

# Monitoring aktywności słonecznej -użyteczne narzędzia

Krzysztof Barczynski<sup>1</sup>

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

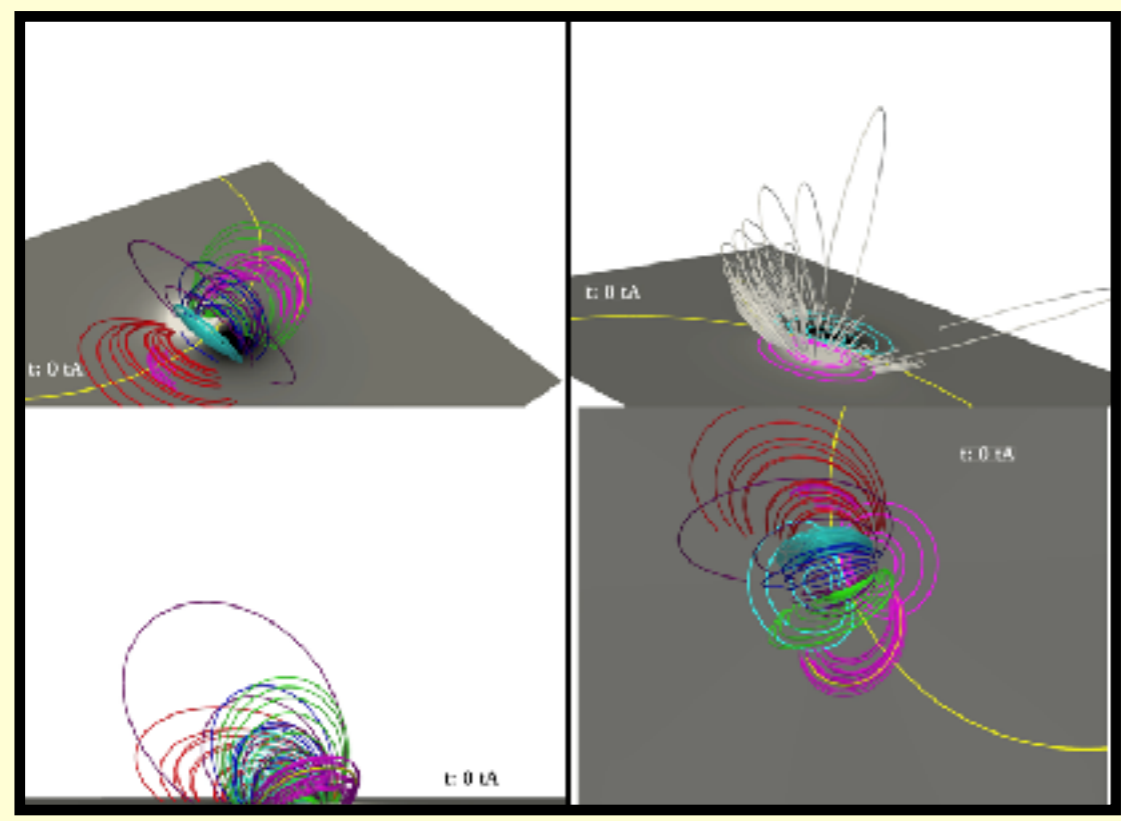


Warszawa, 04.07.2019

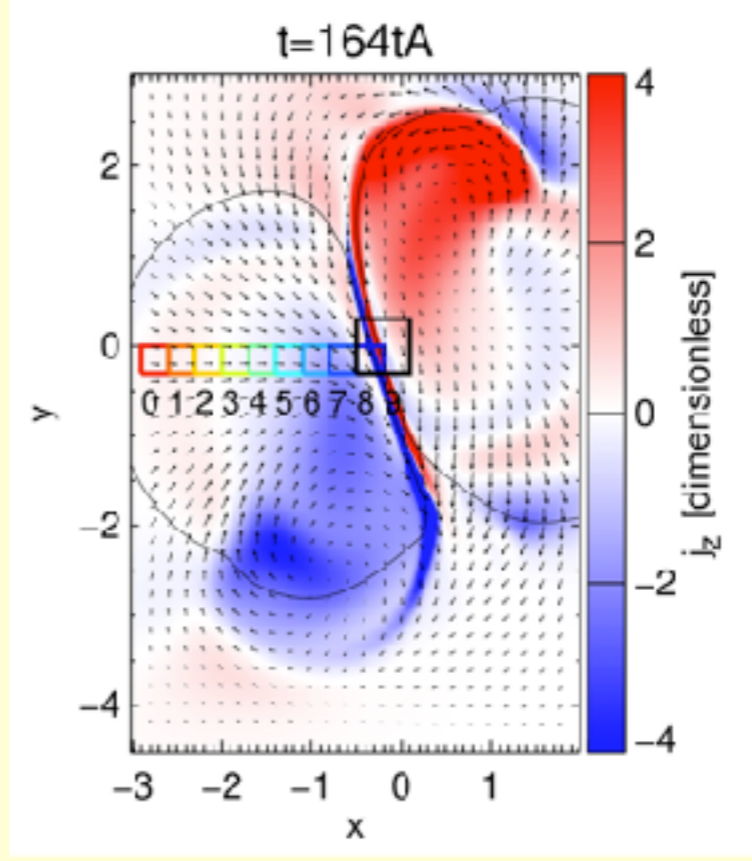


# Moje badania

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

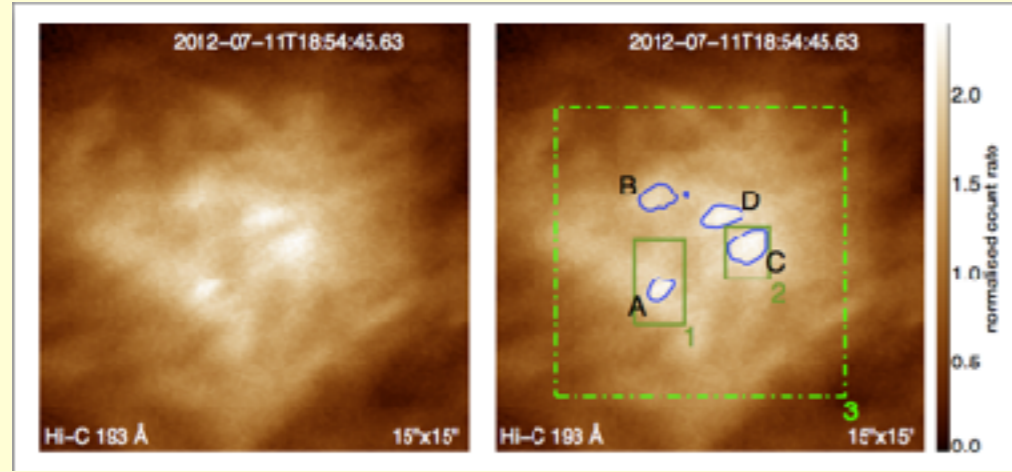


Zuccarello et al. 2015 (ApJ, 814, 126)

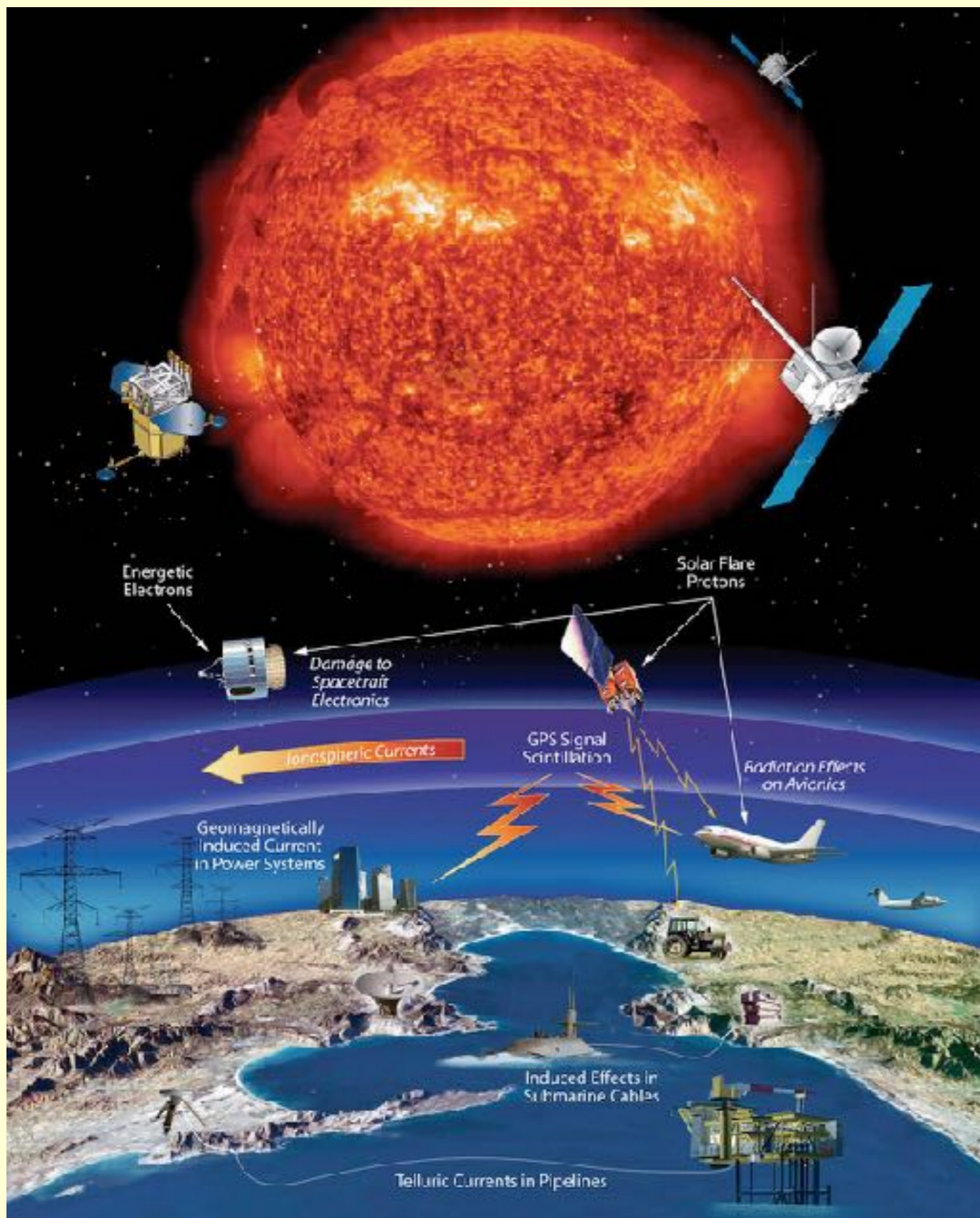


Barczynski et al. 2019 (ApJ, 877, 67)

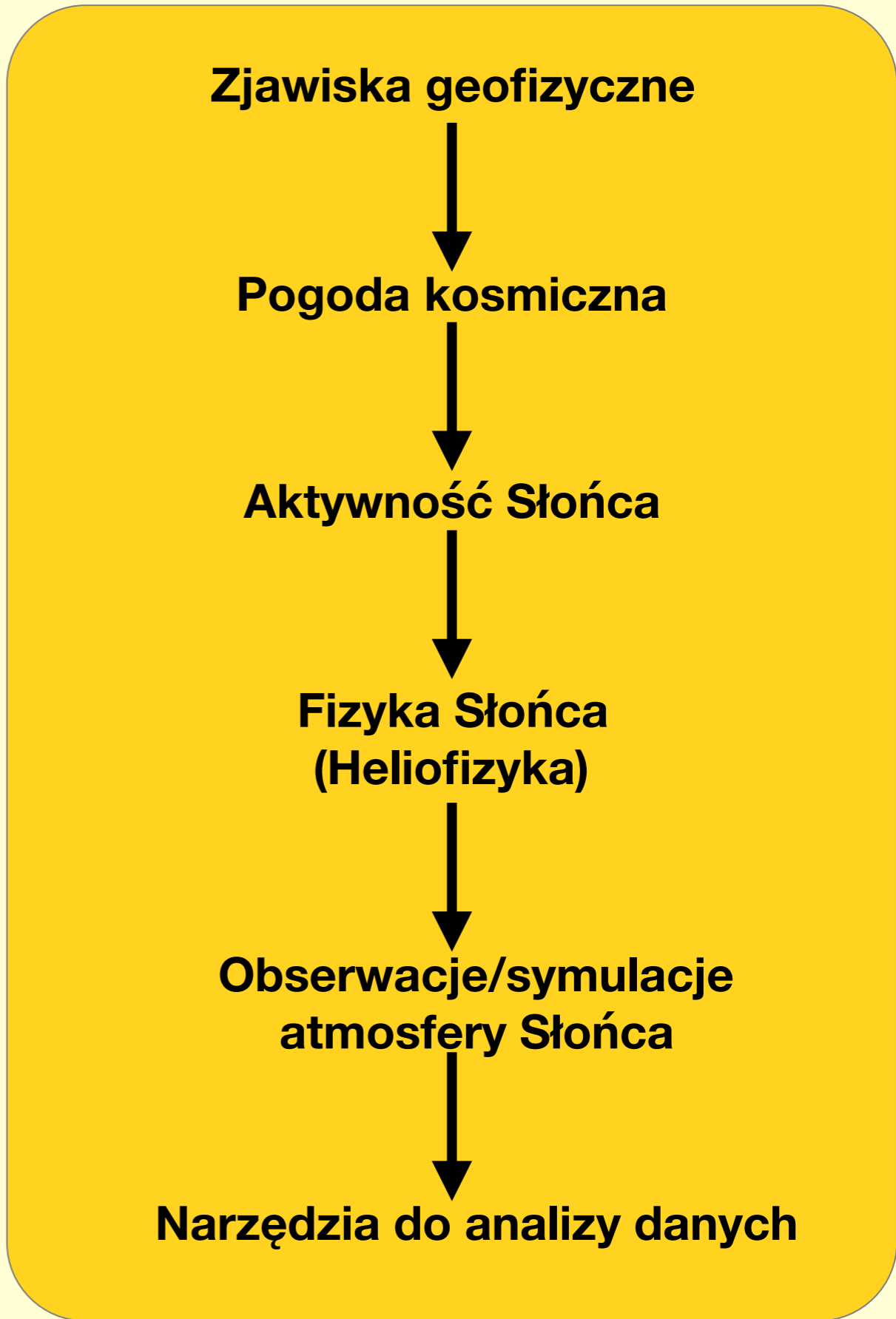
- **Small-scale structure in the upper atmosphere of the Sun**



