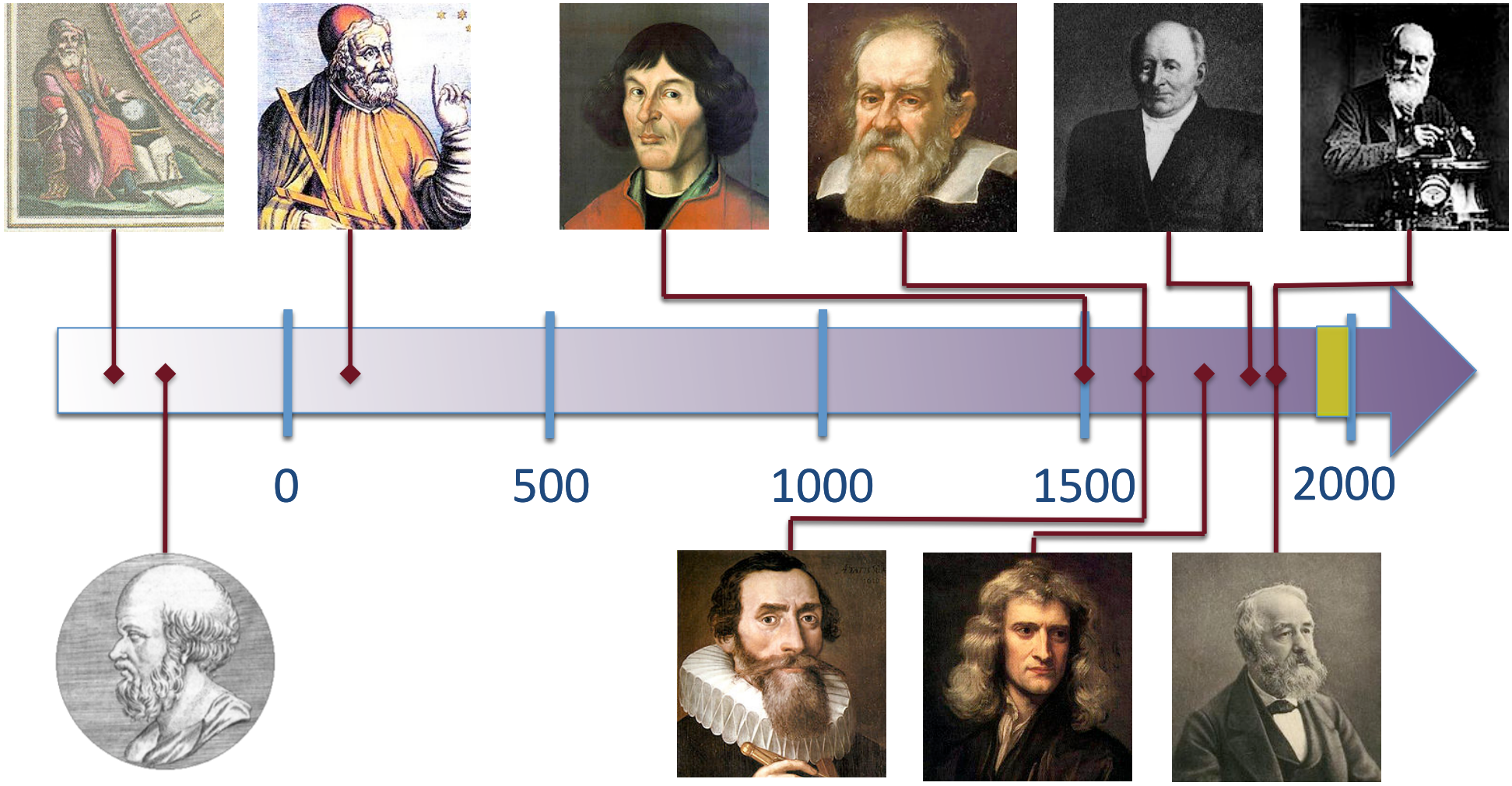
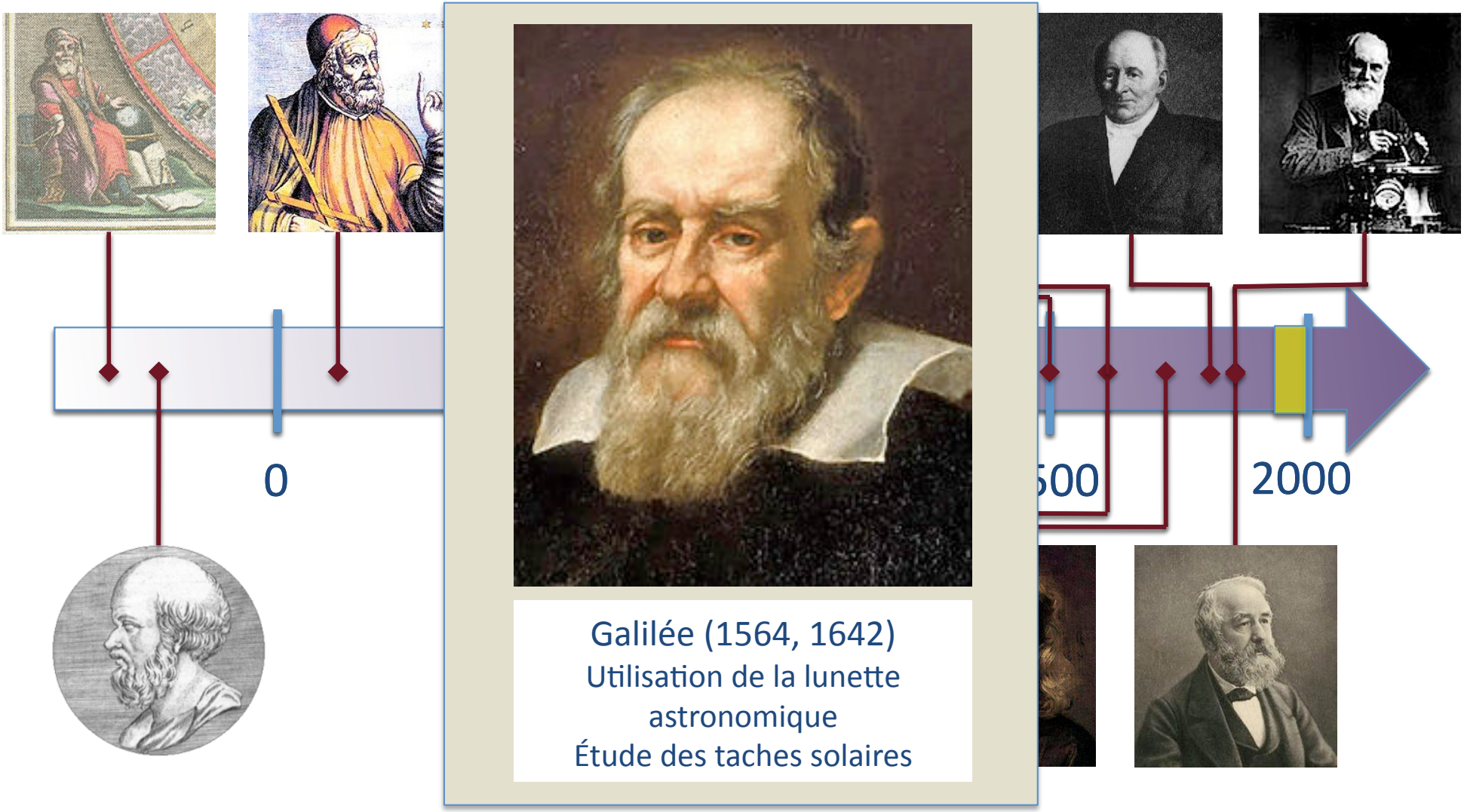
PROBA2
et l'activité solaire

M. Dominique
Observatoire Royal de Belgique

Il était une fois …



Il était une fois …



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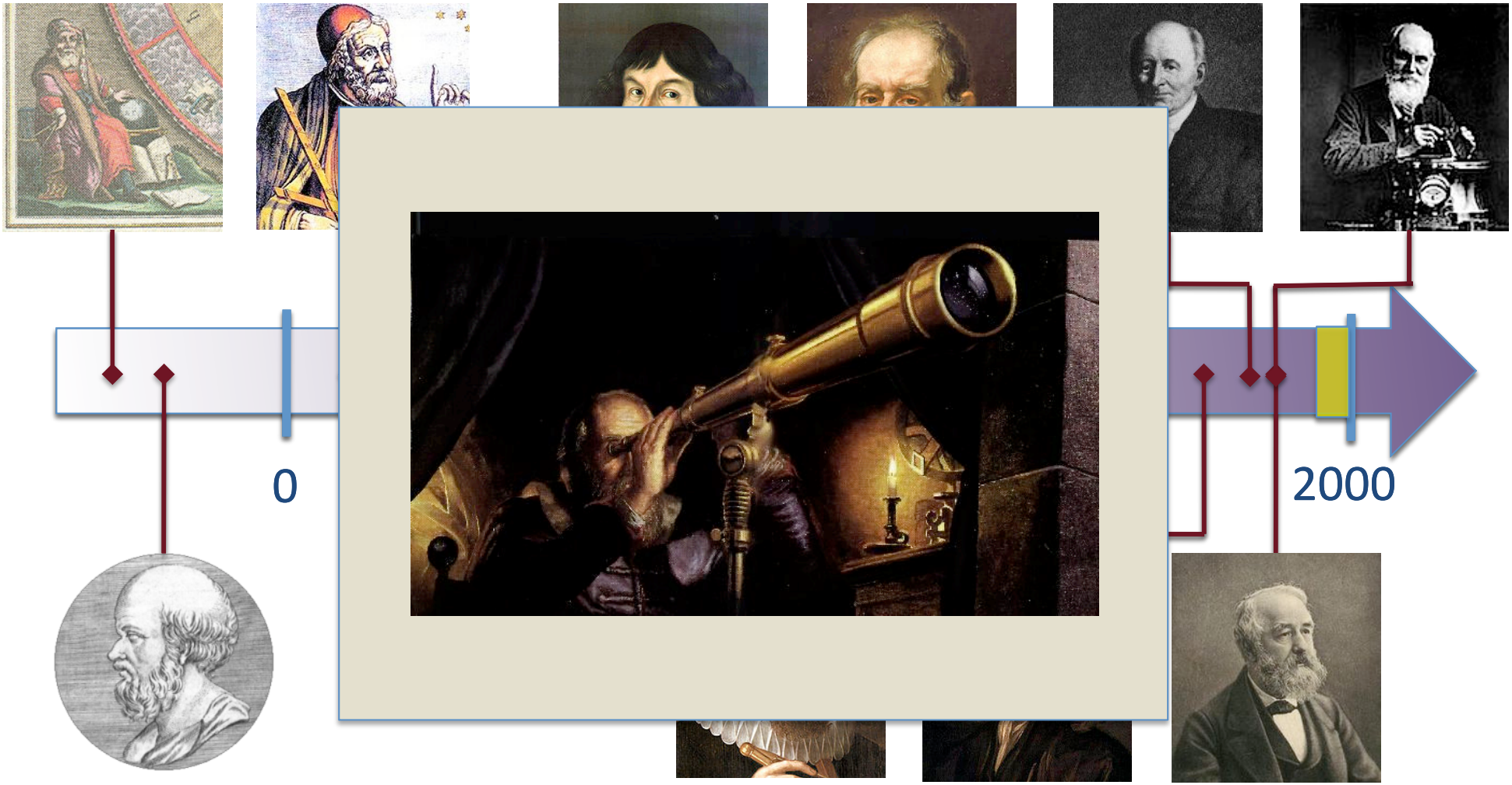

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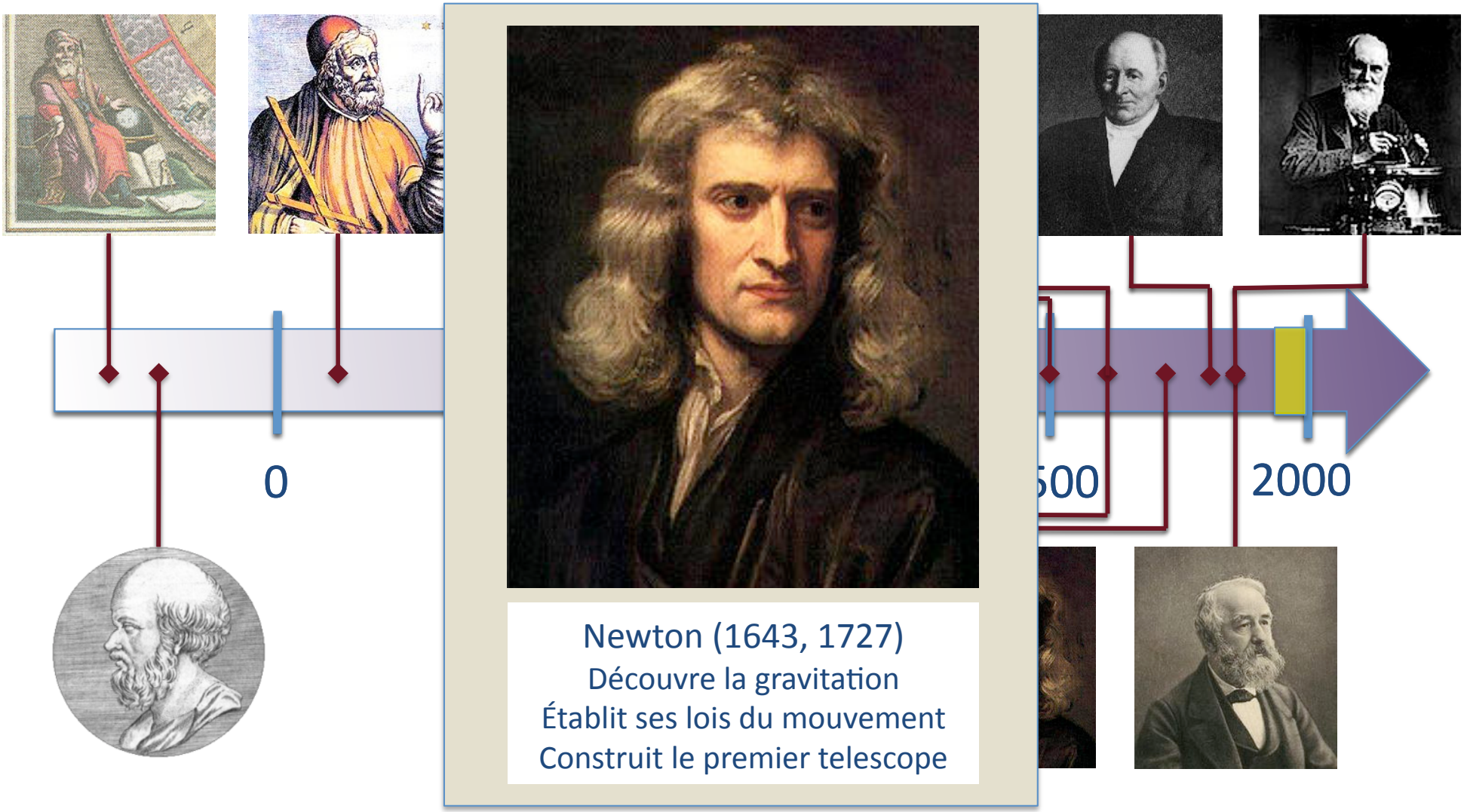

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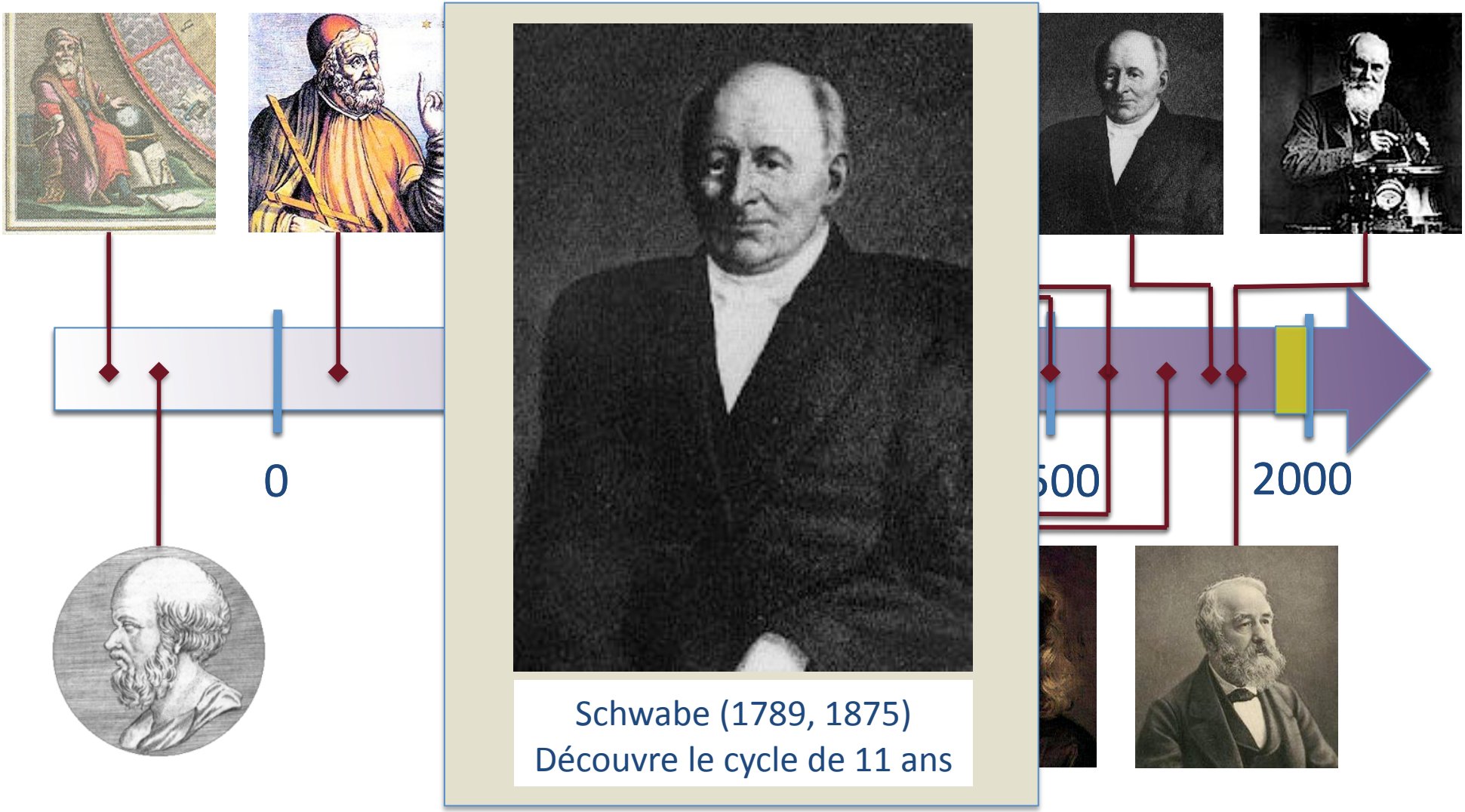

