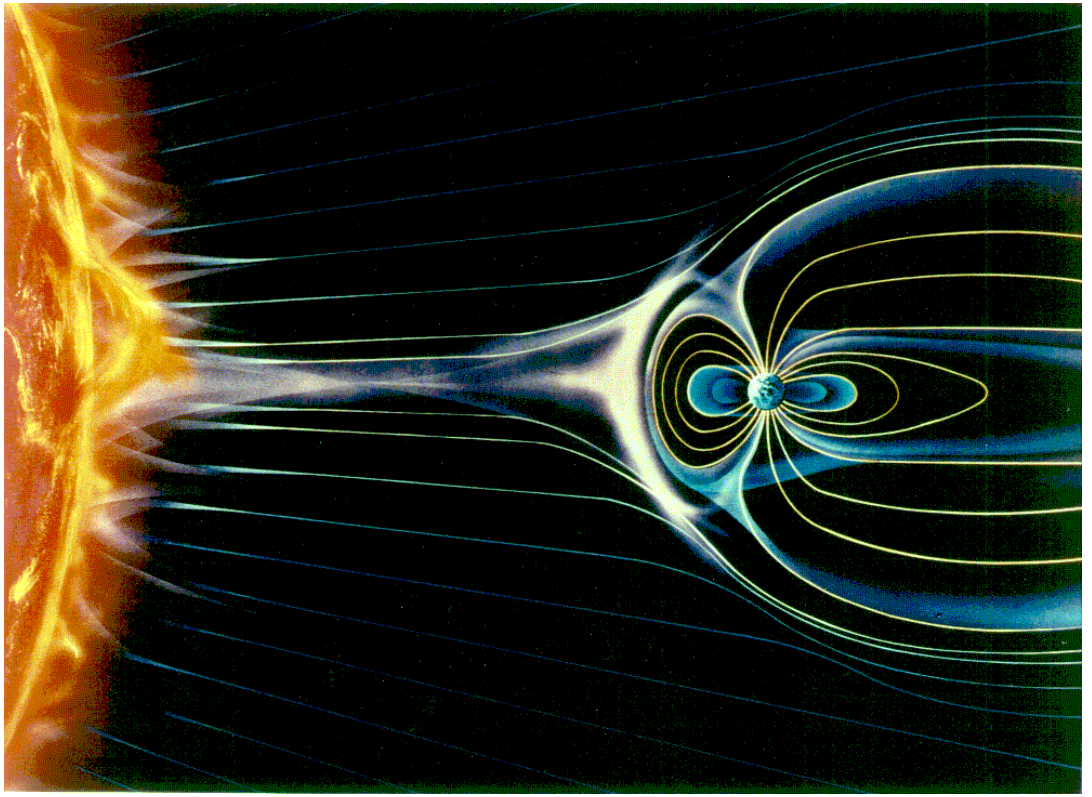
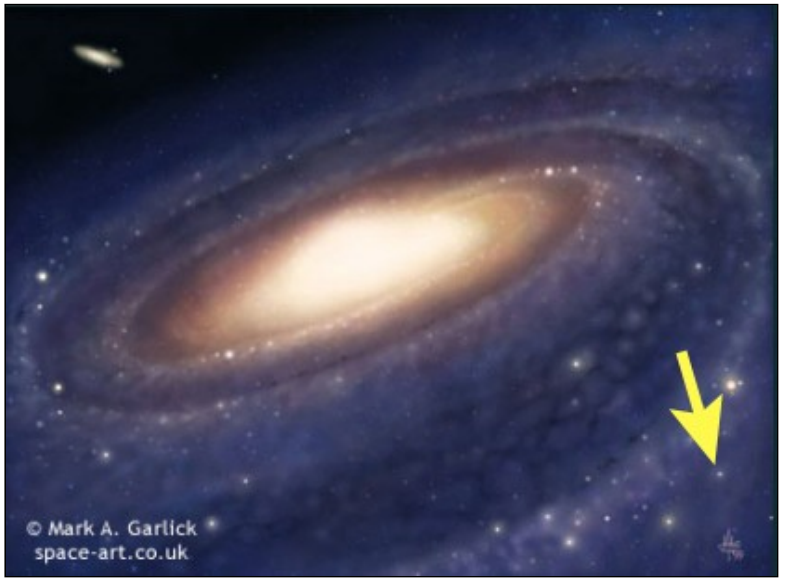
# Soarele si influenta sa asupra magnetosferei terestre

Marilena Mierla – Institutul de Geodinamica al Academiei Romane



# Soarele în Galaxia noastra (Calea Lactee)

- Soarele se afla intr-un brat spiral al Galaxiei - bratul Orion - la aprox. 30.000 ani lumina de centrul Galaxiei;
- Soarele, impreuna cu tot sistemul planetar, se roteste in jurul centrului Caii Lactee in aprox. 225 milioane de ani. Astfel, sistemul solar are o viteza de 230 km/s (830.000 km/h);
- Galaxia noastra contine aprox. 100 miliarde de stele si exista aprox. 100 miliarde de alte galaxii!