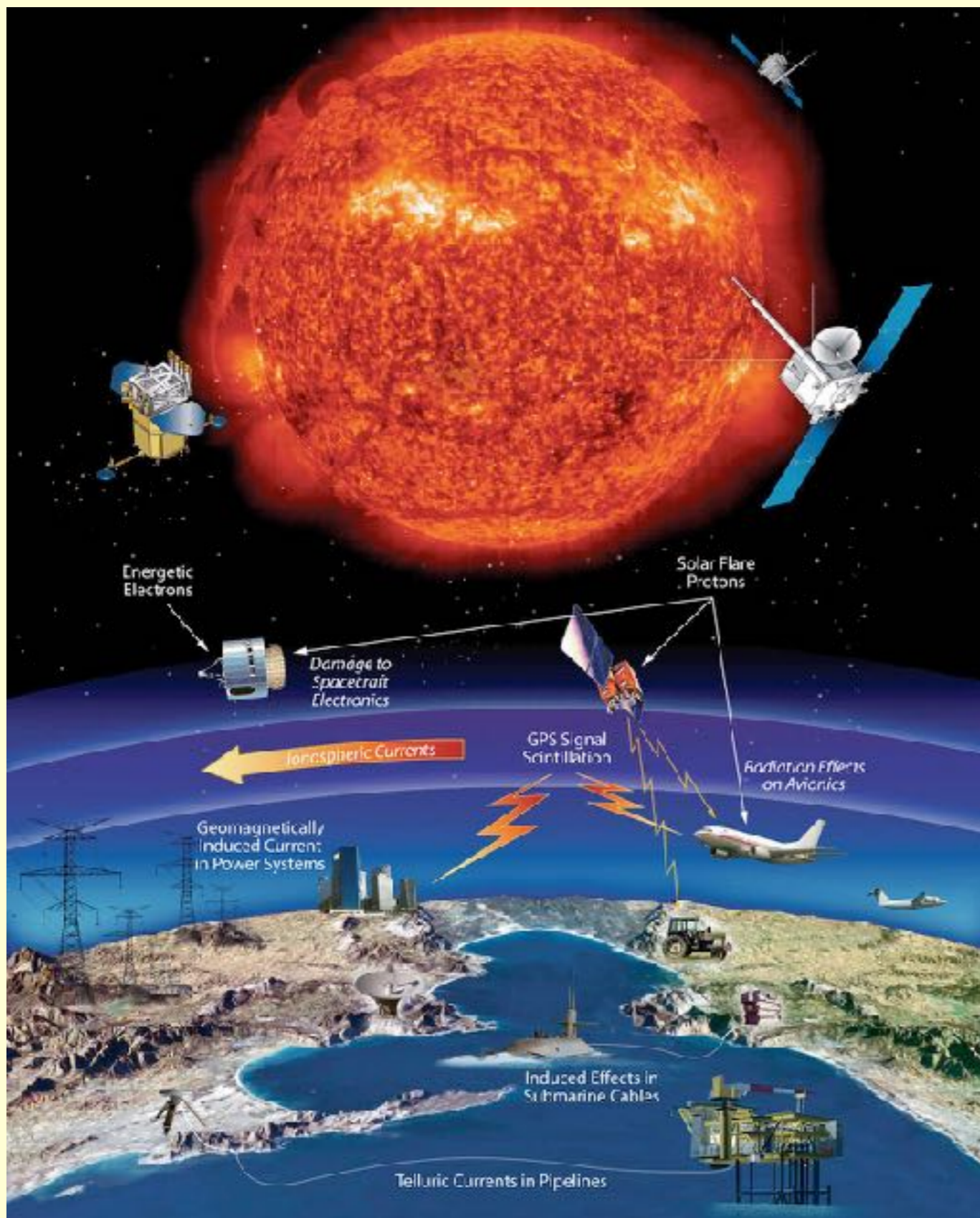
Barczynski et al. 2017 (A&A, 599, 137)



