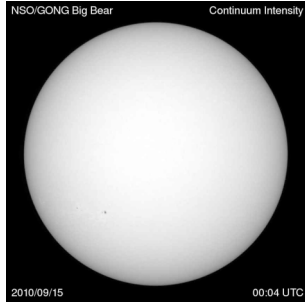


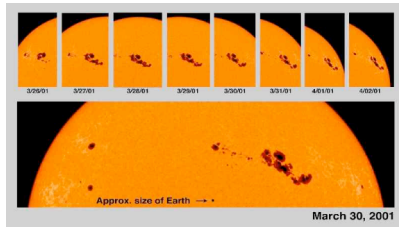
Fundamental properties of the Sun



Last time

- Described the Sun's size (diameter), mass, chemical composition, and temperature
- Today, additional features as preparation for solar observing lab

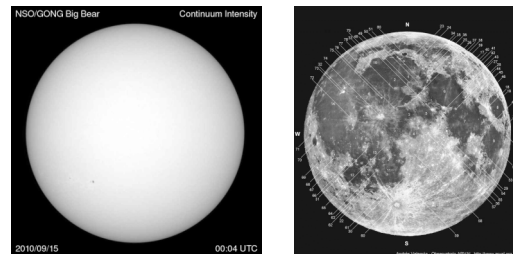
The Sun rotates (spins on its axis)



Movie on SDO website

Rotation period = 24.7 days at equator, increases to 36 days at poles, *differential rotation*

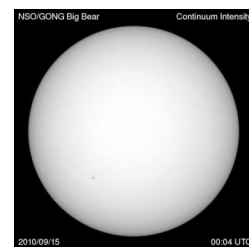
The Sun has a sharp disk, like the Moon



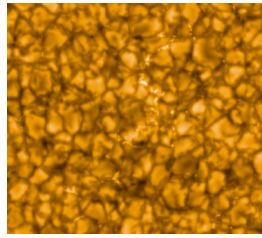
How is this possible when the Sun is a ball of hot gas?

The density in the solar atmosphere increases rapidly from very low values in interplanetary space to very high values, and it becomes opaque within an interval of altitude of about 200 kilometers (out of 696,000)

The region in the solar atmosphere where the gas becomes opaque and from which sunlight comes is referred to as the *photosphere*



The temperature in the solar photosphere is hot (5800K=9981 degrees Fahrenheit), but it is even hotter deeper in the Sun



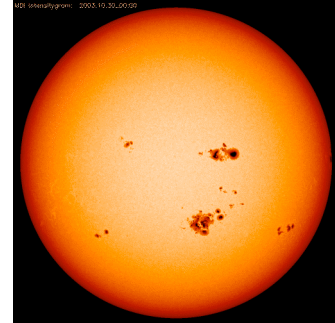
Solar granulation...a boiling motion of the surface of the Sun

Next topic: the active Sun

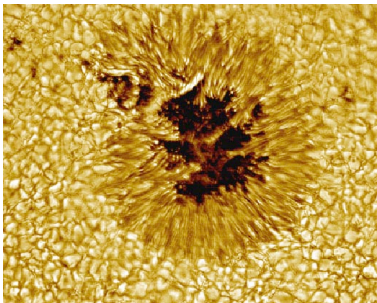
Sun of October 30, 2003



We'll see next week



Structure of a Sunspot

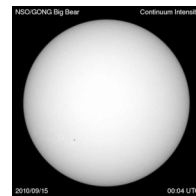


Sunspots are regions of very strong magnetic field (2000 Gauss)

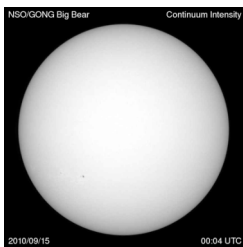


Demo

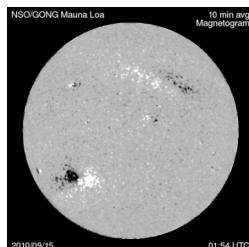
Indication that magnetism is connected with sunspots...measurement of magnetic fields on the surface of the Sun via the Zeeman Effect