Il était une fois …

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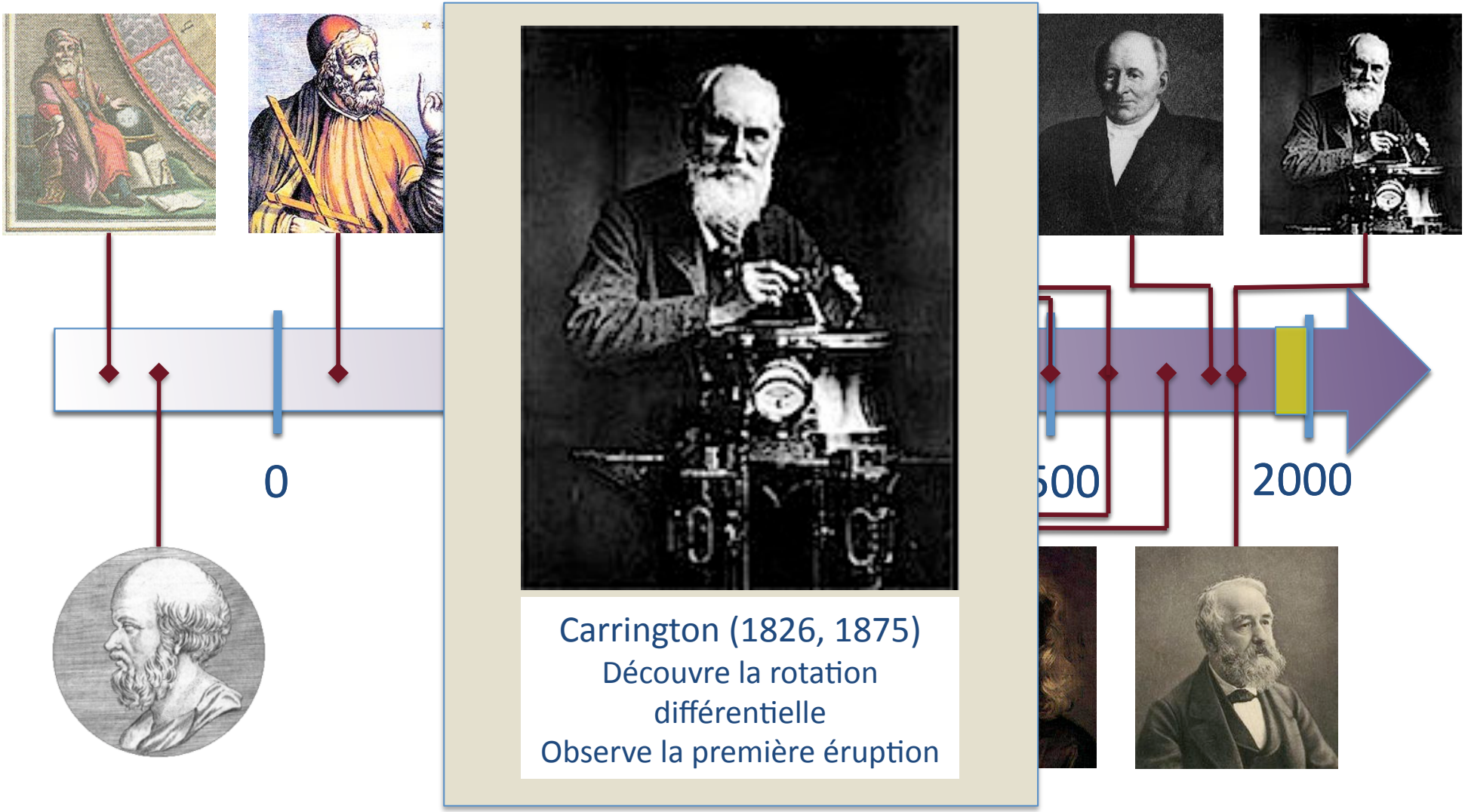
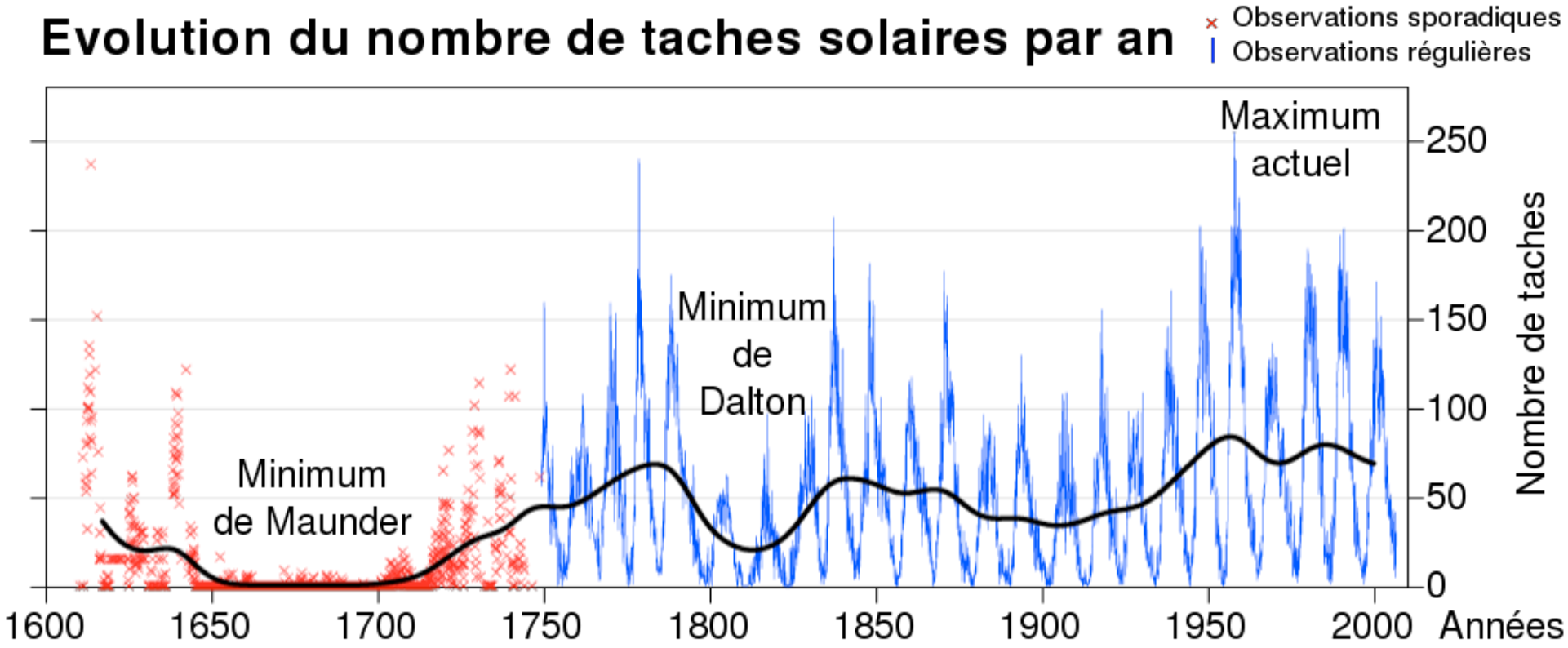
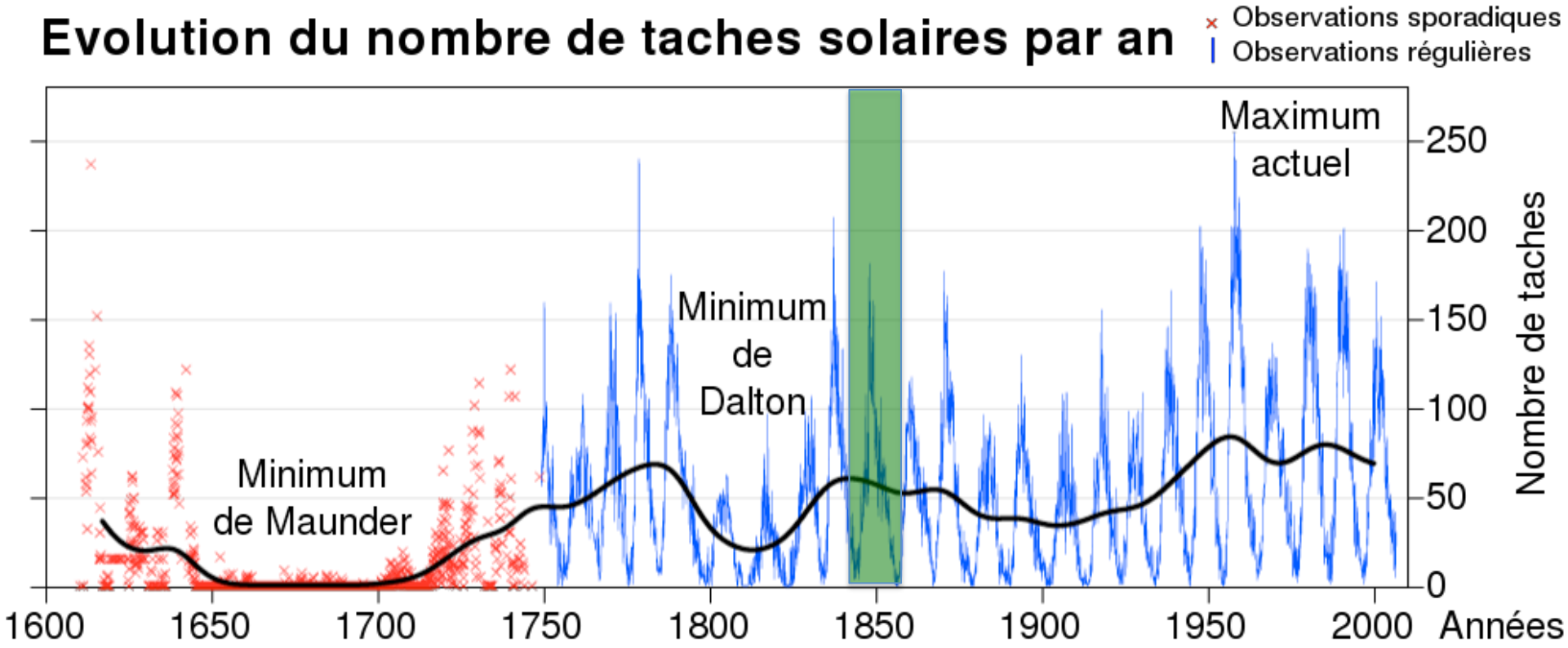