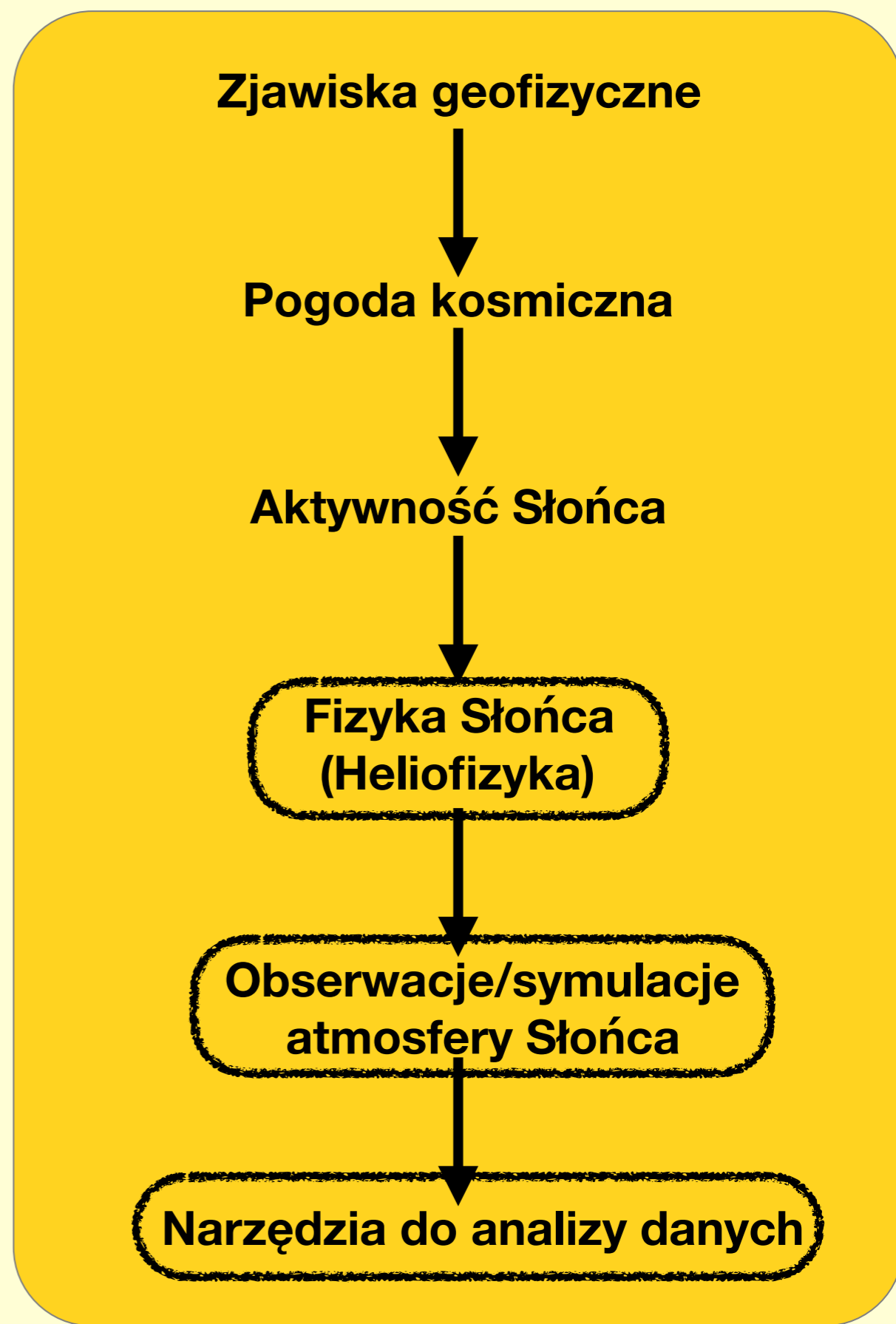
NASA





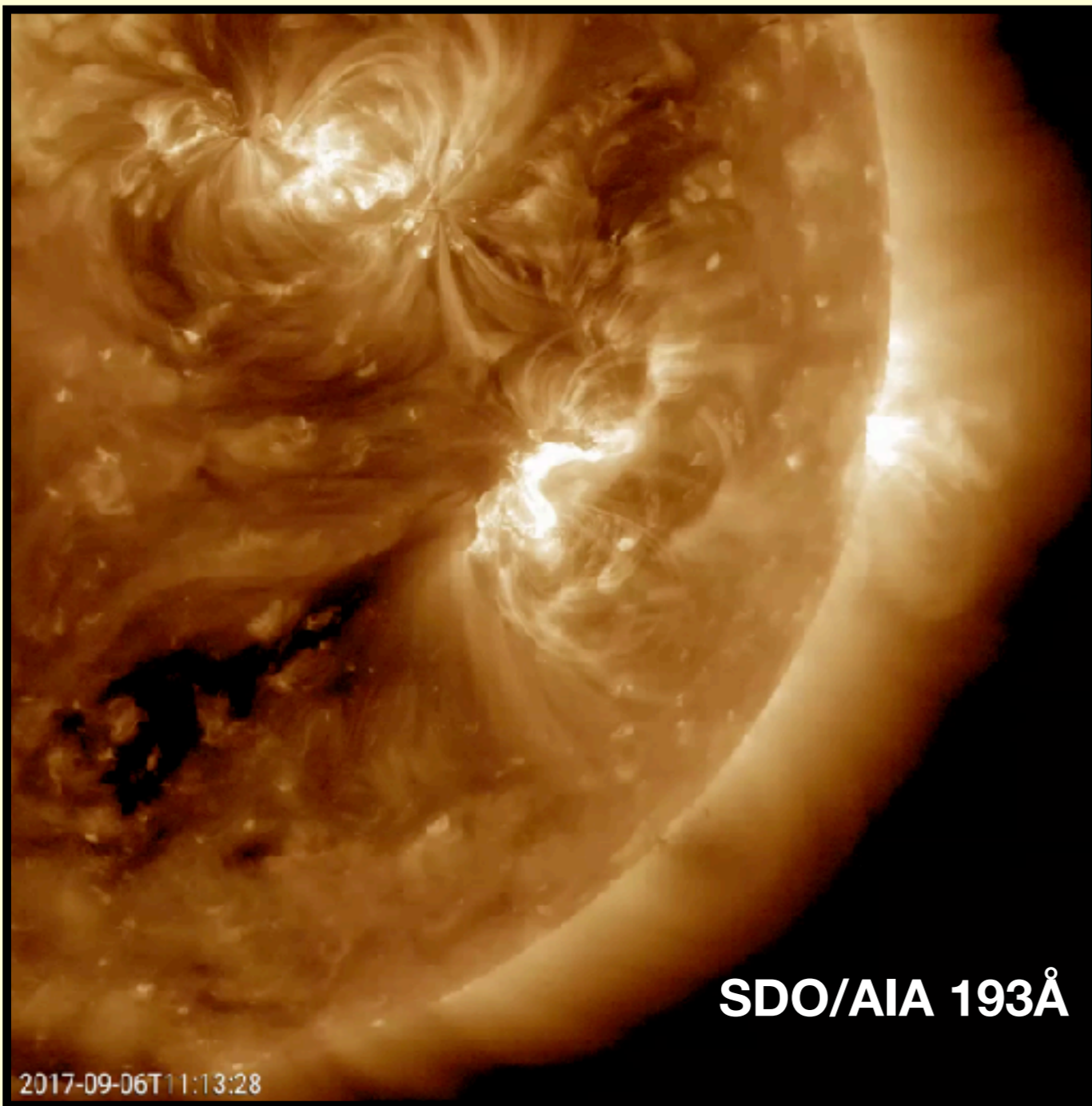


NASA

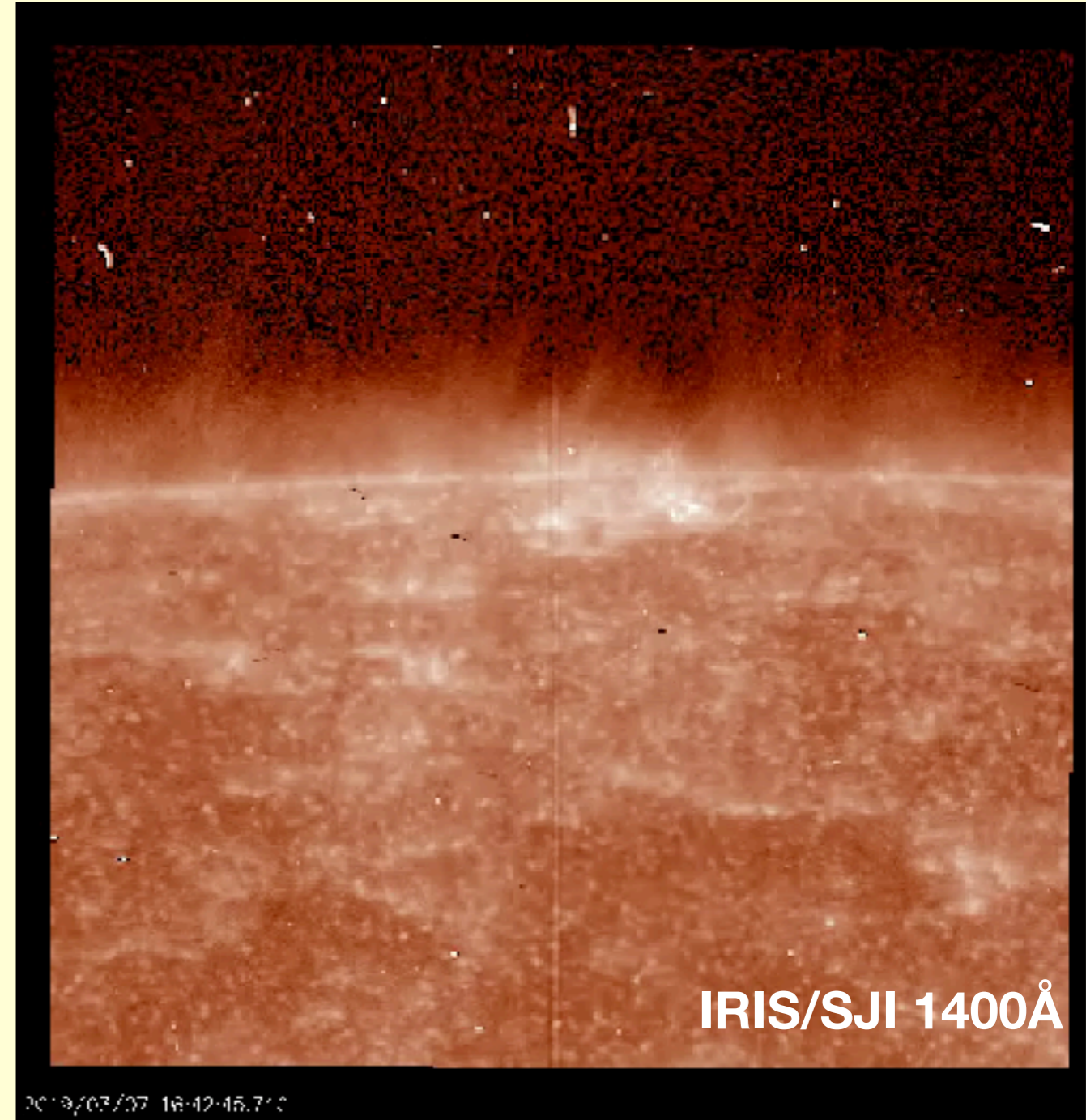




## Rozbłysk (Solar flare)



## Małoskalowe struktury

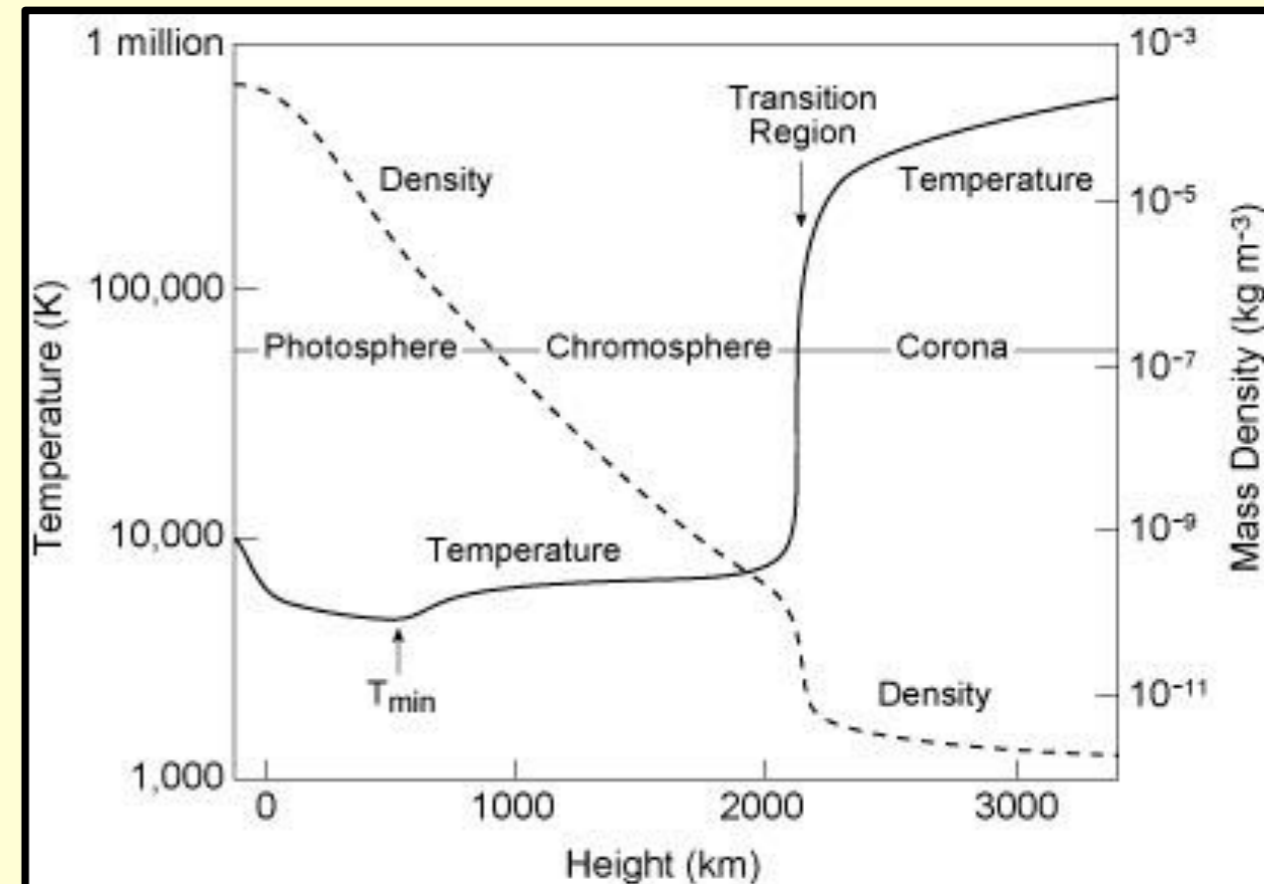
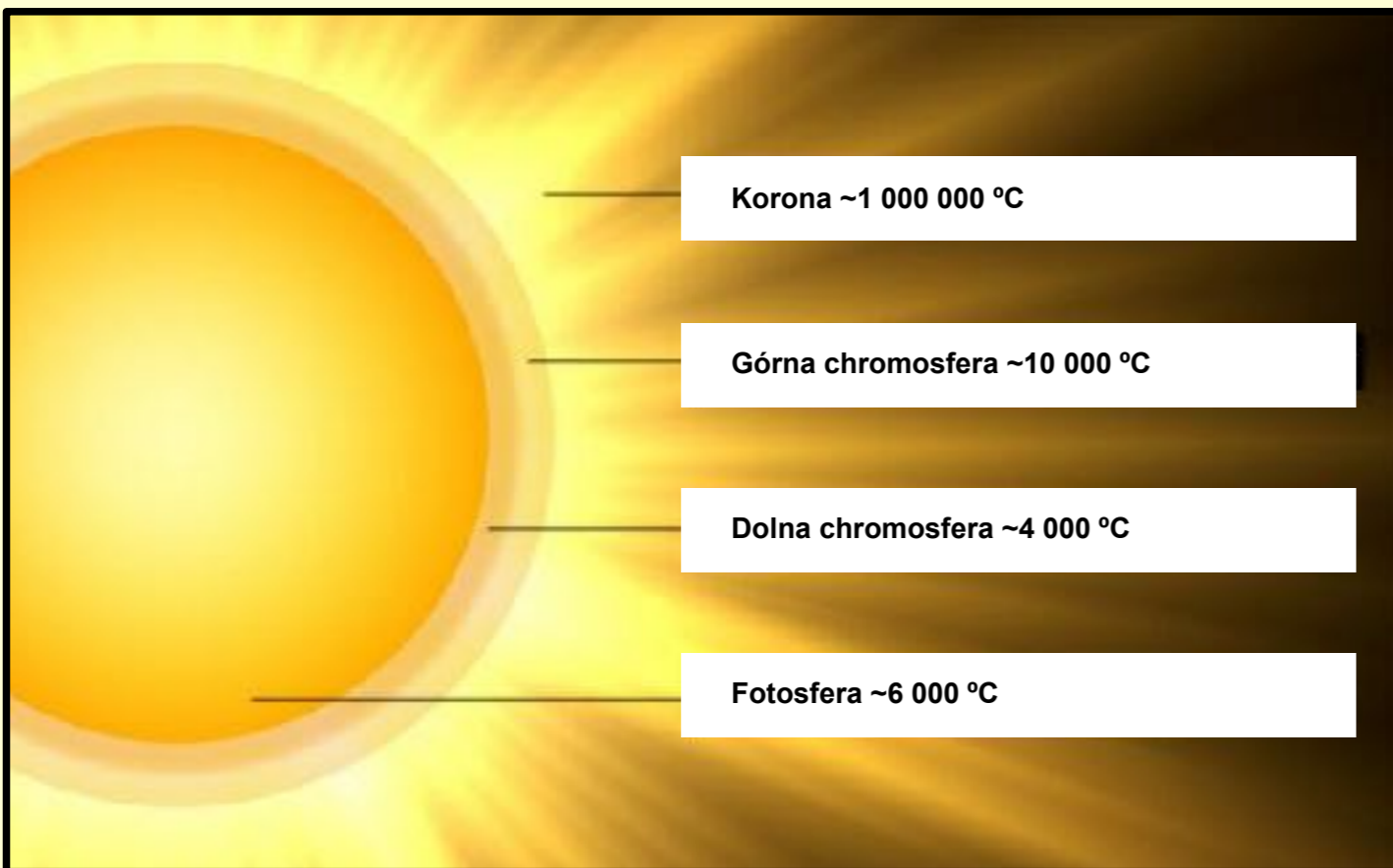


NASA/GSFC/ Solar Dynamics Observatory

IRIS/ LMSAL/ KB

**Rzadkie -wysokoenergetyczne**

**Liczne -niskoenergetyczne**



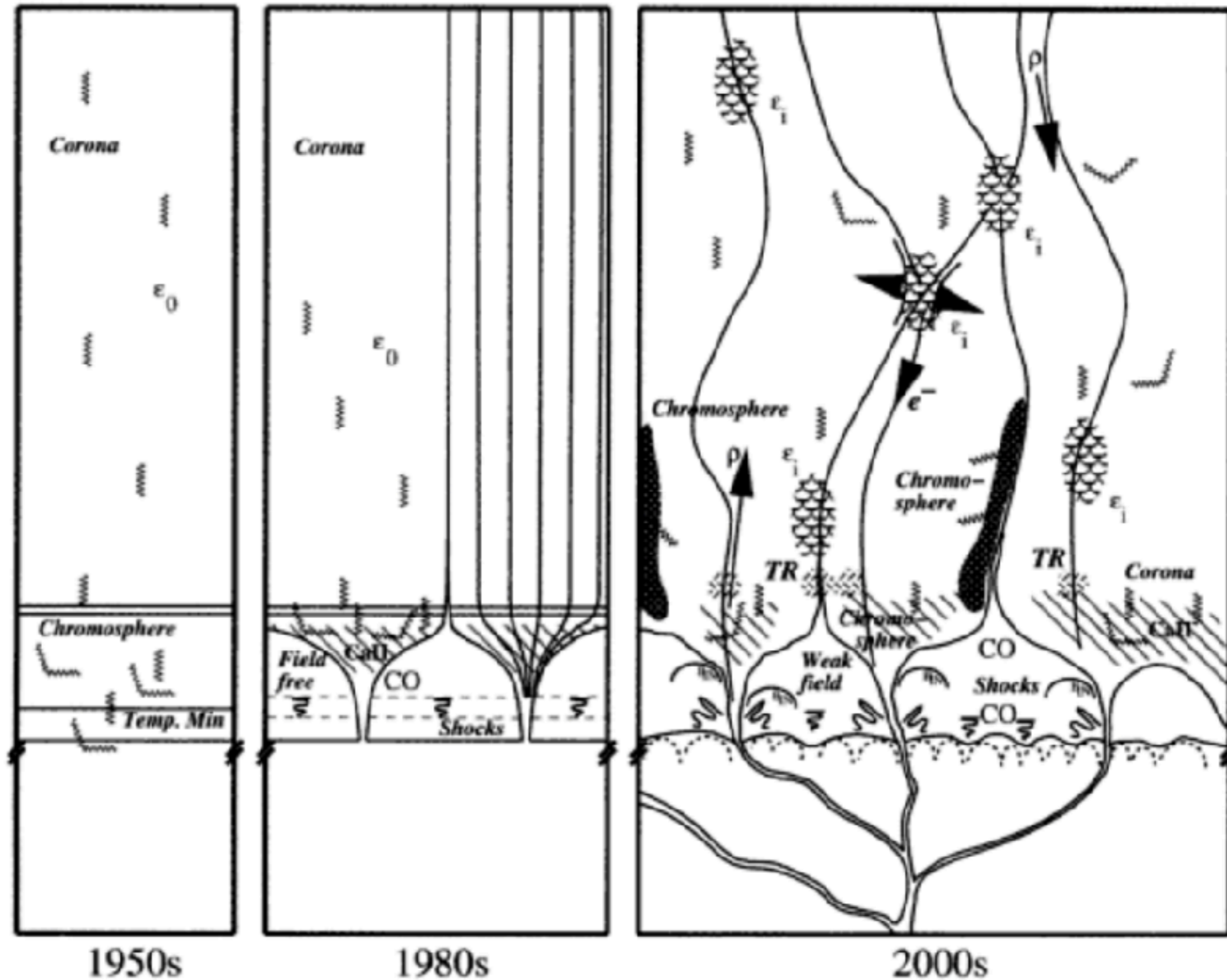
1) Illustration: Per Byhring; 2) Eugene Avrett, Smithsonian Astrophysical Observatory

- 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.)