The magnetic Sun

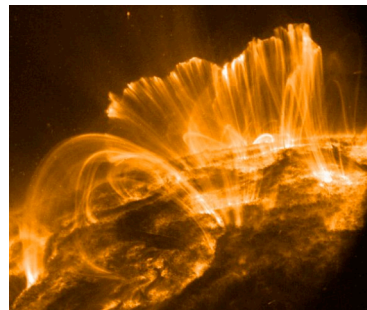


White light



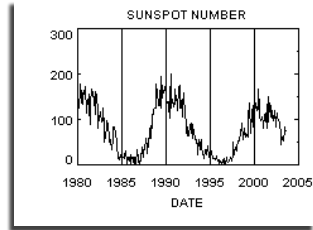
Magnetic field

Solar magnetic fields reach far out into space

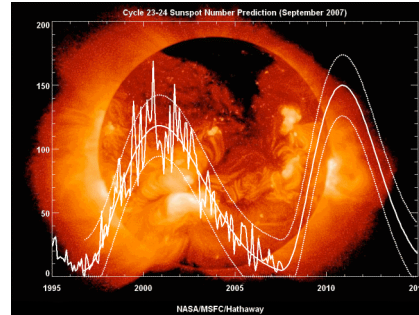


The 11 Year Solar Cycle

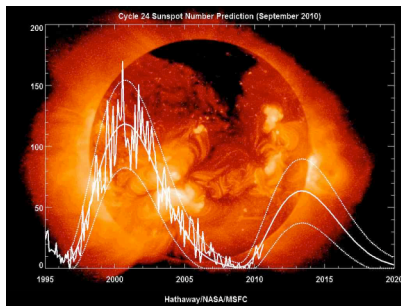
The Sun has a "heartbeat"; its properties change on a period of 11 years



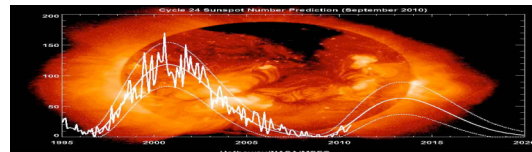
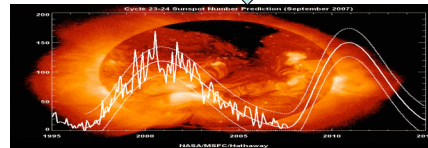
Latest data on this sunspot cycle



An indication that our knowledge of the solar cycle is far from perfect

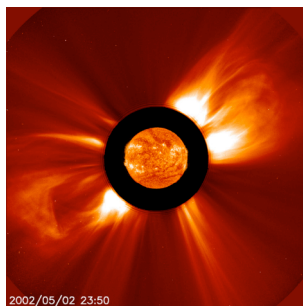


Predictions in 2007

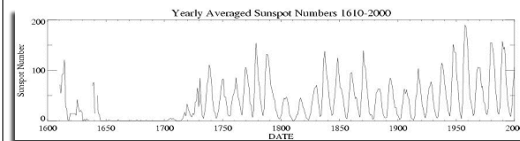


Observations and predictions as of today

Sunspots are the sites of big explosions (solar flares and coronal mass ejections)



The Sunspot Cycle has been going on for a long time



Observations show cycle persisting, but "turning off" from 1650 to 1730 (Maunder Minimum)

The Solar Wind

- A wind past the Earth at 400 km/sec
- The Sun is "melting away"
- Density 19 orders of magnitude less than atmosphere
- A medium for solar events
- May have "sandblasted" the early atmosphere of Mars



The Lesson for Other Stars

- Do they also have sunspots, sunspot cycles, etc?
- How does all this (magnetic fields, solar wind, rotation) relate to the age of a star?