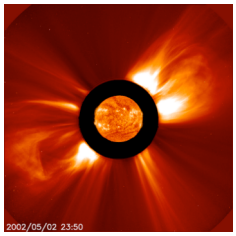
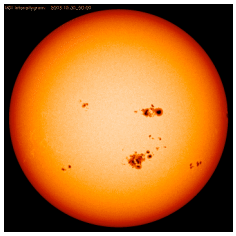
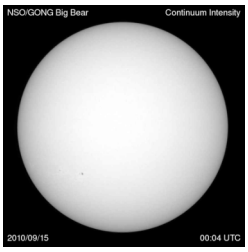
The active Sun

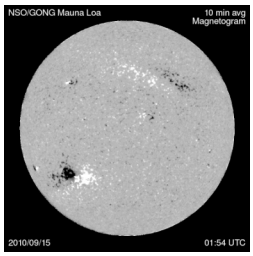




The magnetic Sun

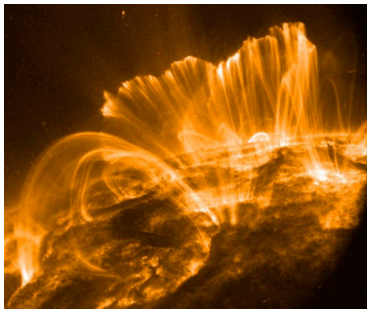


White light



Magnetic field

Solar magnetic fields reach far out into space



Solar magnetic fields reach out into the outermost layer of the Sun's atmosphere…the **corona**

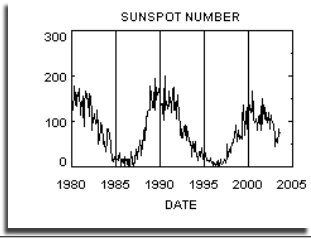
Temperatures in the corona are 1 - 2 million degrees Kelvin

Your chance to see the solar corona

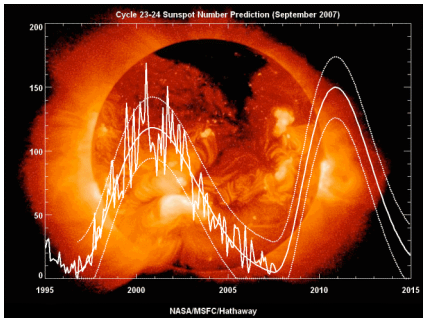
Total eclipse of the Sun…August 21, 2017

The 11 Year Solar Cycle

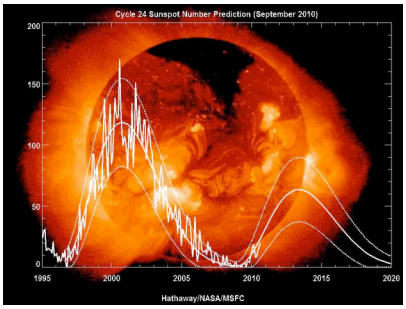
The Sun has a "heartbeat"; its properties change on a period of 11 years