Taches solaires et cycle d'activité

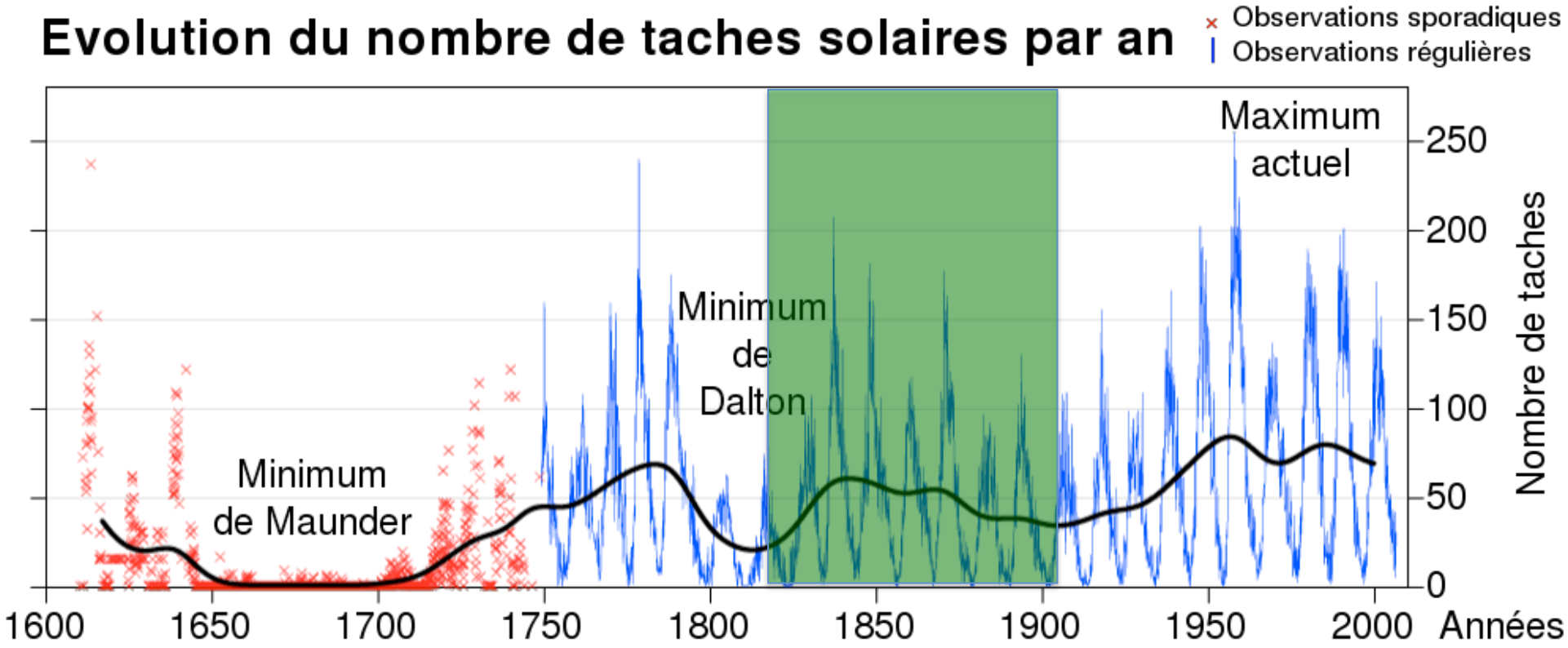


Taches solaires et cycle d'activité



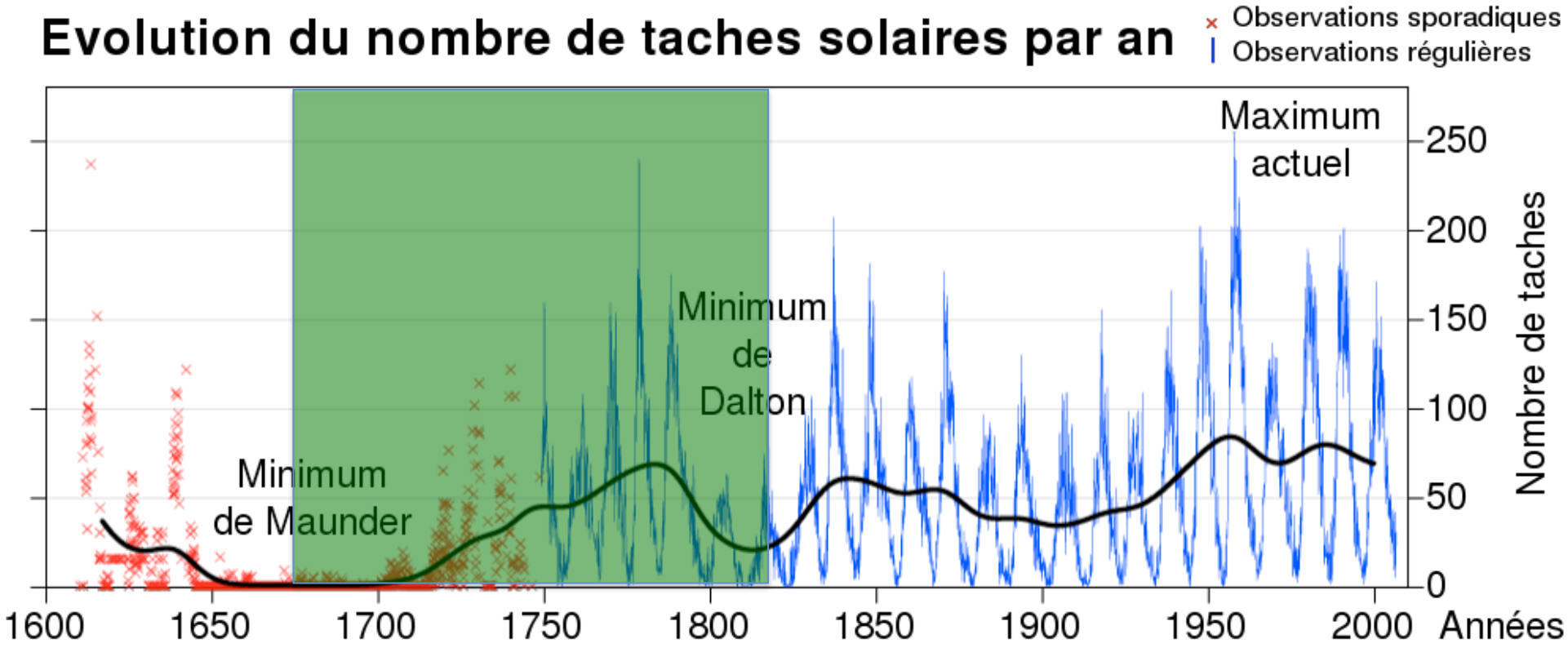
Cycle de Schwabe

Taches solaires et cycle d'activité



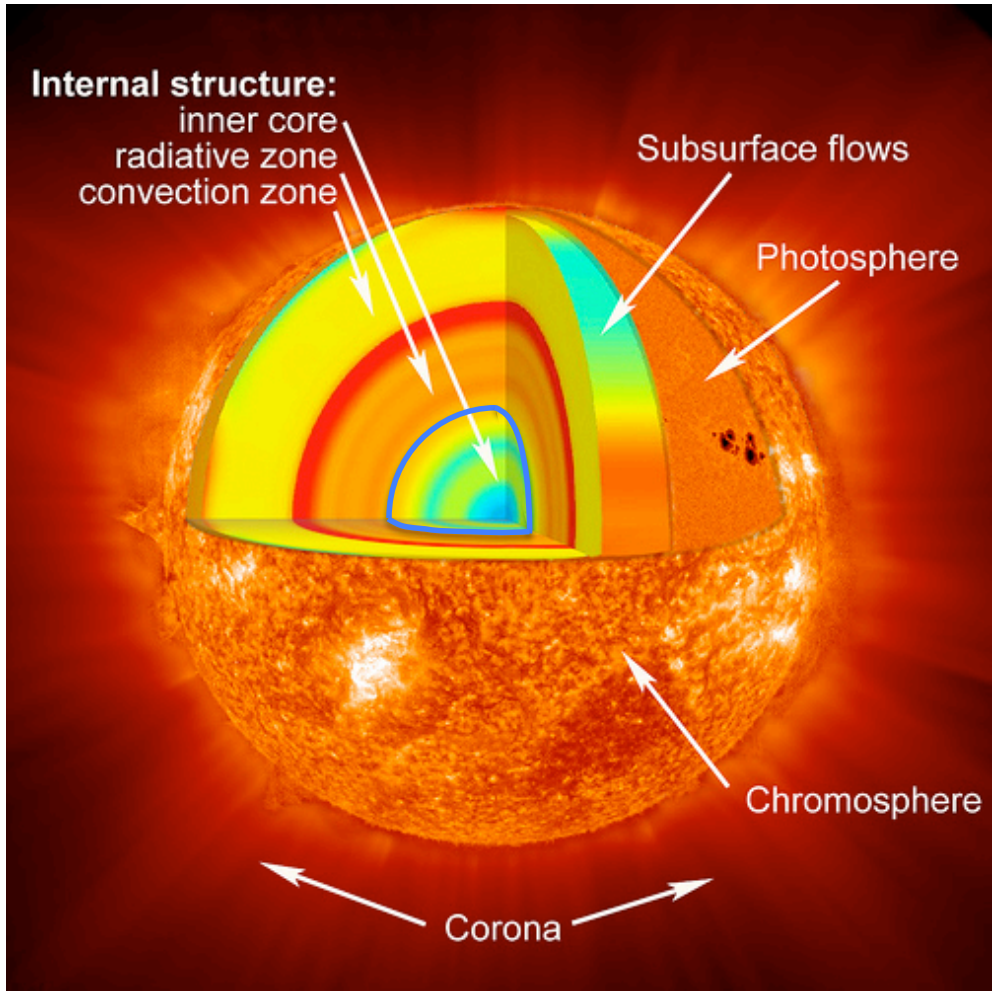
Cycle de Gleissberg

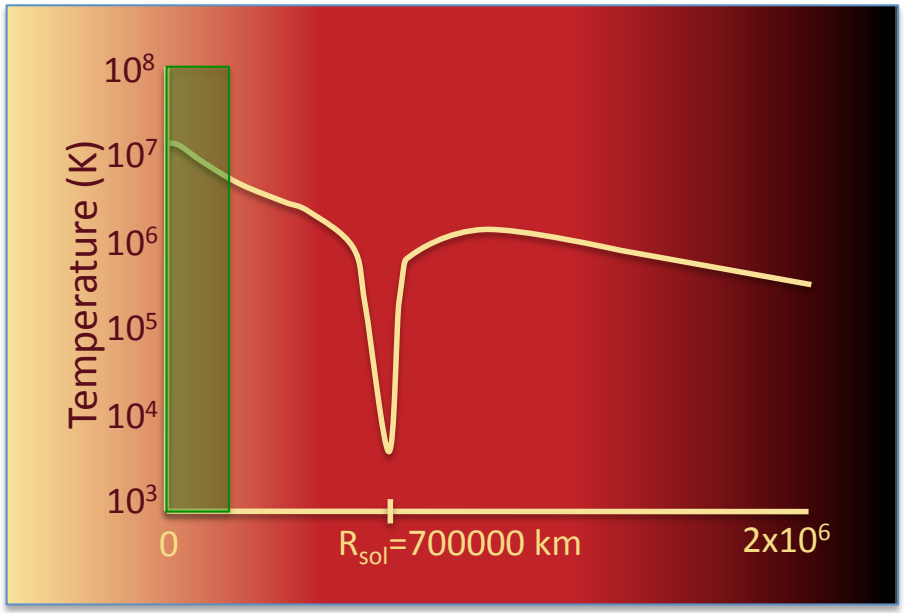
Taches solaires et cycle d'activité



Cycle de Suess

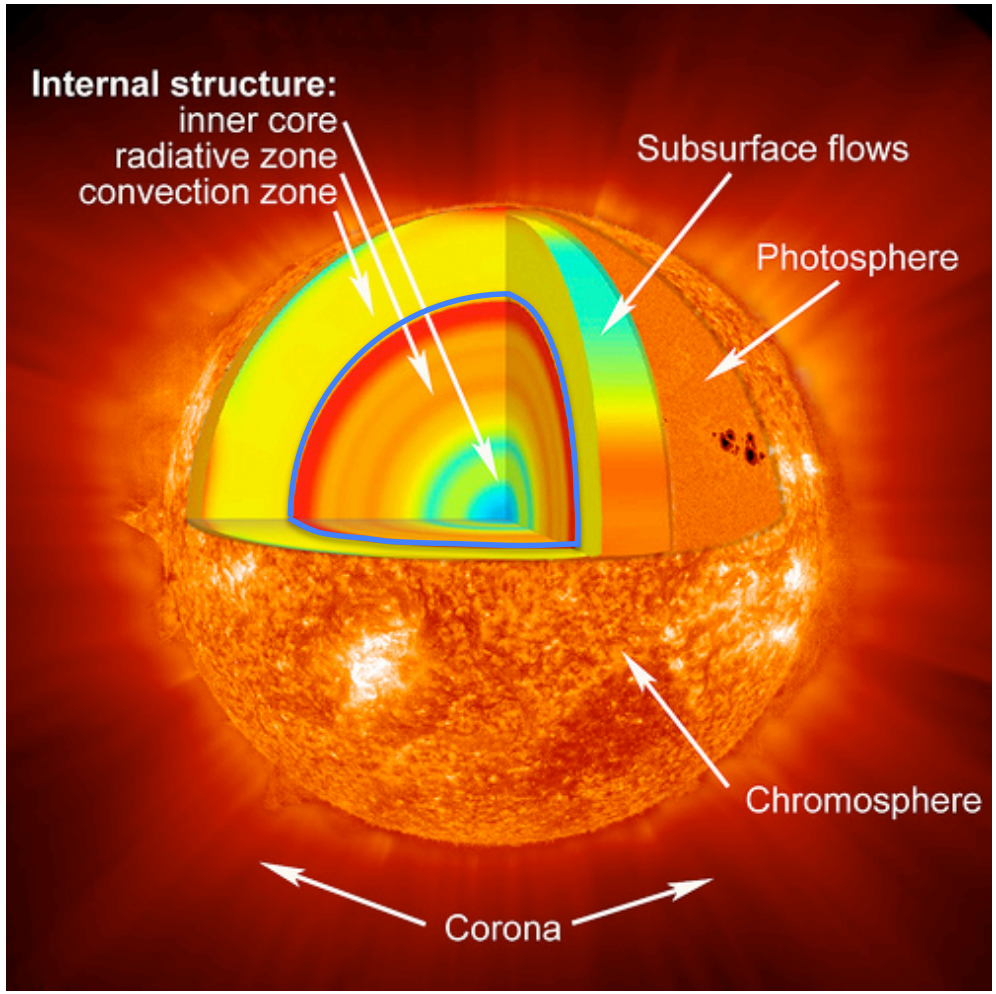
Le soleil, couche par couche.

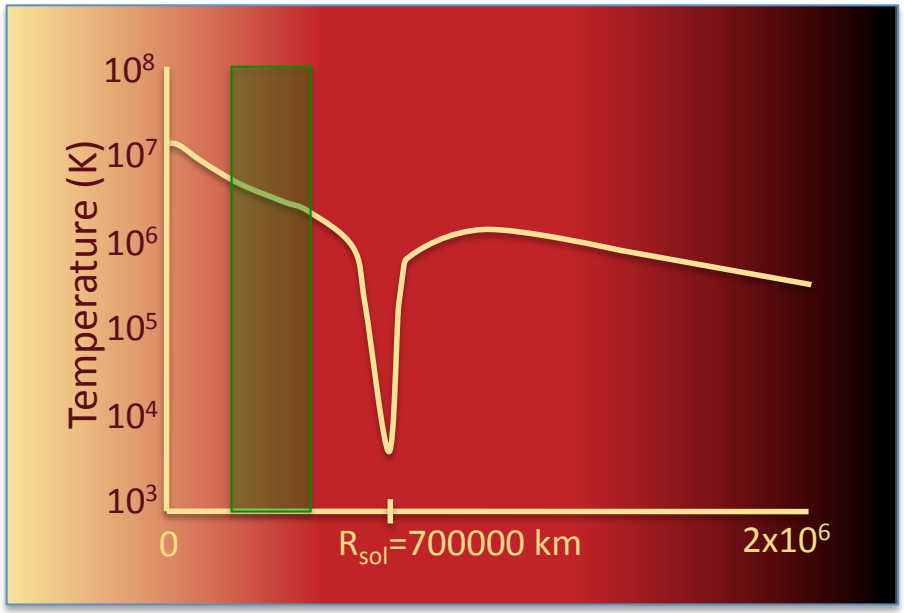




Source : SIDC, Kitt Peak, SOHO

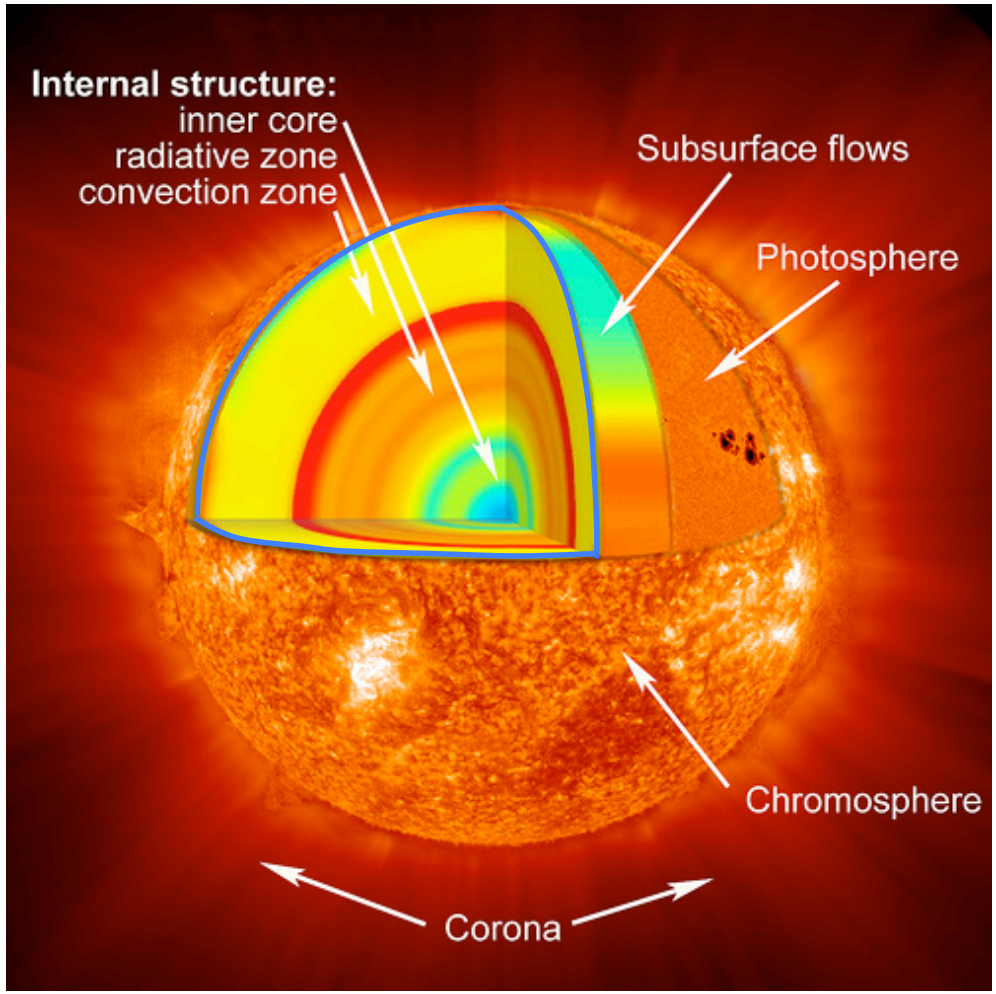
Le soleil, couche par couche.

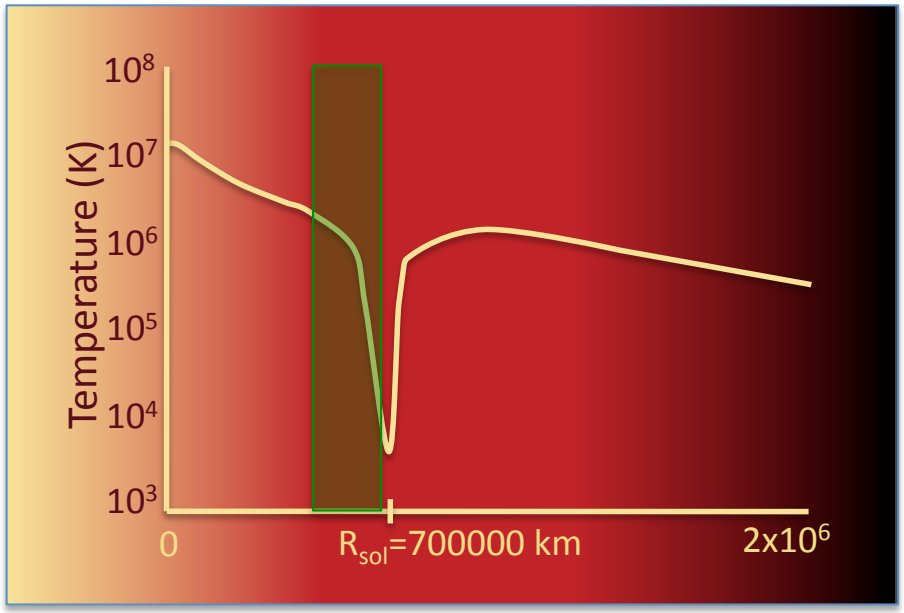




Source : SIDC, Kitt Peak, SOHO

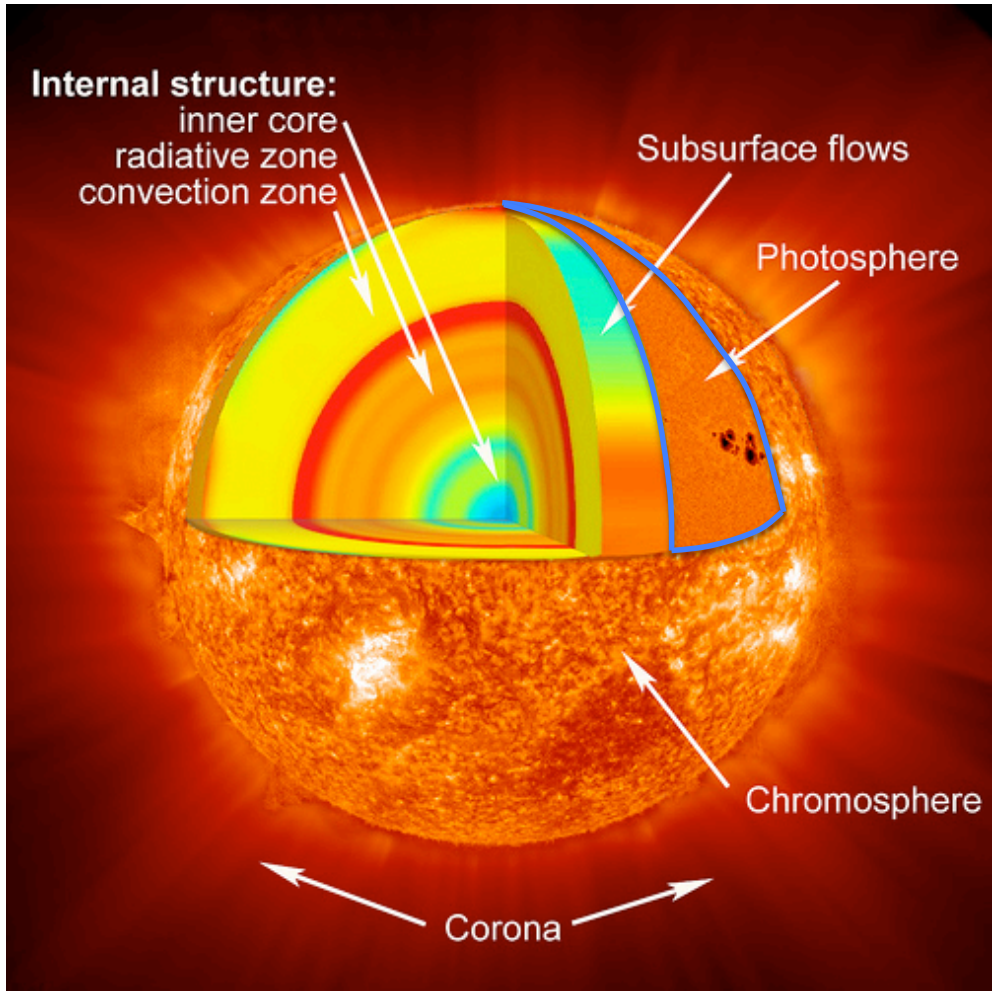
Le soleil, couche par couche.

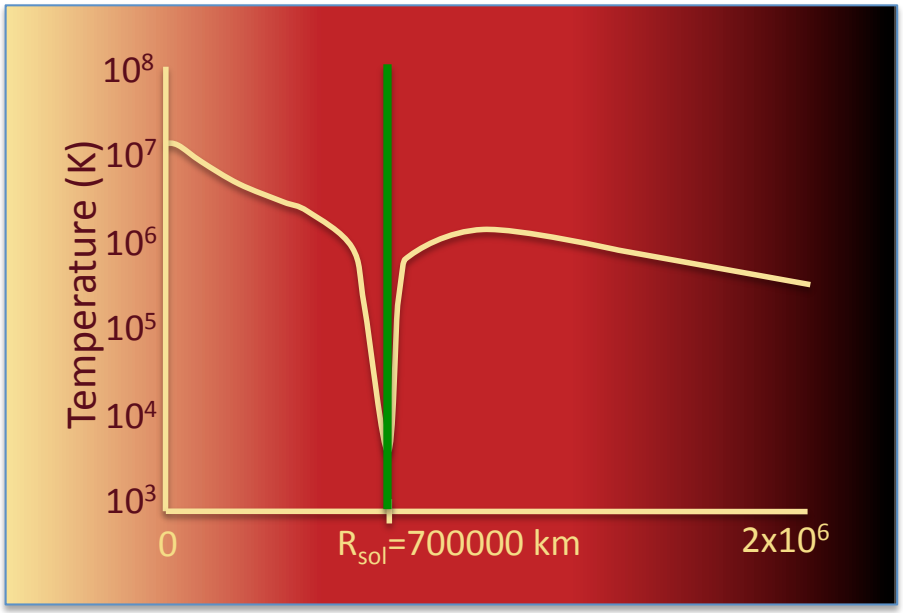


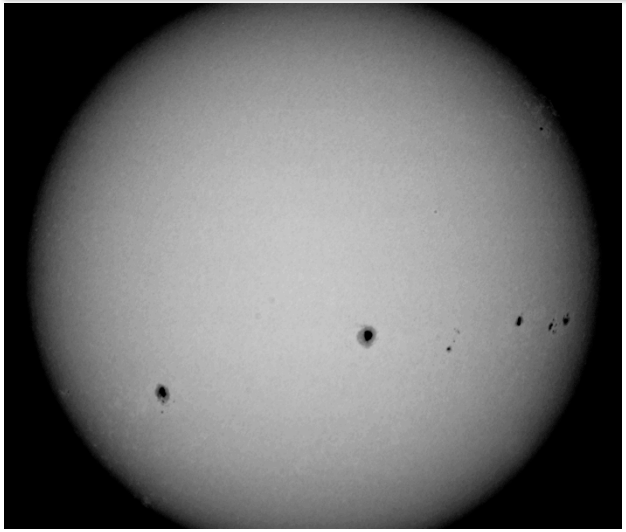


Source : SIDC, Kitt Peak, SOHO

Le soleil, couche par couche.

