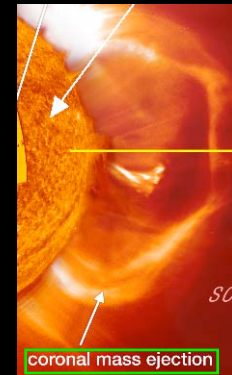
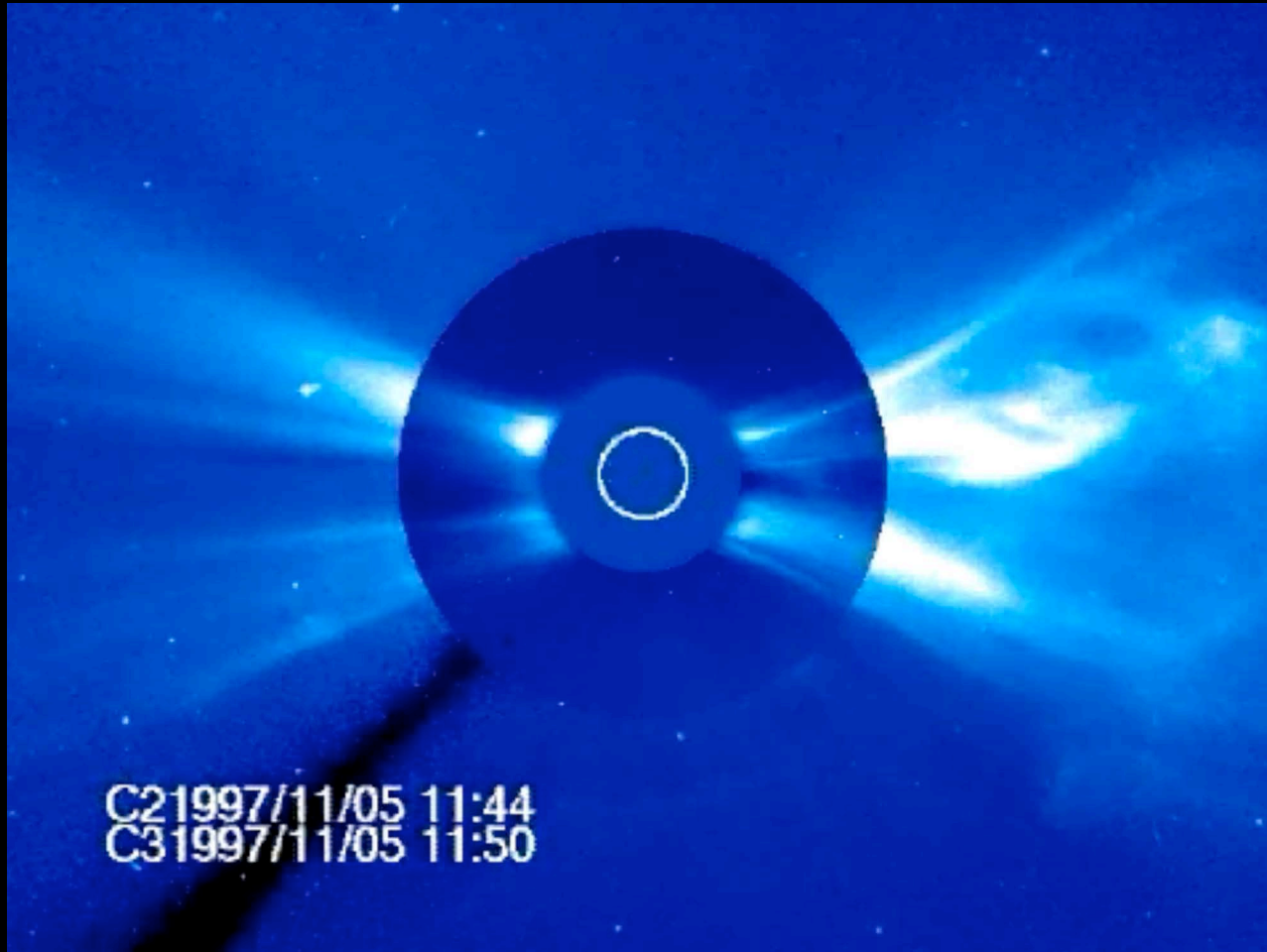