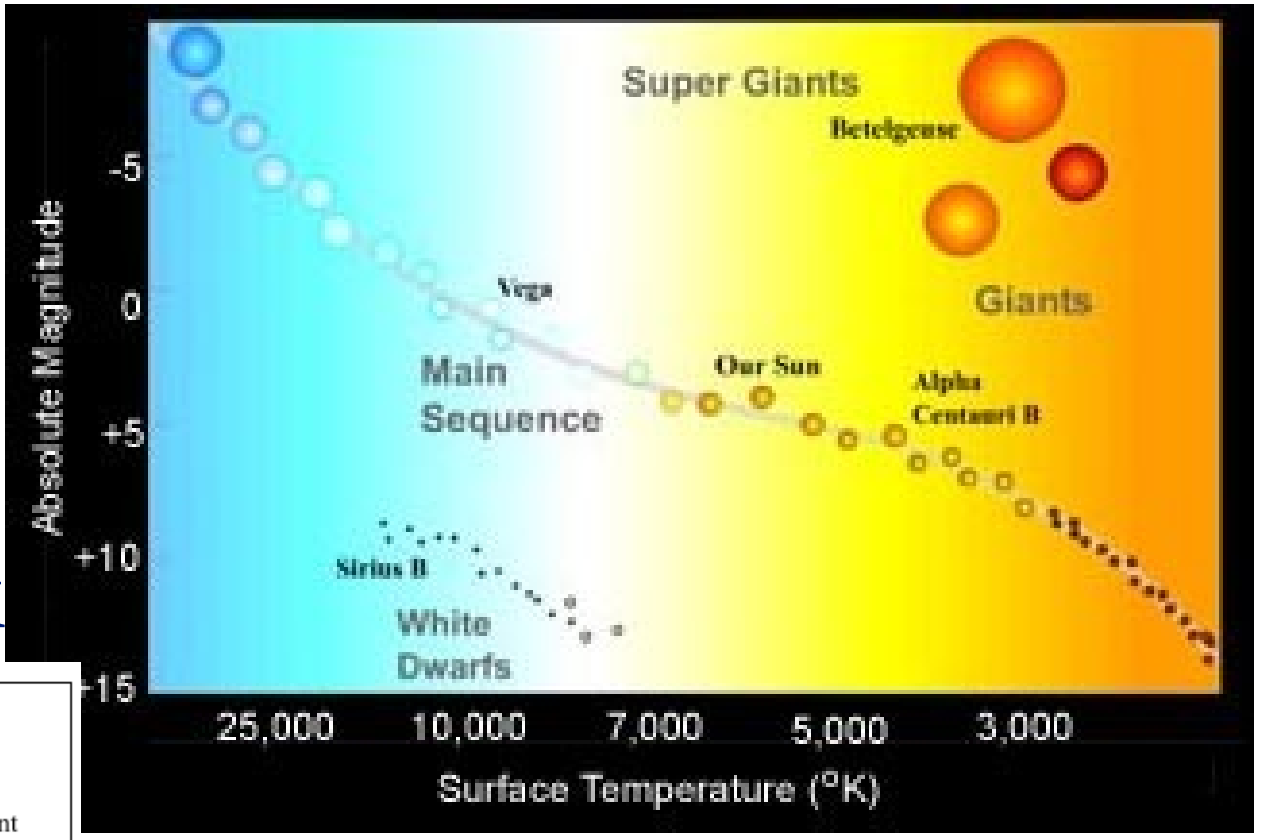


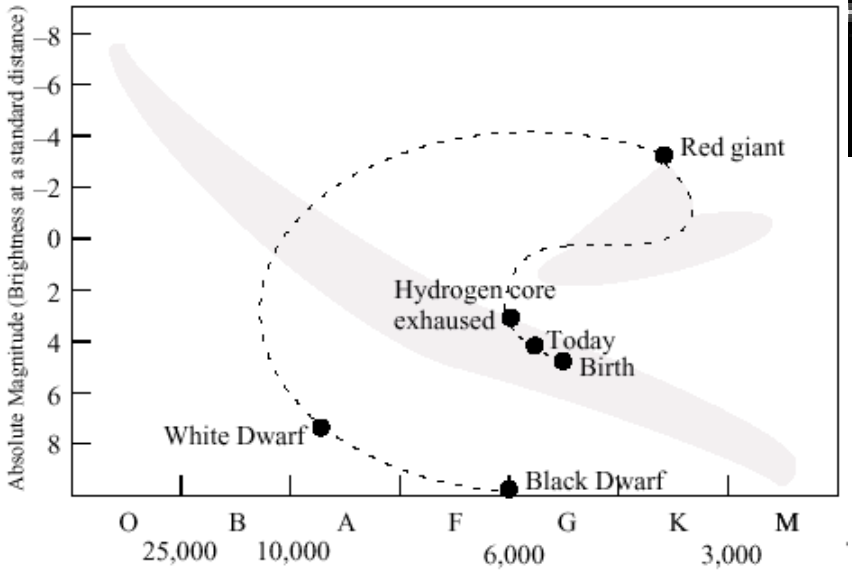

**Pe cerul noptii, Calea Lactee apare ca un "nor" lung de stele**



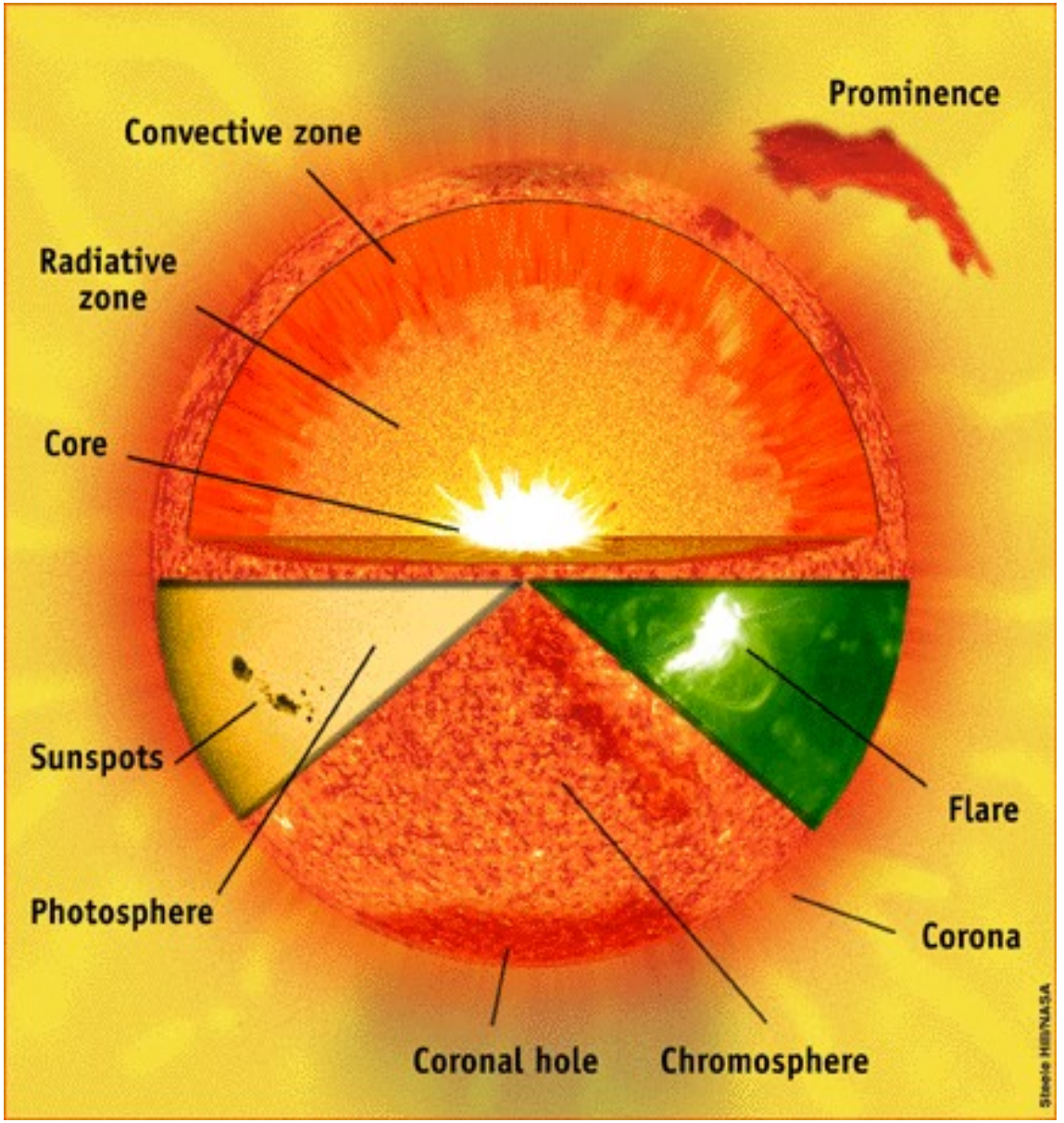
# Parametrii de stare si evolutia Soarelui

- **Varsta : $4,5*10^9$ ani;**
- **Masa : $1,99*10^{30}$ kg;**
- **Raza : 696 000 km;**
- **Temperatura: ~ 6000 K**



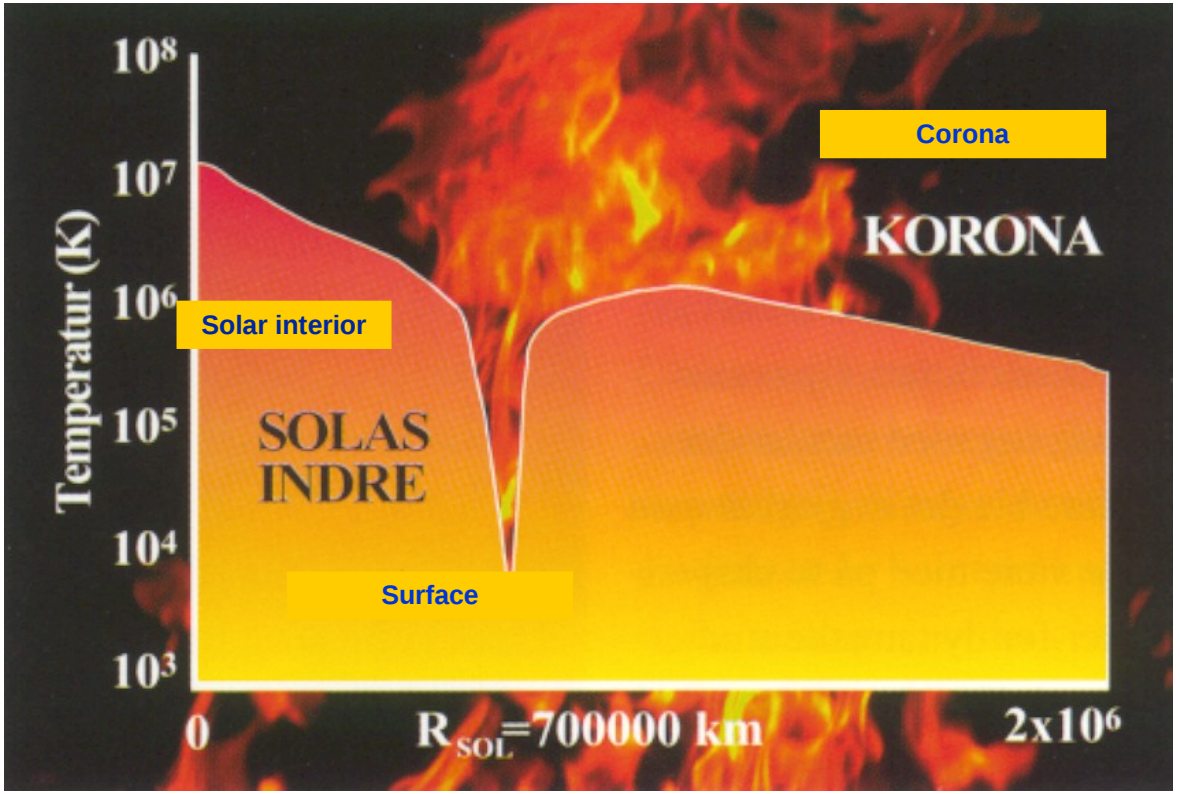



# Structura Soarelui



# Straturile Soarelui

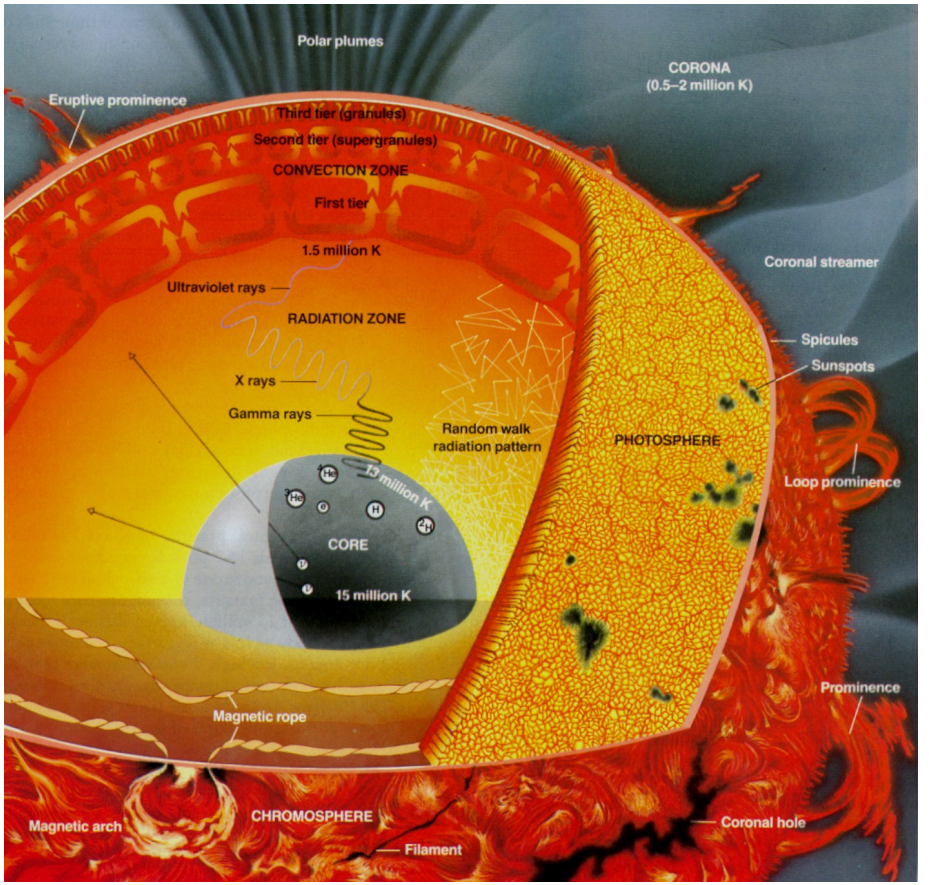
- Nucleul
- Zona radiativa
- Zona convectiva
- Fotosfera
- Cromosfera
- Regiunea de tranzitie
- Coroana