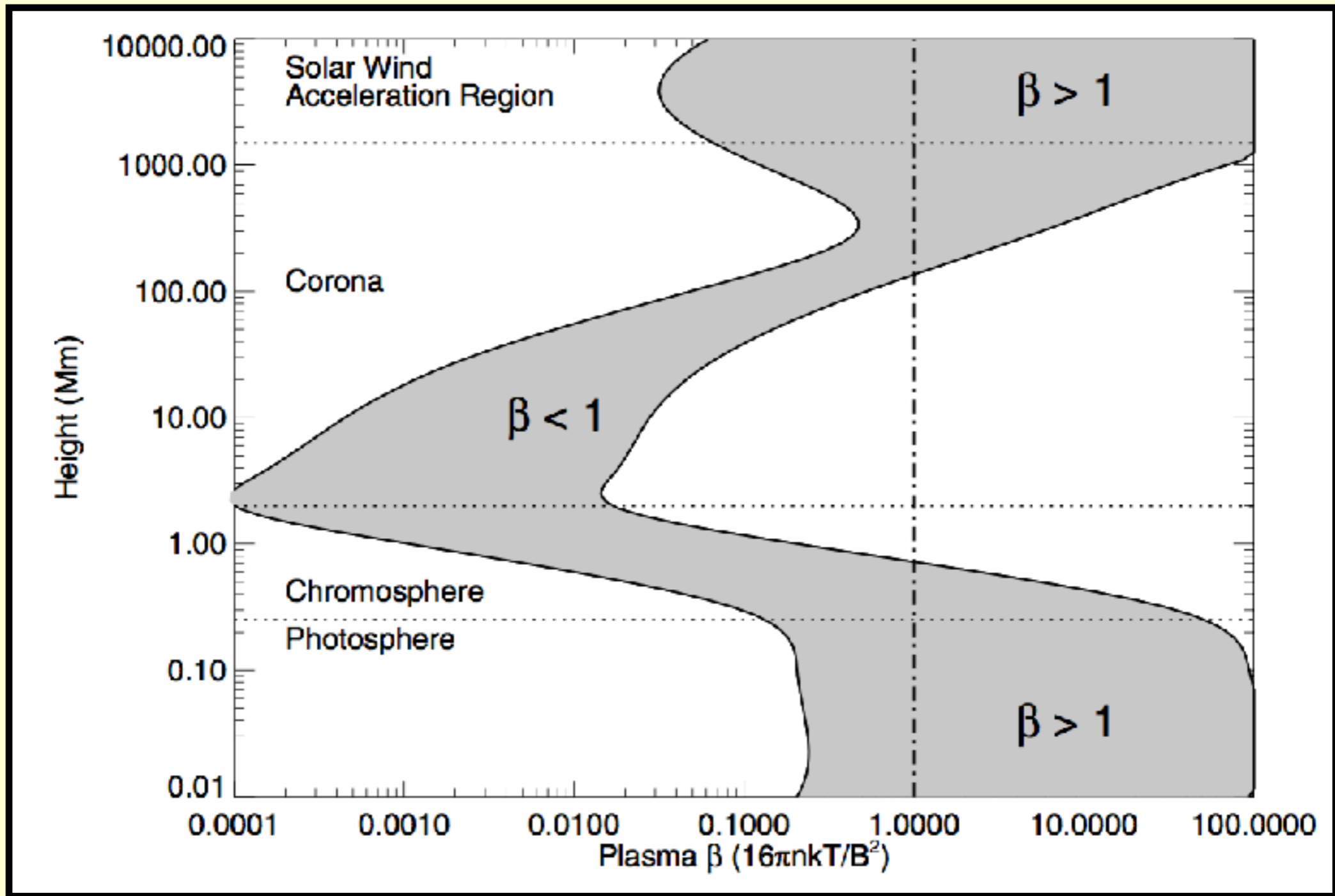


# Budowa atmosfery Słońca -koncept historyczny

6



# Pole magnetyczne vs. plazma



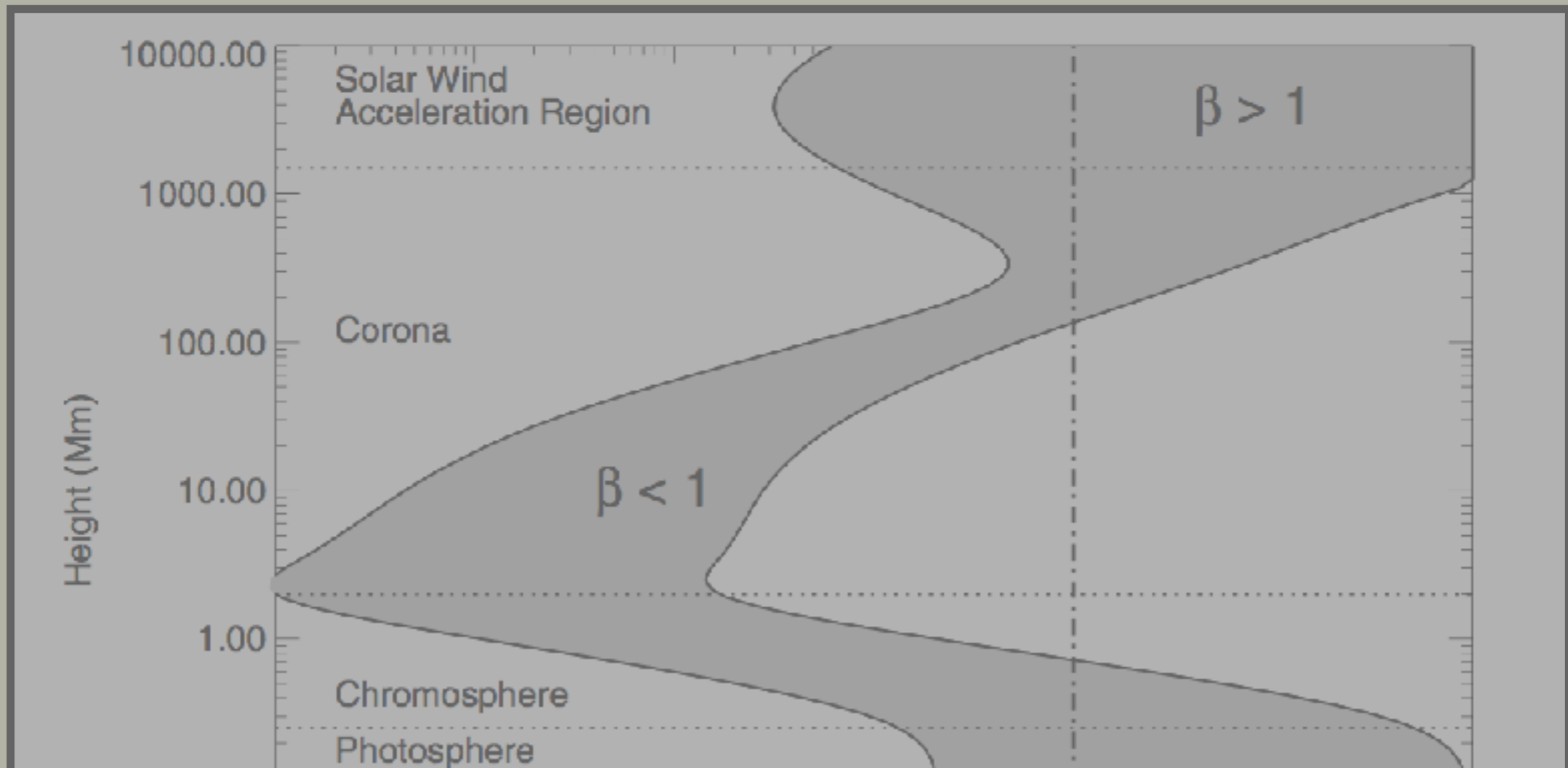
Aschwanden, 2001

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

← ciśnienie gazu

← ciśnienie pola magnetycznego

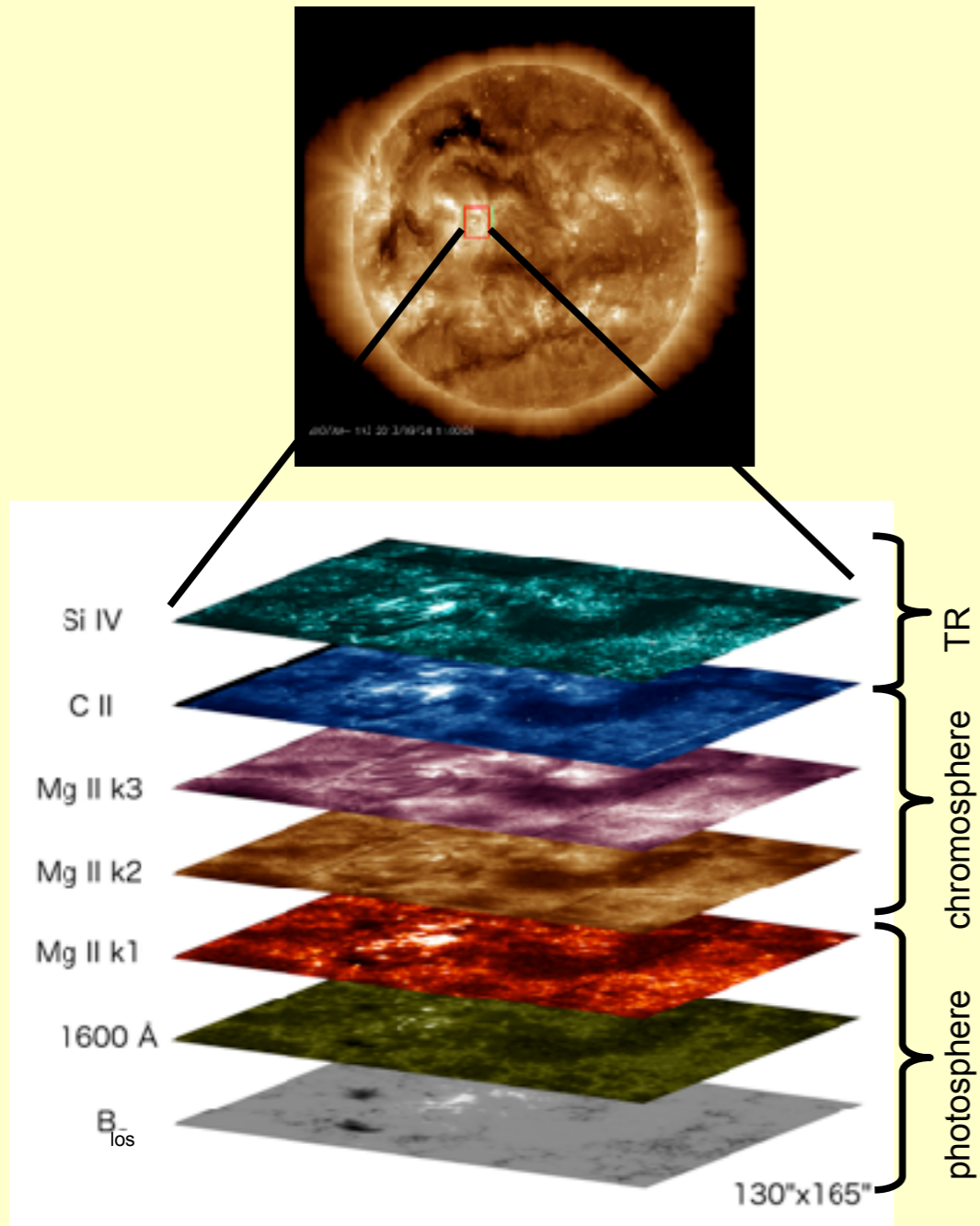




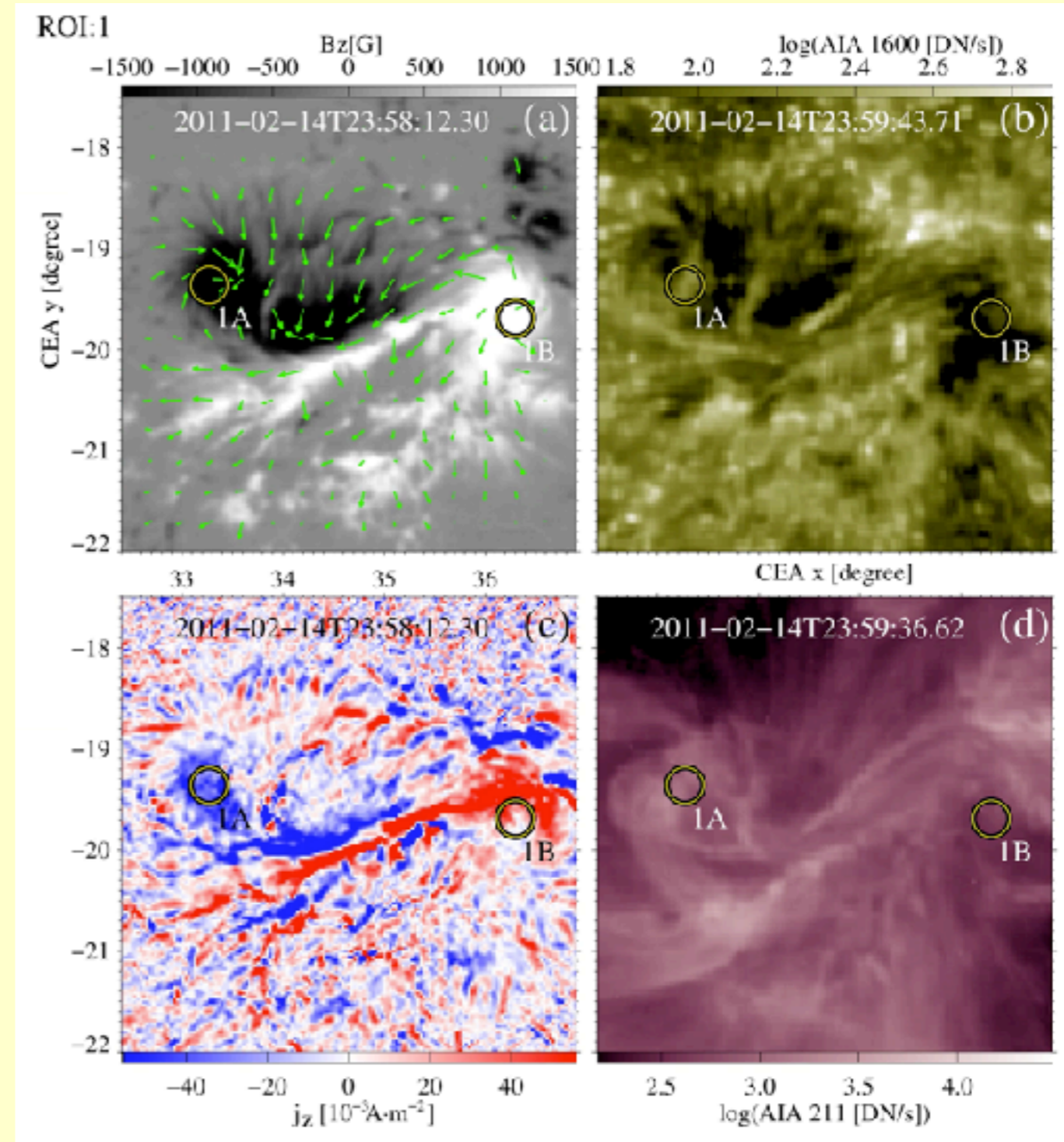
## Atmosfera Słońca

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