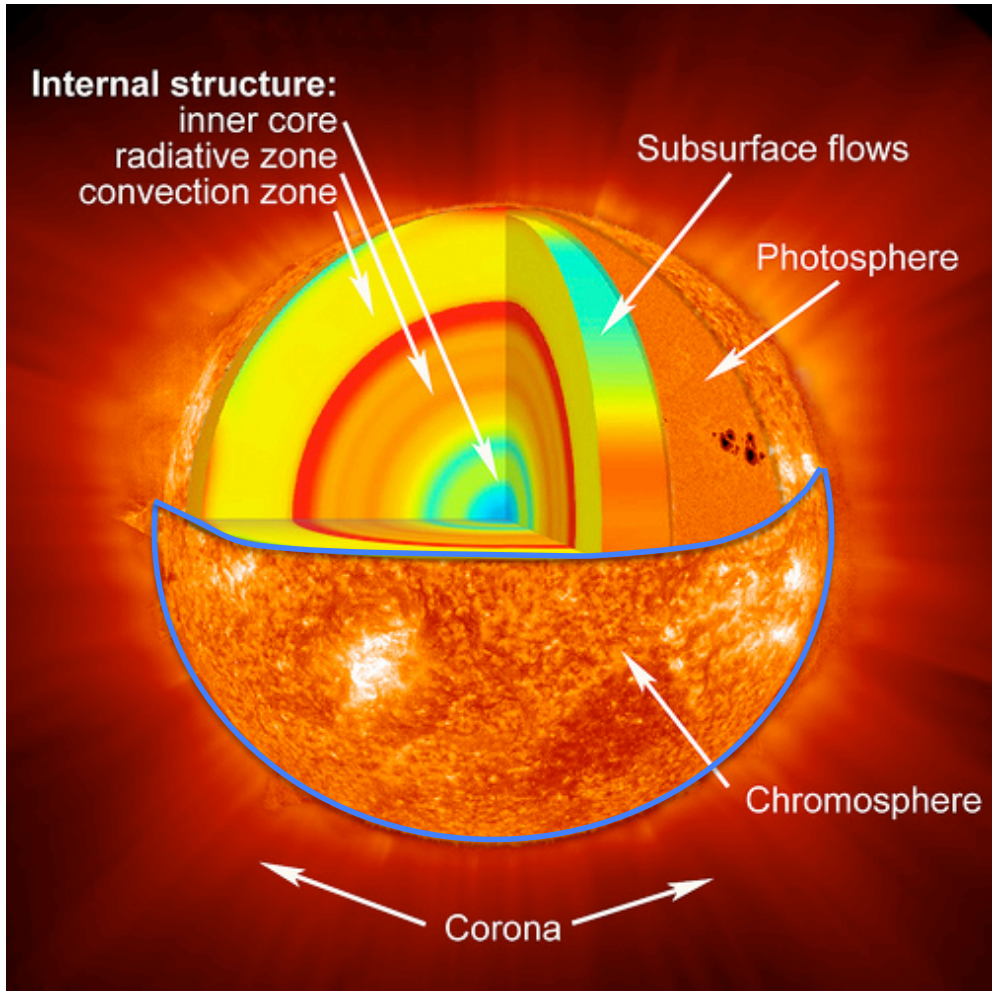


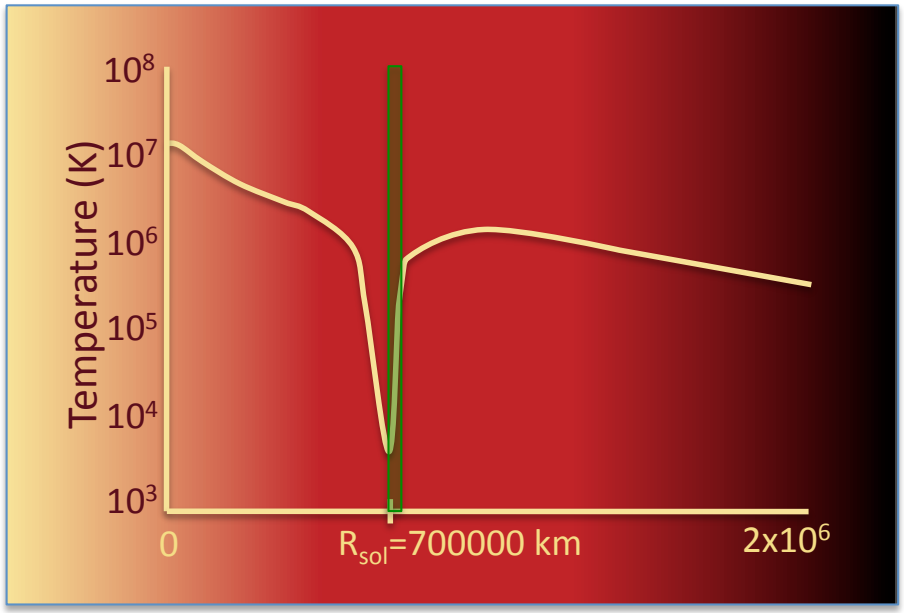


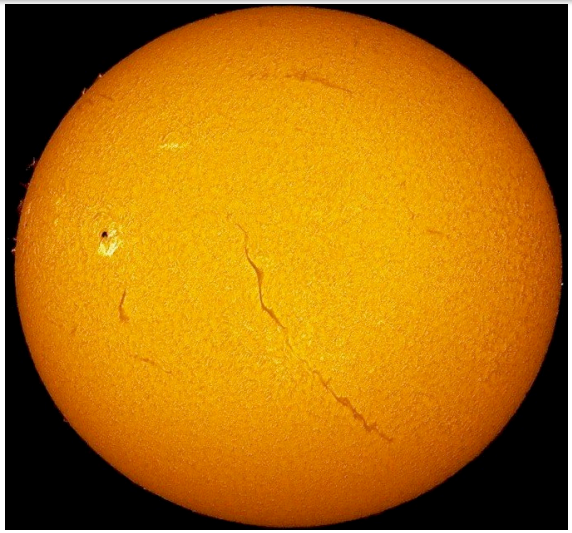


Source : SIDC, Kitt Peak, SOHO

Le soleil, couche par couche.

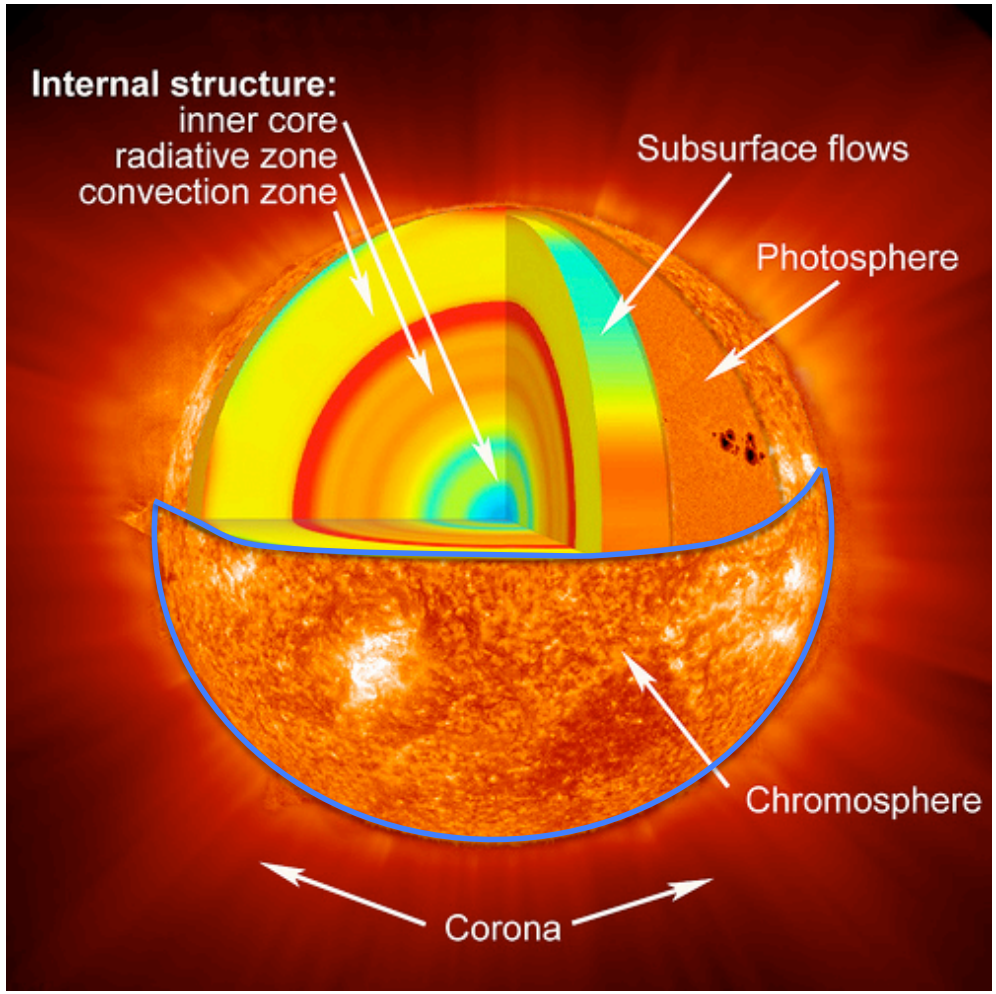


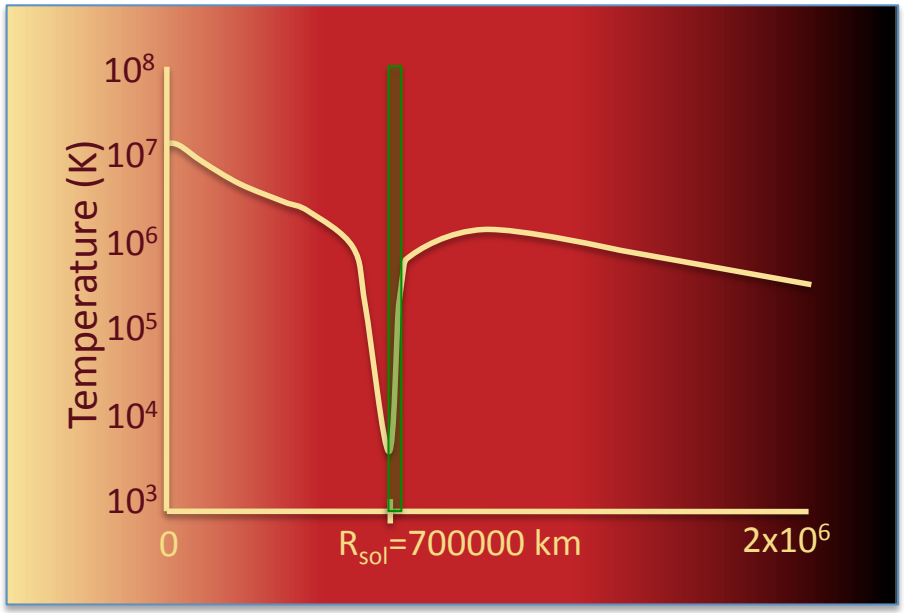


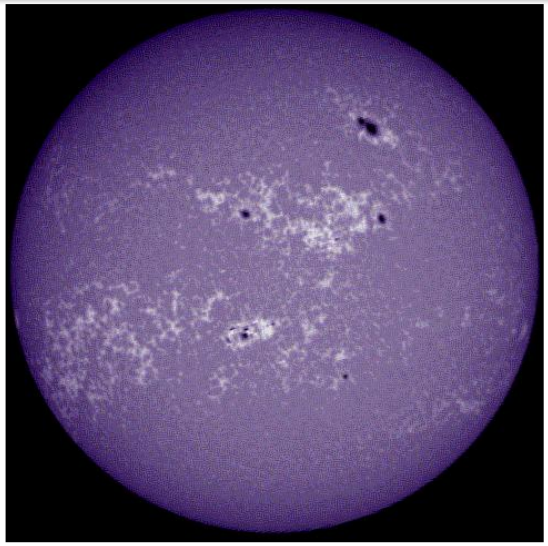


Source : SIDC, Kitt Peak, SOHO

Le soleil, couche par couche.







Source : SIDC, Kitt Peak, SOHO

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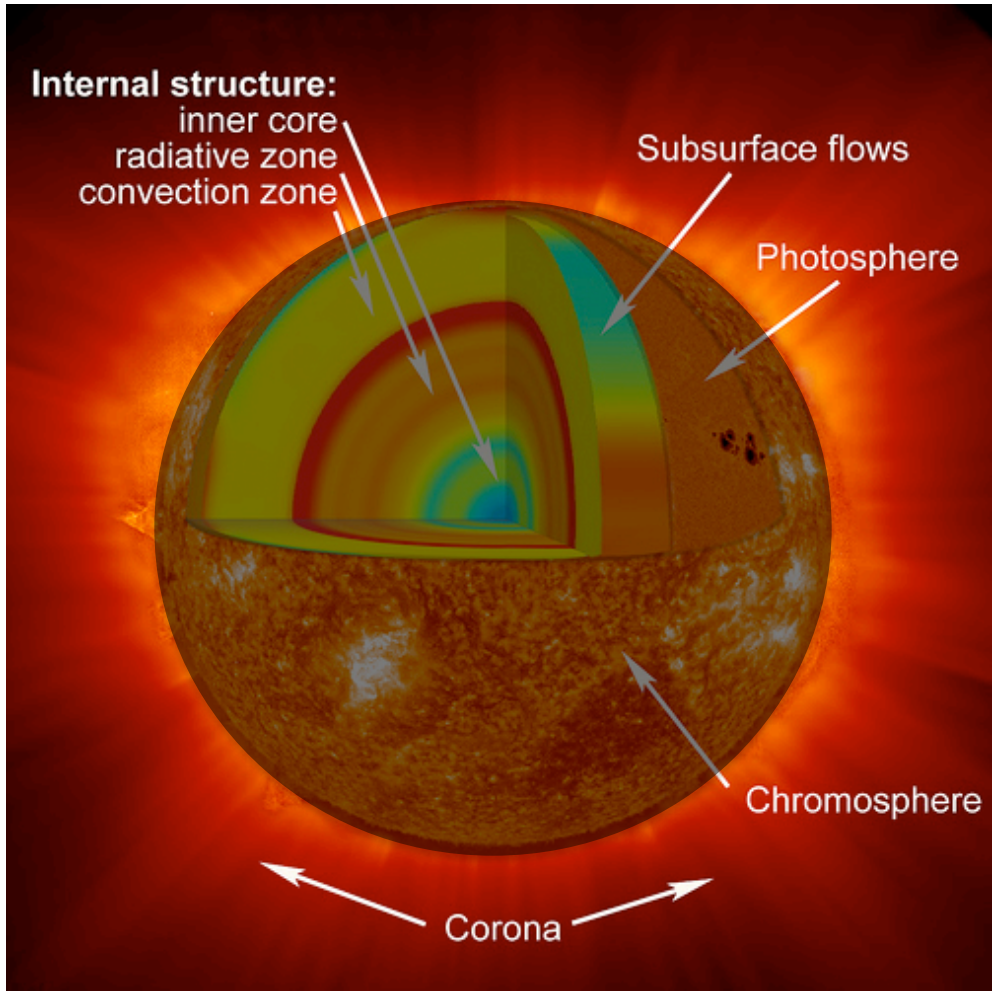
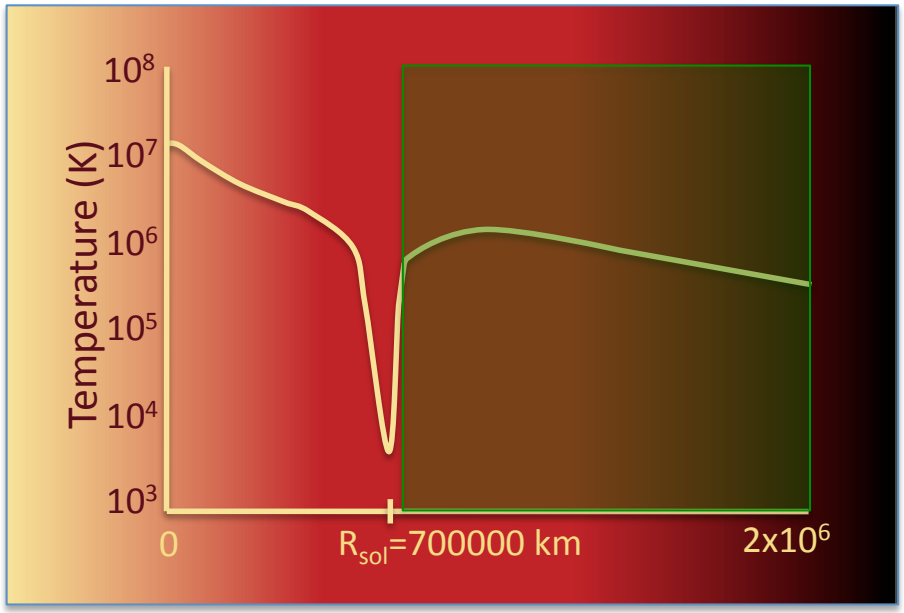
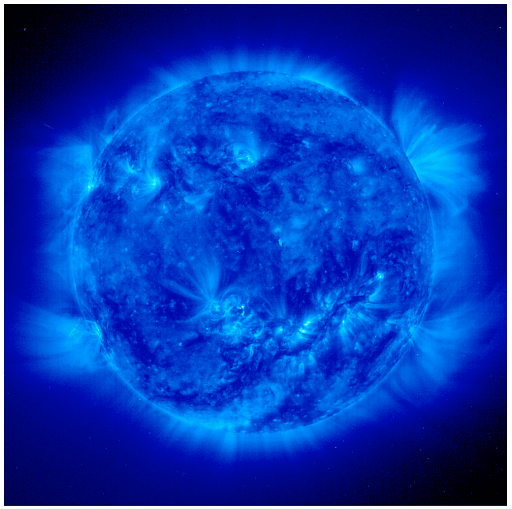