**Coronal mass ejection: global eruption in the corona**

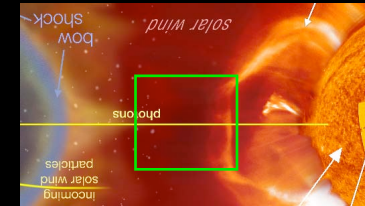
intermittent outflow from the Sun



Observed in white light (SOHO)

# **Solar wind:** outflow of a coronal plasma

continuous outflow from the Sun



Solar wind observed by **STEREO**

## Credits

Animations: NASA Goddard Space Flight Center

Data: Craig DeForest, SwRI

Research:

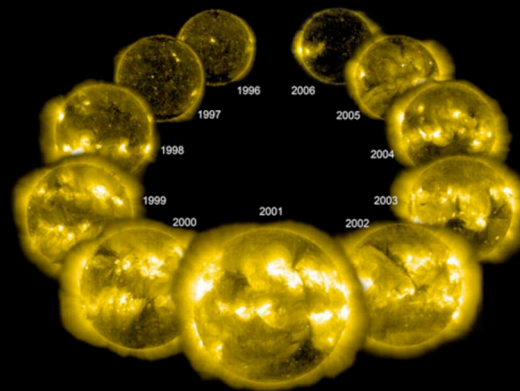
*Fading Coronal Structure And The Onset Of Turbulence In The Young Solar Wind*

C. E. DeForest, W. H. Matthaeus, N. M. Viall, and S. R. Cranmer

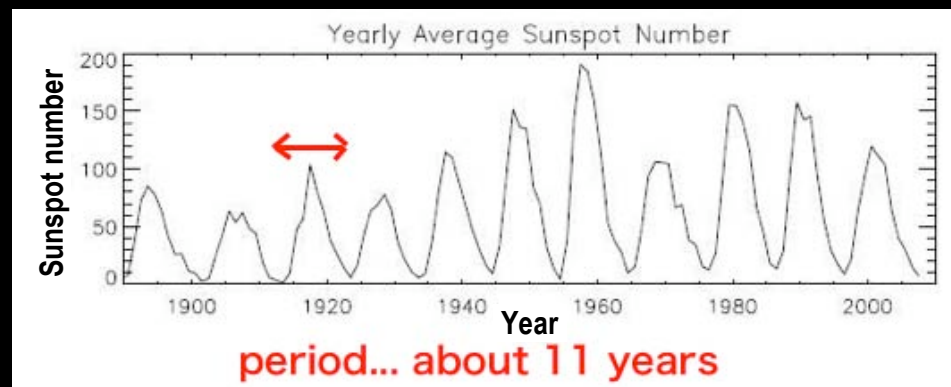
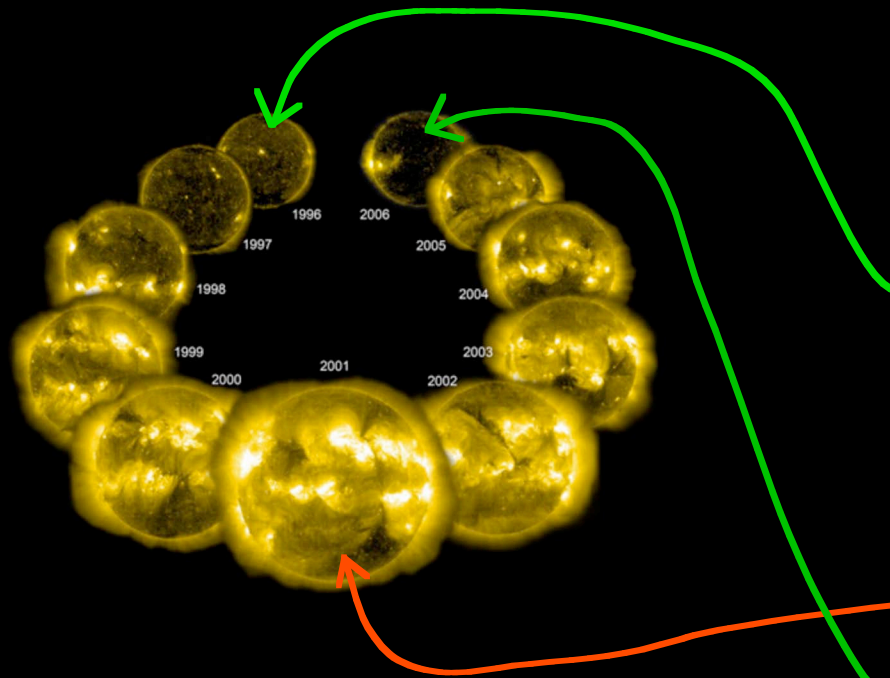
The Astrophysical Journal, doi:10.3847/0004-637X/828/2/66

