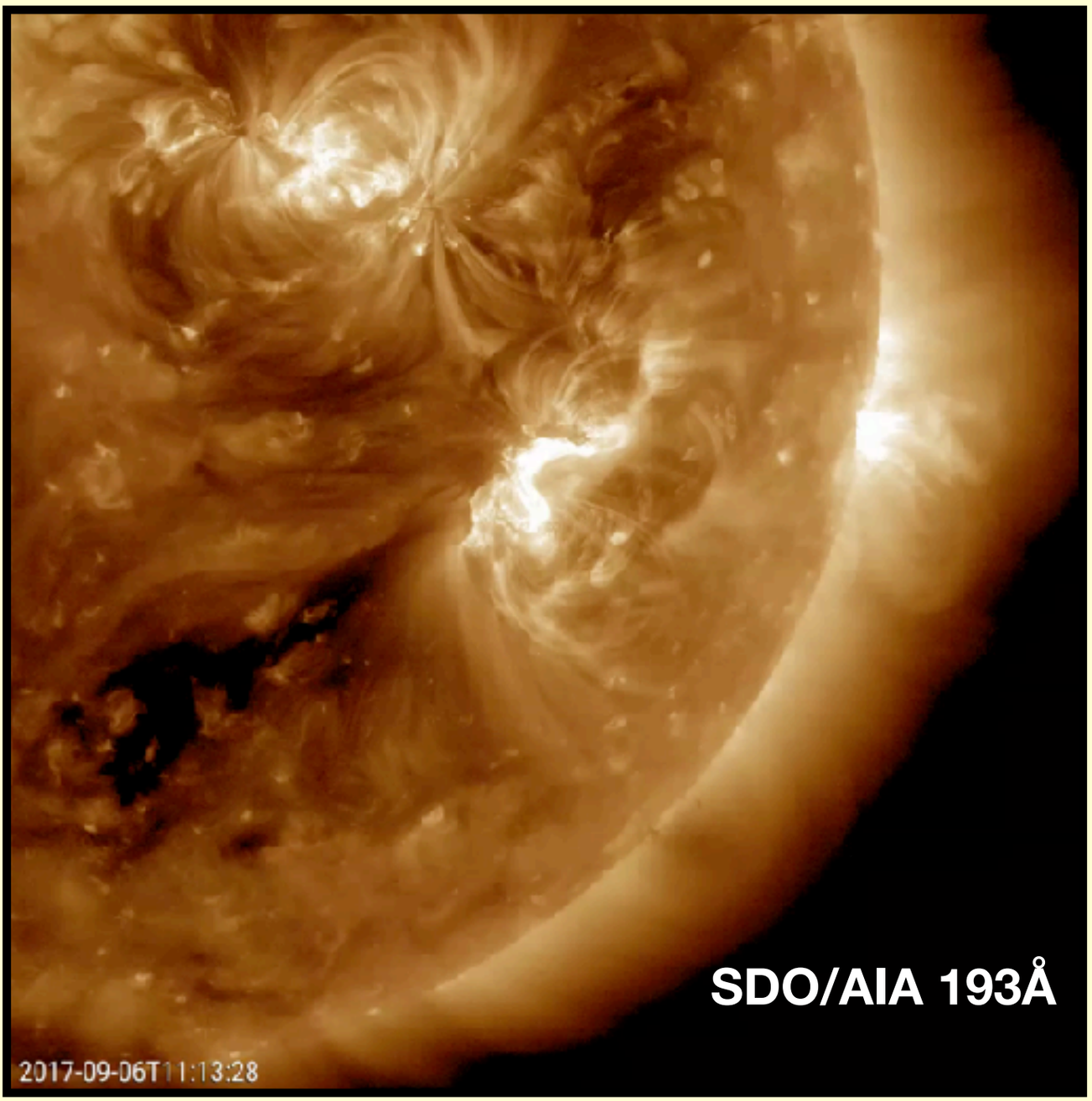
Obserwacje/symulacje atmosfery Słońca

↓

Narzędzia do analizy danych

Słońce

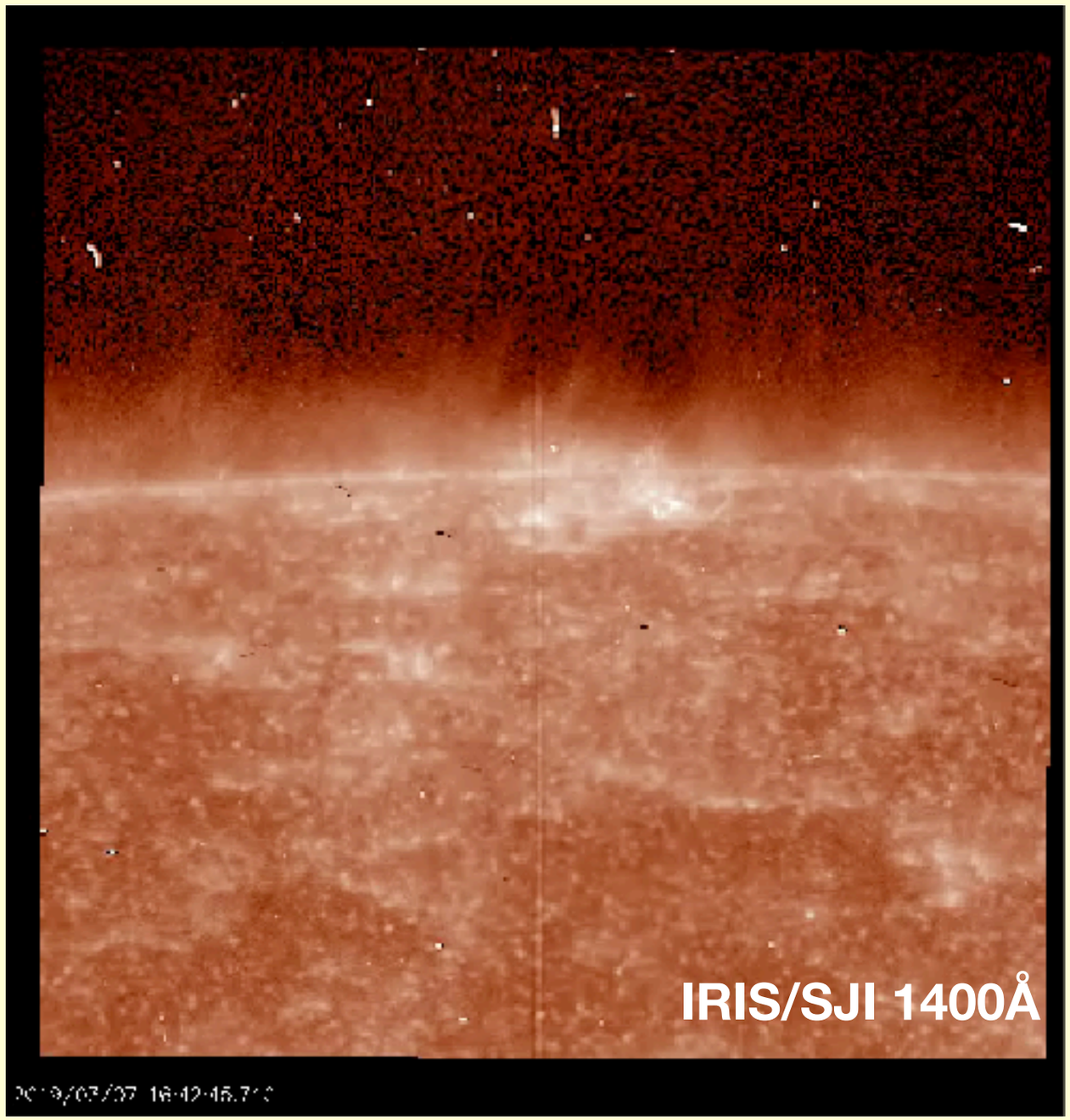
Rozbłysk (Solar flare)