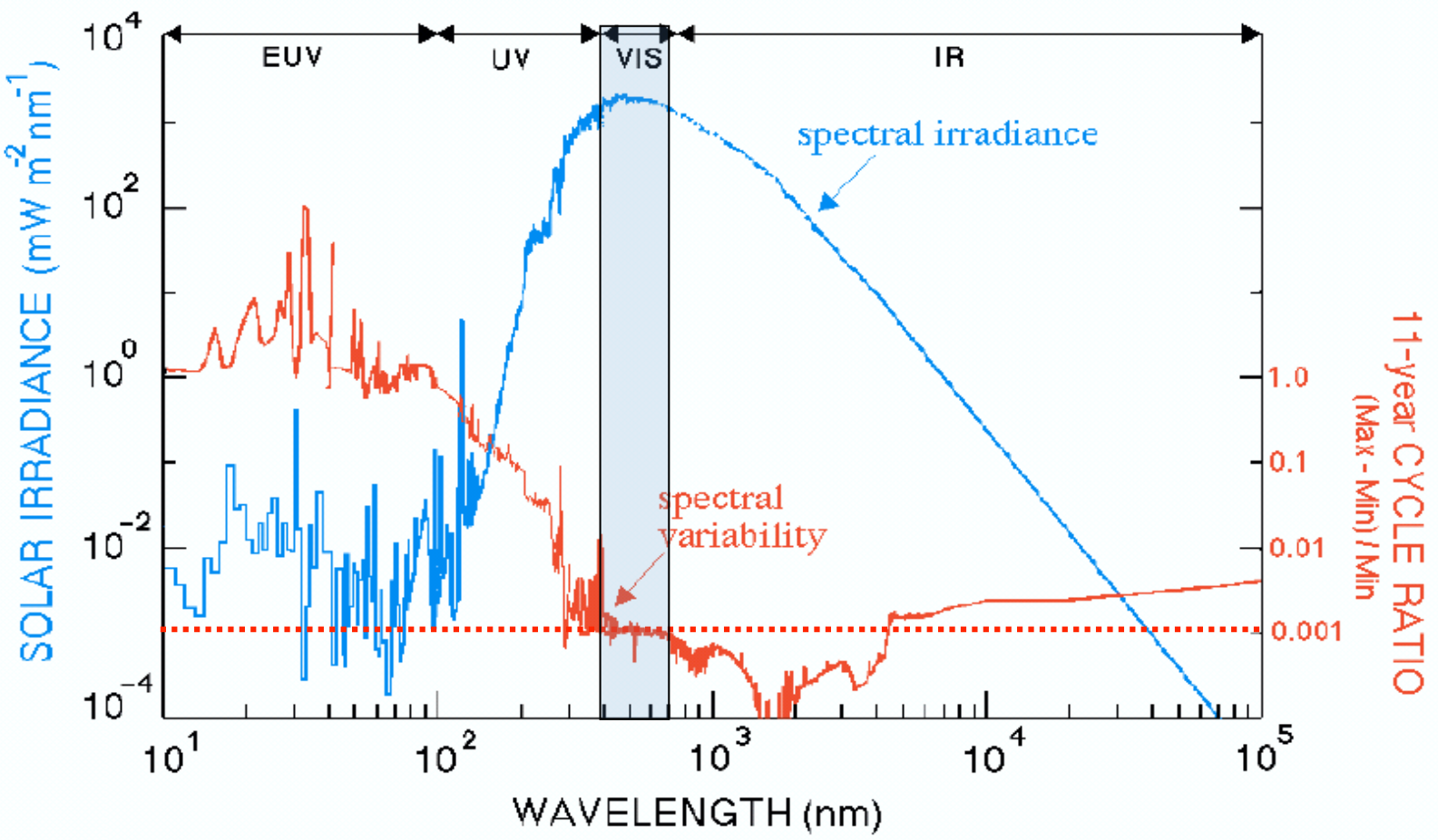




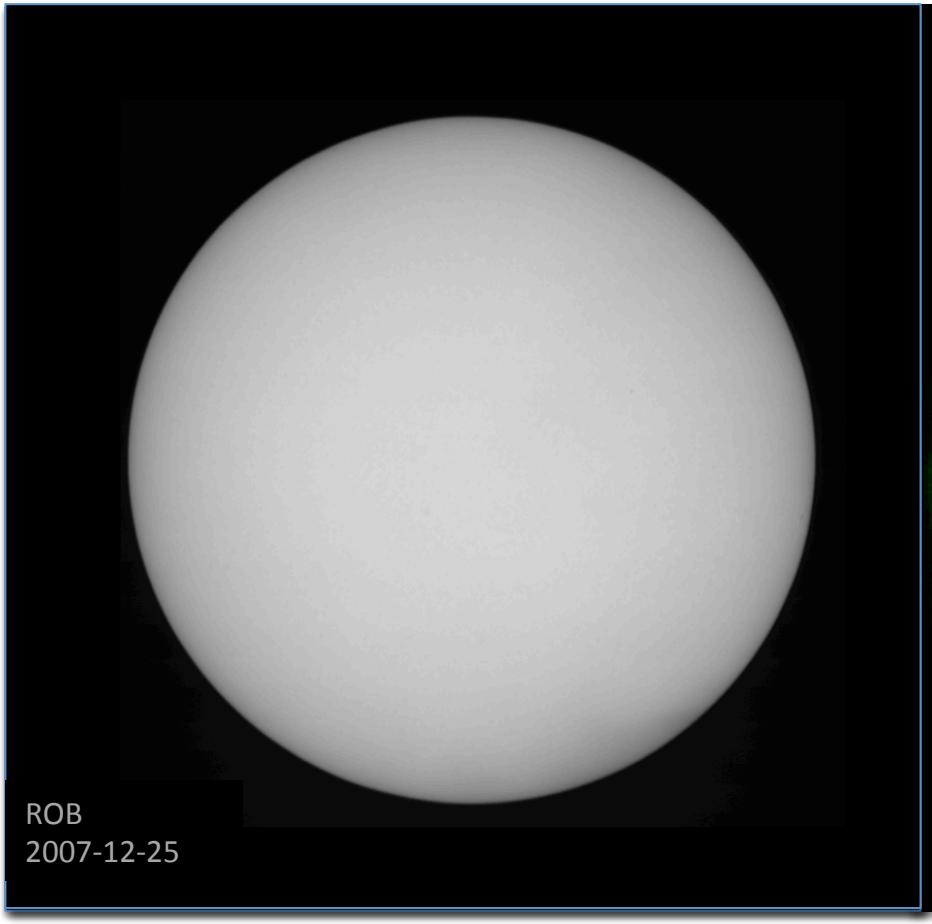
Source : SIDC, Kitt Peak, SOHO

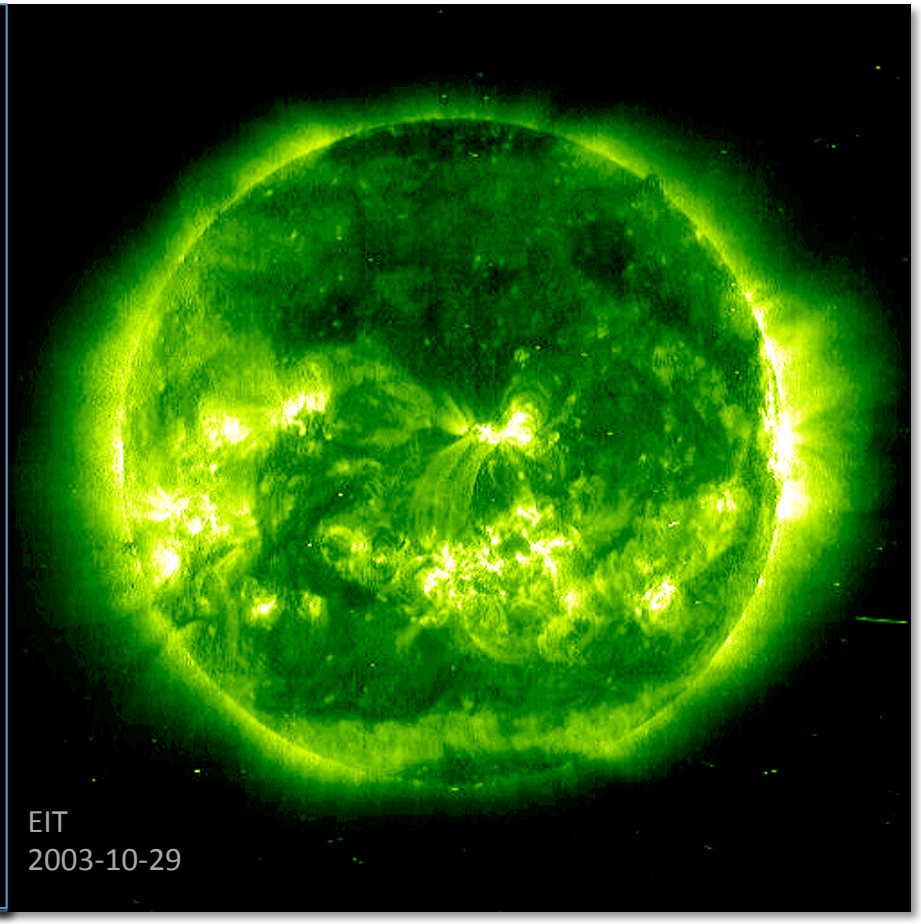
Éclairement spectral et sa variation

- Variabilité très élevée en dessous de 320 nm (facteurs 10 à 1000)
  - 2% du rayonnement total
  - Rayonnement très important pour l'aéronomie



Photosphère versus couronne





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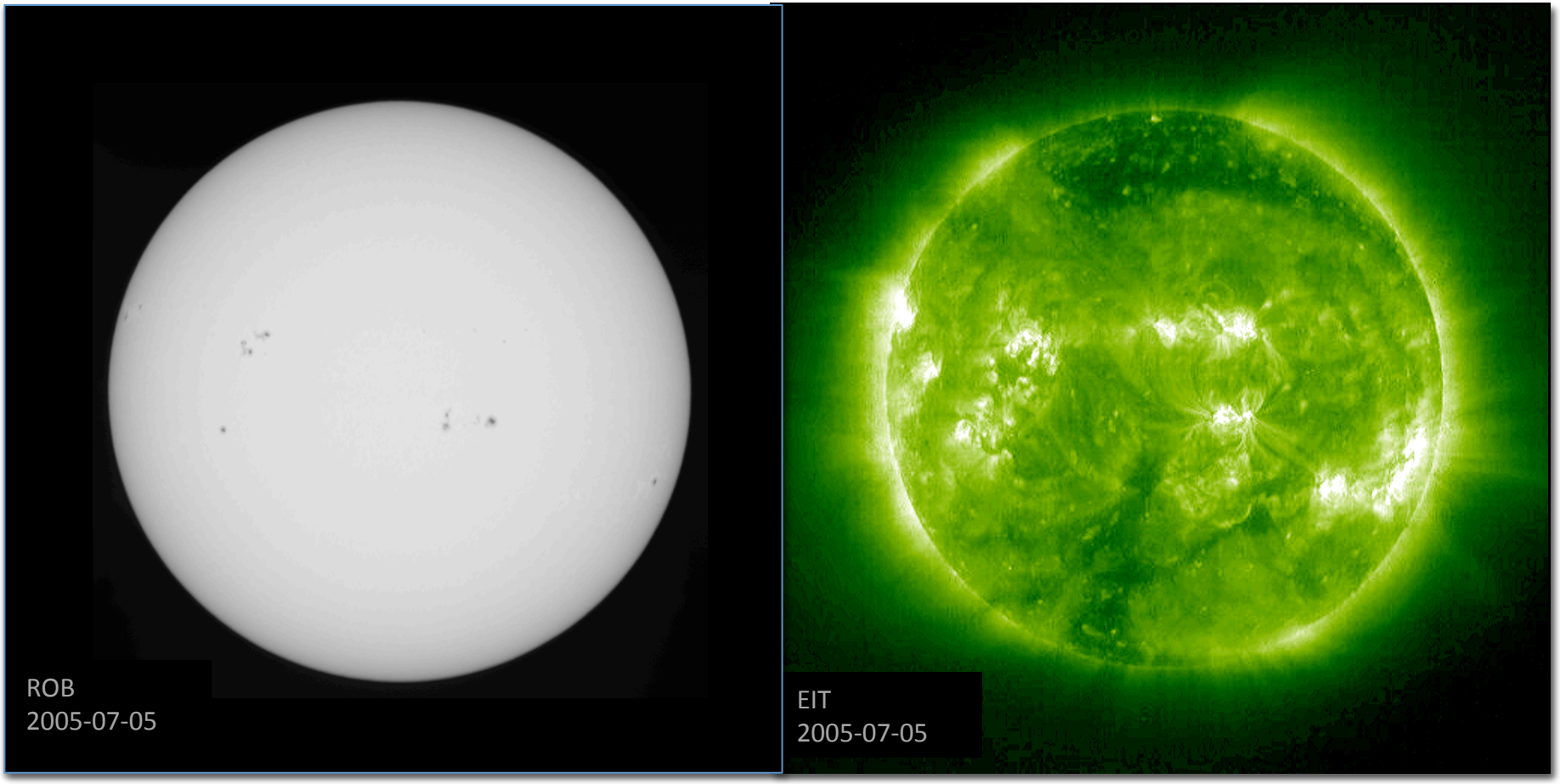
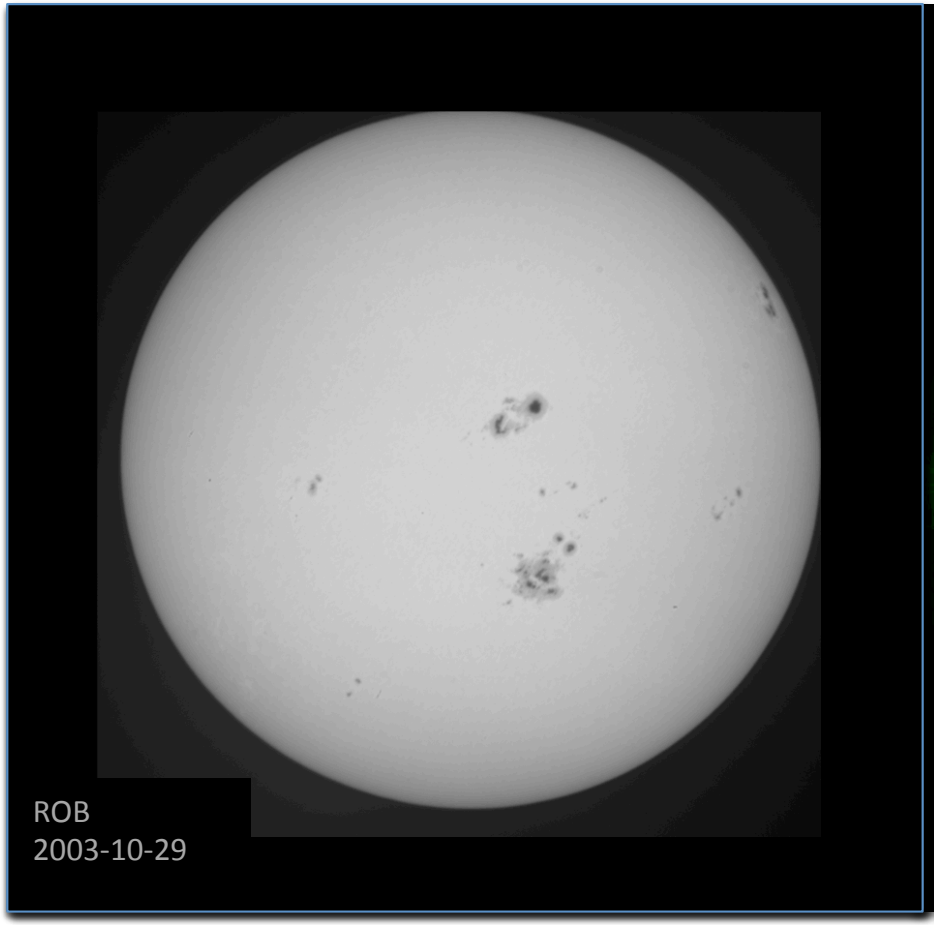
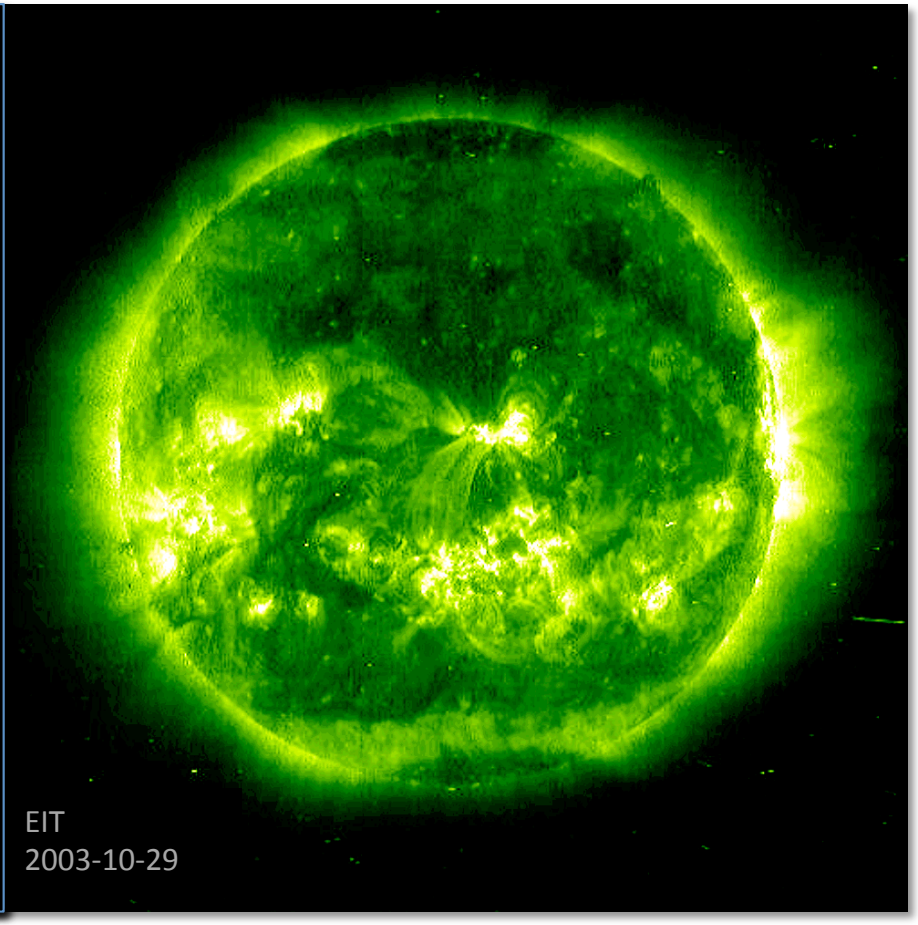
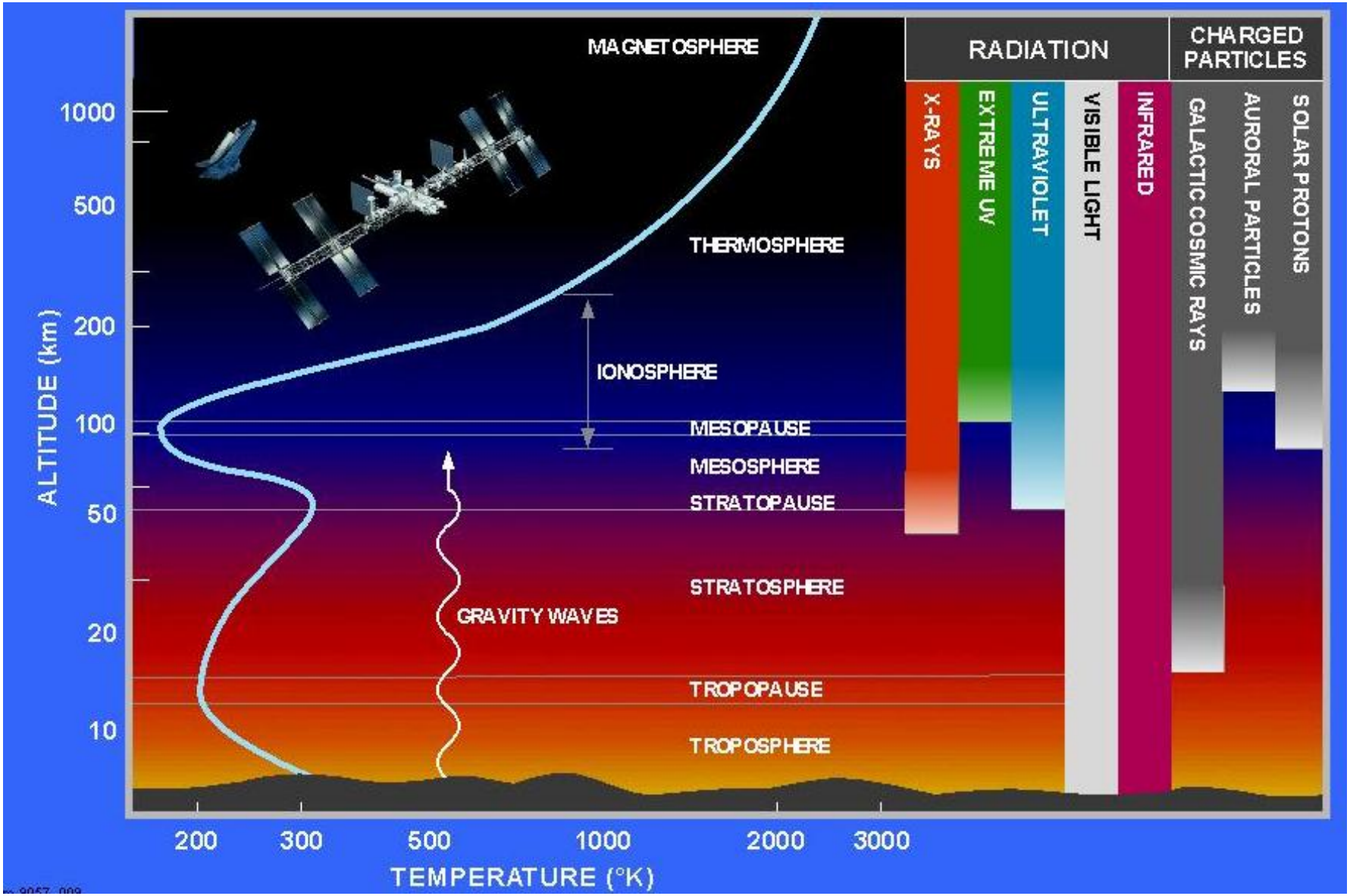