# Obserwacje Słońca (I)



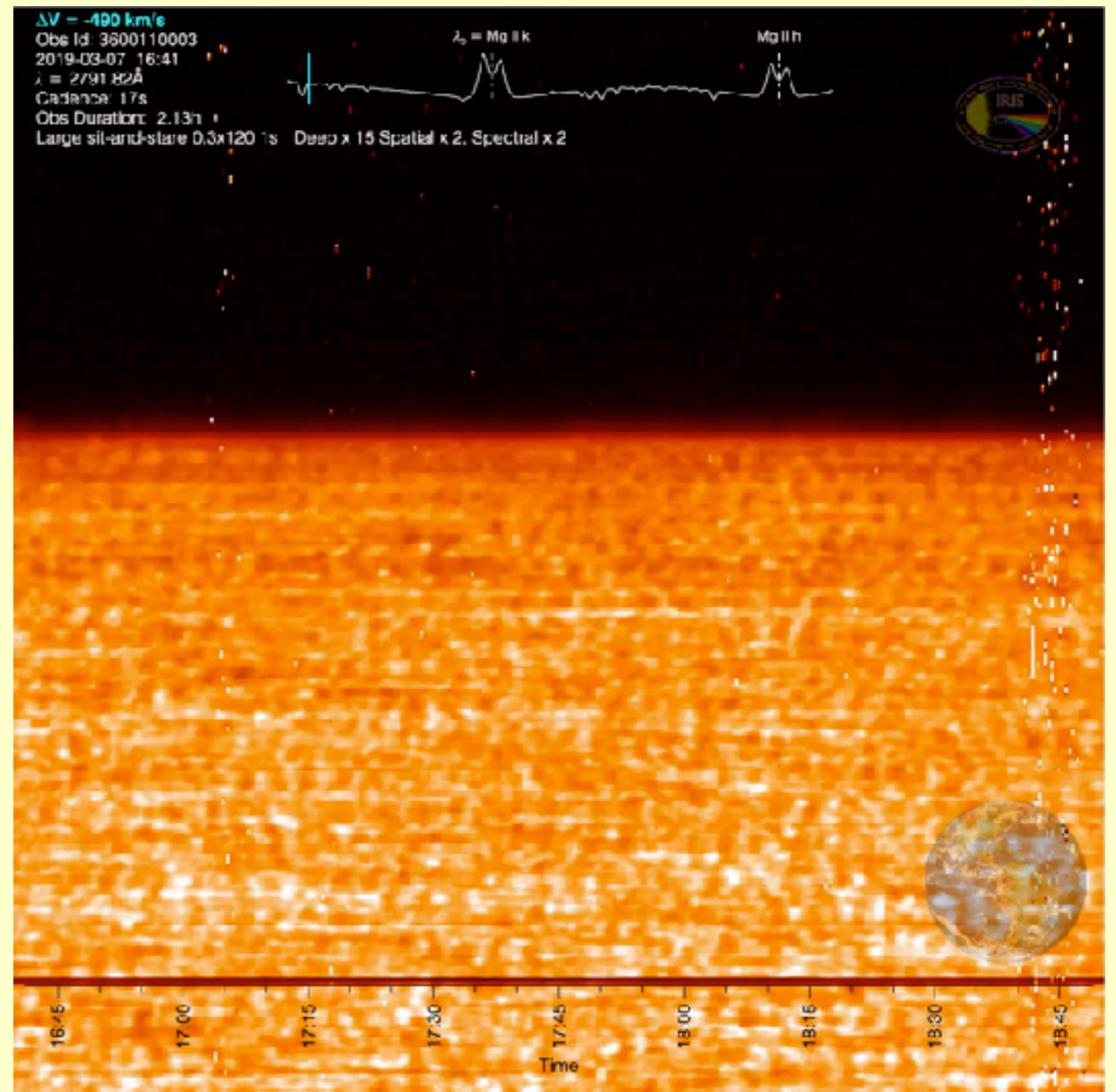
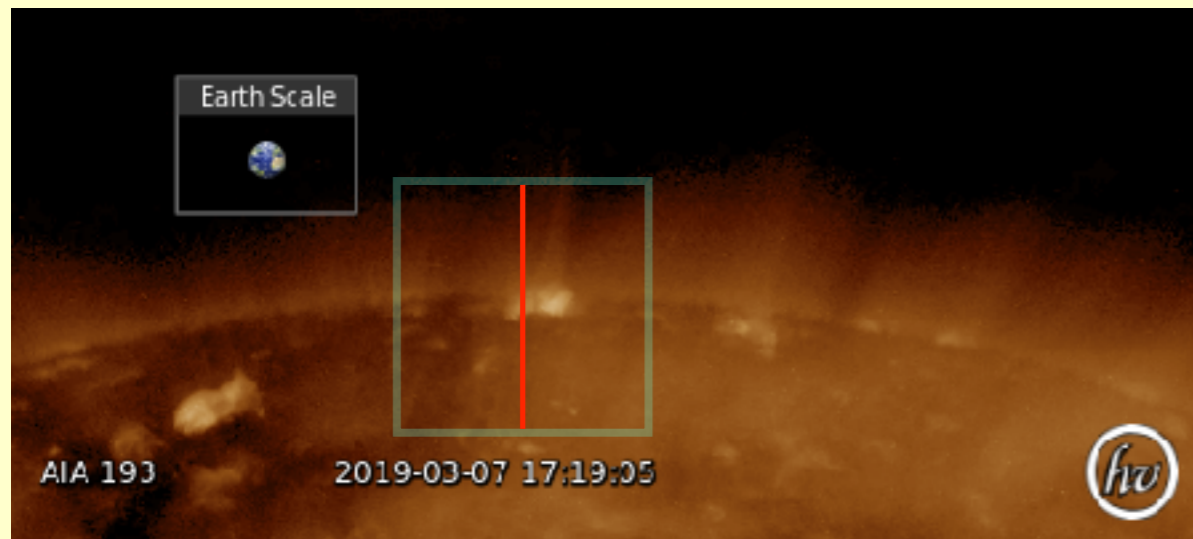
Zdjęcia atmosfery Słońca



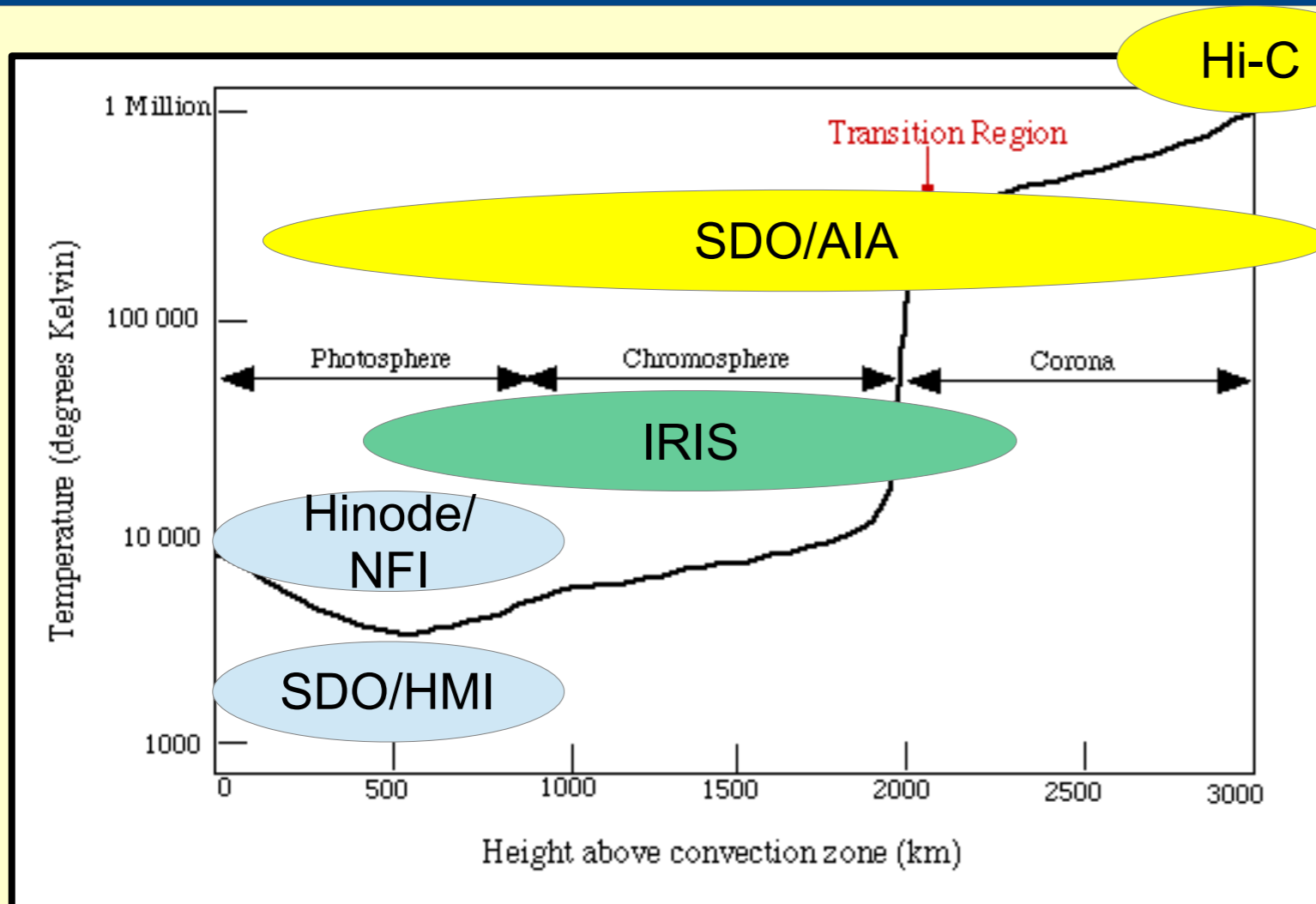
Pole magnetyczne i gęstość prądu



# Obserwacje Słońca (II)



Widmo -linia MgII



Sun, Earth, Sky by Kenneth Lang

## Pole magnetyczne:

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

## Zdjęcia:

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

## Spektrograf:

- Interface Region Imaging Spectrograph (IRIS)