NASA/GSFC/ Solar Dynamics Observatory

Rzadkie -wysokoenergetyczne

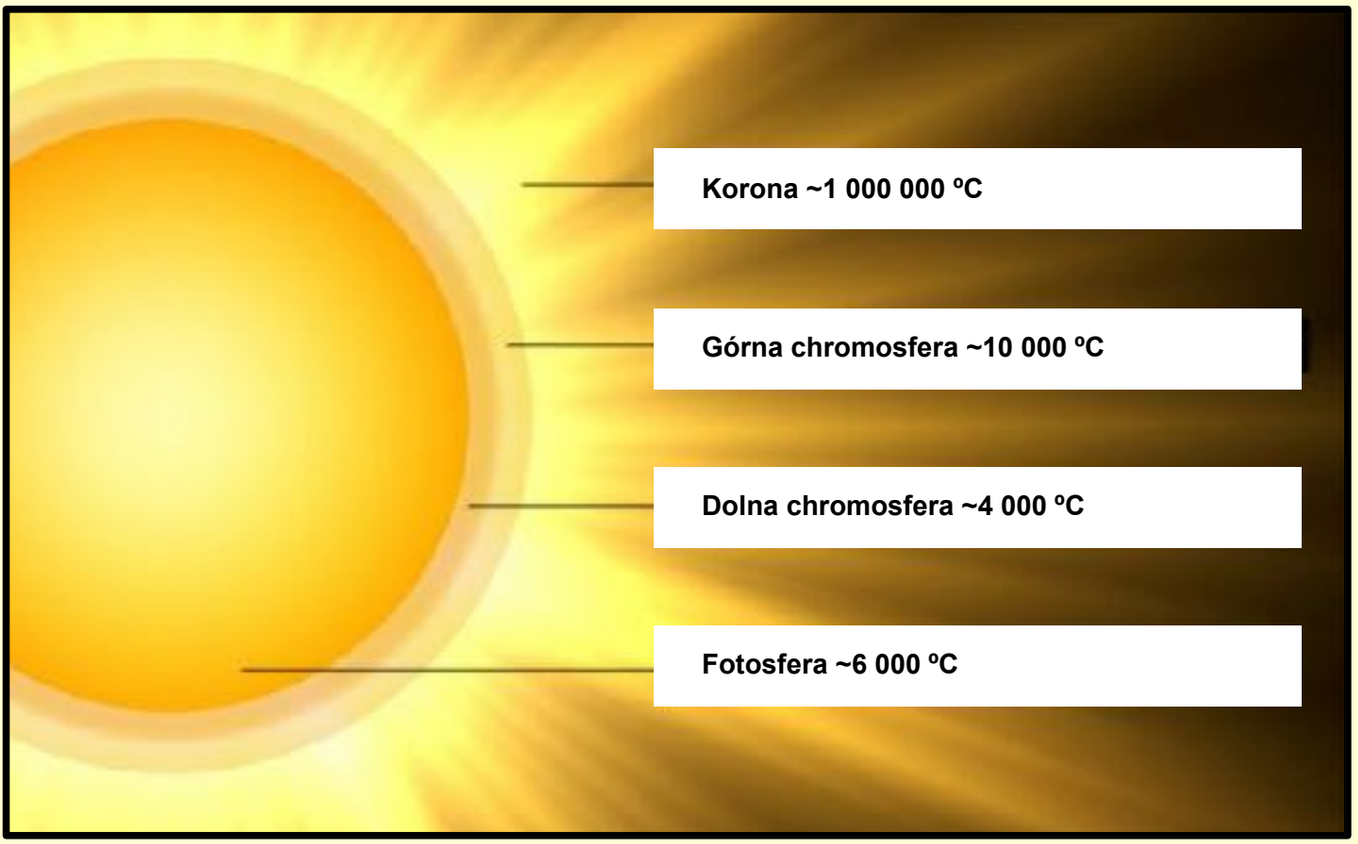
Małoskalowe struktury

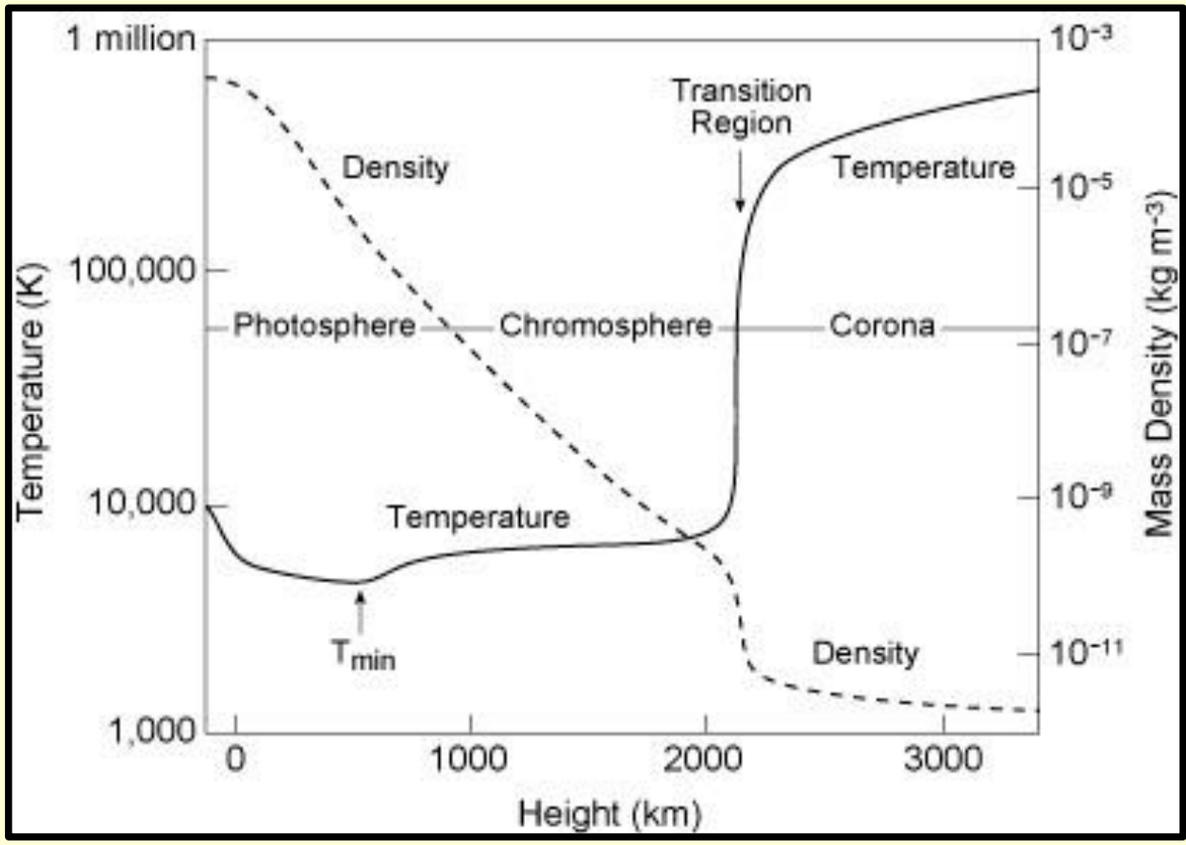


IRIS/ LMSAL/ KB

Liczne -niskoenergetyczne

Atmosfera Słońca

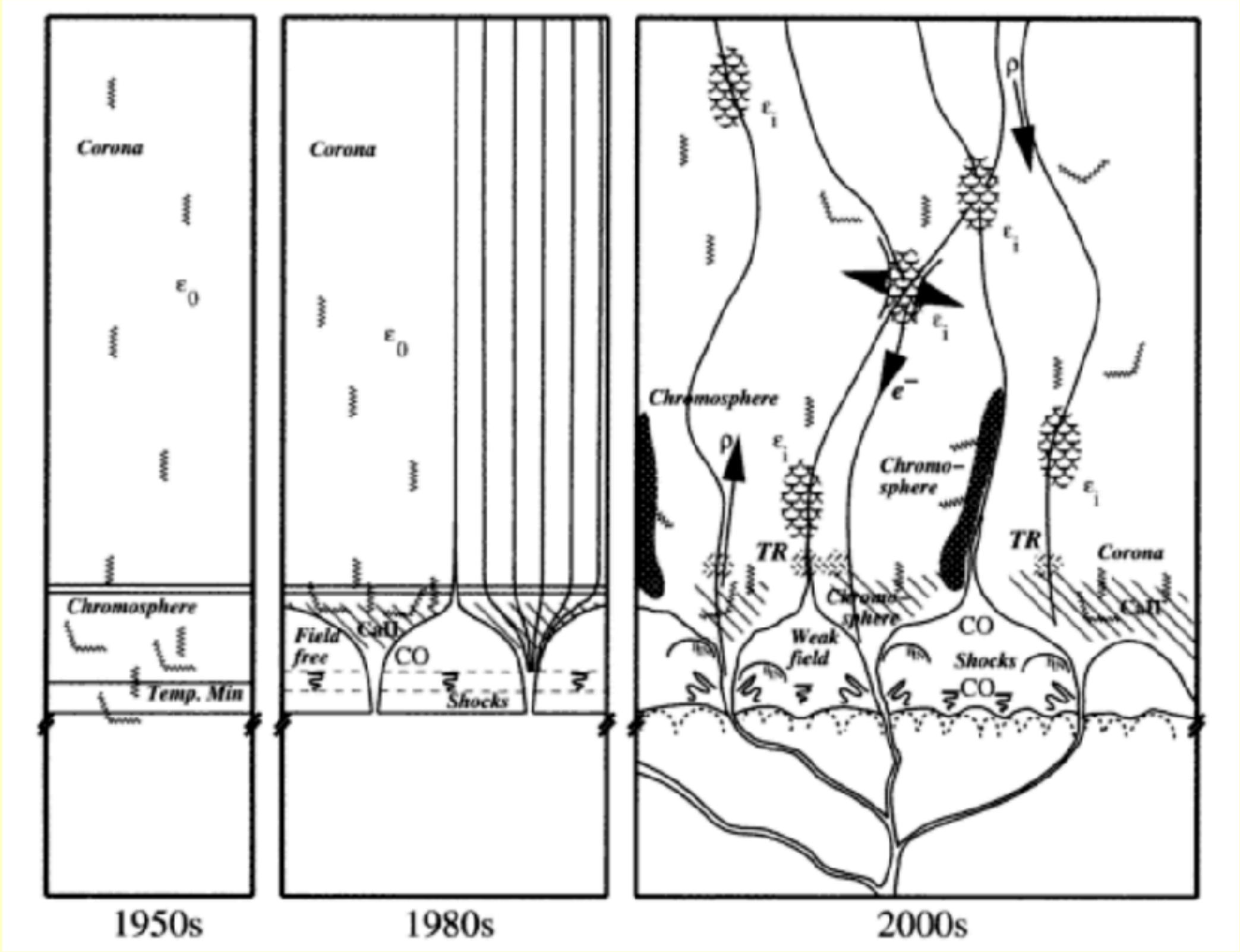




1) Illustration: Per Byhring; 2) Eugene Avrett, Smithsonian Astrophysical Observatory

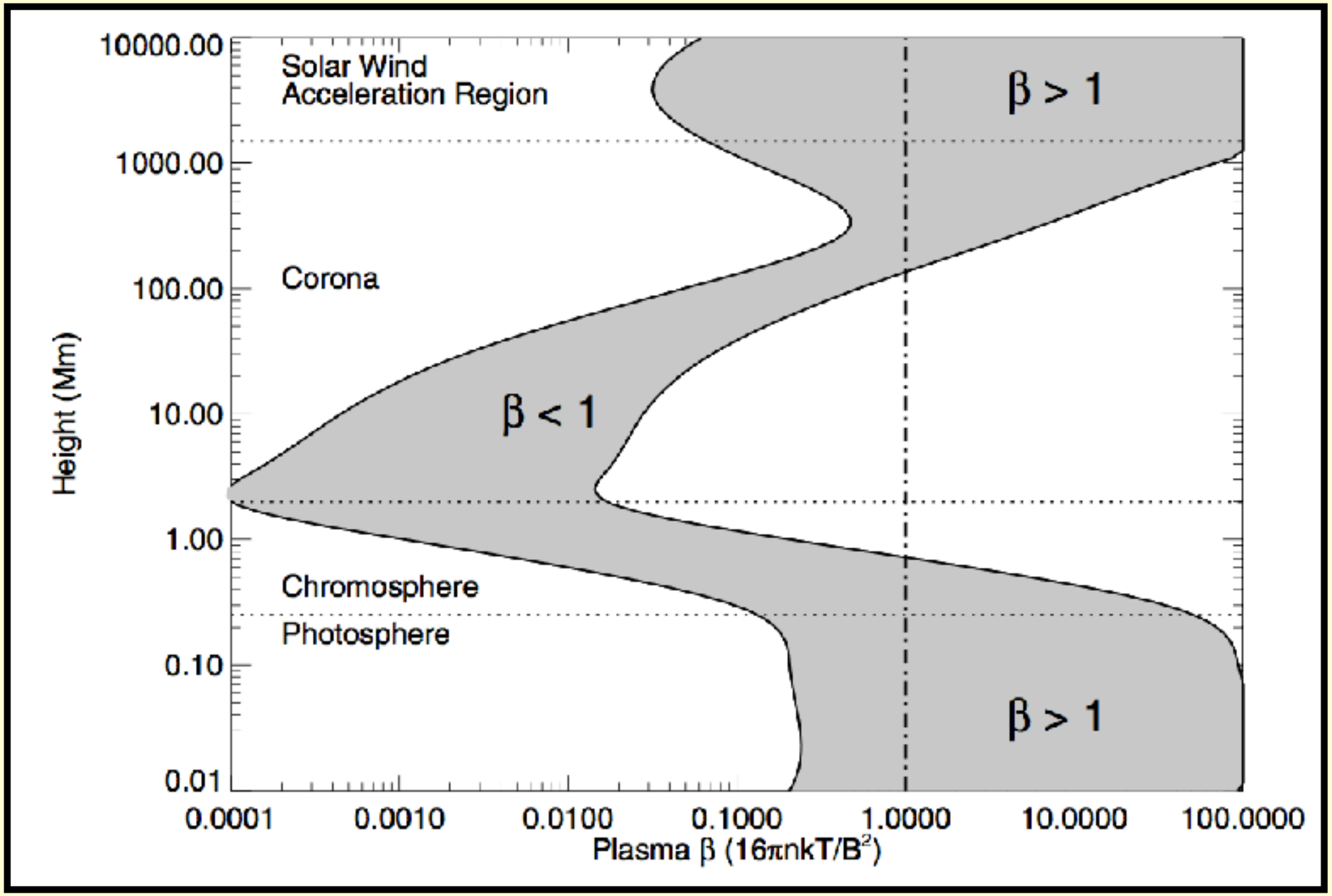
- Atmosfera Słońca jest zbudowana ze struktur (1 Mm – setki Mm)
- Jaki mechanizm jest odpowiedzialny za ogrzewanie korony słonecznej?
→ kilka hipotez (rekoneksja magnetyczna, fale MHD, itd.)