# Dynamic Sun II

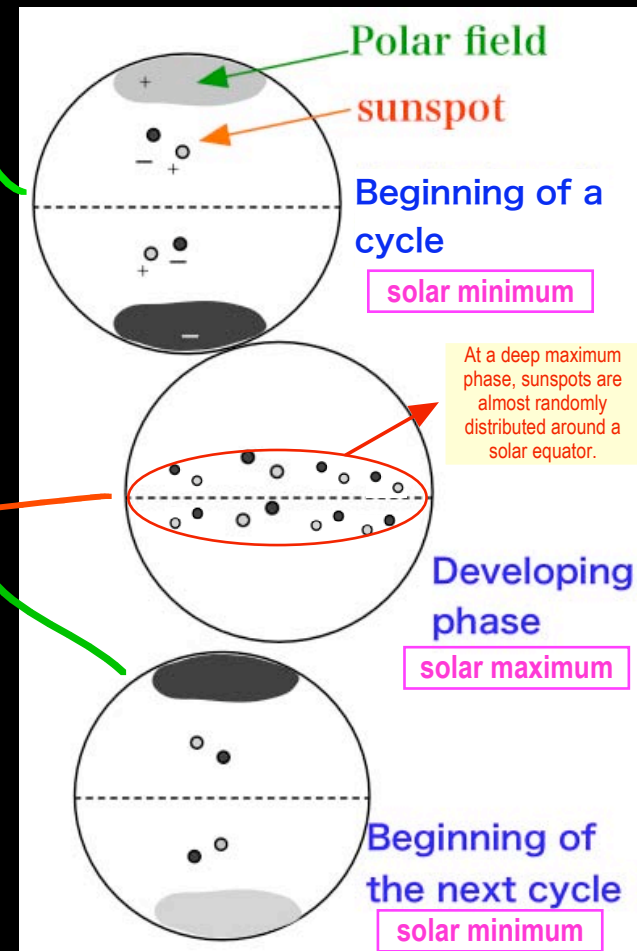
(long time-scale phenomena: ~ years)