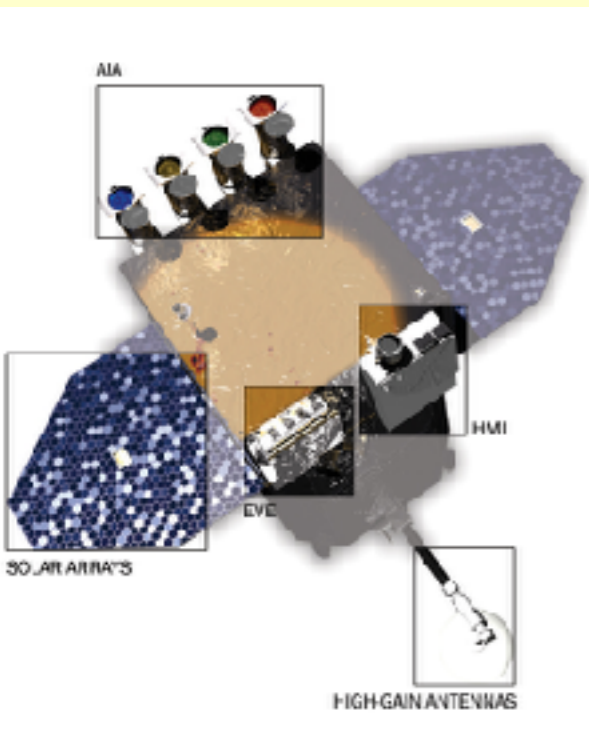
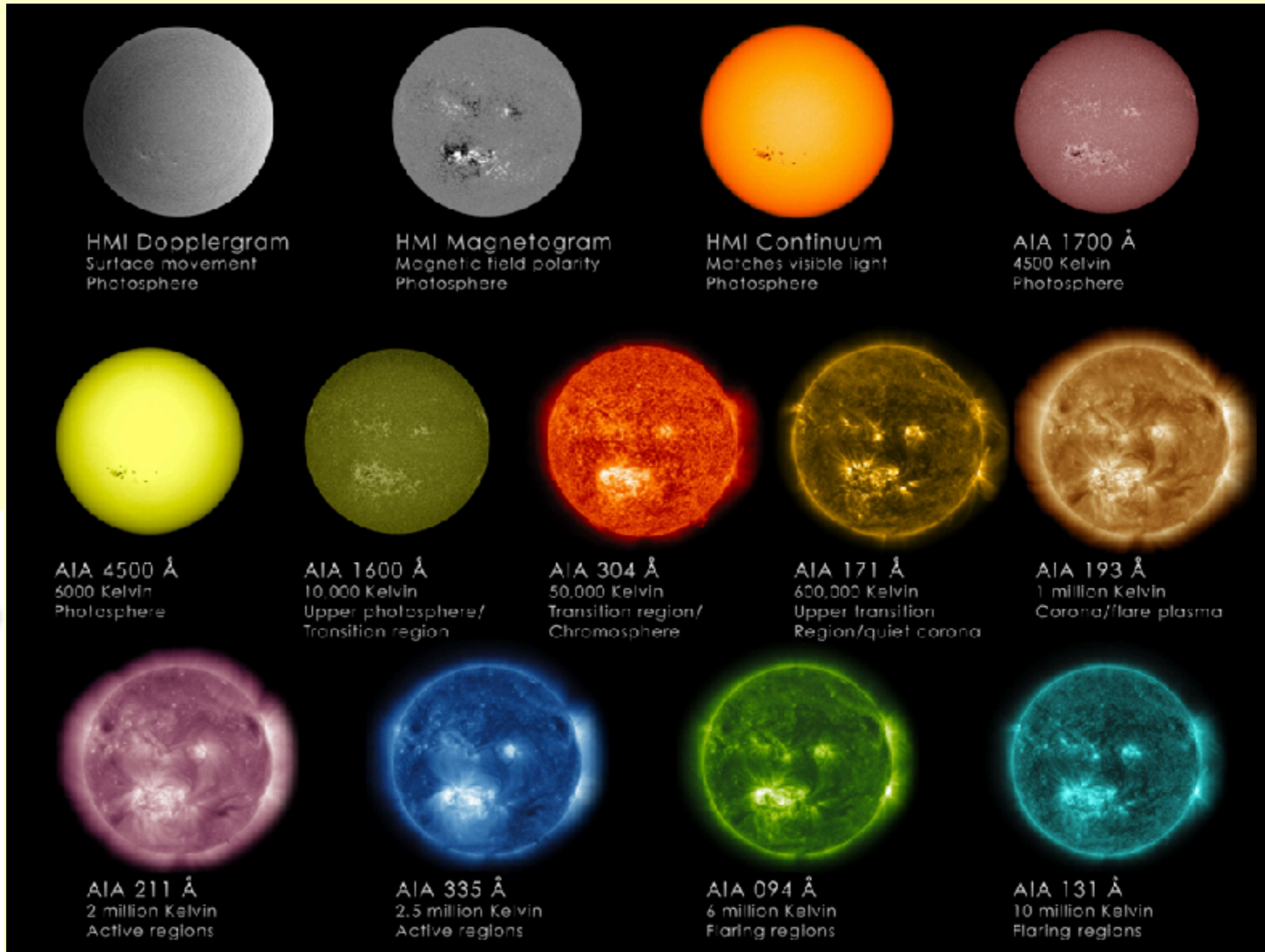


# SDO (Solar Dynamics Observatory)

- 11 Luty 2010



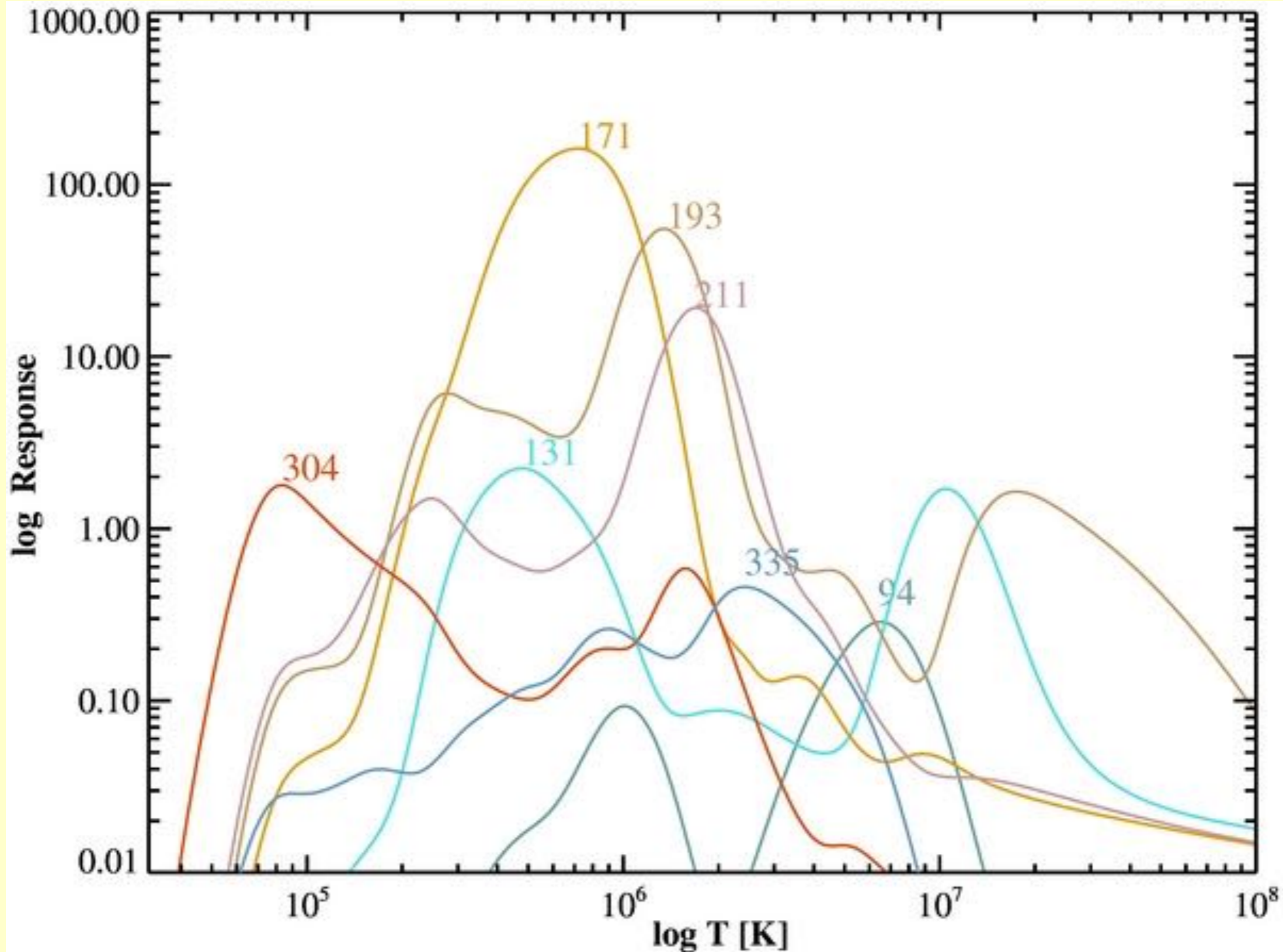
(NASA)



Solar Dynamics Observatory (NASA)

SDO images (NASA)

# SDO (Solar Dynamics Observatory)



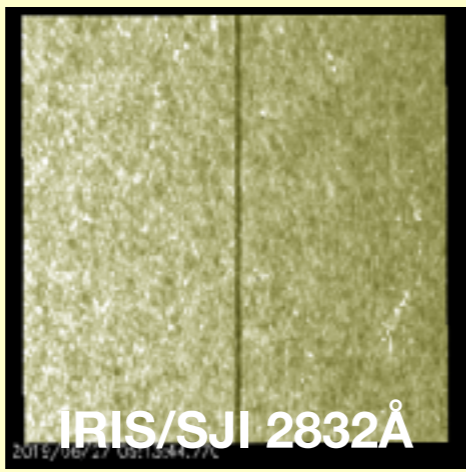


# IRIS (Interface Region Imaging Spectrograph)<sup>14</sup>

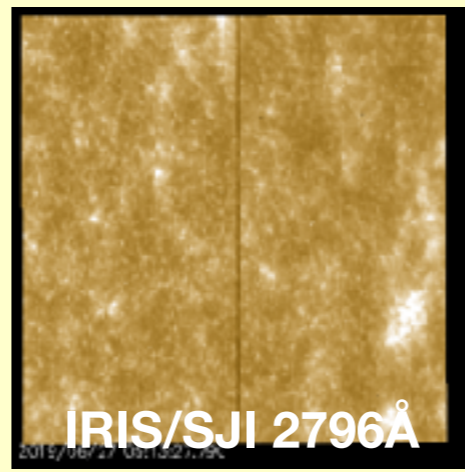
• 28 Czerwiec 2013



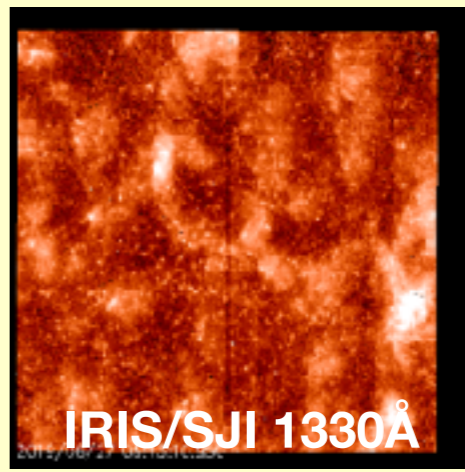
(LMSAL)



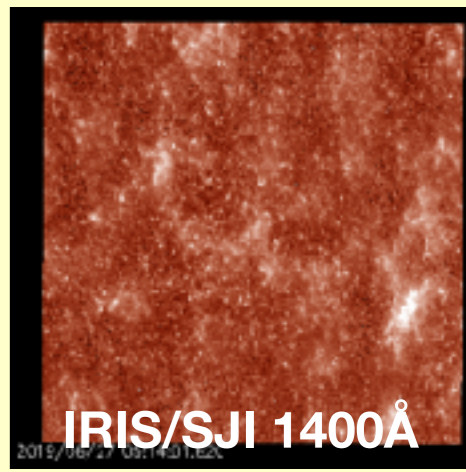
IRIS/SJI 2832Å



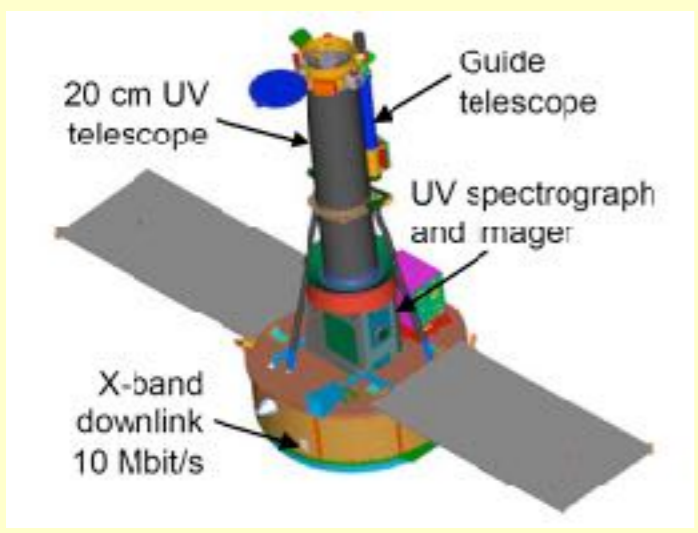
IRIS/SJI 2796Å



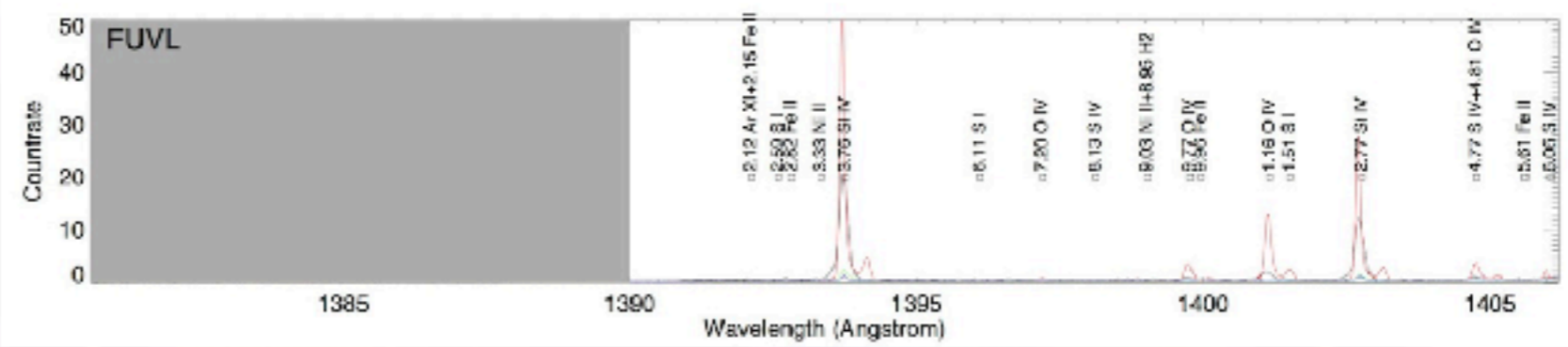
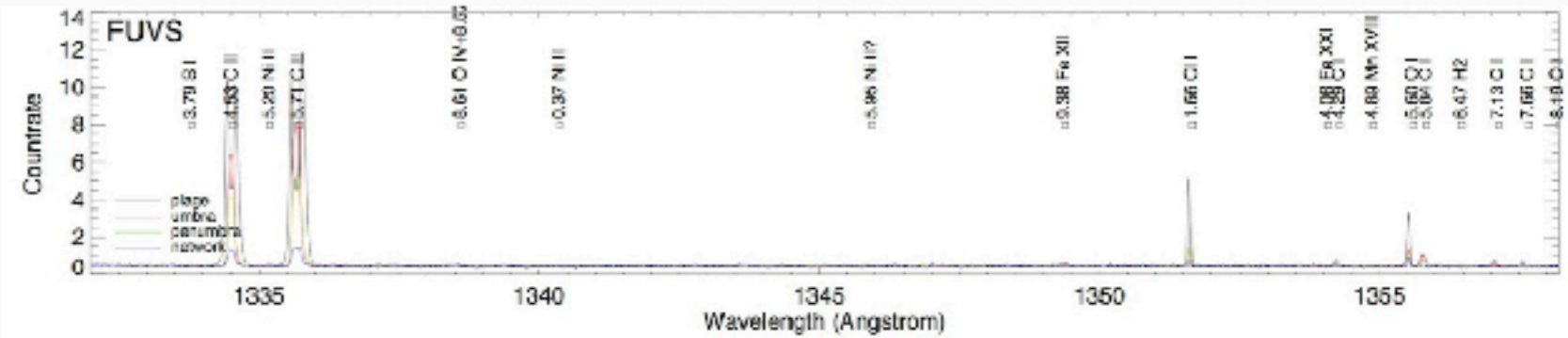
IRIS/SJI 1330Å