Budowa atmosfery Słońca -koncept historyczny



Schrijver, 2001

Pole magnetyczne vs. plazma



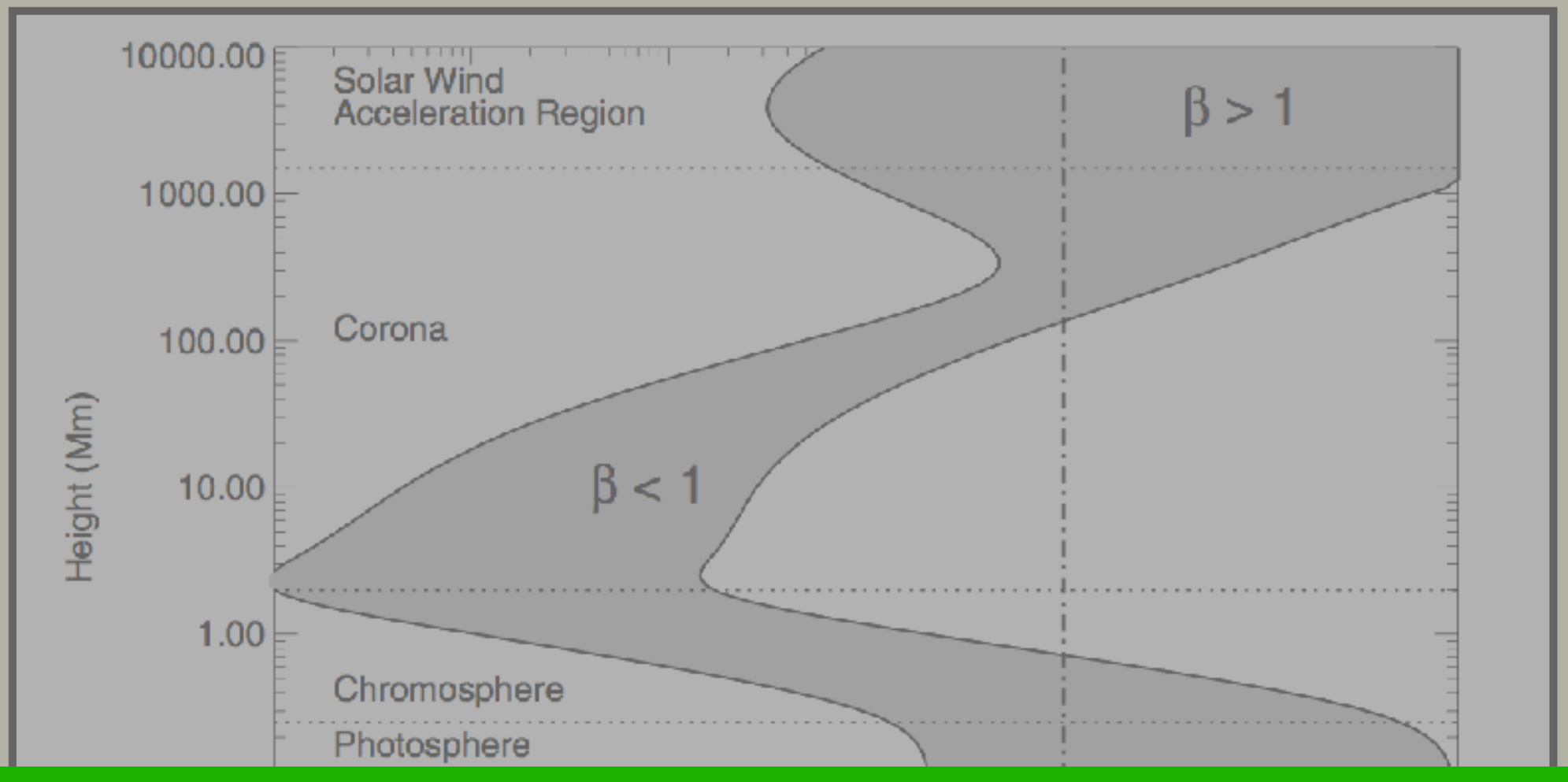
Aschwanden, 2001

$$\beta = \frac{p}{p_{mag}} = \frac{nk_BT}{B^2/(2\mu_0)}$$

← ciśnienie gazu

← ciśnienie pola magnetycznego

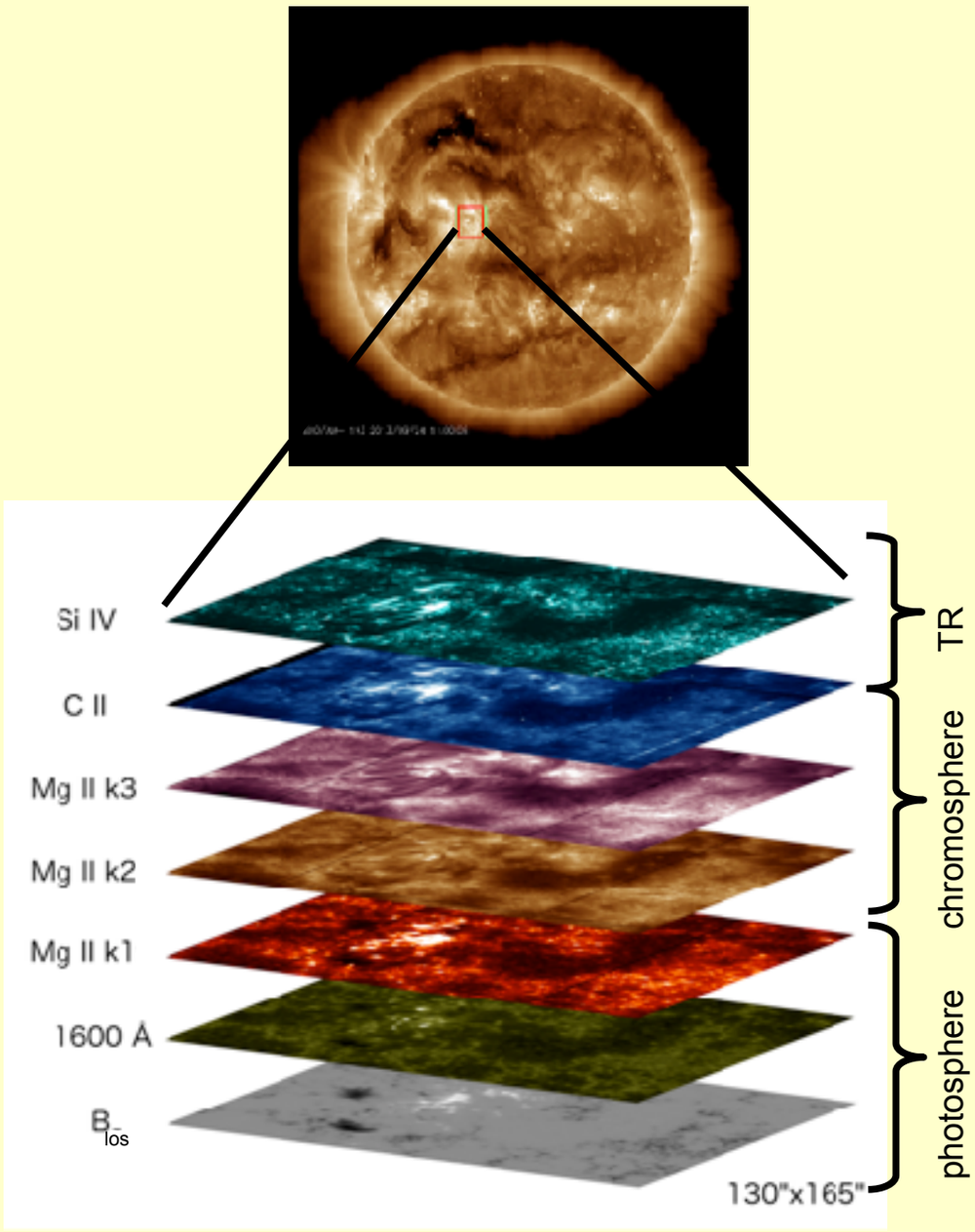
Pole magnetyczne vs. plazma



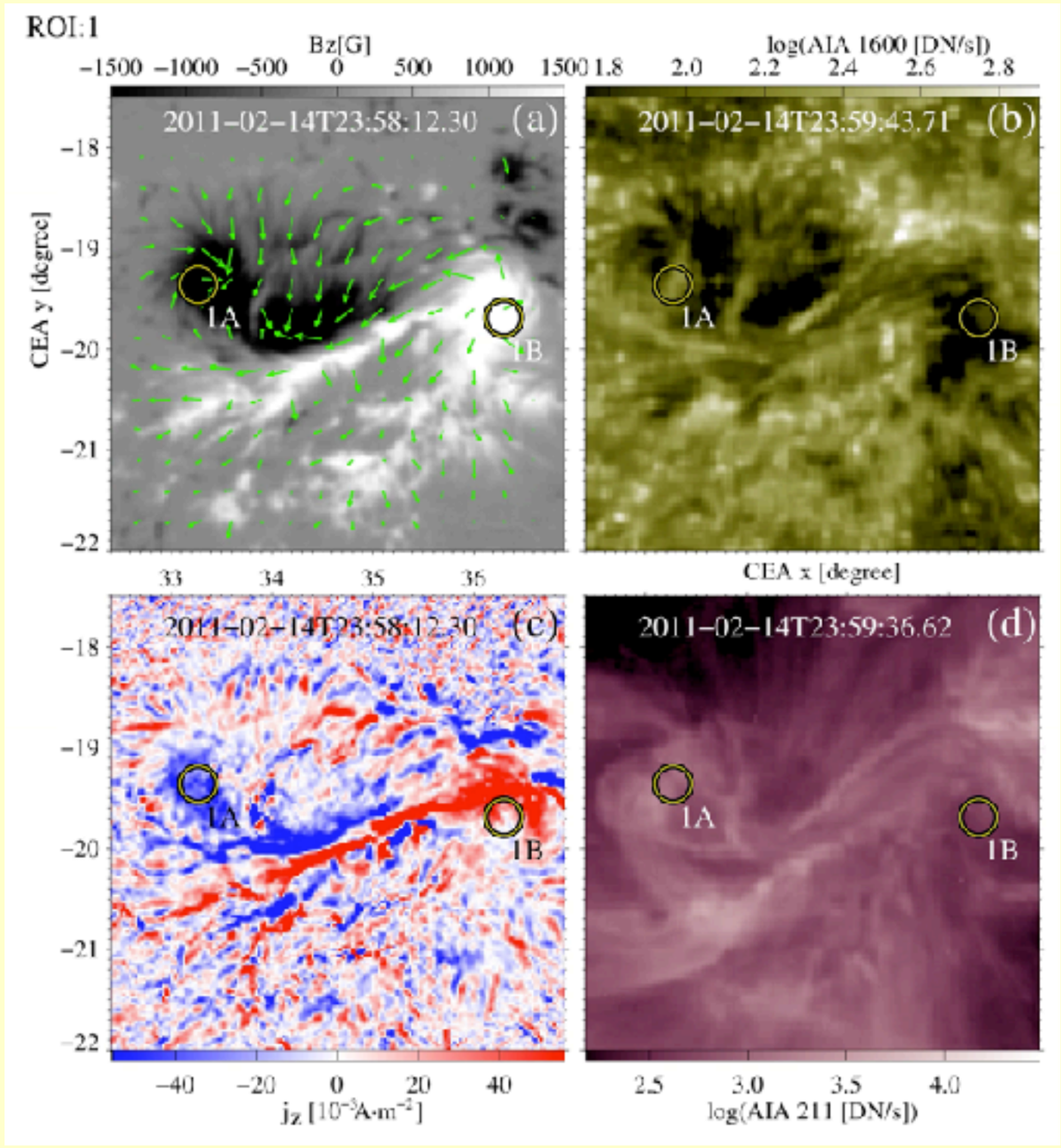
Atmosfera Słońca

- **Dynamiczna i niejednorodna przestrzennie**
- **Atmosfera Słońca = pole magnetyczne + plazma**

Obserwacje Słońca (I)