http://www.columbia.edu/~ah297/unesa/sun/sun-chapter1.html

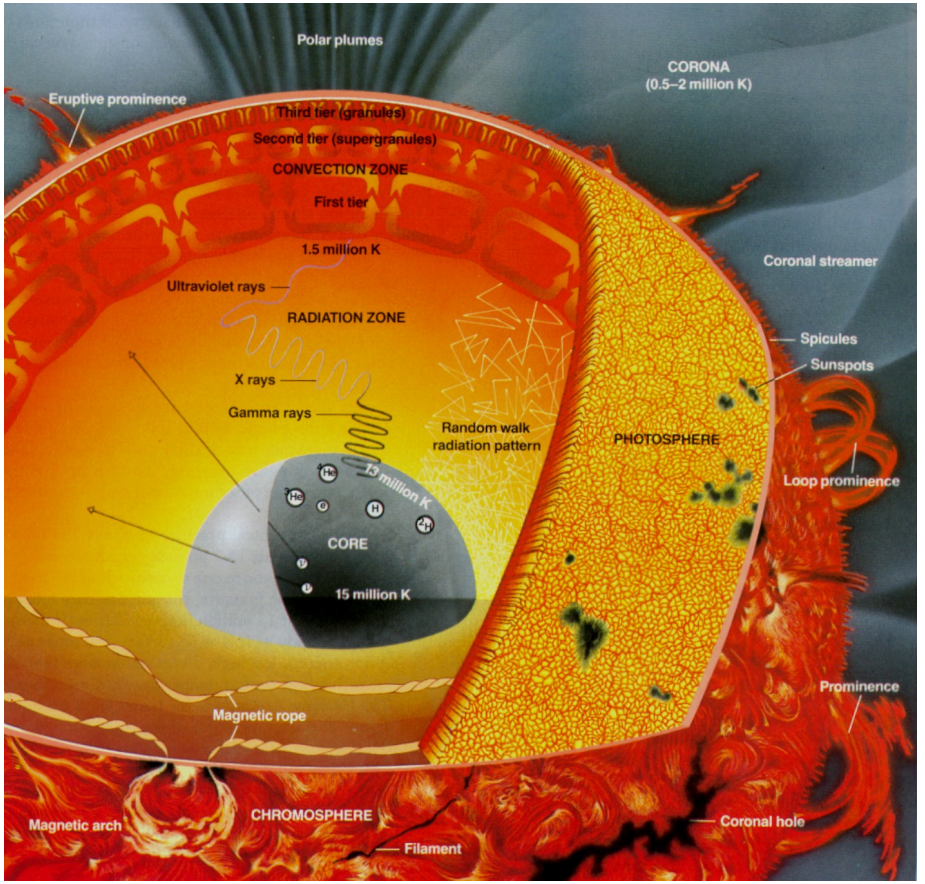
# Nucleul Solar

- Aici se creeaza energia solara.
- Prin reactiile nucleare, in fiecare secunda aprox. 700 milioane de tone de hidrogen se transforma in heliu.
- In nucleu particulele sunt atat de aproape si temperatura este atat de mare (>15 MK) incat atomii de hidrogen se contopesc formand atomi mai grei de heliu si eliberand o cantitate de energie.



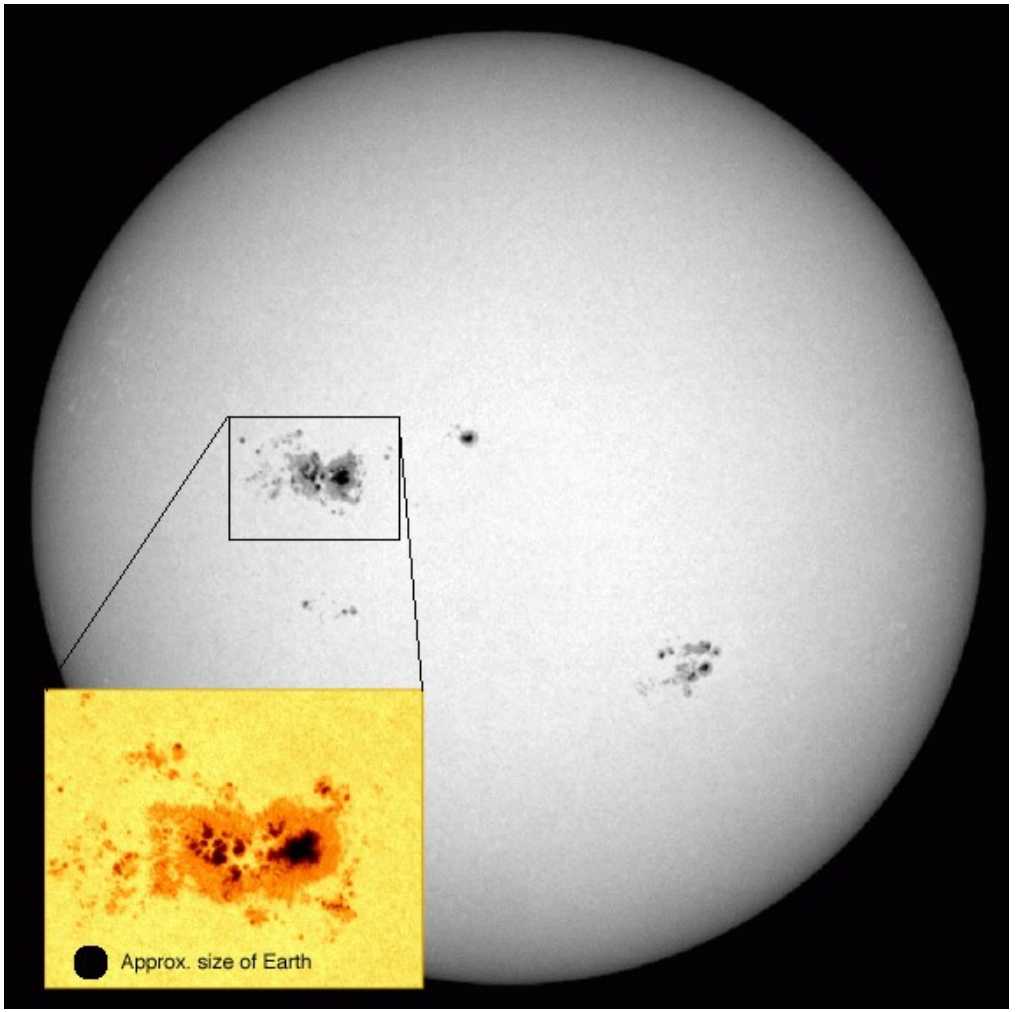
# Zona Radiativa si Zona Convectiva

- Zona Radiativa
  - Energia este transportata prin radiatie.
  - Desi fotonii se propaga cu viteza luminii, le trebuie un timp enorm pentru a strabate materia extrem de densa asa incat abia dupa un milion de ani reusesc sa scape din Soare.
- Zona Convectiva
  - Energia este transportata prin convectie (ca intr-o oala cu apa in clocot) catre suprafata Soarelui.



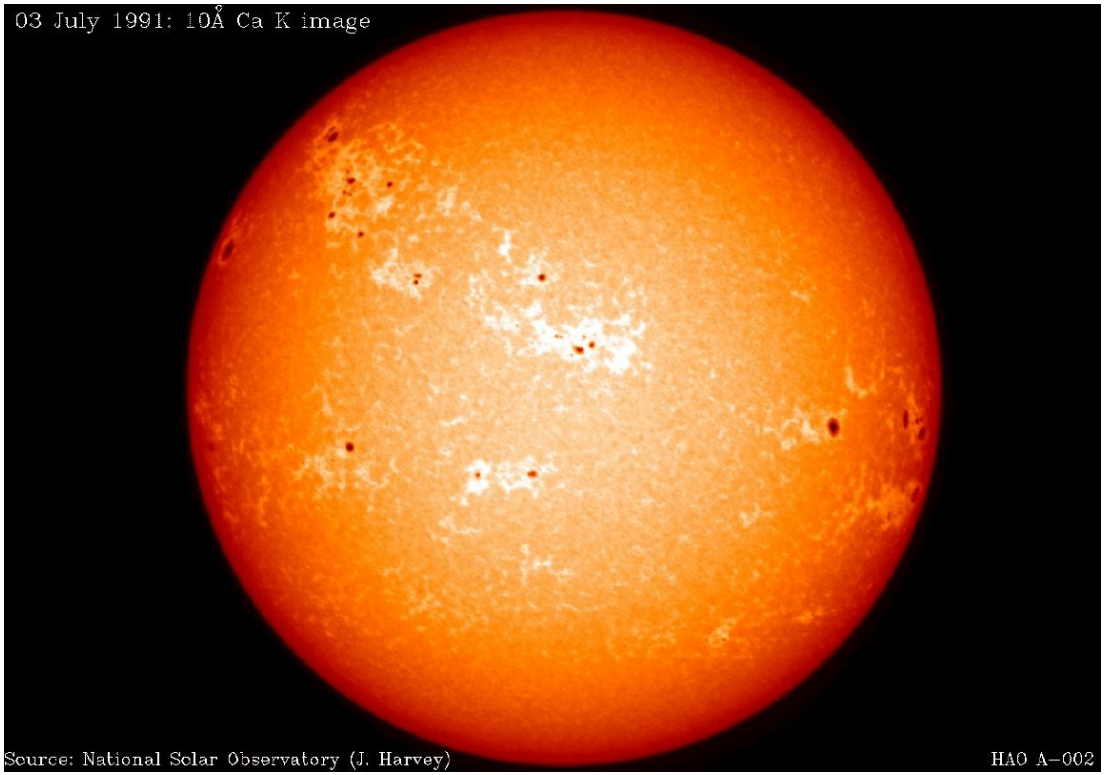
# Fotosfera si Petele Solare

- Fotosfera (sfera luminoasa) - primul strat al atmosferei solare (400 - 500 km, 6000 K)
- Petele solare - Arii întunecate (umbra, penumbra) caracterizate de
  - Câmpuri magnetice puternice;
  - Inhibã transportul convectiv dinspre interior;
  - Arii mai reci, deci mai întunecate (4500 K);
  - Frecventa de aparitie variaza cu un ciclu de 11 ani.