Photosphère versus couronne



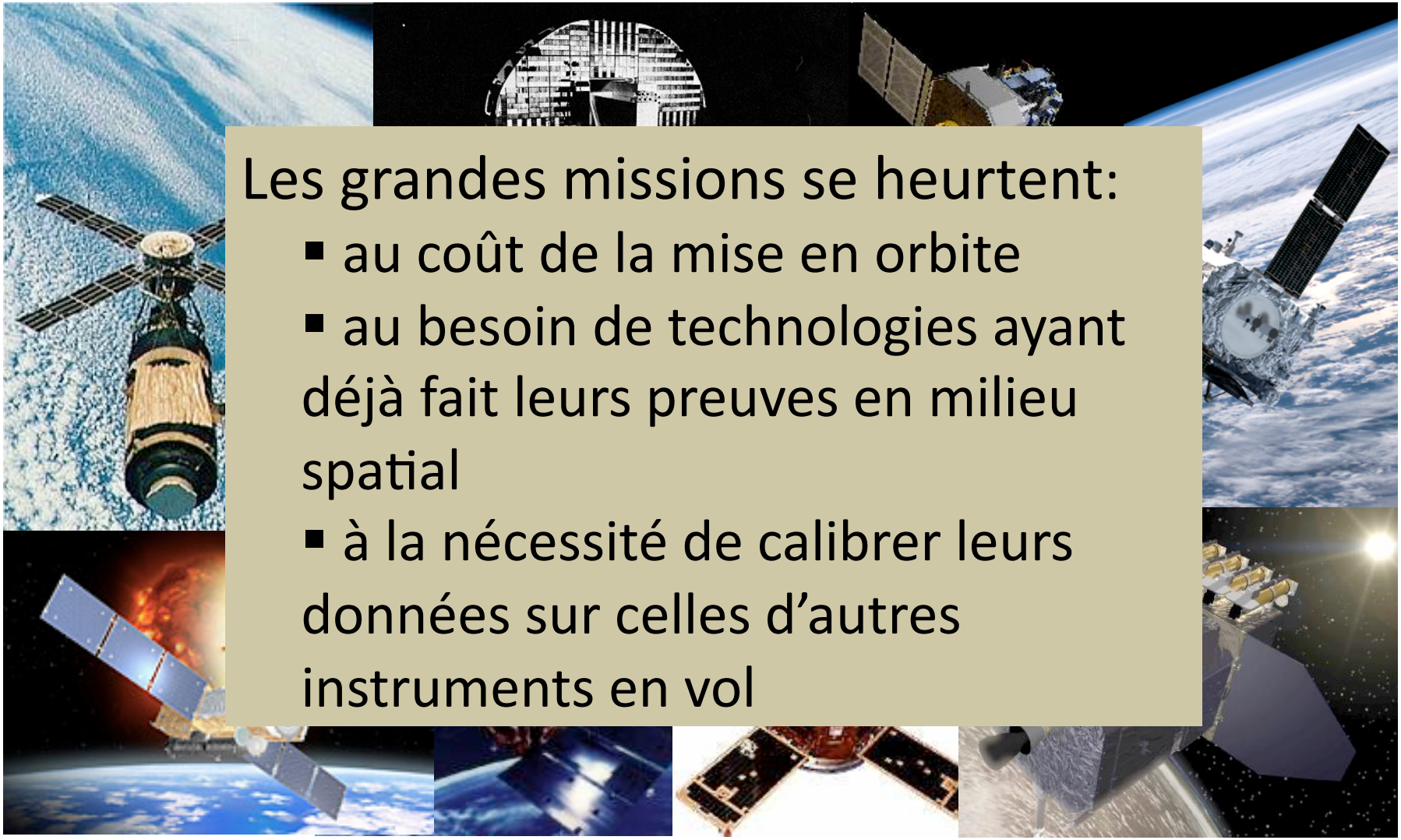



MAGNETOSPHERE
THERMOSPHERE
IONOSPHERE
MESOPAUSE
MESOSPHERE
STRATOPAUSE
STRATOSPHERE
GRAVITY WAVES
TROPOPAUSE
TROPOSPHERE
ALTITUDE (km)
1000
500
200
100
50
20
10
RADIATION
X-RAYS
EXTREME UV
ULTRAVIOLET
VISIBLE LIGHT
INFRARED
CHARGED PARTICLES
GALACTIC COSMIC RAYS
AURORAL PARTICLES
SOLAR PROTONS
200
300
500
1000
2000
3000
TEMPERATURE (°K)

L’aire spatiale et l’observation du soleil

Sources: NASA - ESA

L’aire spatiale et l’observation du soleil

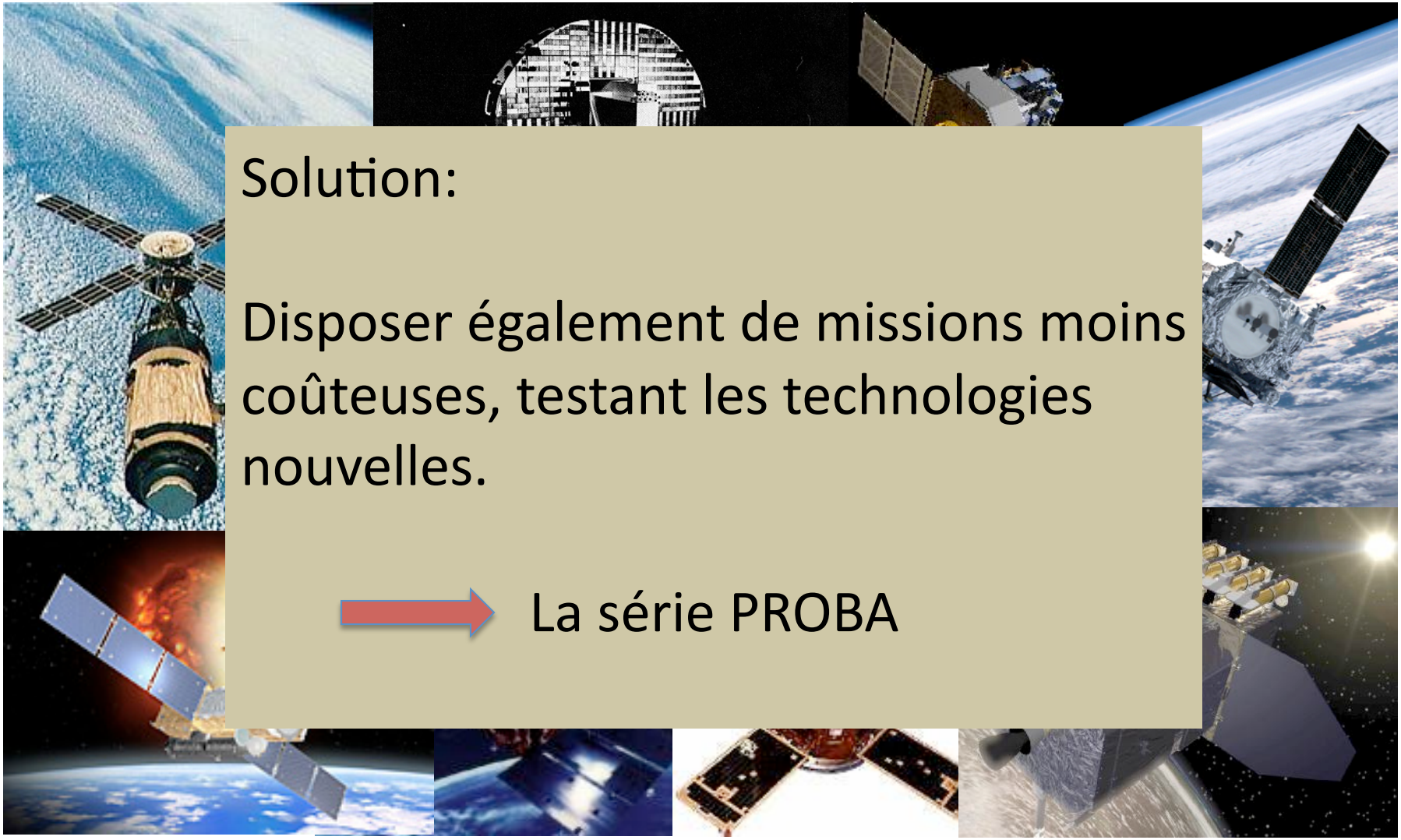


Les grandes missions se heurtent:

- au coût de la mise en orbite
- au besoin de technologies ayant déjà fait leurs preuves en milieu spatial
- à la nécessité de calibrer leurs données sur celles d’autres instruments en vol

Sources: NASA - ESA

L’aire spatiale et l’observation du soleil



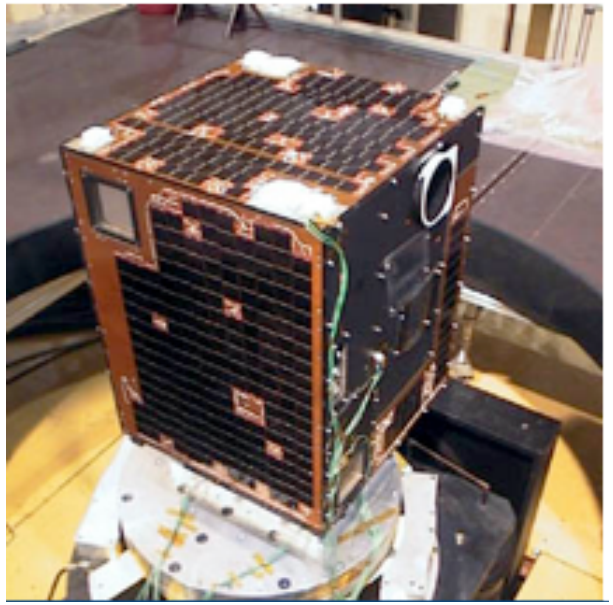
Solution:

Disposer également de missions moins coûteuses, testant les technologies nouvelles.

→ La série PROBA

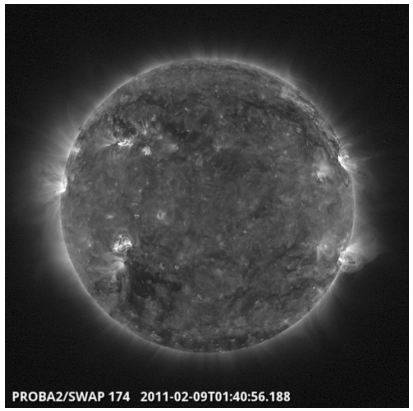
Sources: NASA - ESA

La série PROBA – en orbite



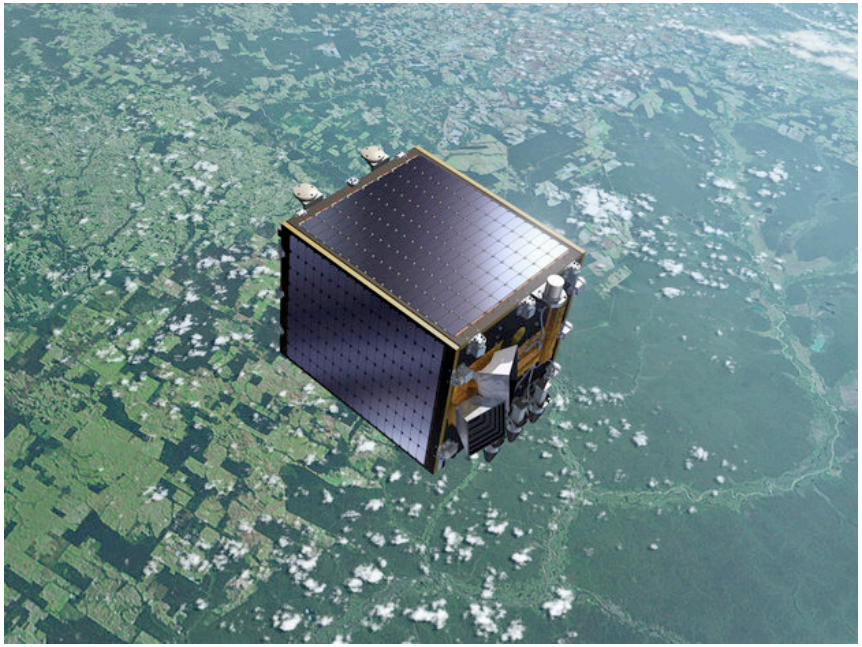
PROBA1: lancé en 2001

PROBA2: lancé en 2009



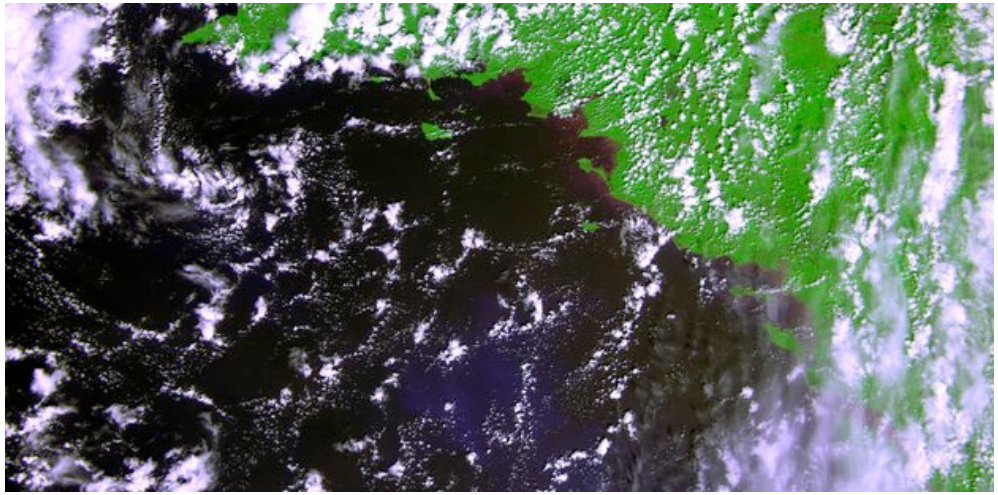
Sources: ESA, ROB

Le petit dernier: PROBA-V



Lancé le 7 mai 2013!

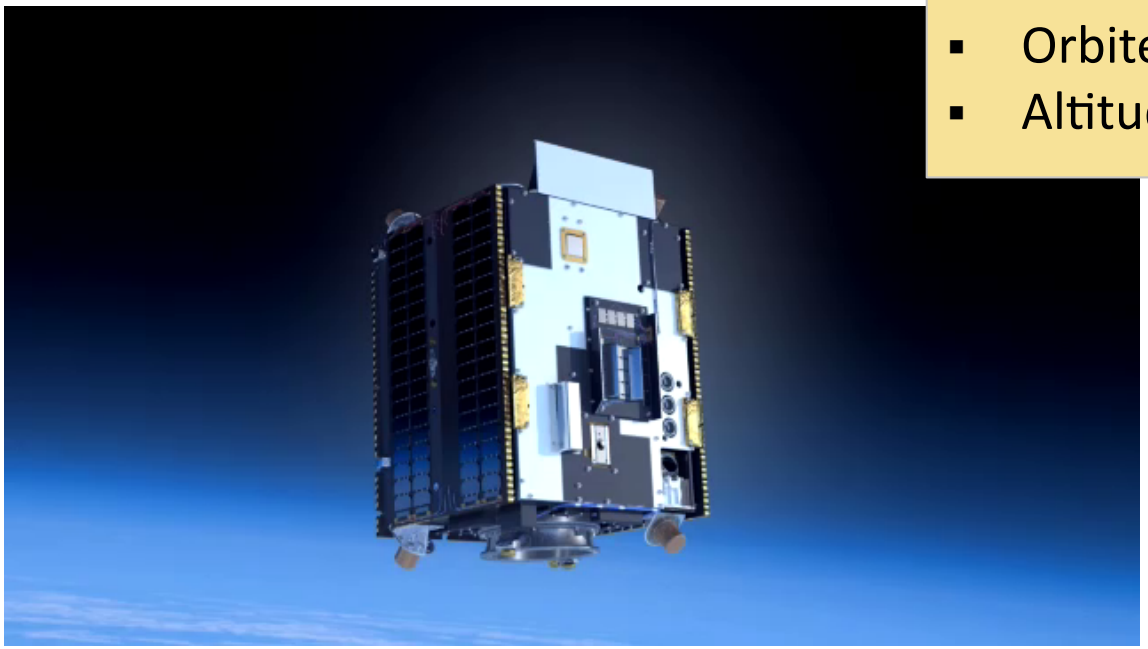
Première image acquise le 15 mai:
Le sud de la France



Sources: ESA

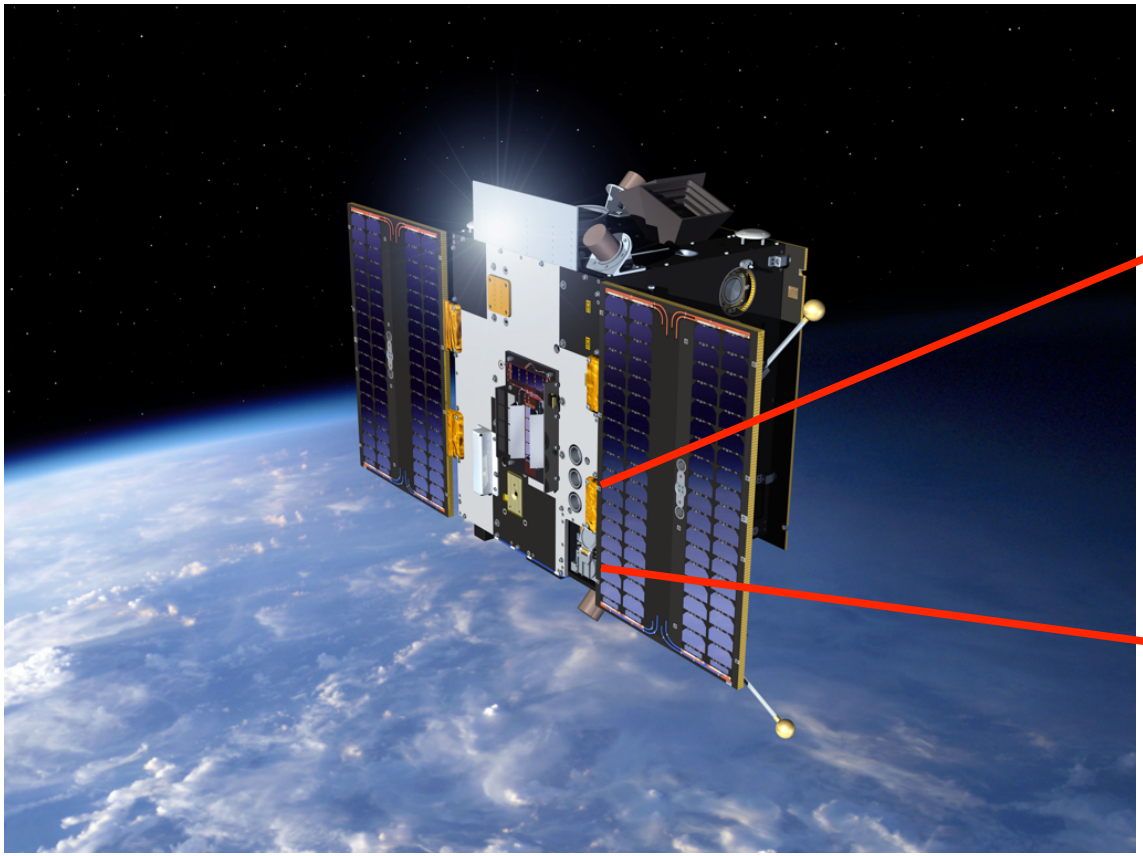
PROBA2: Project for On-Board Autonomy

- Un micro-satellite ESA
- Dimension: 80x70x60cm
- Masse: 120kg
- 17 démonstrateurs technologiques
- 4 instruments scientifiques
- Lancé le 2 novembre 2009
- Orbite polaire héliosynchrone
- Altitude de 725km