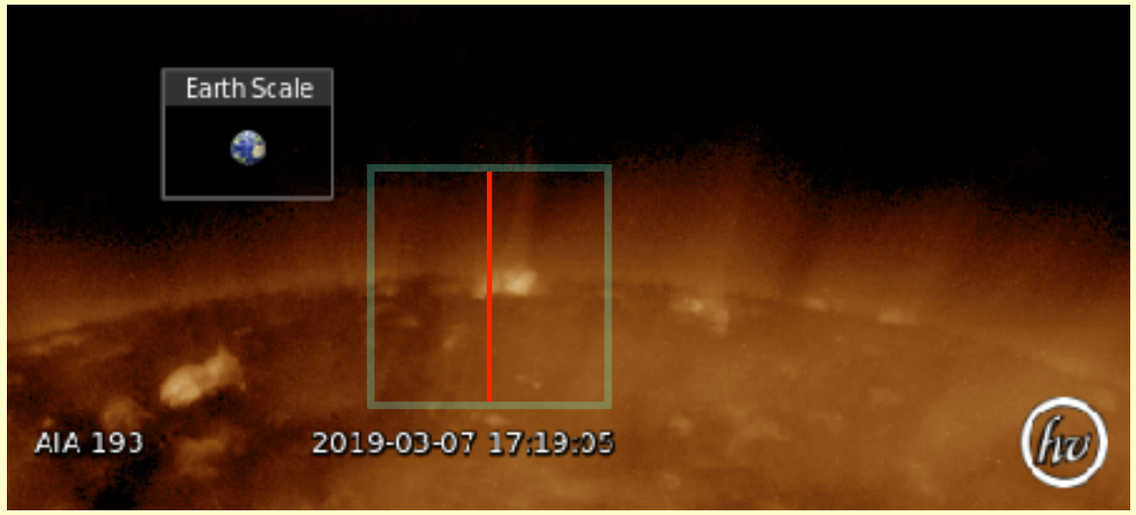


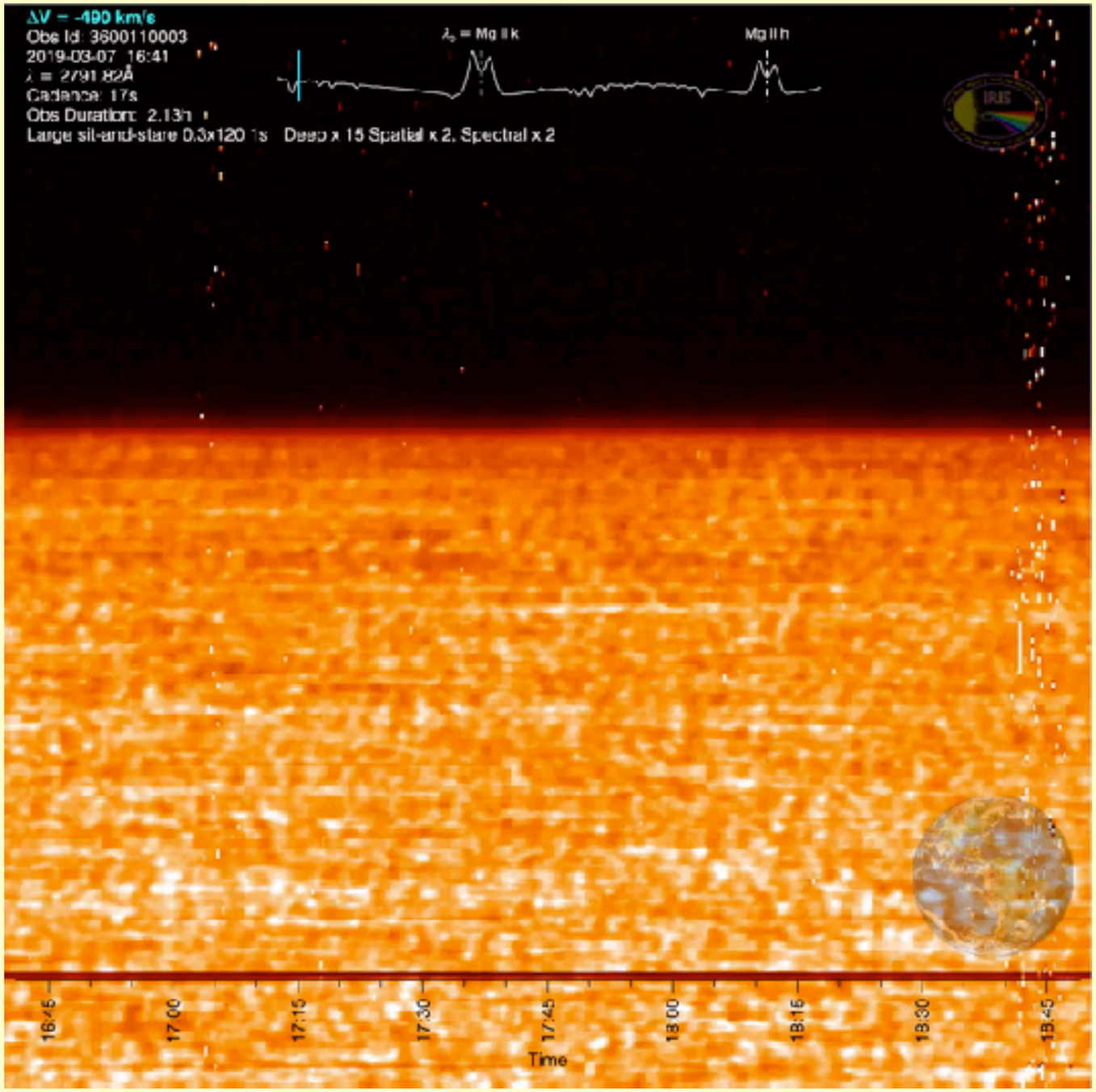
Zdjęcia atmosfery Słońca



Pole magnetyczne i gęstość prądu

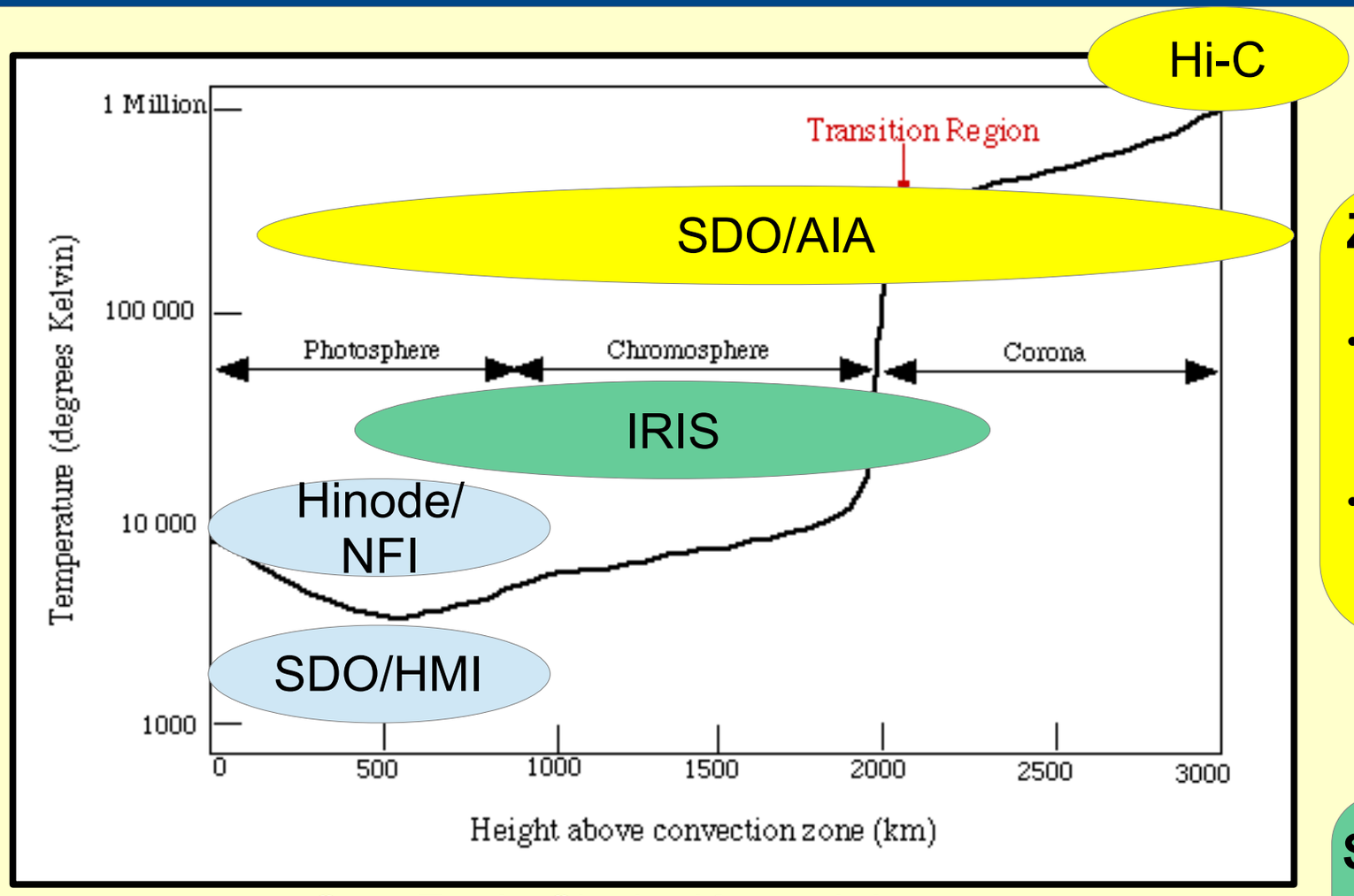
Obserwacje Słońca (II)





Widmo -linia MgII

Instrumenty obserwacyjne



Sun, Earth, Sky by Kenneth Lang

Zdjęcia:

- High-resolution coronal images (Hi-C)
- Atmospheric Imaging Assembly (SDO/AIA)

Spektrograf:

- Interface Region Imaging Spectrograph (IRIS)

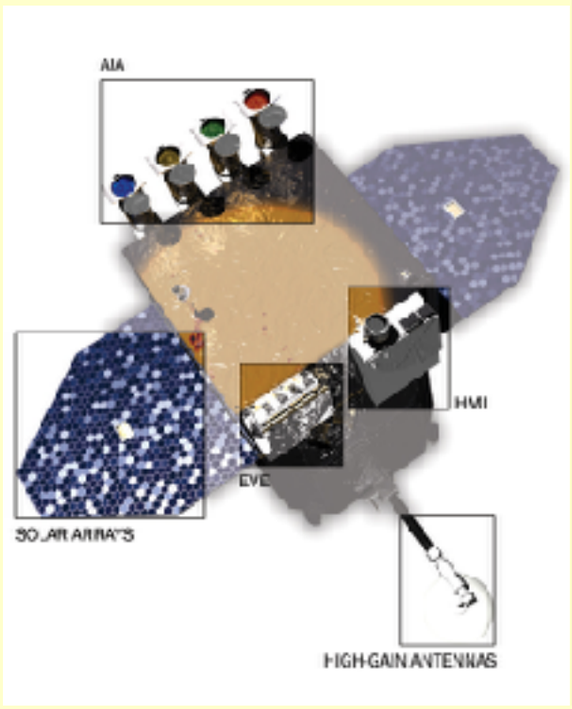
Pole magnetyczne:

- Helioseismic and Magnetic Imager (SDO/HMI)
- Narrowband Filter Imager (Hinode/NFI)