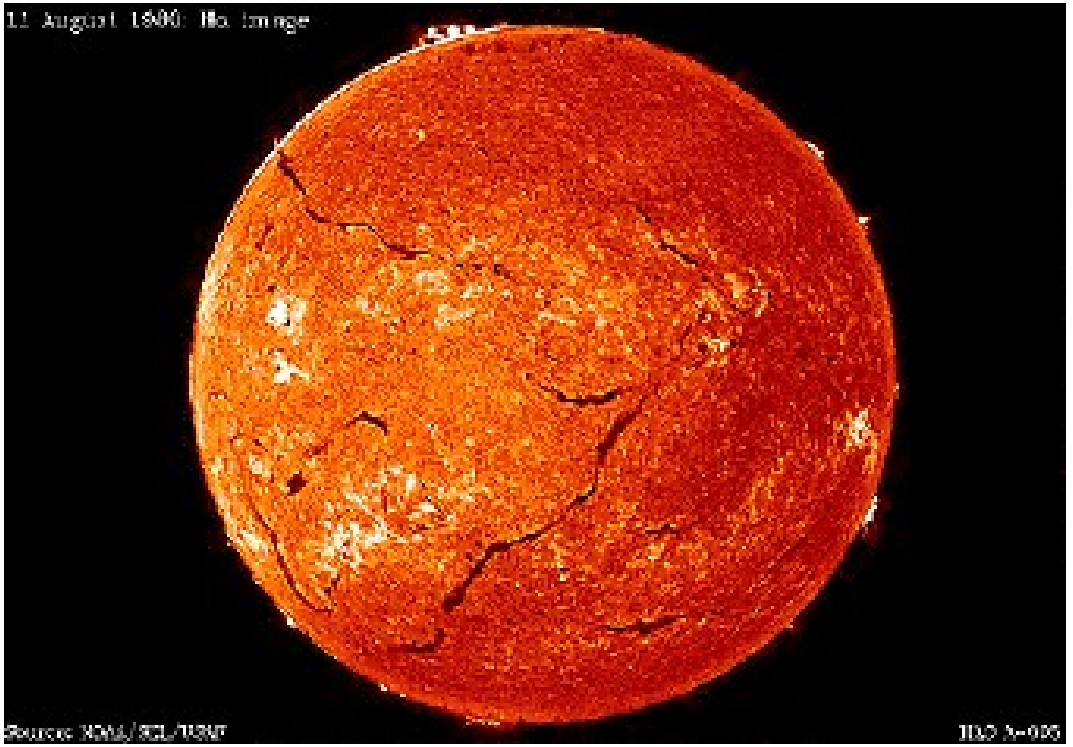


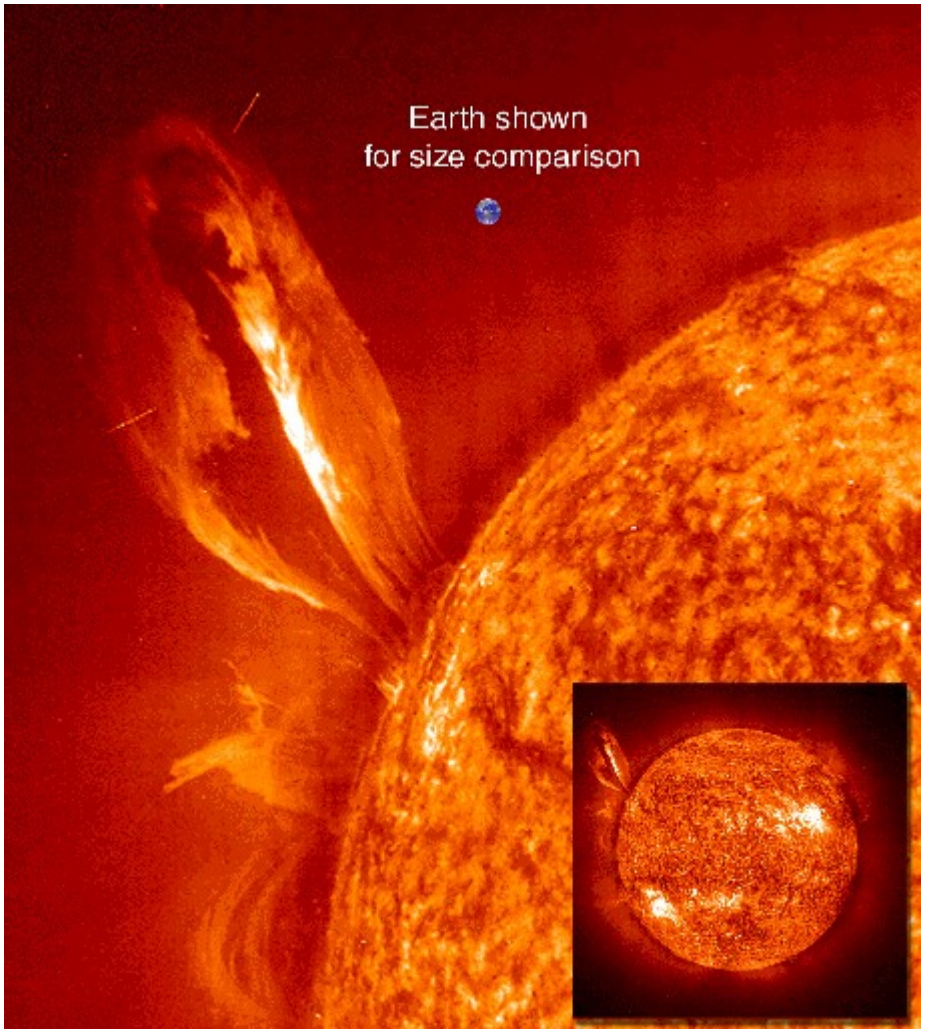
# Cromosfera solara

- Cromosfera (sfera colorata) - al doilea strat al atmosferei solare;
- Imagine a Soarelui luata cu un filtru cu banda de trecere de 10Å, centrat pe linia K a Calciului ionizat (3934 Å).
- Structuri strãlucitoare, filamentare, vizibile mai usor la marginea discului solar. Temperaturi de la 6 000 la 20 000 K.



# Structuri ale Cromosferei

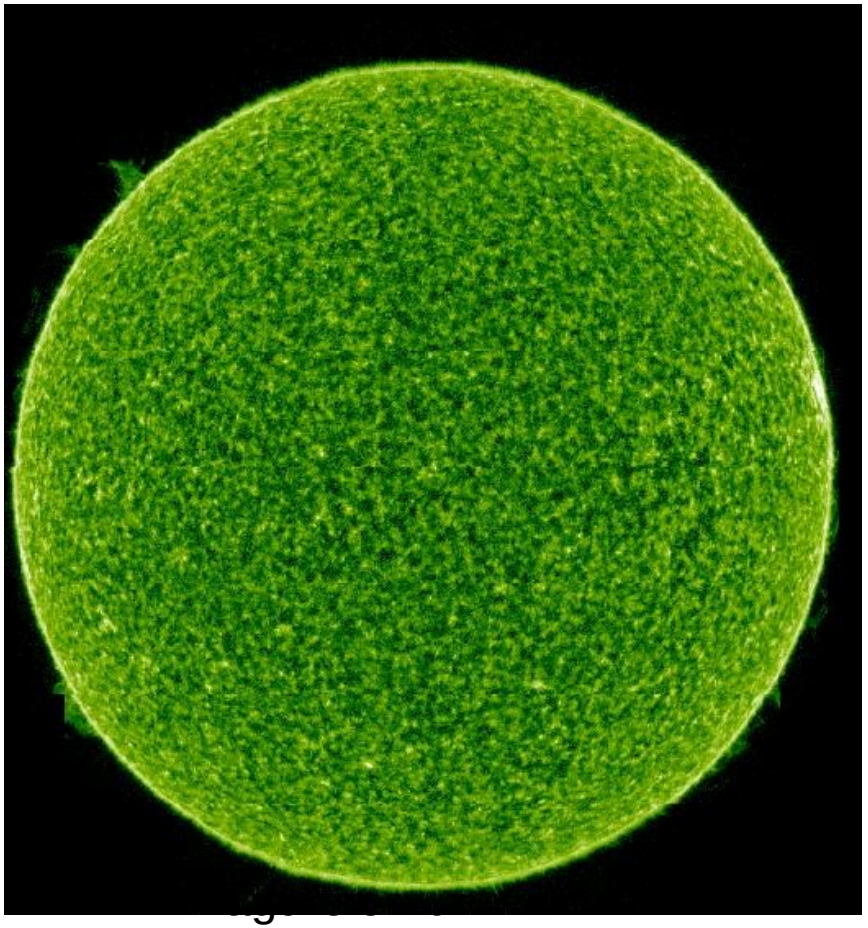





**Filamente / Protuberante**

# Regiunea de Tranzitie

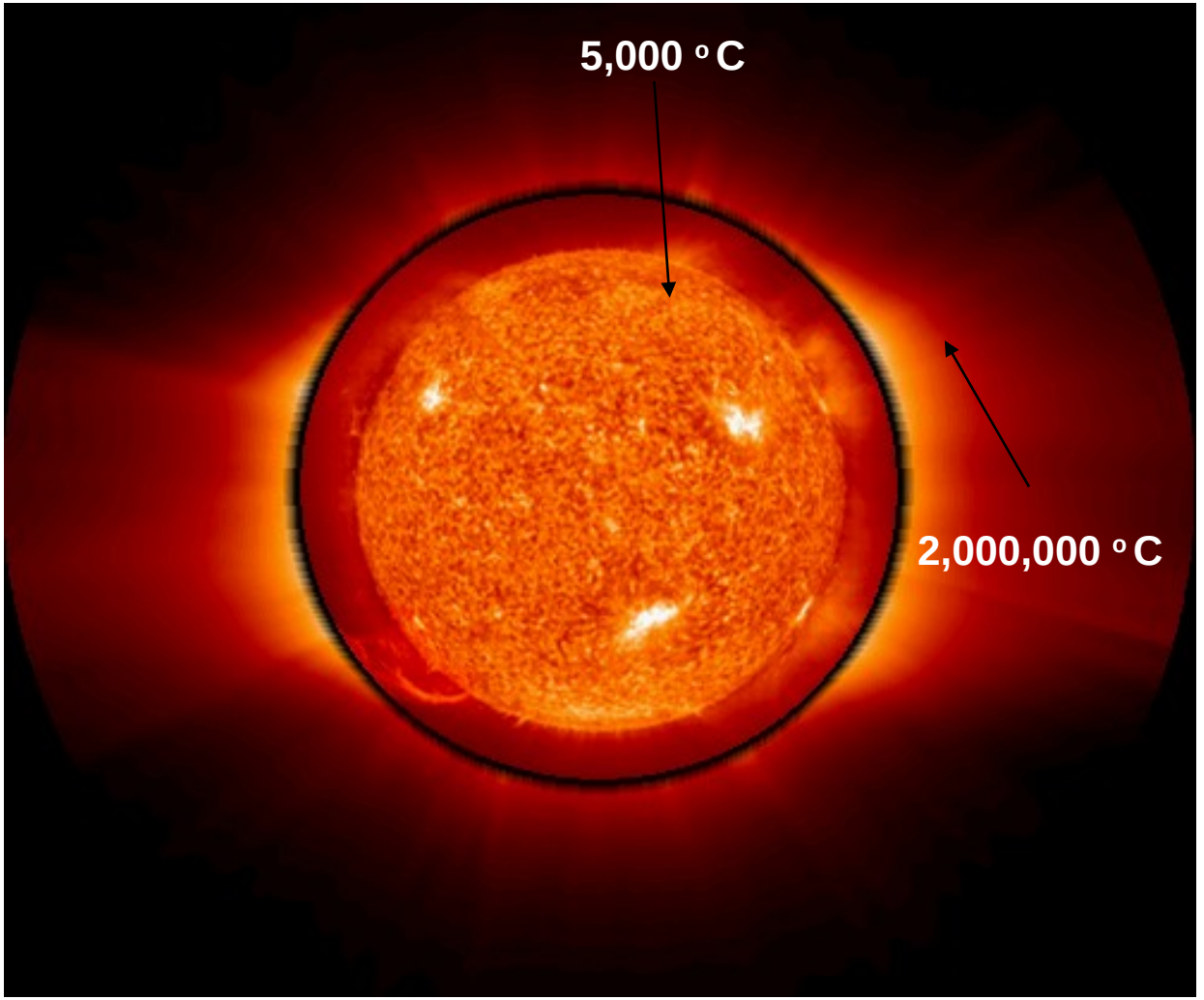
- Strat al atmosferei solare, subtire si neregulat, ce separa coroana de cromosfera
- Temperaturile cresc rapid de la 20 000 K la 1 MK