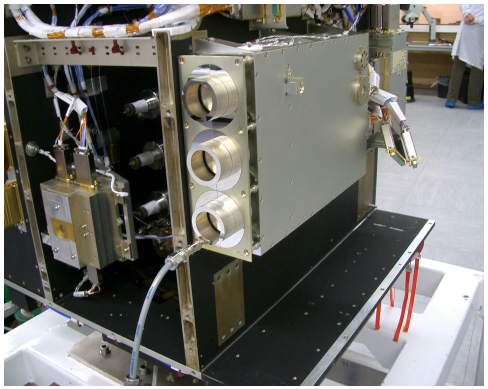


Source: ESA

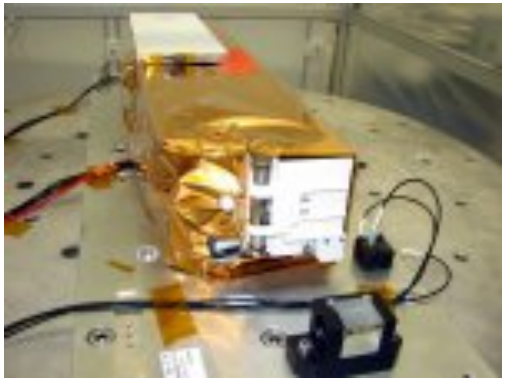
Deux instruments solaires à bord



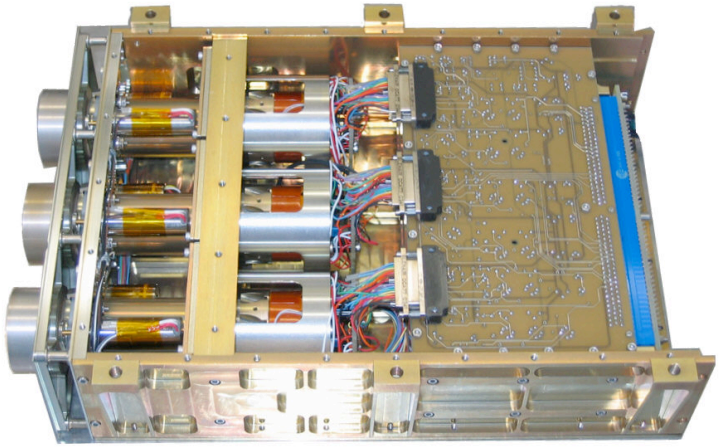
LYRA



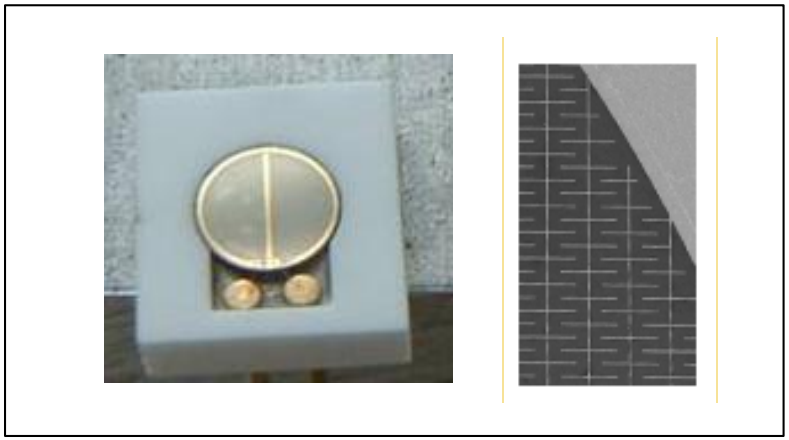
SWAP

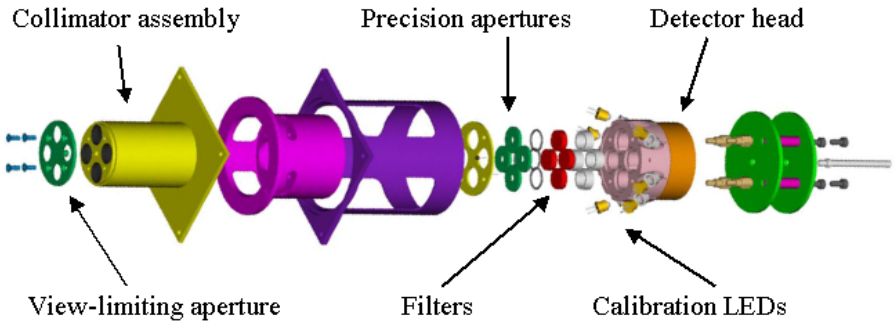


Radiomètre LYRA



- 4 canaux dans l'UV-EUV
- Détecteurs en diamant
  - Résistants au radiations
  - Insensible à la lumière visible
- Cadence d'acquisition max = 100 Hz





Telescope SWAP

- imageur EUV– 17.4 nm
- 54 arcmin FOV
- 1 min cadence d’acquisition
- possibilité de dépointage
- CMOS - Active Pixel Sensor

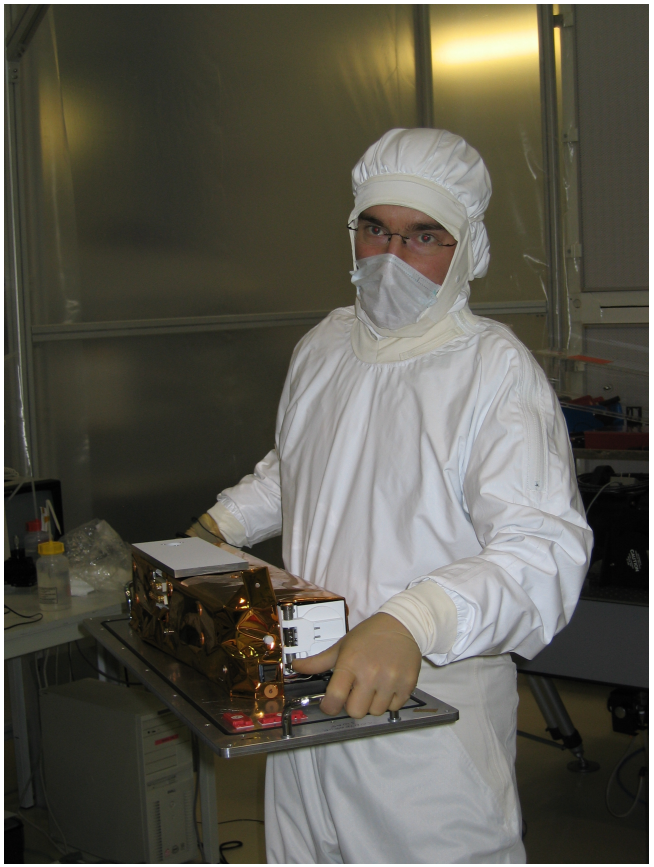
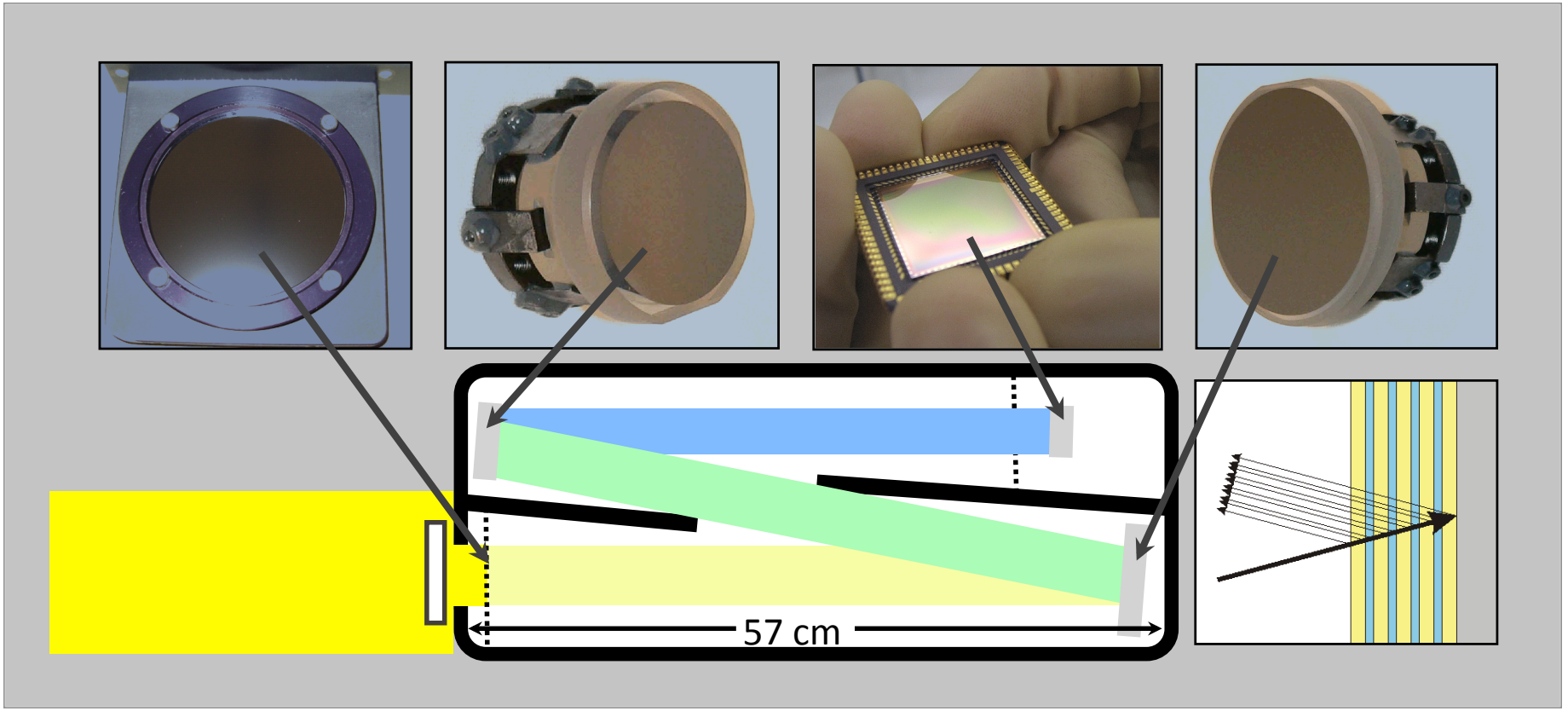
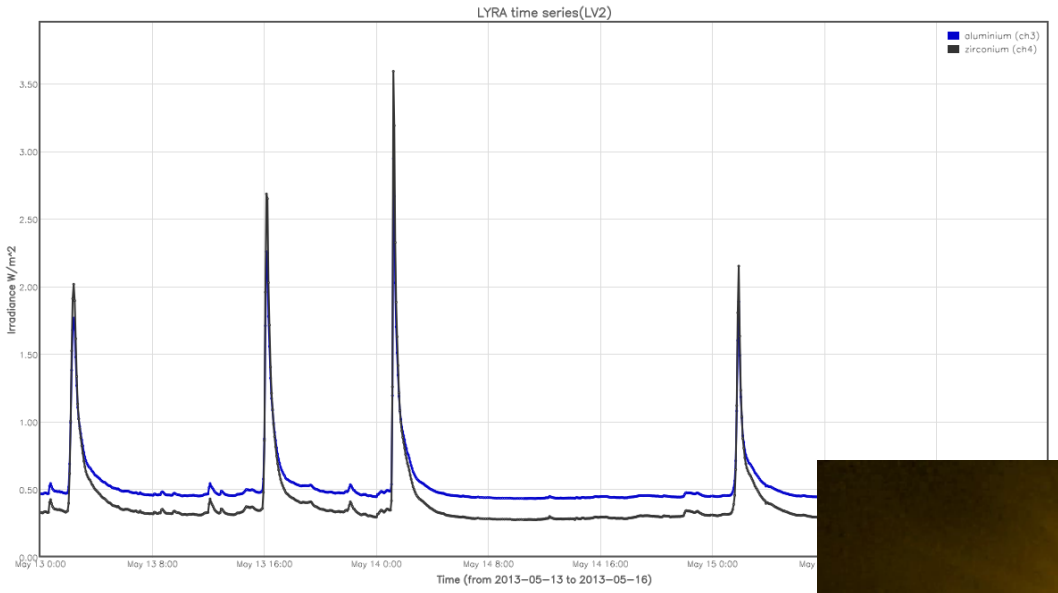