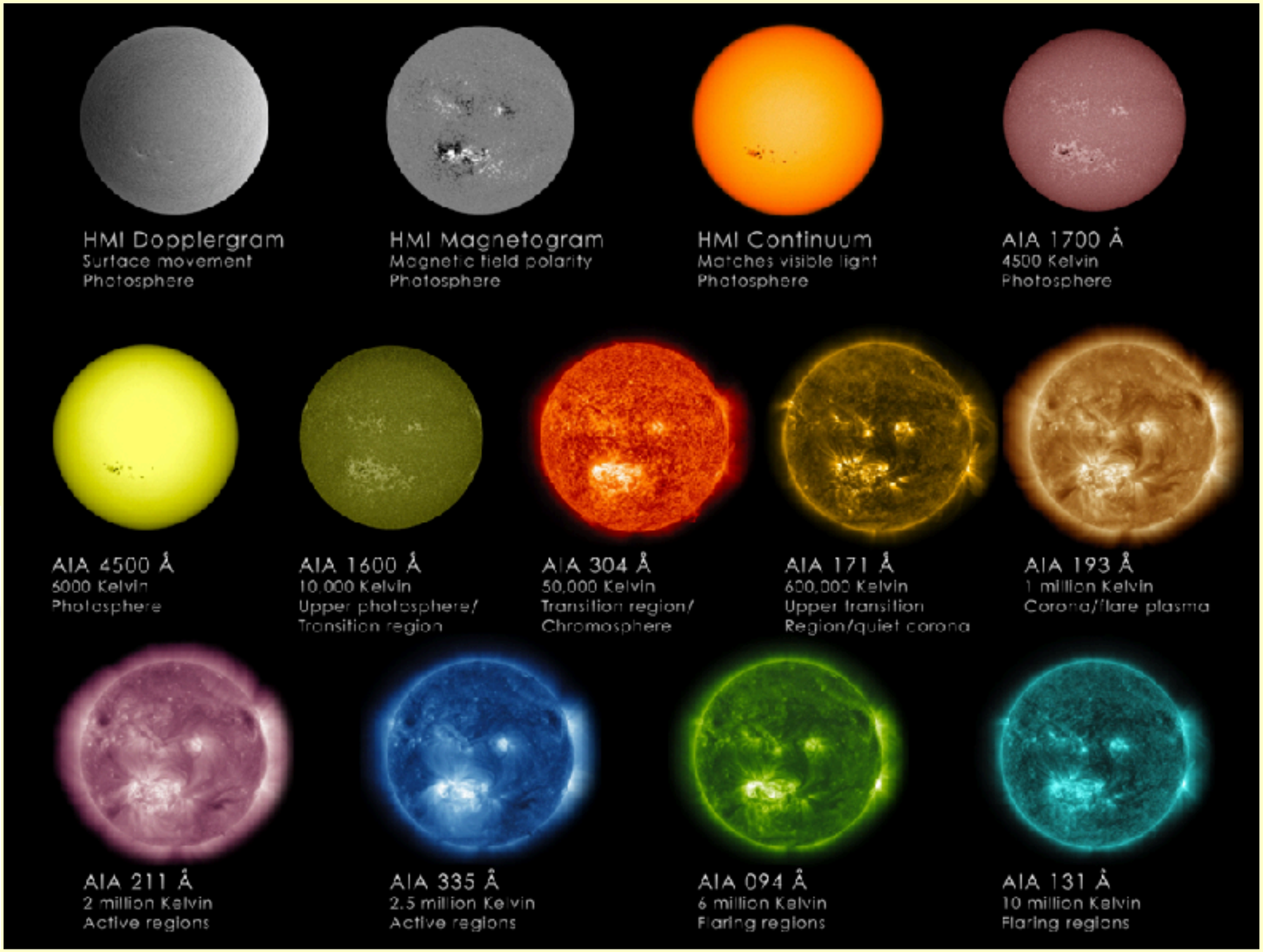
SDO (Solar Dynamics Observatory)

- 11 Luty 2010

(NASA)

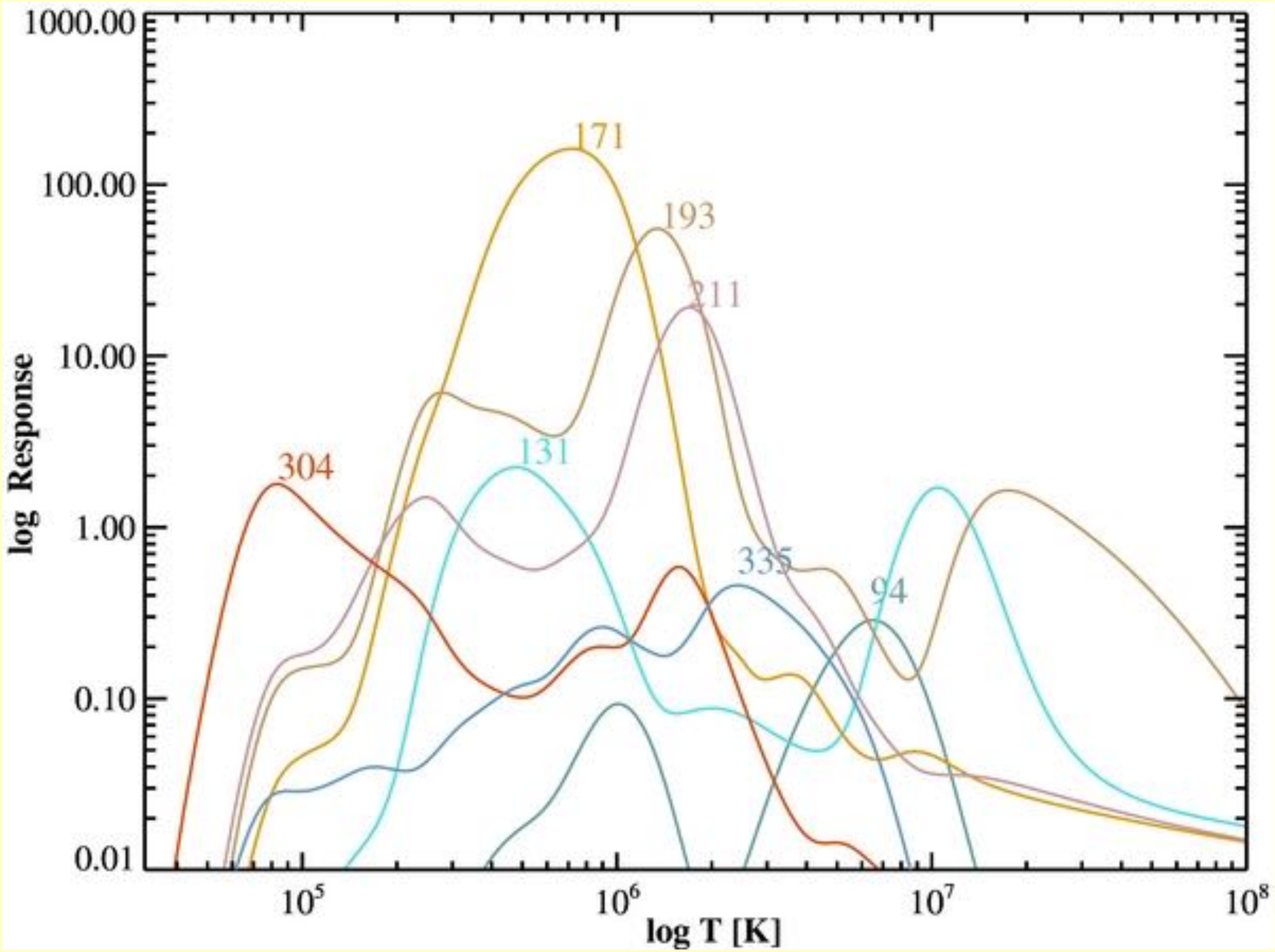


Solar Dynamics Observatory (NASA)



SDO images (NASA)

SDO (Solar Dynamics Observatory)

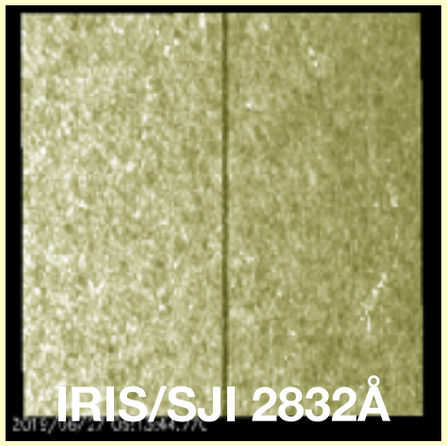


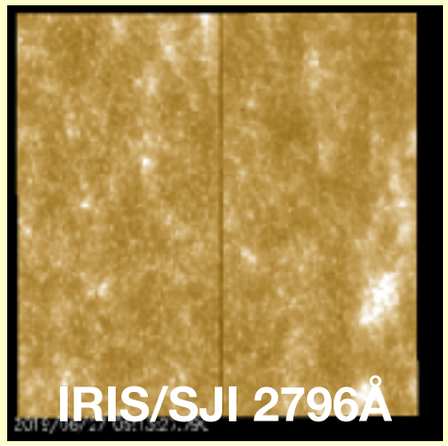
Downs et all, 2012

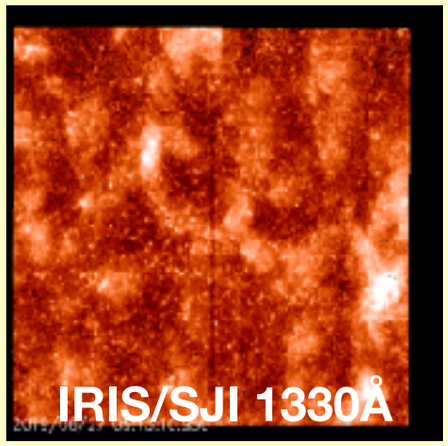
IRIS (Interface Region Imaging Spectrograph)

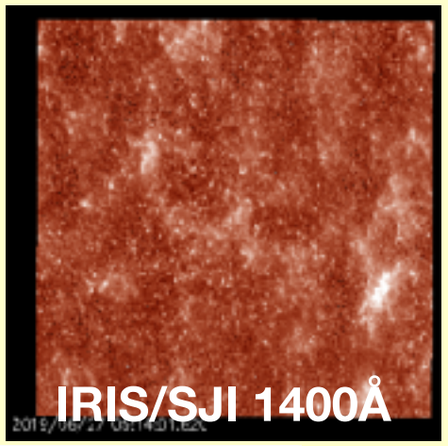
- 28 Czerwiec 2013

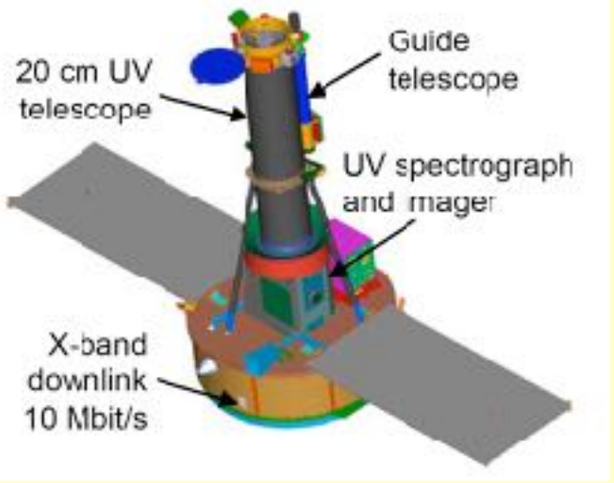
(LMSAL)