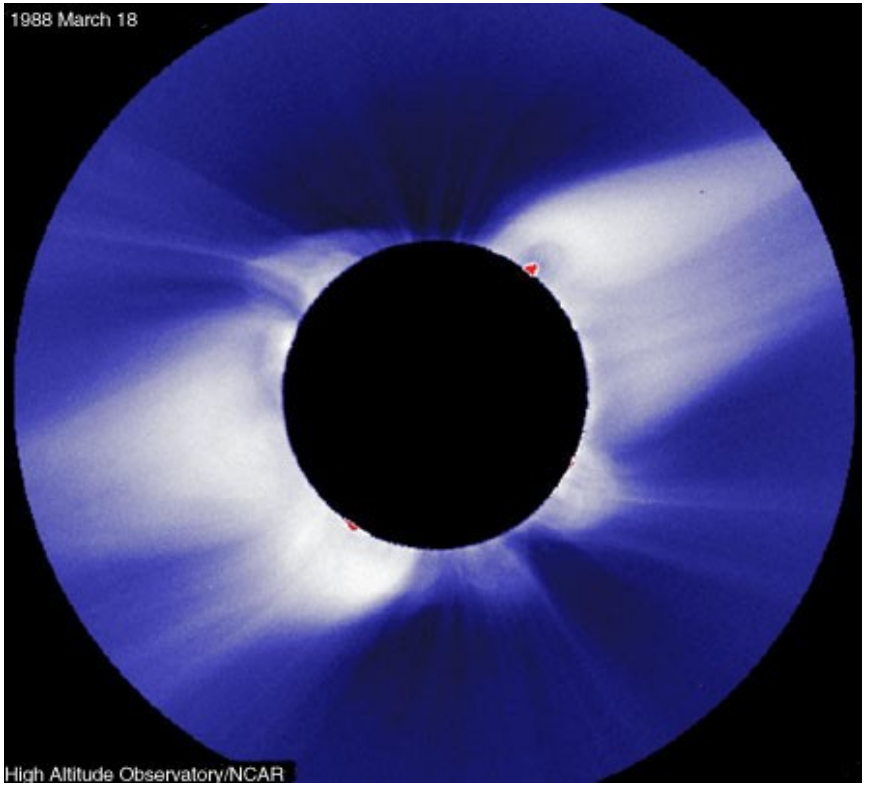
**C IV**

# Coroana Solara

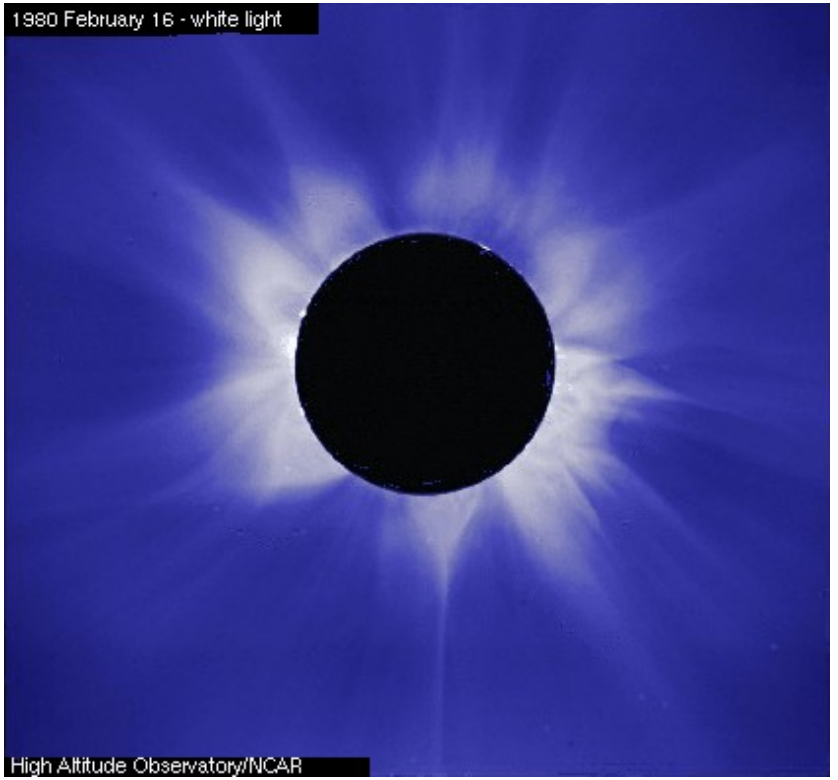
- Coroana este patura externa a atmosferei Soarelui.
- La suprafata Soarele are doar 6.000$^{o}$ K, temperatura in coroana atinge aprox. 1 - 2 milioane de grade Kelvin.
- Motivul acestei incalziri a coroanei este inca o enigma a fizicii solare.



# Coroana Solara

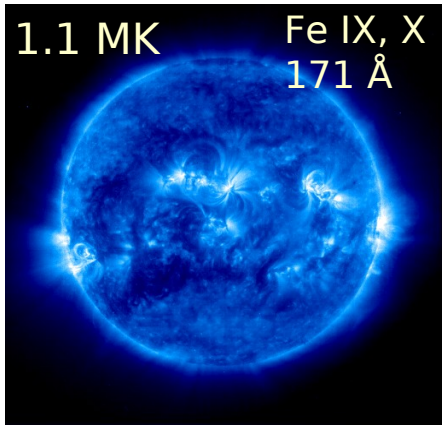


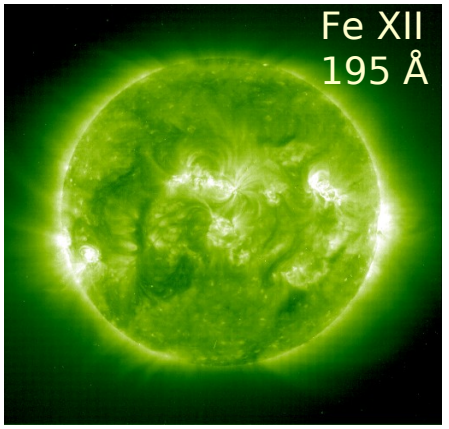

**Eclipsa Solara (1988)**

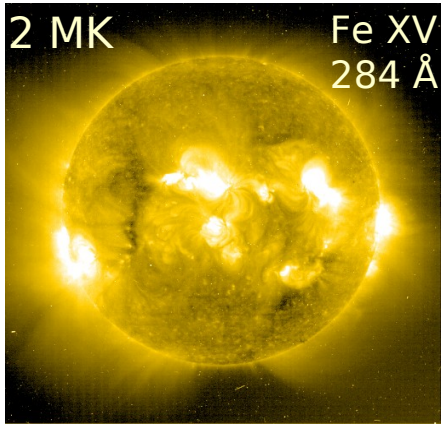


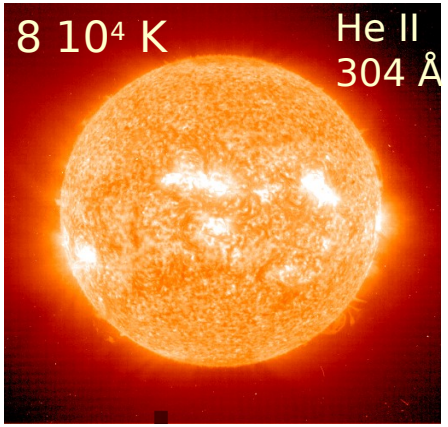

**Eclipsa Solara (1980)** So

# Coroana Solara

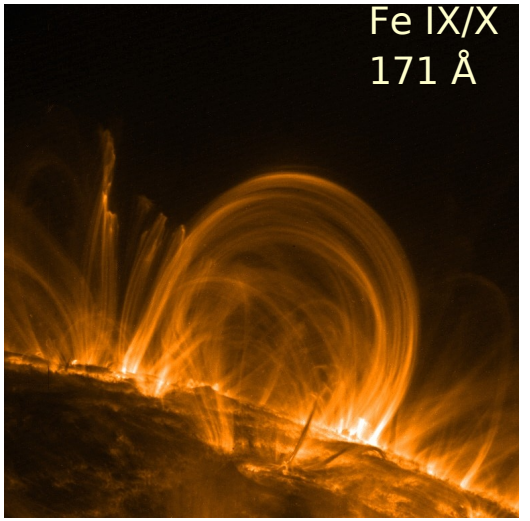


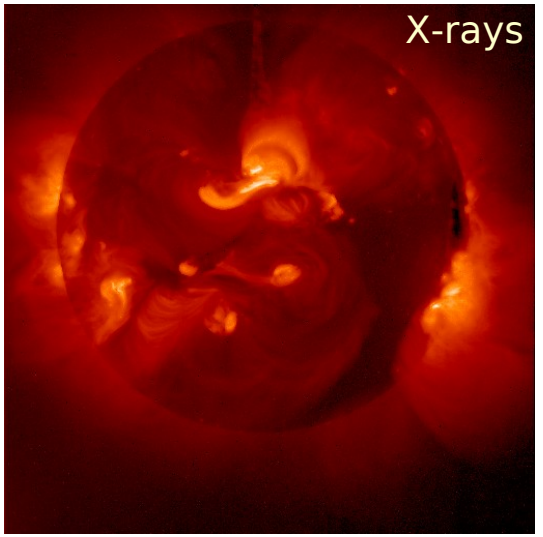




**EIT/SOHO (3rd of November 2004)**




**TRACE (6th of November 1999)**




**SXT/Yohkoh (December, 2001)**

# Fenomene caracteristice Coroanei solare

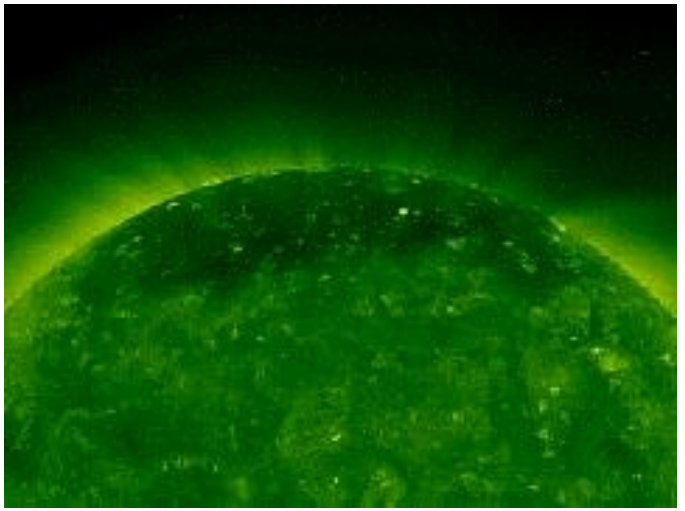
- **Curenti coronali**
- **Regiuni active**
- **Bucle coronale**
- **Gauri coronale**
- **Pene polare**
- **Ejectii coronale de masa**
- **Vantul Solar**