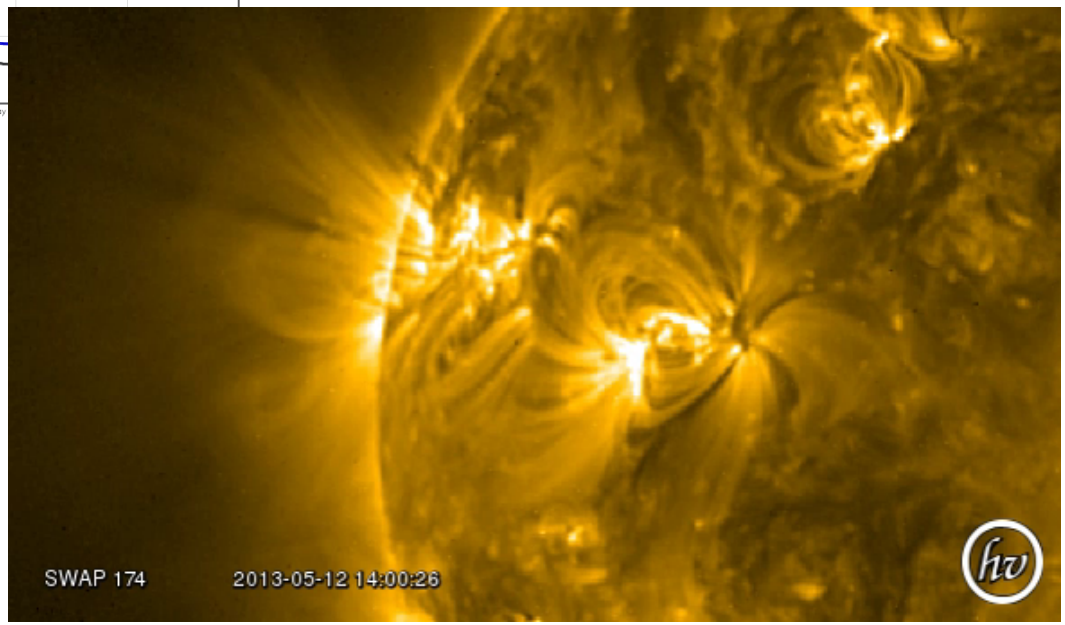
Schéma optique de SWAP

- Schéma de type Ritchey-Chrétien

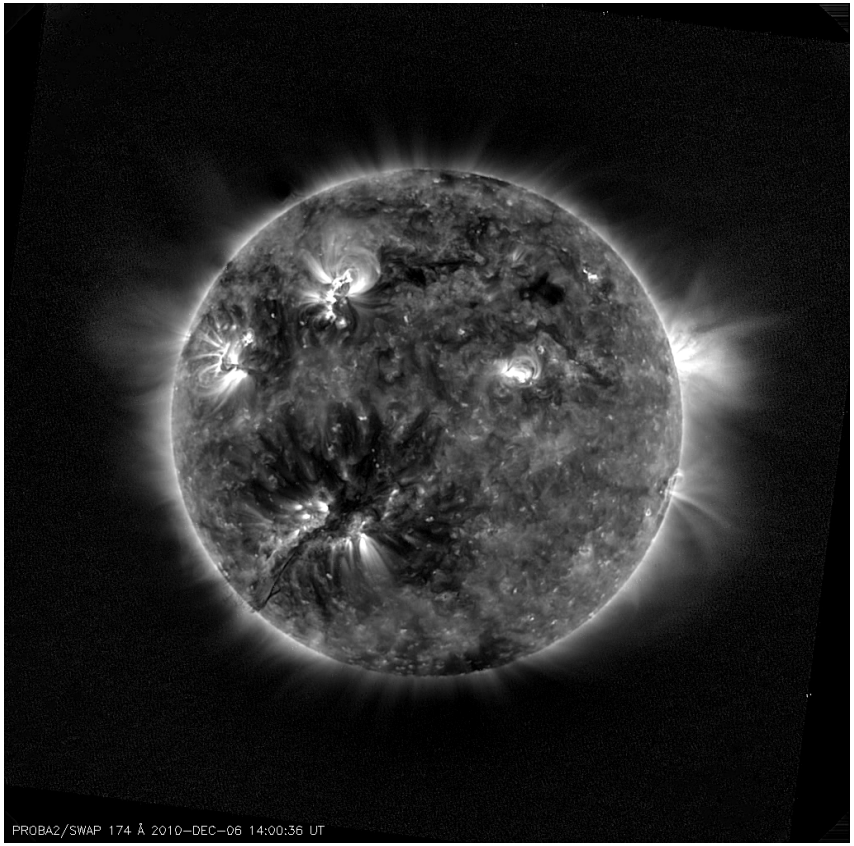


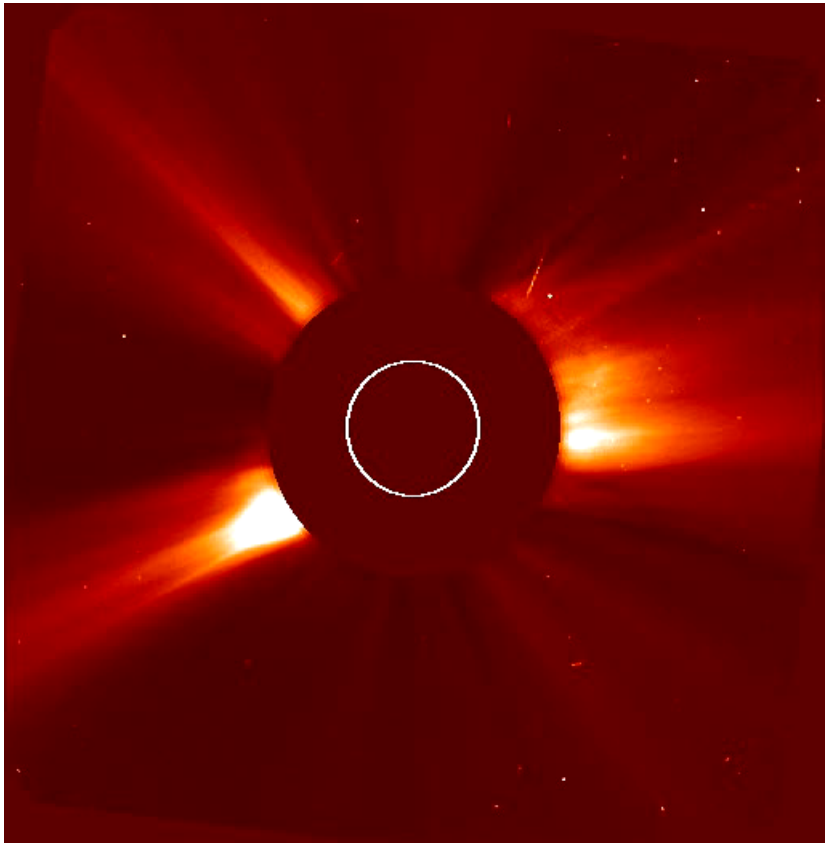
Eruption SWAP et LYRA



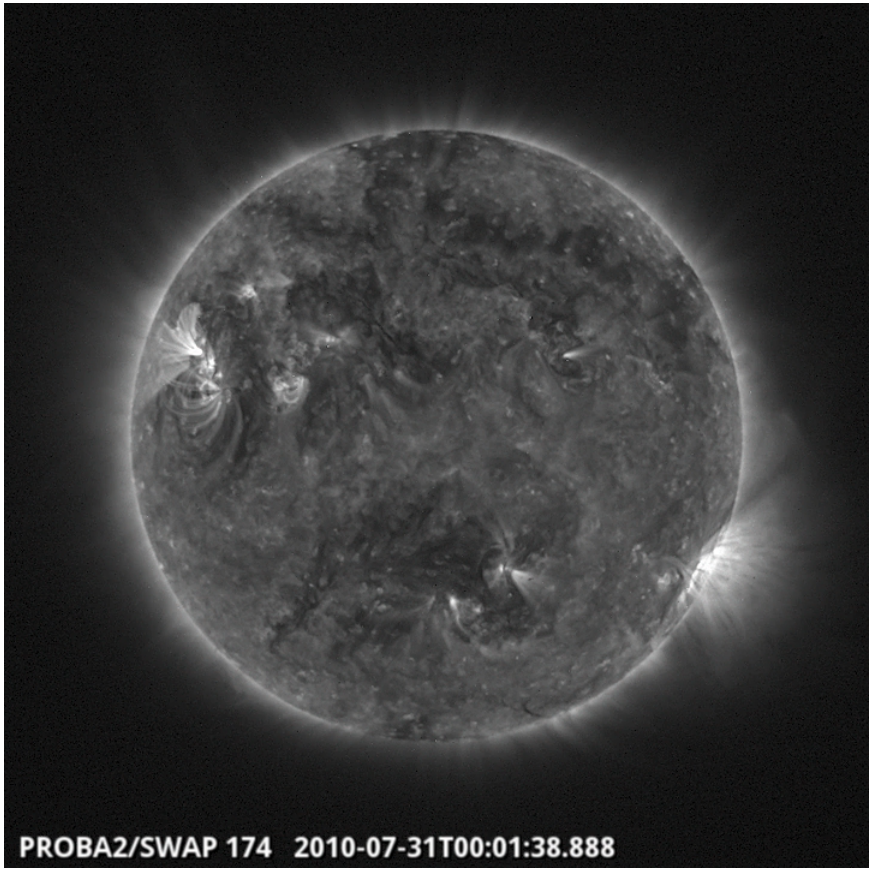


Eruption et CME





Onde EIT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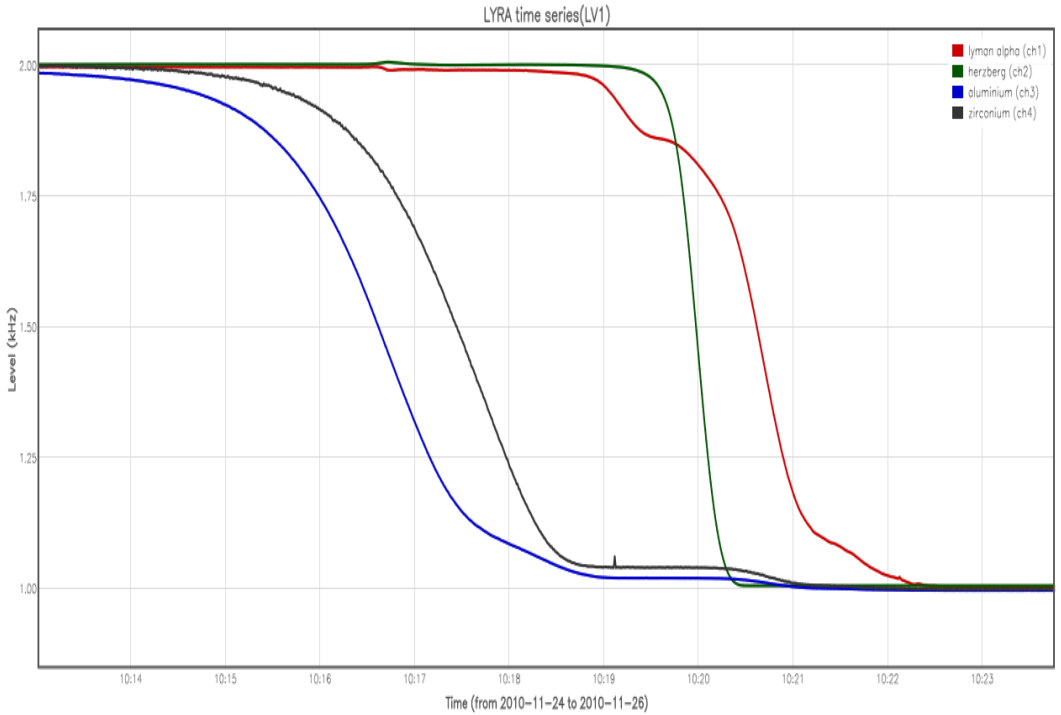
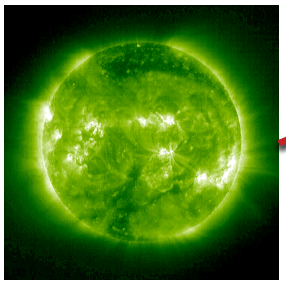
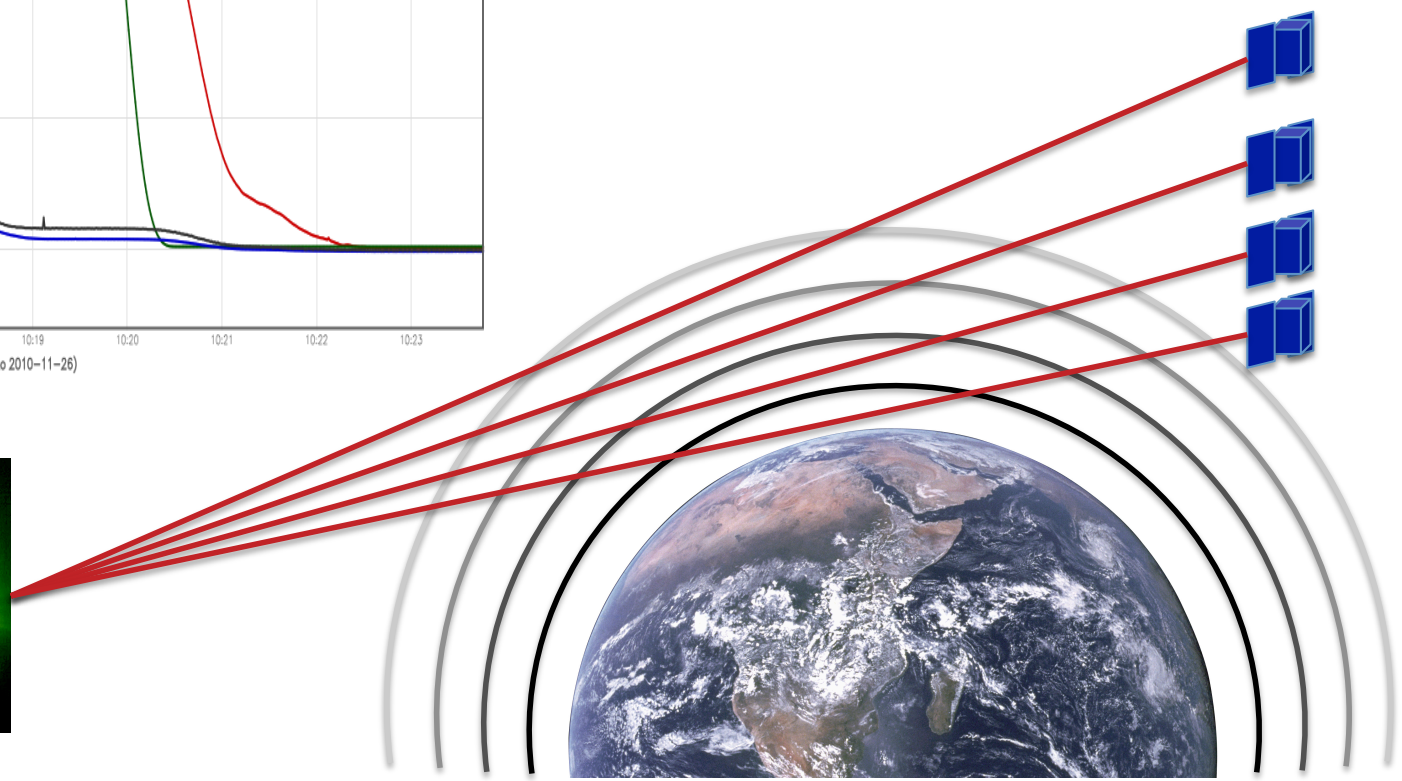
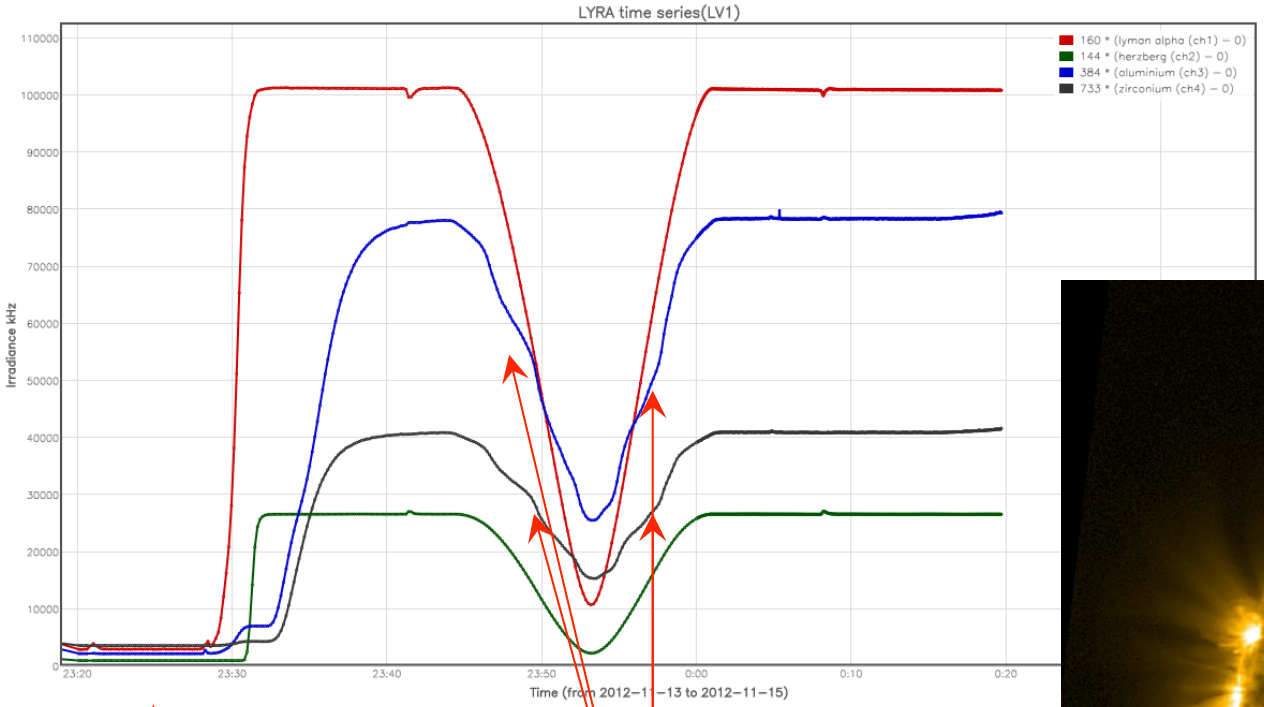
occultation





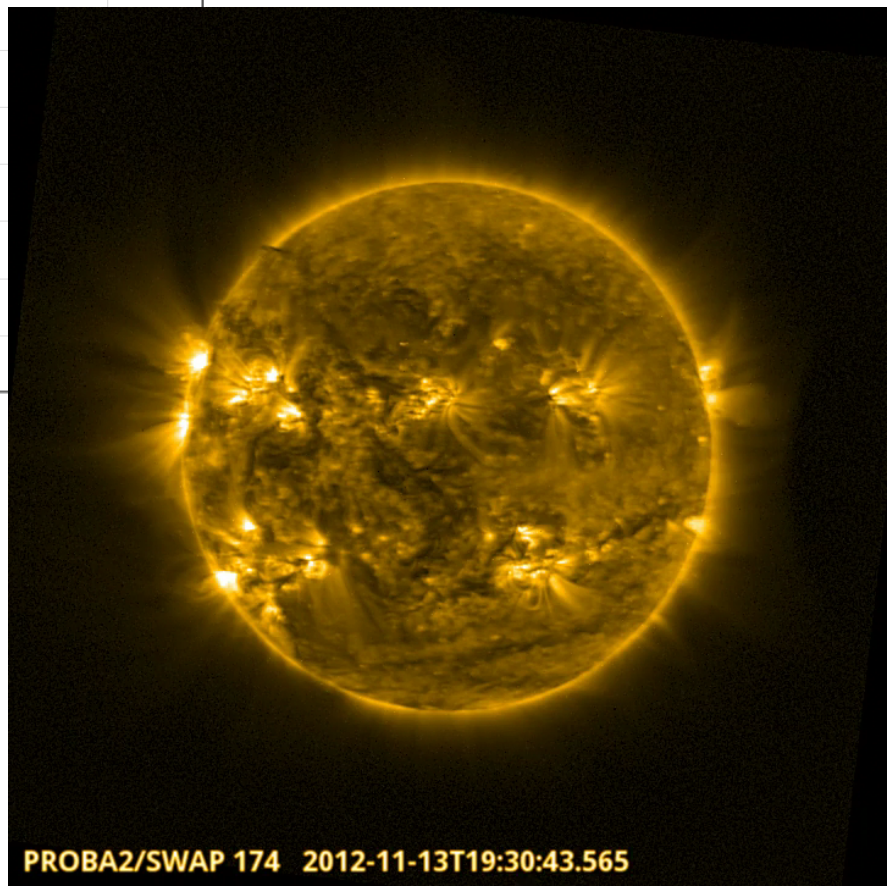


Eclipse du soleil vue de PROBA2

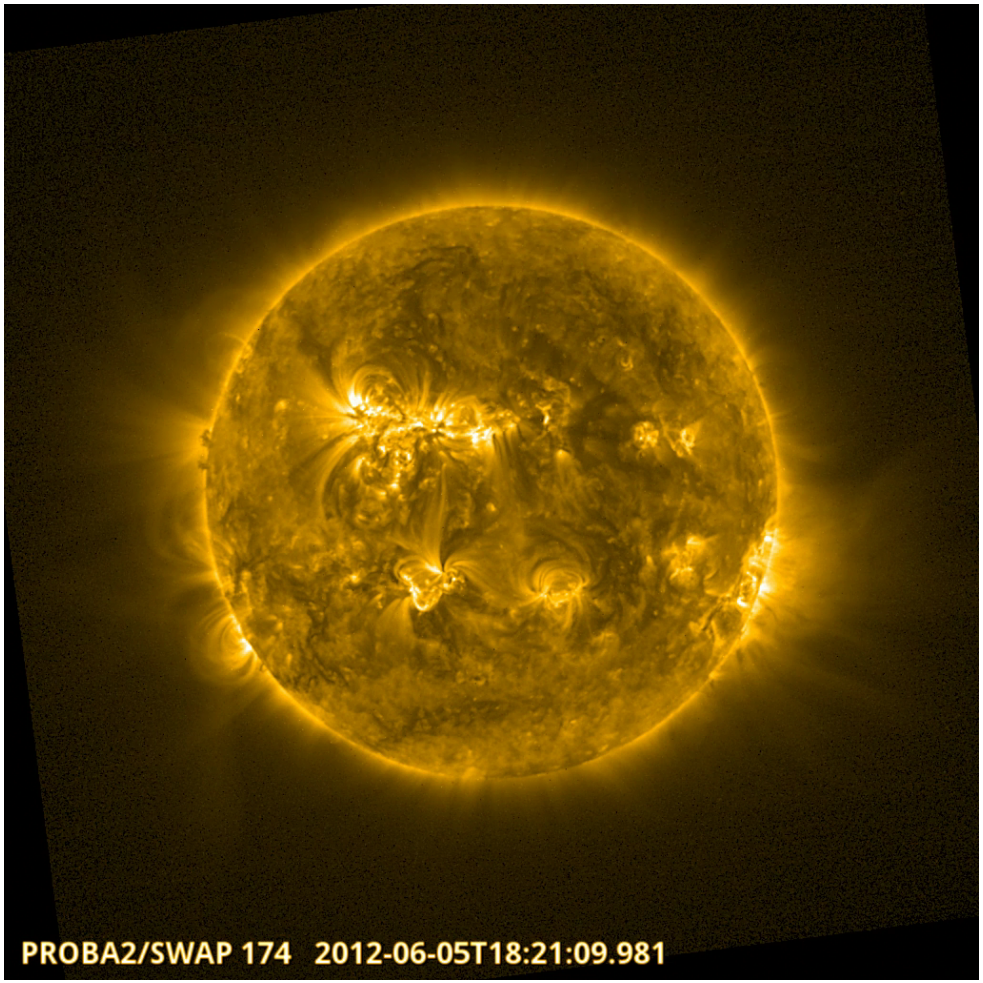


Occultation

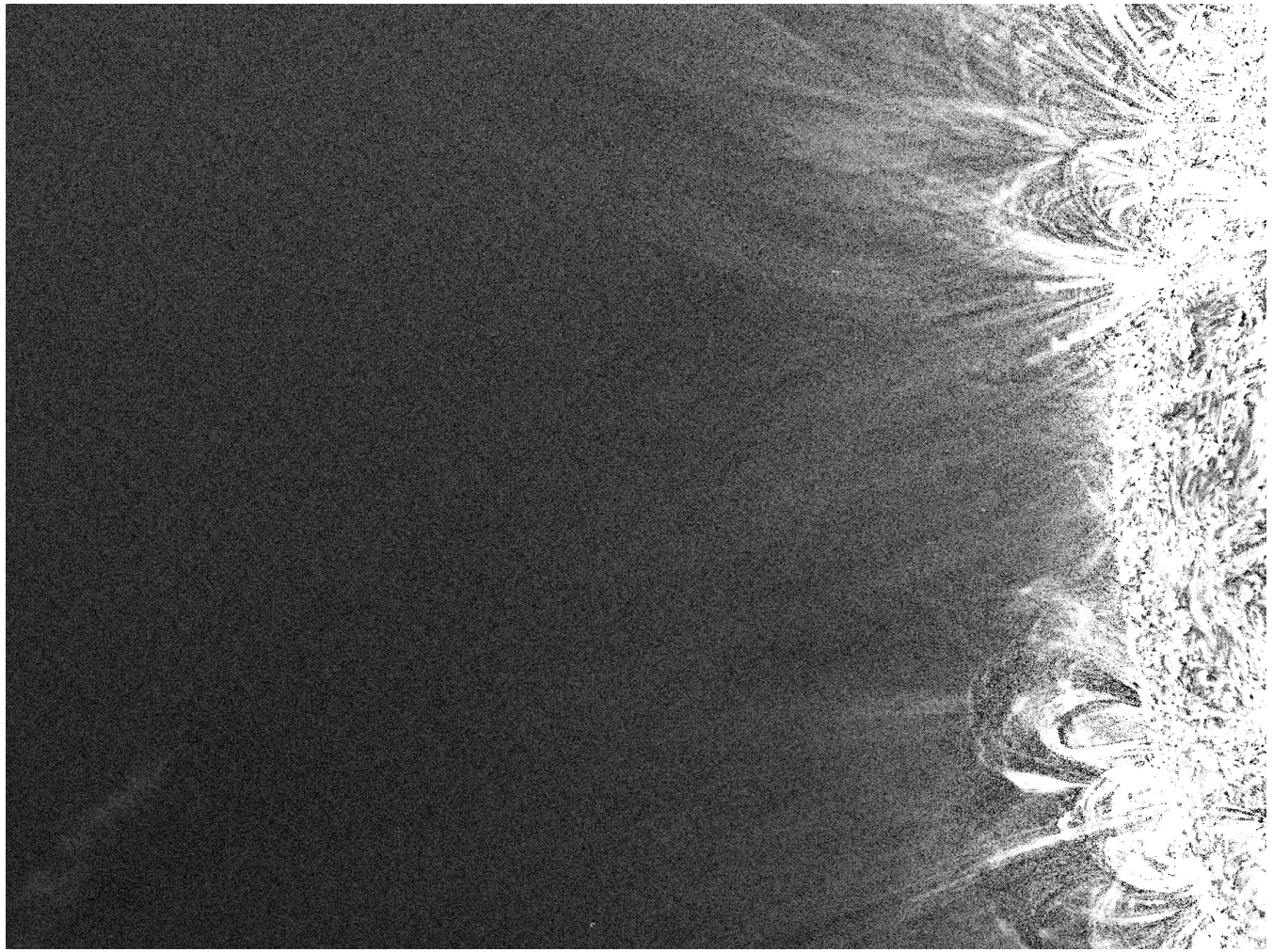
Apparition et disparition des régions actives derrière le disque lunaire

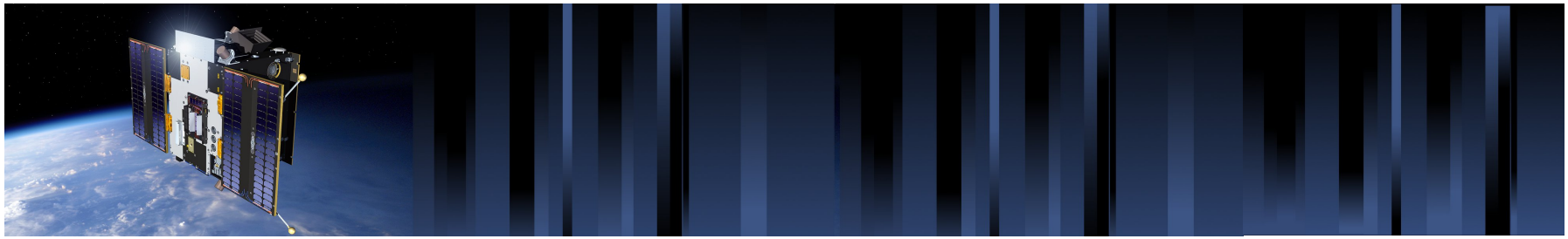


Transit de Vénus 05/06/2012



Comète Lovejoy 15/12/2011





Merci pour votre attention !