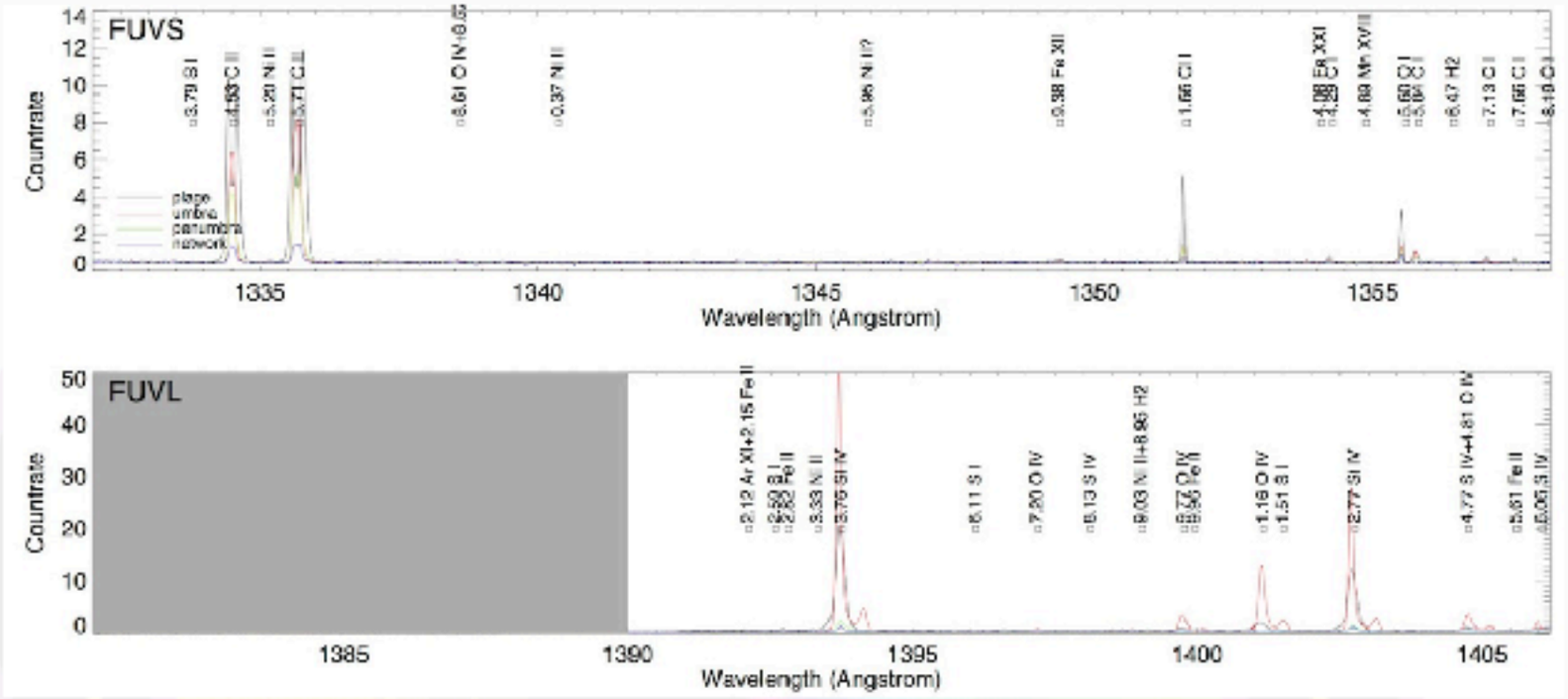




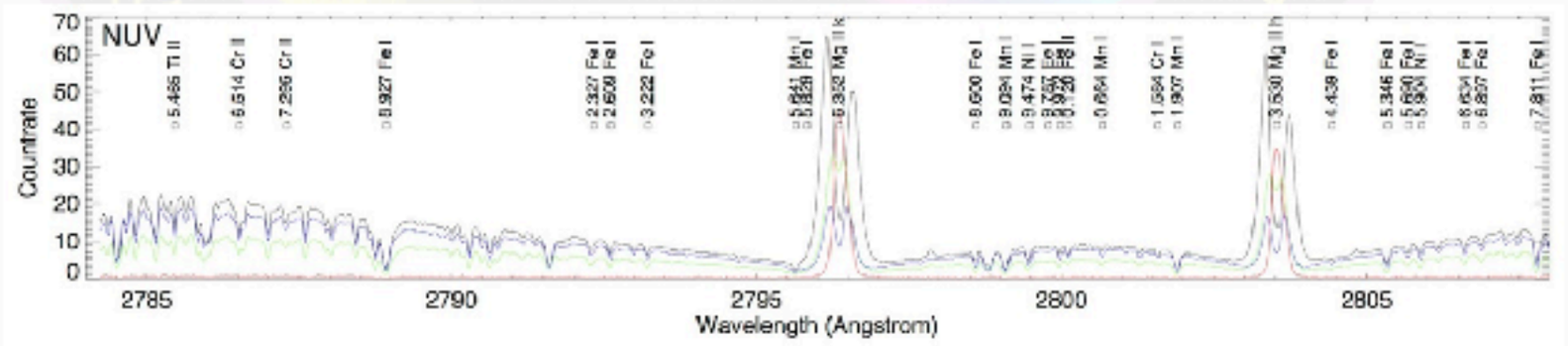


(LMSAL)

Zdjęcia
+
Widma



Quiet Sun "FUV" Sample Spectra



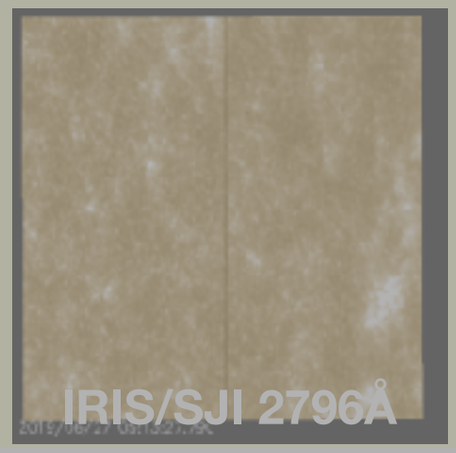
Quiet Sun "NUV" Sample Spectra

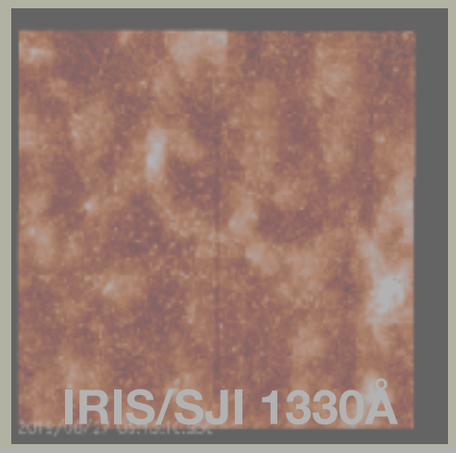
(LMSAL)

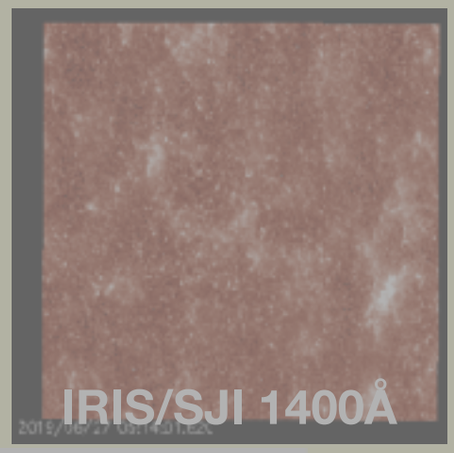
IRIS (Interface Region Imaging Spectrograph)

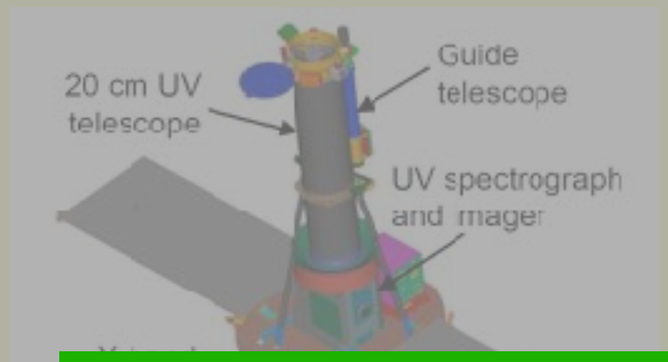
- 28 Czerwiec 2013

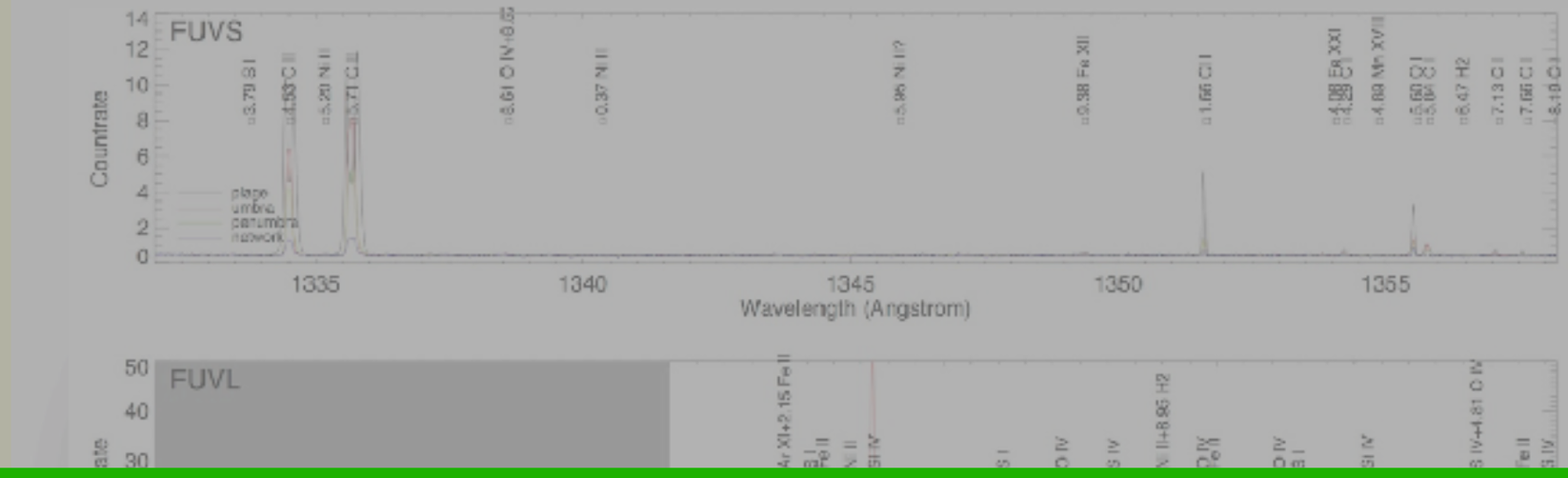
(LMSAL)