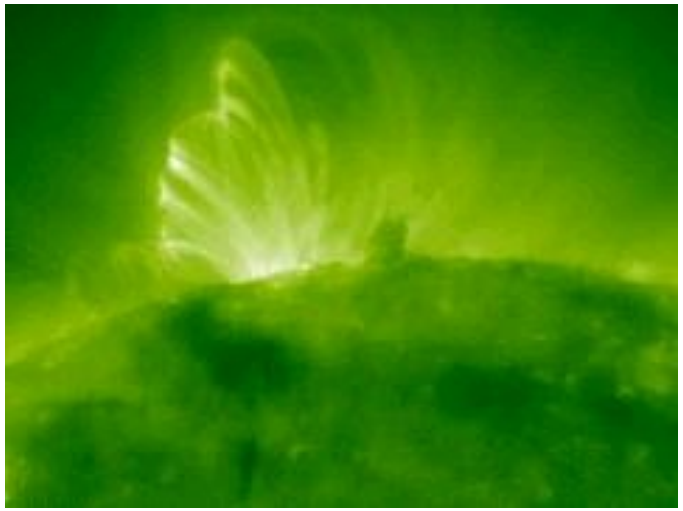
# Structuri ale Coroanei Solare

Curenti coronali

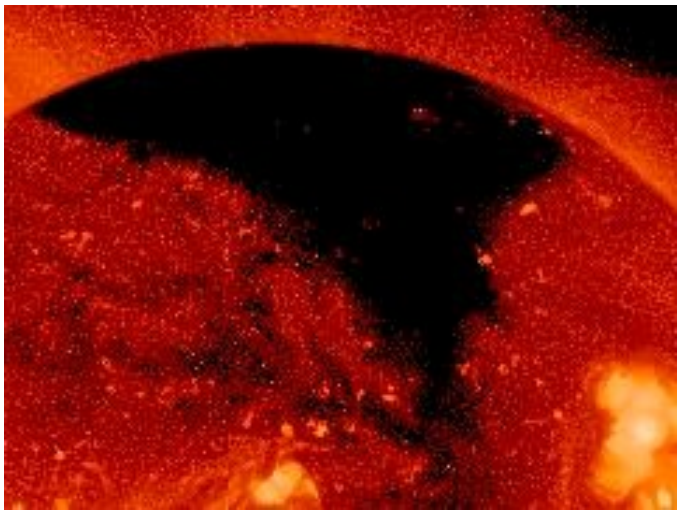


Pene polare





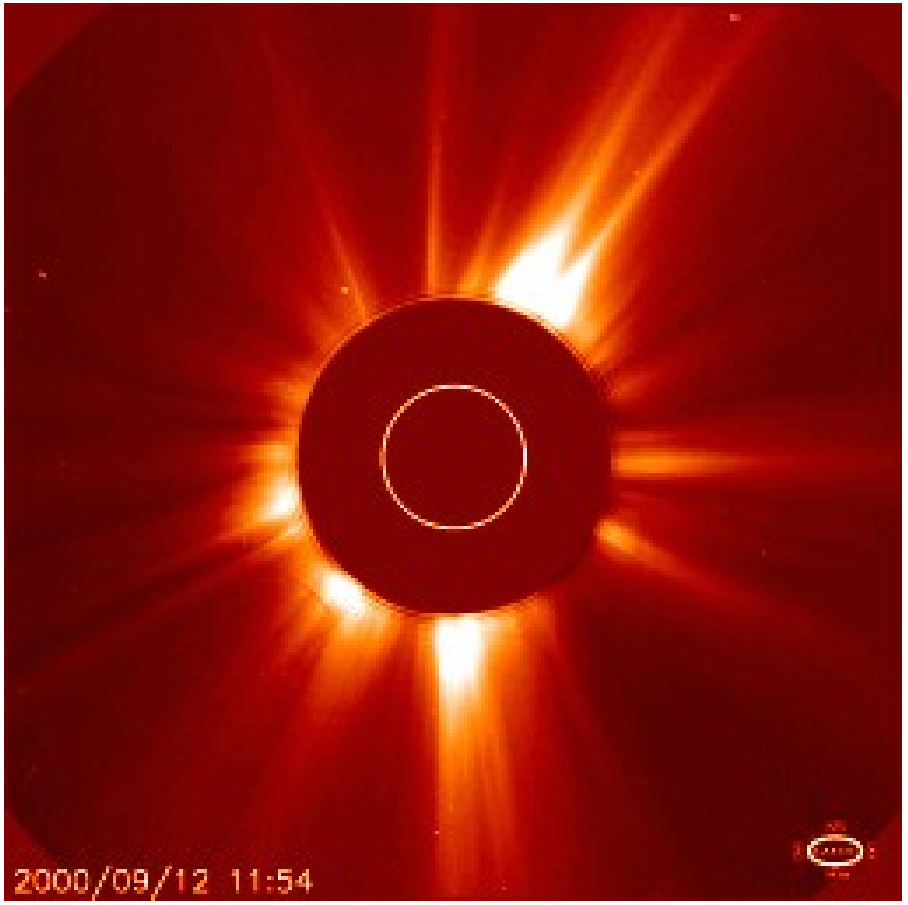
Bucle coronale



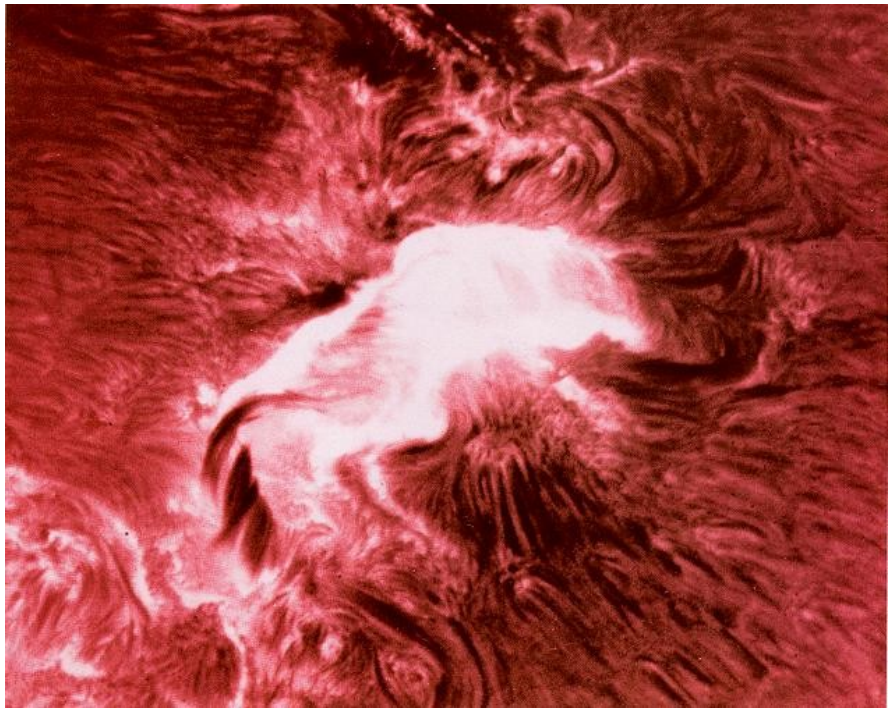
Gauri coronale

# Soarele in Actiune

- Eruptii solare
- Ejectii coronale de masa

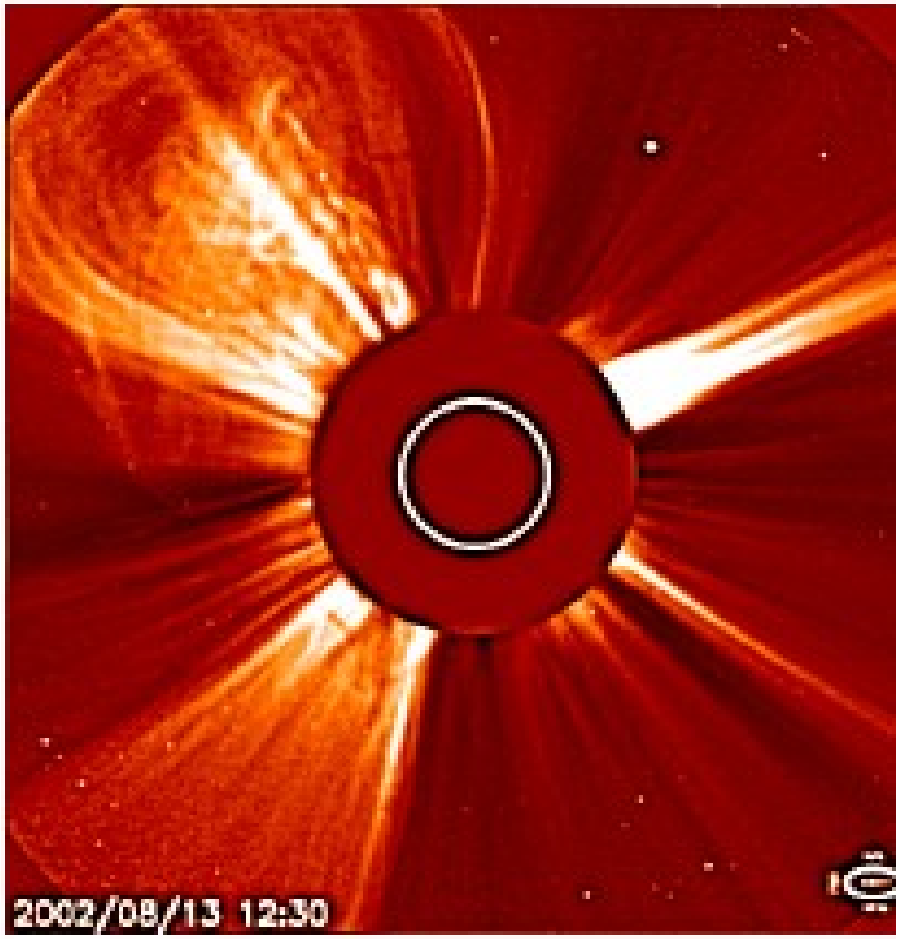


# Eruptii Solare



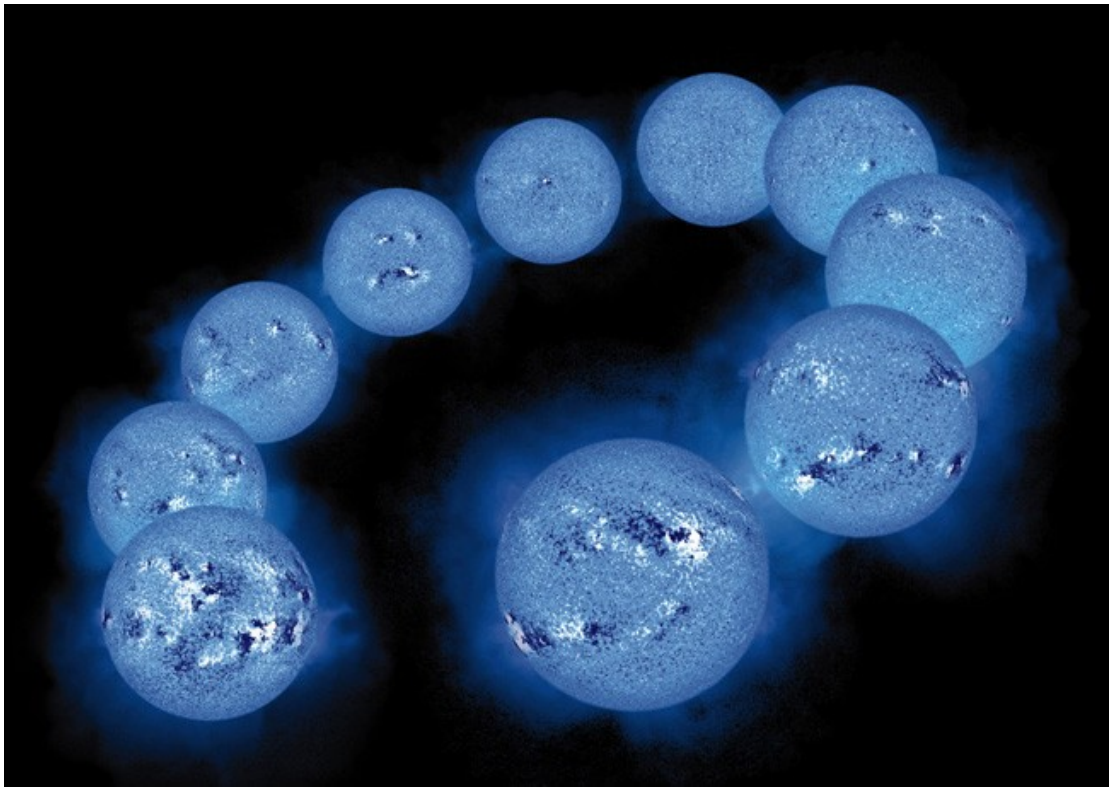
- Explozii puternice pe suprafata Soarelui