## Solar cycle: periodic variations of solar global activity

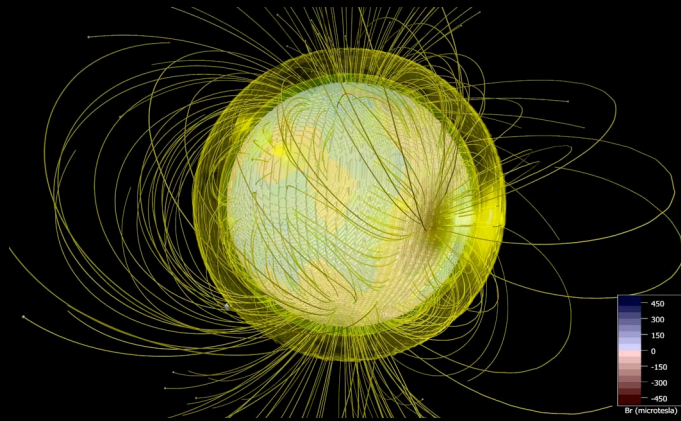


### Hale's law on solar magnetic cycle



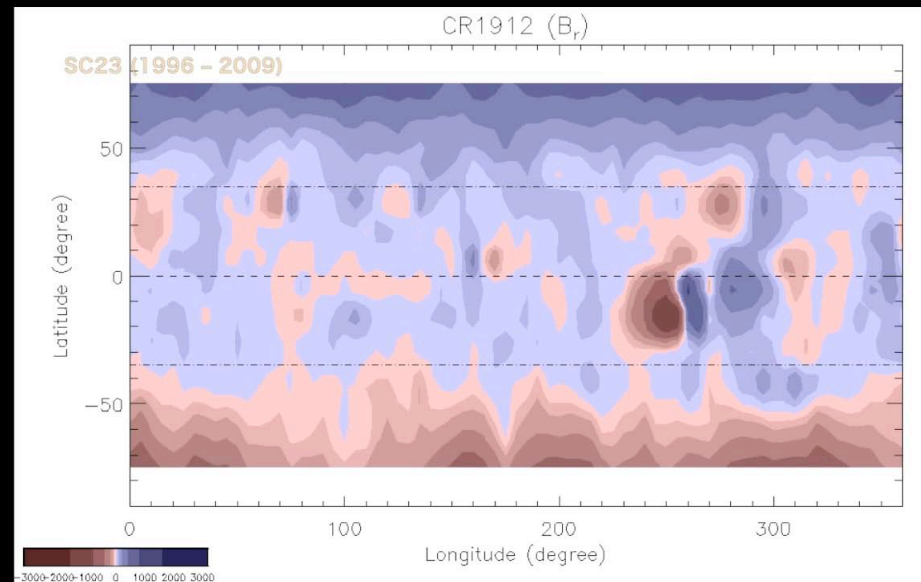
# Variations of the Sun's large-scale magnetic field

<http://163.180.179.74/~magara/Download/SDMS-2021-02d.pdf>



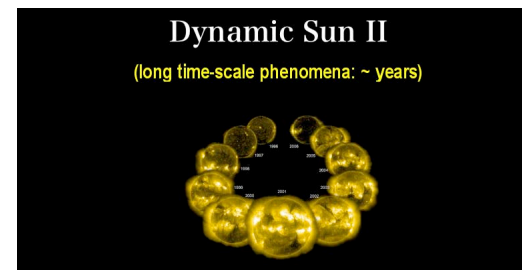
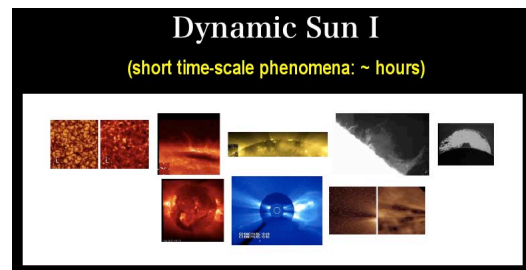
CR1912  
(1996 07/25 - 08/21)

WSO synoptic map



unit:  $\mu\text{T}$

# What produces solar dynamic phenomena?



***Magnetic fields play important roles in producing solar dynamic phenomena.***

- **Cyclic amplification of magnetic fields in the solar interior (dynamo)**  
=> **Produces long-term activity variations** known as **solar cycle**
- **Transport of magnetic fields through the convection zone (magnetconvection)**  
=> **Lifts magnetic fields against solar gravity** via **magnetic buoyancy**
- **Emergence of magnetic fields into the solar atmosphere (flux emergence)**  
=> **Forms magnetic structure on the Sun** (e.g. sunspot, sigmoid, prominence/filament)
- **Diffusion of magnetic fields in the solar atmosphere (release of magnetic energy)**  
=> **Produces explosive phenomena** via **magnetic reconnection** (e.g. flare, jet, coronal heating?)
- **Ejection of magnetic fields into the interplanetary space (removal of magnetic fields from the Sun)**  
=> **Produces outflow/eruptive phenomena** (e.g. solar wind, coronal mass ejection)