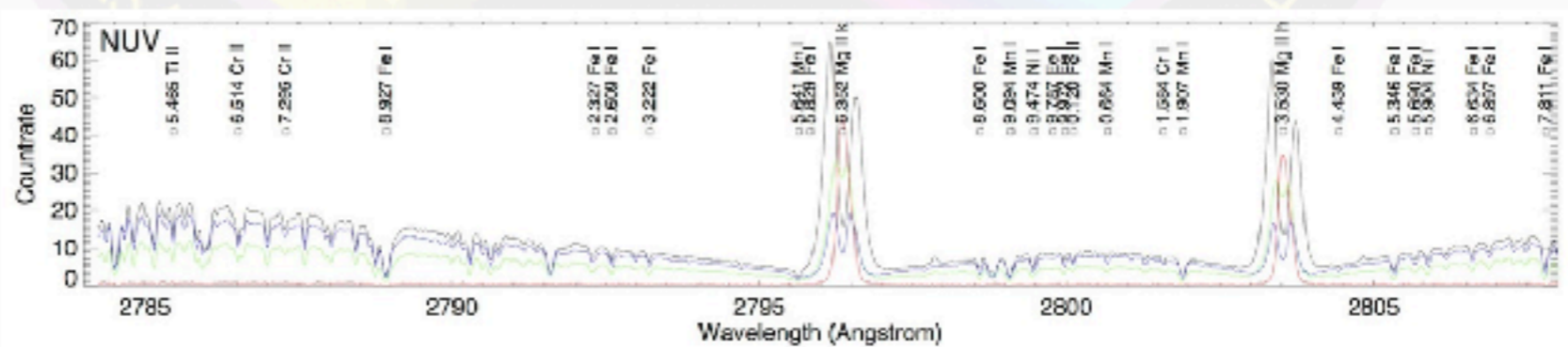
IRIS/SJI 1400Å



(LMSAL)



Quiet Sun "FUV" Sample Spectra



Quiet Sun "NUV" Sample Spectra

(LMSAL)

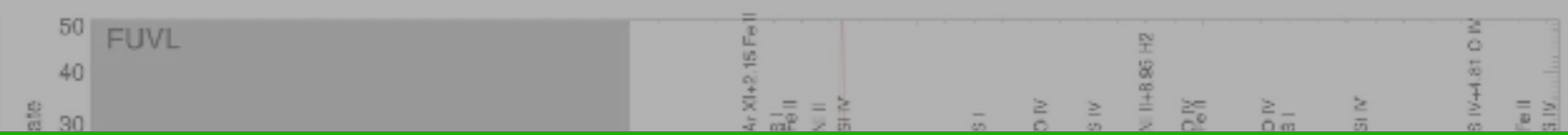
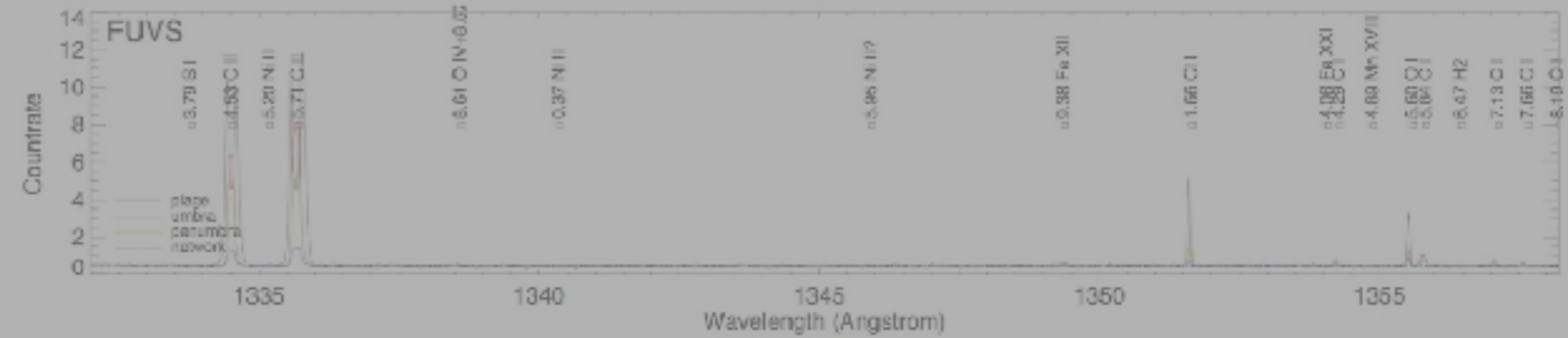
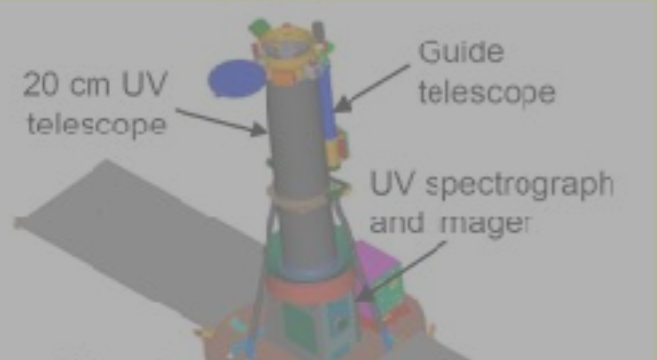
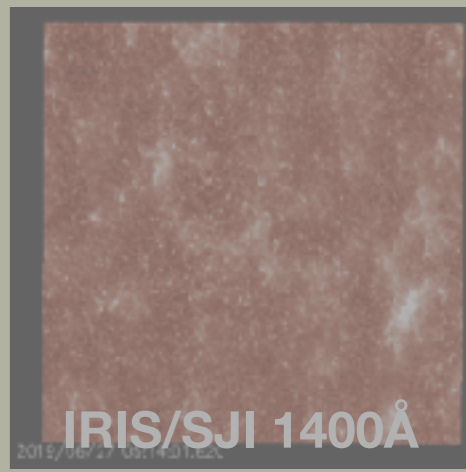
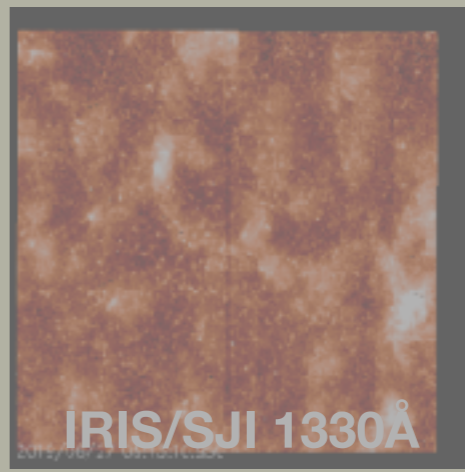
Zdjęcia  
+  
Widma

# IRIS (Interface Region Imaging Spectrograph)<sup>14</sup>

- 28 Czerwiec 2013



(LMSAL)

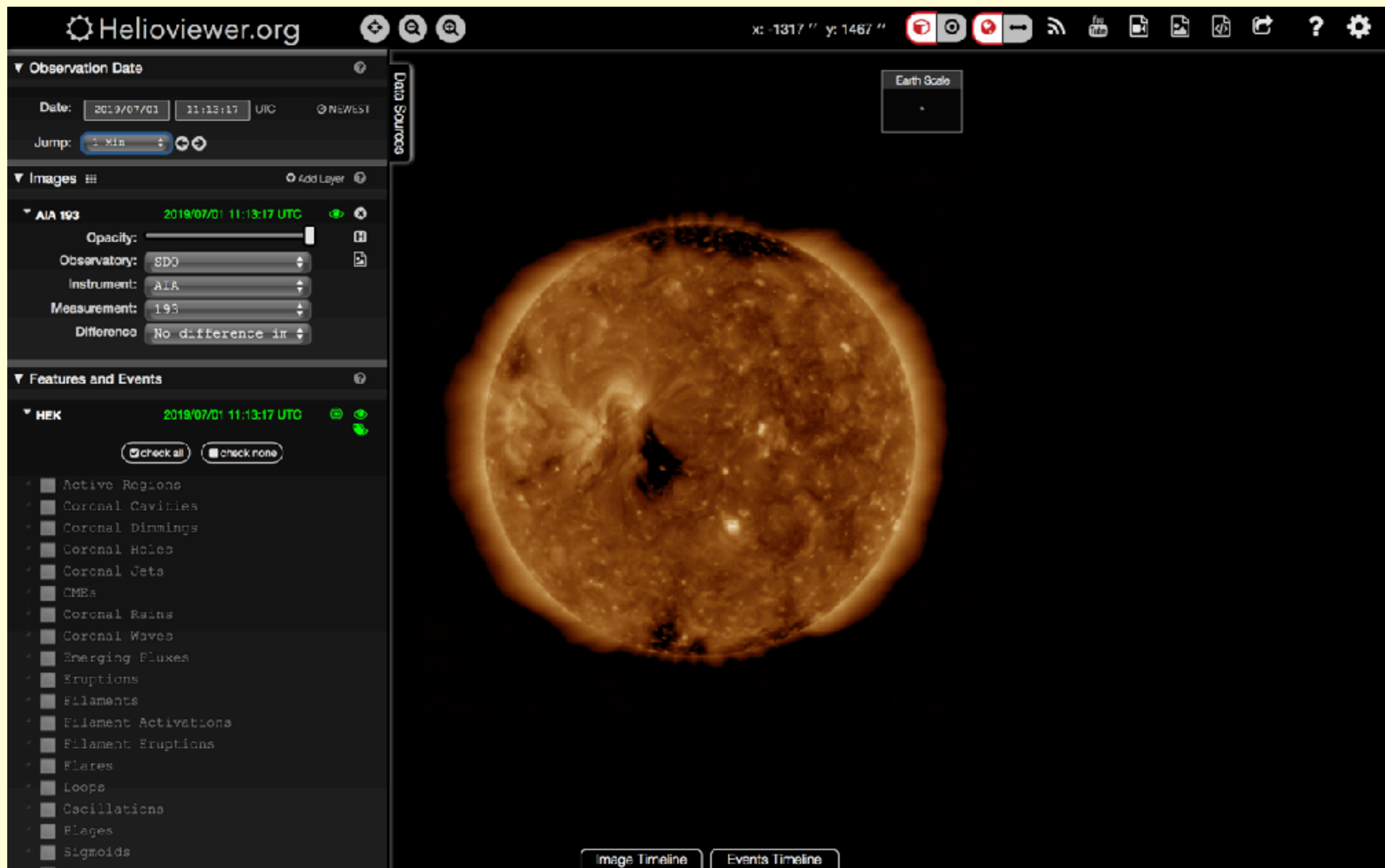


## Satelitarne obserwacje Słońca

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



# Helioviewer



The screenshot displays the Helioviewer.org web interface. At the top left, the logo "Helioviewer.org" is visible. The main content area shows a large, circular solar image in orange and yellow tones, with a dark sunspot visible near the center. The interface includes several control panels on the left side:

- Observation Date:** Date: 2019/07/01 11:13:17 UTC. Jump: 1 Min.
- Images:** AIA 193, 2019/07/01 11:13:17 UTC. Opacity: [slider]. Observatory: SDO. Instrument: AIA. Measurement: 193. Difference: No difference in.
- Features and Events:** HEK, 2019/07/01 11:13:17 UTC. [check all] [check none]. A list of solar features is shown, including Active Regions, Coronal Cavities, Coronal Dimmings, Coronal Holes, Coronal Jets, CMEs, Coronal Rain, Coronal Waves, Emerging Fluxes, Eruptions, Filaments, Filament Activations, Filament Eruptions, Flares, Loops, Oscillations, Plages, and Sigmoids.

At the bottom of the interface, there are buttons for "Image Timeline" and "Events Timeline". The top right corner shows the coordinates "x: -1317 '' y: 1467 ''" and various navigation icons.

<https://helioviewer.org>

# Helioviewer

The screenshot displays the Helioviewer.org interface. At the top left, the logo and name 'Helioviewer.org' are visible. The top right shows coordinates 'x: 5848 '' y: 3447 '' and a toolbar with icons for home, search, zoom, and other functions. The left sidebar contains several control panels:

- Observation Date:** Date: 2019/04/29 22:35:17 UTC, NEWEST, Jump: 12 hours.
- Images:** Add Layer button.
- XRT AI poly/Open:** 2019/04/29 22:36:41 UTC. Opacity slider, Observatory: Hinode, Instrument: XRT, Filter Wheel 1: Any, Filter Wheel 2: Any, Difference: No difference in.
- AIA 193:** 2019/04/29 22:35:29 UTC. Opacity slider, Observatory: SDO, Instrument: AIA, Measurement: 193, Difference: No difference in.
- LASCO C2:** 2019/04/29 22:36:07 UTC. Opacity slider, Observatory: SOHO, Instrument: LASCO, Detector: C2, Measurement: white-light, Difference: No difference in.
- LASCO C3:** 2019/04/29 22:30:07 UTC. Opacity slider, Observatory: SOHO, Instrument: LASCO, Detector: C3, Measurement: white-light.