- Elibereaza energie in forma: electromagnetica (Radiatie gamma si X), particule energetice (protoni si electroni) si curgeri de masa.

# Ejectii Coronale de Masa (CMEs)




- Cantitati uriase de plasma si camp magnetic de pe Soare ejectate in spatiul interplanetar in decurs de cateva ore.

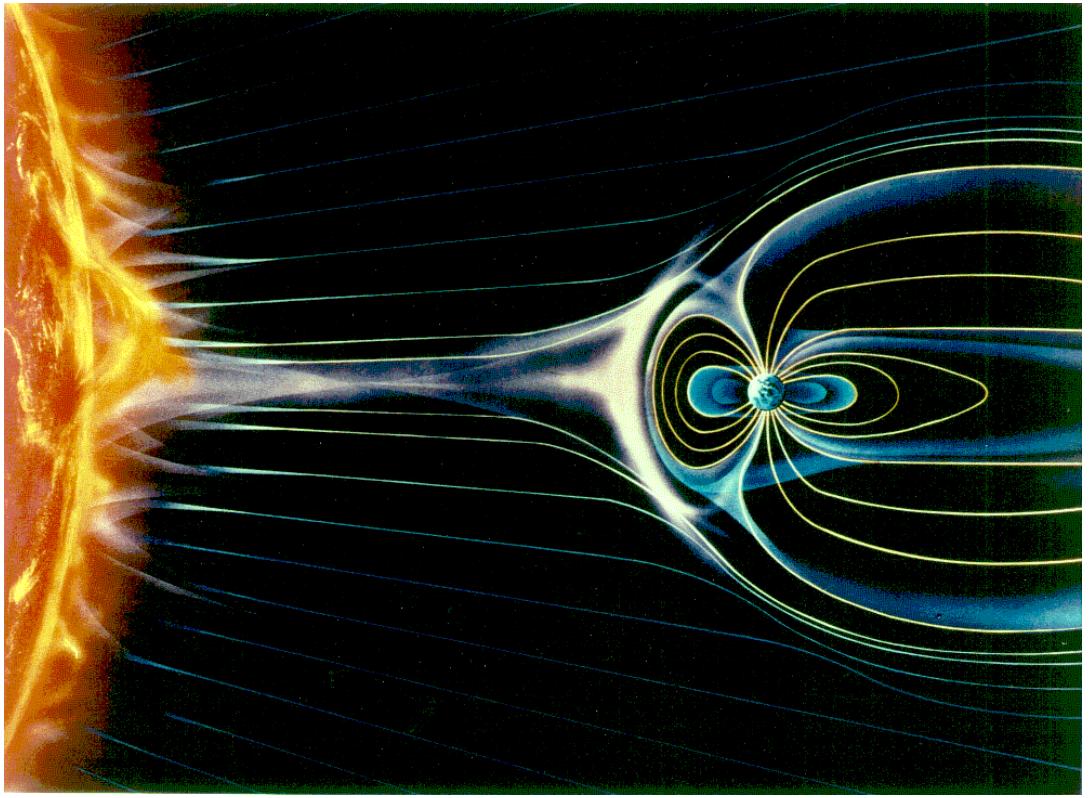
# Coroana solara în ciclul de 11 ani



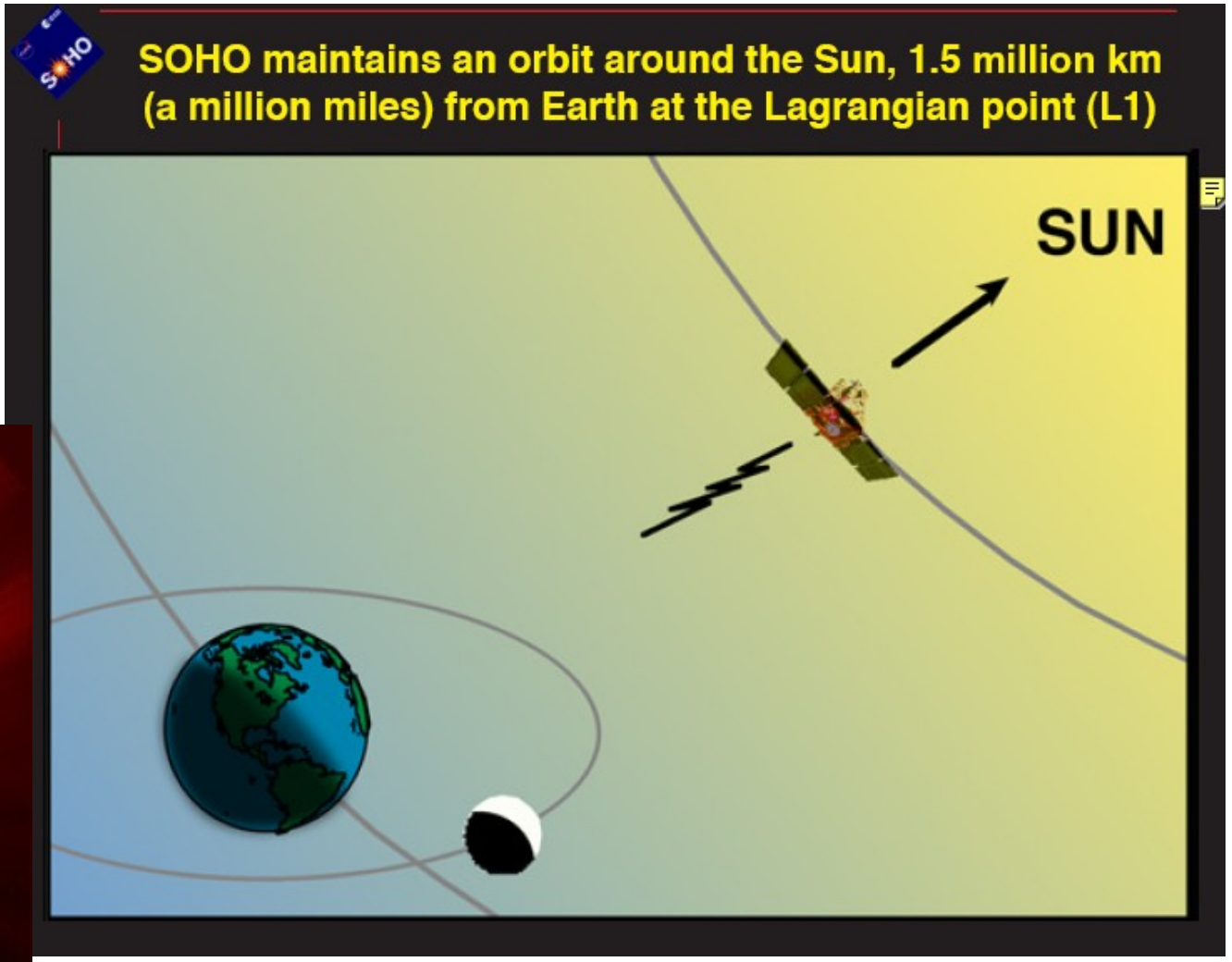
Imaginea coroanei solare in fiecare an, din 1989 - maximul ciclului solar 22 - pana in 1998.