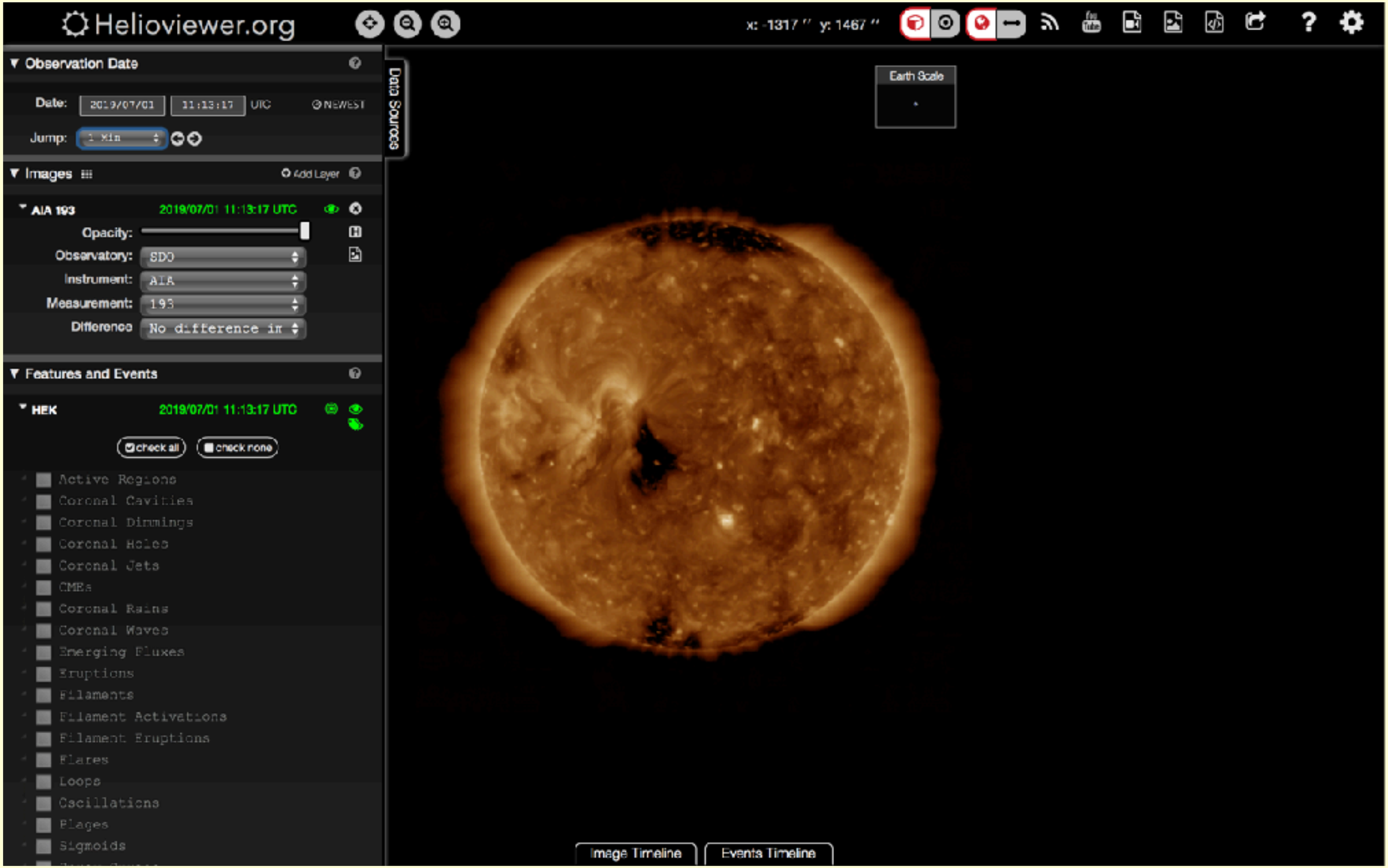


(LMSAL)

Satelitarne obserwacje Słońca

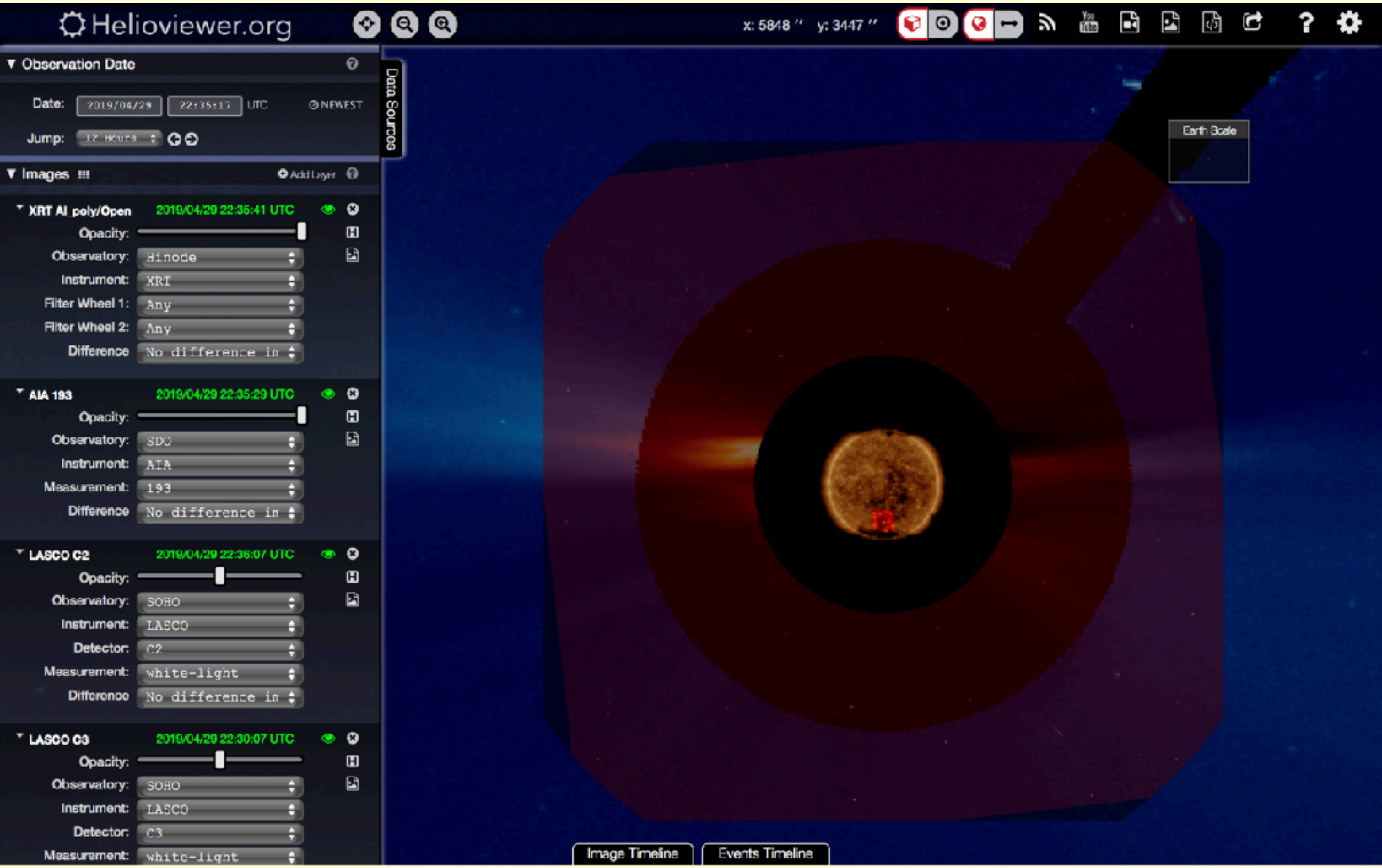
- **Obecne misje: SOHO, STEREO, SDO, Hinode, IRIS,**
- **Misje planowane: Solar Orbiter (Luty 2020), L5 (dyskusje)**

Helioviewer



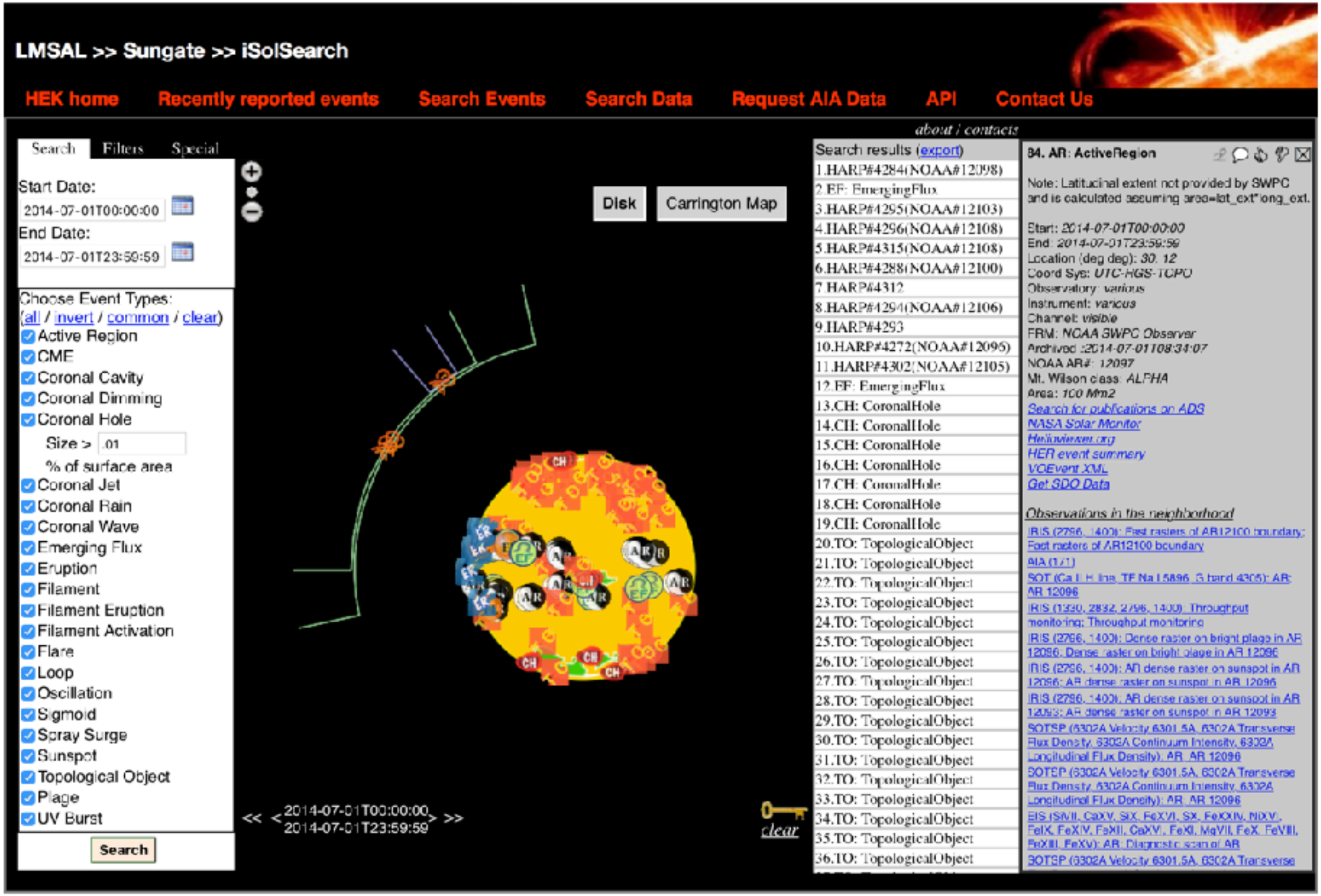
https://helioviewer.org

Helioviewer



https://helioviewer.org

Heliospheric Event Knowledgebase



http://www.lmsal.com/hek/index.html

Bazy danych -VSO

VSO Time / Instrument Search Form

Version 1.4

All from	Source	Instrument	Date Range
☐	BBSO	☐ BBSO	2000.07.05 →
☐	ChroTel	☐ ChroTel	2012.04.01 →
☐	EUNIS	☐ LONGWAVE-LOBE-06	2006.04.12 – 2006.04.12
		☐ LONGWAVE-LOBE-07	2007.11.06 – 2007.11.06
		☐ LONGWAVE-SLIT-06	2006.04.12 – 2006.04.12
		☐ LONGWAVE-SLIT-07	2007.11.06 – 2007.11.06
		☐ SHORTWAVE-LOBE-06	2006.04.12 – 2006.04.12
		☐ SHORTWAVE-LOBE-07	2007.11.06 – 2007.11.06
		☐ SHORTWAVE-SLIT-06	2006.04.12 – 2006.04.12
		☐ SHORTWAVE-SLIT-07	2007.11.06 – 2007.11.06
☐	Evans	☐ spectroheliograph	1996.02.05 – 1999.05.28
☐	GOES-12	☐ SXI-0	2001.09.10 →
☐	GONG	☐ Big Bear	2006.08.15 →
		☐ Cerro Tololo	2006.08.15 →
		☐ El Teide	2006.08.15 →
		☐ Learmonth	2006.08.15 →
		☐ MERGED GONG	2001.07.22 →
		☐ Mauna Loa	2006.08.15 →
		☐ Udaipur	2007.04.10 →
☑	Hi-C	☑ Hi-C	2012.07.11 – 2012.07.11
☐	Hinode	☐ EIS	2006.10.23 →
		☑ SOT	2006.10.23 →
		☐ XRT	2006.10.23 →
☐	HXECLIPSE	☐ HXECLIPSE	1869.08.07 – 2009.07.22
☐	IRIS	☐ IRIS	2013.07.16 →
☐	ISOON	☐ ISOON	2003.01.02 – 2012.04.18
☐	IVM	☐ IVM	1999.11.24 – 2003.12.19
☐	KANZ	☐ KANZ	2001.02.07 →
☐	KPVT	☐ 512-channel magnetograph	1974.02.01 – 1993.04.10
		☐ spectromagnetograph	1992.04.19 – 2003.09.21