The central area shows a composite solar image with a central disk and surrounding coronal structures. A 'Earth Scale' box is located in the upper right of the image area. At the bottom, there are buttons for 'Image Timeline' and 'Events Timeline'.



# Heliospheric Event Knowledgebase

LMSAL >> Sungate >> iSolSearch

HEK home Recently reported events Search Events Search Data Request AIA Data API Contact Us

Search Filters Special

Start Date: 2014-07-01T00:00:00

End Date: 2014-07-01T23:59:59

Choose Event Types:  
[all](#) / [invert](#) / [common](#) / [clear](#)

- Active Region
- CME
- Coronal Cavity
- Coronal Dimming
- Coronal Hole
  - Size > .01
  - % of surface area
- Coronal Jet
- Coronal Rain
- Coronal Wave
- Emerging Flux
- Eruption
- Filament
- Filament Eruption
- Filament Activation
- Flare
- Loop
- Oscillation
- Sigmoid
- Spray Surge
- Sunspot
- Topological Object
- Plage
- UV Burst

Search

Disk Carrington Map

Search results ([export](#))

- 1.HARP#4284(NOAA#12098)
- 2.EF: EmergingFlux
- 3.HARP#4295(NOAA#12103)
- 4.HARP#4296(NOAA#12108)
- 5.HARP#4315(NOAA#12108)
- 6.HARP#4288(NOAA#12100)
- 7.HARP#4312
- 8.HARP#4294(NOAA#12106)
- 9.HARP#4293
- 10.HARP#4272(NOAA#12095)
- 11.HARP#4302(NOAA#12105)
- 12.EF: EmergingFlux
- 13.CH: CoronalHole
- 14.CIH: CoronalHole
- 15.CH: CoronalHole
- 16.CH: CoronalHole
- 17.CH: CoronalHole
- 18.CH: CoronalHole
- 19.CIH: CoronalHole
- 20.TO: TopologicalObject
- 21.TO: TopologicalObject
- 22.TO: TopologicalObject
- 23.TO: TopologicalObject
- 24.TO: TopologicalObject
- 25.TO: TopologicalObject
- 26.TO: TopologicalObject
- 27.TO: TopologicalObject
- 28.TO: TopologicalObject
- 29.TO: TopologicalObject
- 30.TO: TopologicalObject
- 31.TO: TopologicalObject
- 32.TO: TopologicalObject
- 33.TO: TopologicalObject
- 34.TO: TopologicalObject
- 35.TO: TopologicalObject
- 36.TO: TopologicalObject

84. AR: ActiveRegion

Note: Latitudinal extent not provided by SWPC and is calculated assuming area=lat\_ext\*long\_ext.

Start: 2014-07-01T00:00:00  
 End: 2014-07-01T23:59:59  
 Location (deg deg): 30, 12  
 Coord Sys: UTC-HGS-TCPU  
 Observatory: various  
 Instrument: various  
 Channel: visible  
 FRM: NOAA SWPC Observer  
 Archived: 2014-07-01T08:34:07  
 NOAA AR#: 12097  
 Mt. Wilson class: ALPHA  
 Area: 100 Mm2

[Search for publications on ADS](#)  
[NASA Solar Monitor](#)  
[Heliosphere.org](#)  
[HEK event summary](#)  
[VCEvent XML](#)  
[Get SDO Data](#)

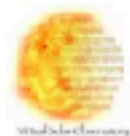
Observations in the neighborhood

[IRIS \(2786, 1400\): Fast rasters of AR12100 boundary; Fast rasters of AR12100 boundary](#)  
[AIA \(171\)](#)  
[SOT \(Ca I H line, TF Na I 5896, G band 4305\): AR: AR 12096](#)  
[IRIS \(1330, 2832, 2796, 1400\): Throughput monitoring; Throughput monitoring](#)  
[IRIS \(2786, 1400\): Dense raster on bright plage in AR 12096; Dense raster on bright plage in AR 12096](#)  
[IRIS \(2786, 1400\): AR dense raster on sunspot in AR 12096; AR dense raster on sunspot in AR 12096](#)  
[IRIS \(2786, 1400\): AR dense raster on sunspot in AR 12093; AR dense raster on sunspot in AR 12093](#)  
[SOTSP \(6302A Velocity 6301.5A, 6302A Transverse Flux Density, 6302A Continuum Intensity, 6302A Longitudinal Flux Density\): AR: AR 12096](#)  
[SOTEP \(6302A Velocity 6301.5A, 6302A Transverse Flux Density, 6302A Continuum Intensity, 6302A Longitudinal Flux Density\): AR: AR 12096](#)  
[EIS \(SiIV, CaXV, SiX, FeXVI, SiX, FeXXIV, NiXV, FeIX, FeXIV, FeXIII, CaXVI, FeXI, MgVII, FeX, FeVIII, FeXIII, FeXV\): AR: Diagnostic scan of AR](#)  
[SOTSP \(6302A Velocity 6301.5A, 6302A Transverse](#)

<< 2014-07-01T00:00:00 >>  
 2014-07-01T23:59:59 >>>

clear

# Bazy danych -VSO



## VSO Time / Instrument Search Form

Version 1.4



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

**Start:** 2019 Jun 05 / 12 : 00  
**End:** 2019 Jun 05 / 15 : 59



# Bazy danych -IRIS+Hinode

Heliophysics Knowledgebase Event+Data Search [Help/About](#) [Export SSW](#) [Export JSON](#)

2019-06-20T00:00 2019-06-21T00:00

**Exposure Time**  
 Min Exp:   
 Exp Time:

**Target**  
 XCEN:   
 YCEN:   
 Radius:   
 OBSID:   
 Target:

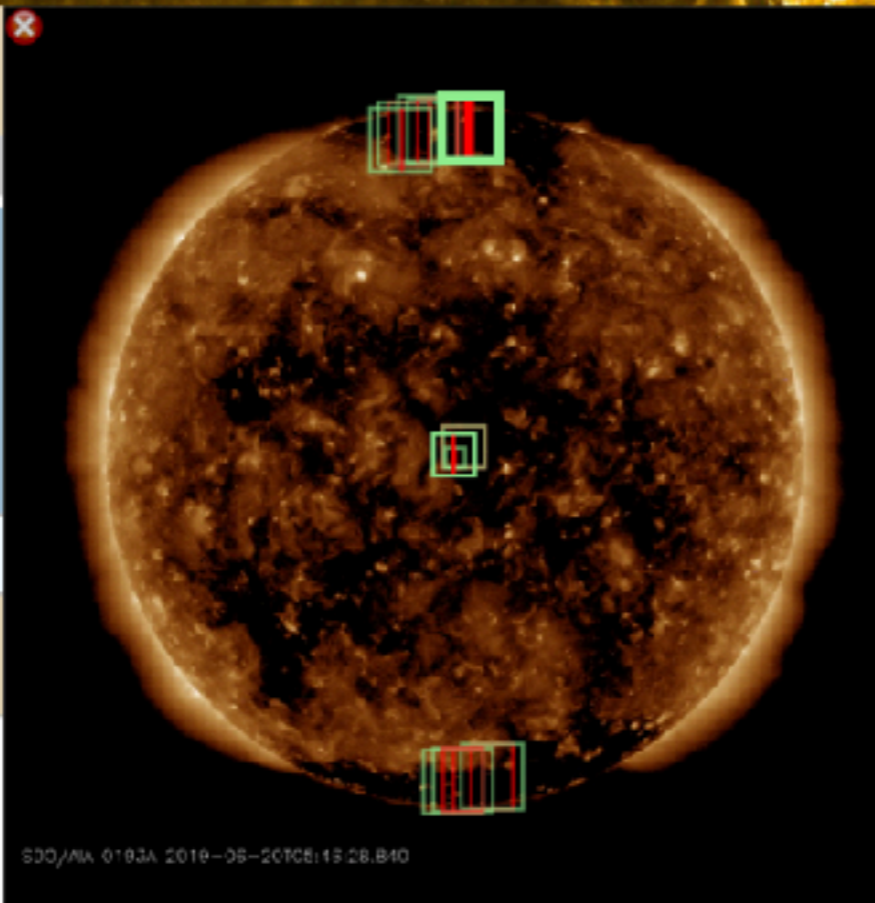
**Spectral Lines**

Desc:  **Events**

**Correlated**  
 SOT:  Req  Opt  
 SOTSP:  Req  Opt  
 XRT:  Req  Opt  
 EIS:  Req  Opt

Count: 13    193

Only OBS with data  Only Annotated

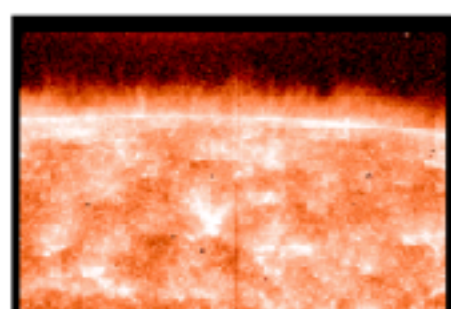


SDO/MIA\_0103A\_2019-06-20T06:15:28.B40


Time	Goal	X,Y
+1d		
2019-03-20 01:20-02:47	Plume region at the South Pole	105°, -880"
2019-03-20 02:58-03:47	Plume region at the North Pole, sit-and-stare	-70°, 896"
2019-03-20 04:20-04:38	A1: QS monitoring	26°, 24"
2019-03-20 04:49-06:16	Plume region at the North Pole	-45°, 891"
2019-03-20 09:27-07:25	Plume region at the North Pole, sit-and-stare	-145°, 866"
2019-05-20 07:39-12:05	SST/GREGOR coordination	3°, -5"
2019-03-20 12:18-14:01	Plume region at the South Pole	-1°, -893"
2019-03-20 14:15-15:52	Plume region at the North Pole, sit-and-stare	-46°, 897"

**Event Details**

**IRIS**  
 2019-06-20T14:15:03 - 2019-06-20T15:52:25



# Bazy danych - JSOC


JSOC Data Export

[Home 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	<input type="checkbox"/>	Check box to allow upload of RecordSet list file, file will be requested after Submit button click.
RecordSet	<input type="text" value="hmi.sharp_cea_720s[377][2011.02.15_00:00:00_TAI-2011.02.15_04:00:00_TAI][Ep,Br"/>	<input type="button" value="Generate"/>
Record Limit	<input type="text" value="none"/>	Optional manual limit to number of records to export.
Record Count	<input type="text" value="21"/>	<input type="button" value="Recount"/> Limit for AIA to about 15,000 and for HMI about 30,000 in each request.
Method	<input type="text" value="url"/>	Choose method, url_quick or url for now. url_quick implies protocol of "as-is"
Filename Format	<input type="text" value="hmi.sharp_cea_720s.(HARPNUM).(I_REC:A)"/>	File name template.
	<input type="checkbox"/> no_op - none <input type="checkbox"/> hide <input type="checkbox"/> aia_scale - Scale image to 0.6 arcsec/pixel (compatible with 2D datasets with CTYPE1 == HPLN-TAN and CTYPE2 == HPLT-TAN only) <input type="checkbox"/> HmiB2ptr - Convert HMI B_720s to Phi,Theta,R coordinates <input type="checkbox"/> resize - Resize and rotate if needed, use sub-pixel registration <input type="checkbox"/> im_patch - Extract sub-frame <input checked="" type="checkbox"/> maproj - Extract a sub-frame and remap to a chosen projection. <input type="checkbox"/> rebin - Rebin with boxcar or gaussian smoothing	
Processing		
	<p>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.level_cuv_12s, aia.level_uv_24s, or aia.level_vis_1h</p> <p>Options      Visible grid spacing in degrees, <input type="text" value="none"/>      NOAA AR number: <input type="text" value="11158"/> at 2011.02.13_23:59:59Z</p> <p>CLong      <input type="text" value="034"/>      Carrington longitude of patch center.    <input type="checkbox"/> Check for disk center longitude.</p> <p>CLat      <input type="text" value="-20"/>      Latitude of patch center.</p> <p>MapProjection      <input type="text" value="Plate Carree - simple latitude vs lon"/></p> <p>MapScale      <input type="text" value="0.00179"/>      Scale in degrees per pixel after mapping. Choose &lt;= 0.00179</p> <p>Width      <input type="text" value="800"/>      Width of extracted patch in pixels.</p> <p>Height      <input type="text" value="400"/>      Height of extracted patch in pixels.</p> <p>Verify      <input type="text" value="check params"/>      OK to submit</p>	
Maproj		
Protocol	<input type="text" value="FITS"/>	Choose protocol, "FITS", "JPEG", "MPG", "MP4", or "as-is". Note uncompressed FITS not an option
Notify	<input type="text" value="solarmail"/>	Provide your email address for notification. If Requestor is your SolarMail name you may use "solarmail" here.
Requestor	<input type="text" value="none"/>	Provide your identifier, e.g. your SolarMail name.
	<input type="button" value="Check Params for Export"/>	<span style="color: red;">Notify field must be set before submit.</span>
	<input type="button" value="Not Ready To Submit"/>	Please only click once for export request.
	<input type="checkbox"/>	check to show export params.

Home page for: [SDO-JSOC](http://jsoc.stanford.edu)

<http://jsoc.stanford.edu>



# Bazy danych - JSOC

JSOC Data Export

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

Record Limit  Optional manual limit to number of records to export.

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

Method  Choose method, url\_quick or url for now. url\_quick implies protocol of "as-is"

Filename Format  File name template.

Processing

no\_op - none  hide

aia\_scale - Scale image to 0.6 arcsec/pixel (compatible with 2D datasets 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

maproj - Extract a sub-frame and remap to a chosen projection.

rebin - Rebin with boxcar or gaussian smoothing

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.

**Narzędzia online + bazy danych**

- Darmowe
- Proste w obsłudze

Thank you for your attention!

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