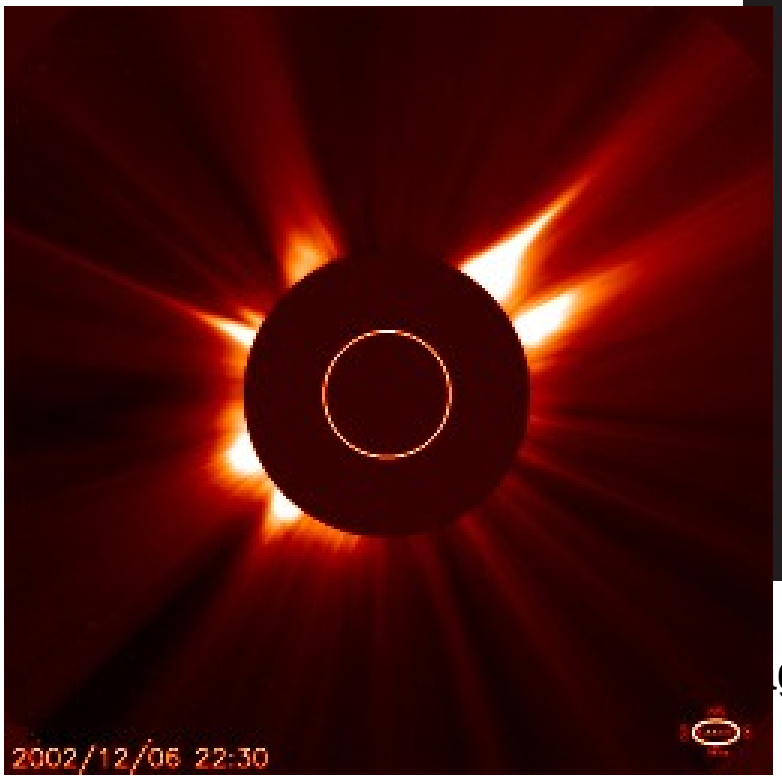
# Vantul Solar

- Un flux constant de particule ce “curg” din coroana solara, cu temperatura de aprox. 1 milion de grade K si cu  o viteza de aproximativ 450 km/s.  Vantul solar strabate intreg sistemul solar pana dincolo de orbita lui Pluto (aprox. 5900 milioane km). Schita de mai jos arata cum vantul solar “preseaza” magnetosfera Pamantului si o comprima in directia dinspre Soare, alungind-o in directia anti-solara.

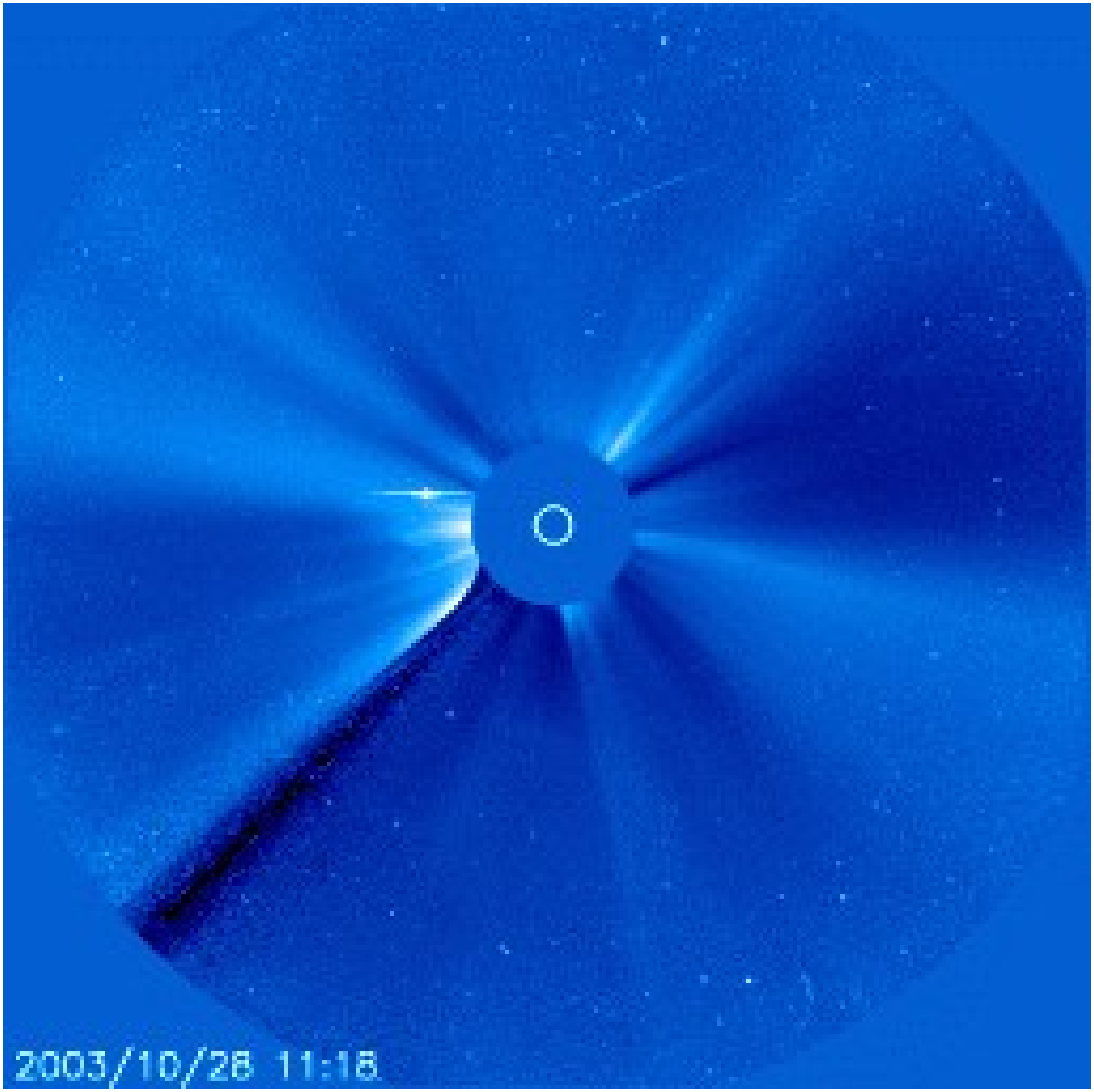


# CMEs – de la Soare la Pamant

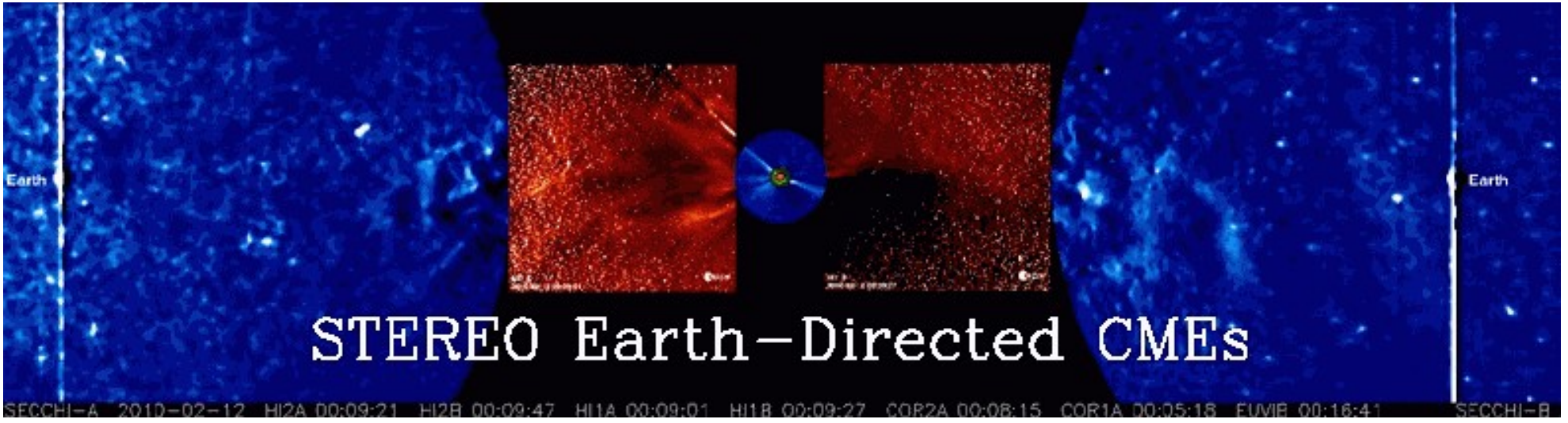


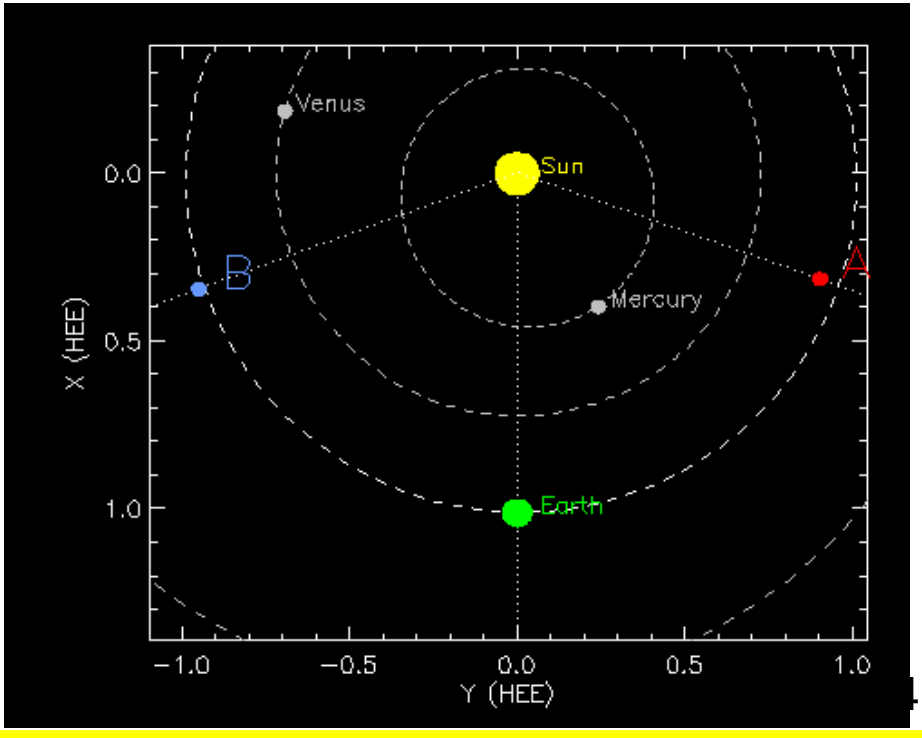



# CMEs – de la Soare la Pamant



# CMEs – de la Soare la Pamant




http://sprg.ssl.berkeley.edu/~liuxying/CME_catalog.htm

# CMEs – de la Soare la Pamant

http://www.spaceweathercenter.org

# Fenomene asociate cu activitatea Solara

Furtuni geomagnetice

- aurore polare
- caderi ale retelelor electrice aflate pe arii extinse
- coroziuni ale conductelor de gaze etc.



# Aurore Polare