Start: 2019 Jun 05 / 12 : 00

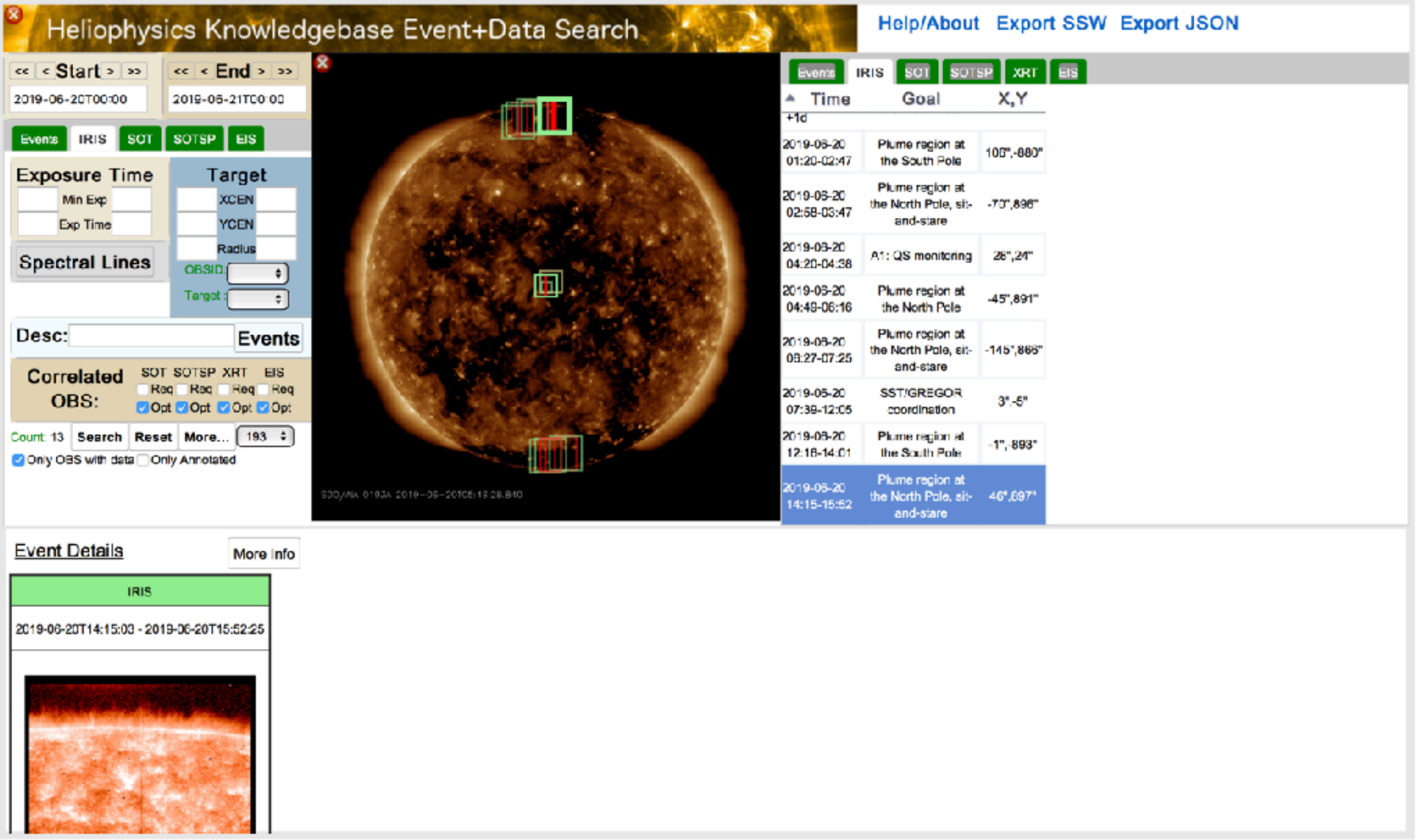
End: 2019 Jun 05 / 15 : 58

All Month All Day

Search Clear

https://sdac.virtualsolar.org/cgi/search

Bazy danych -IRIS+Hinode



http://www.lmsal.com/heksearch/

Bazy danych -JSOC

JSOC Data Export reset page Turn Help Off 1 Requests Pending , Loading...

JSOC Data Export Request Generation

Help with Error Messages Release Notes

If the Method is changed from "url_quick" or "url_direct" you will have additional options to specify. "url-direct" is temporarily disabled.

After the request is submitted for Methods of "url", "ftp", "url-tar" or "ftp-tar" you will receive ON THIS PAGE a "Request_ID" that will be used to access the data when it is ready.

If you enter an email address you will be notified when the data is ready. If you do not provide an email address you must leave this page open or save the Request_ID in order to access the data.

RecordSet from file — Check box to allow upload of RecordSet list file, file will be requested after Submit button click.

RecordSet: hmi.sharp_cea_720s[377][2011.02.15_00:00:00_TAI-2011.02.15_04:00:00_TAI][Bp,Br, Examine

Record Limit: none — Optional manual limit to number of records to export.

Record Count: 21 — Recount — Limit for AIA to about 15,000 and for HMI about 30,000 in each request.

Method: url — Choose method, url_quick or url for now. url_quick implies protocol of "as-is"

Filename Format: hmi.sharp_cea_720s.{HARPNUM}.{T_REC:A} — File name template.

Processing:
- no_op - none hide
- aia_scale - Scale image to 0.6 arcsec/pixel (compatible with 2D dataseries with CTYPE1 == HPLN-TAN and CTYPE2 == HPLT-TAN only)
- HmiB2ptr - Convert HMI B_720s to Phi,Theta,R coordinates
- resize - Resize and rotate if needed, use sub-pixel registration
- im_patch - Extract sub-frame
- mapproj - Extract a sub-frame and remap to a chosen projection.
- rebin - Rebin with boxcar or gaussian smoothing

Mapproj:

Projected Patch Extract - used to export sub-frames from a sequence of images. The extracted patches are remapped to the requested projection. The patch will be tracked at the Carrington rate.
The location of the extracted sub-frame must be specified in Carrington latitude and longitude.
The recordset should be specified fully. For the time being, for AIA at lower cadence use one of the time slotted series: aia.lev1_euv_12s, aia.lev1_uv_24s, or aia.lev1_vis_1h

Options	Visible grid spacing in degrees, none	NOAA AR number: 11158 at 2011.02.13_23:59:59Z
CLong	034	Carrington longitude of patch center. Check for disk center longitude.
CLat	-20	Latitude of patch center.
MapProjection	Plate Carree - simple latitude vs lon	
MapScale	0.00179	Scale in degrees per pixel after mapping. Choose <= 0.00179
Width	800	Width of extracted patch in pixels.
Height	400	Height of extracted patch in pixels.
Verify	check params	OK to submit

Protocol: FITS — Choose protocol, "FITS", "JPEG", "MPG", "MP4", or "as-is". Note uncompressed FITS not an option

Notify: solarmail — Provide your email address for notification. If Requestor is your SolarMail name you may use "solarmail" here.

Requestor: none — Provide your identifier, e.g. your SolarMail name.

Check Params for Export — Notify field must be set before submit.

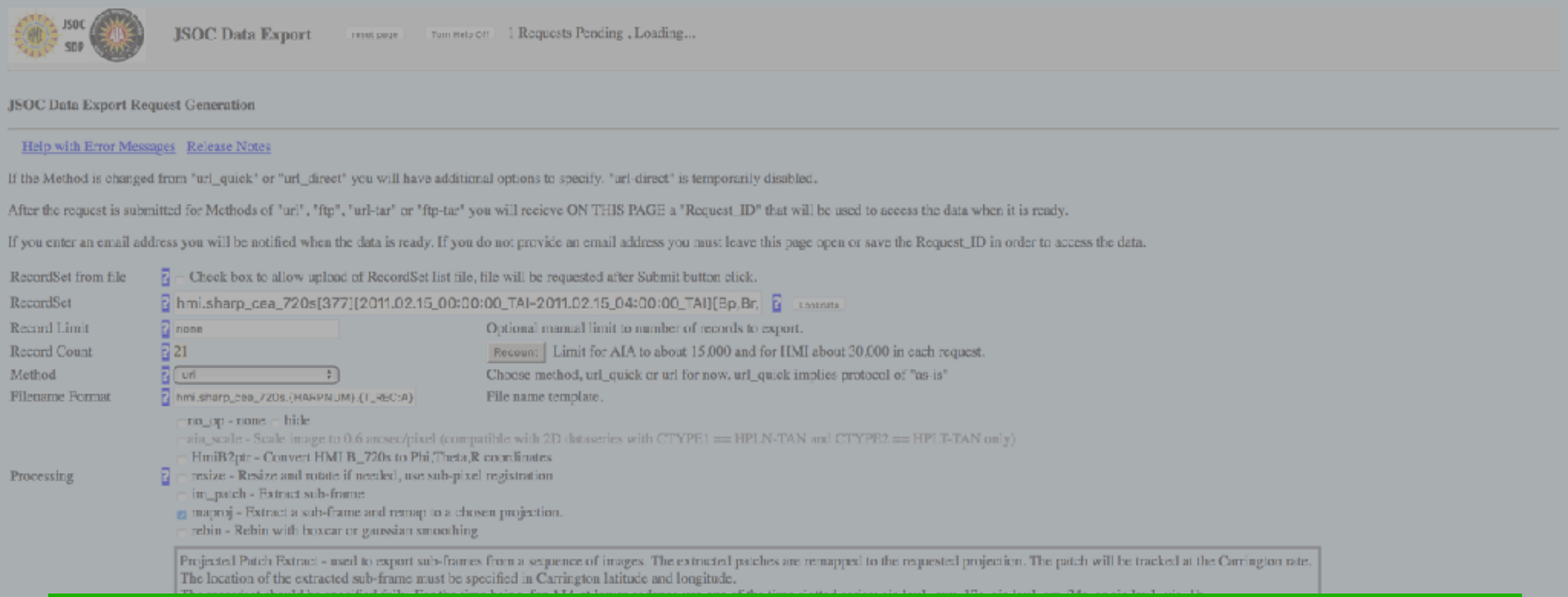
Not Ready To Submit — Please only click once for export request.

check to show export params.

Home page for: SDO:JSOC

http://jsoc.stanford.edu

Bazy danych -JSOC



Narzędzia online + bazy danych

- **Darmowe**
- **Proste w obsłudze**

http://jsoc.stanford.edu

Thank you for your attention!

krzysztof.barczynski@obspm.fr