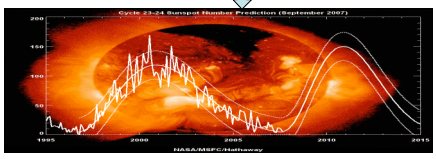
Latest data on this sunspot cycle

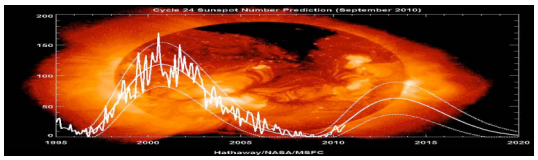


An indication that our knowledge of the solar cycle is far from perfect



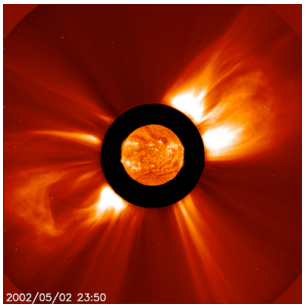
Predictions in 2007



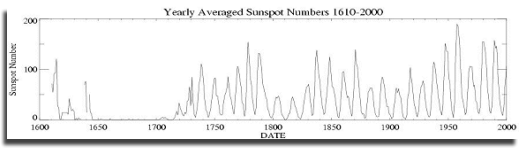


Observations and predictions as of today

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



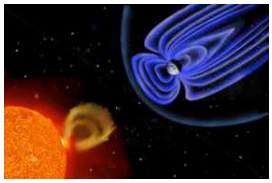
The Sunspot Cycle has been going on for a long time



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

The Solar Wind

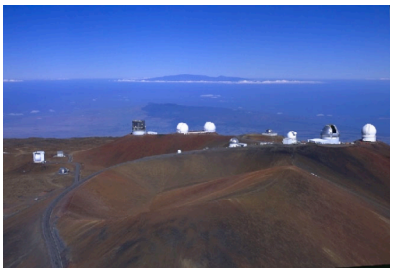
- A wind past the Earth at 400 km/sec
- The Sun is "melting away"
- Density 19 orders of magnitude less than atmosphere
- A medium for solar events
- May have "sandblasted" the early atmosphere of Mars



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?

Telescopes



The instruments we use to study the universe

More about telescopes

- What you will be looking through later in the semester
- Progress in astronomy would have been impossible without them

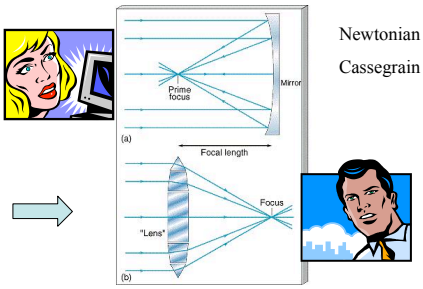
Telescopes do two things:

- Collect “Big Piles” of light
- Magnify object (it looks a lot closer than it is)

Types of Telescopes

- Refractors
- Reflectors
- Radio telescopes
- None of the above

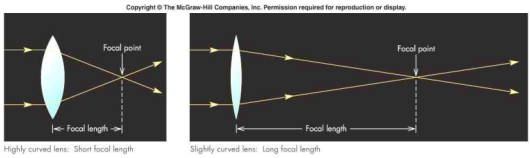
Reflectors and Refractors



Newtonian

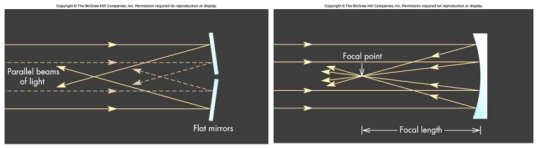
Cassegrain

Refractors: more details from the book



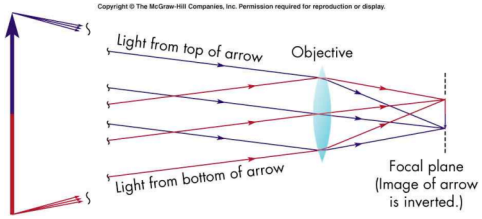
Demo

Reflectors: more details from the book

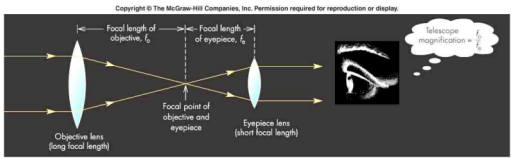


Demo

Formation of an image

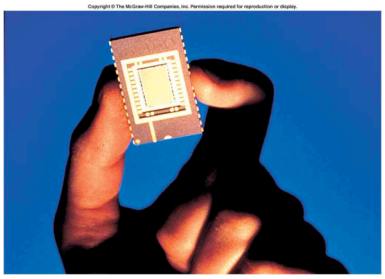


Magnification of a telescope

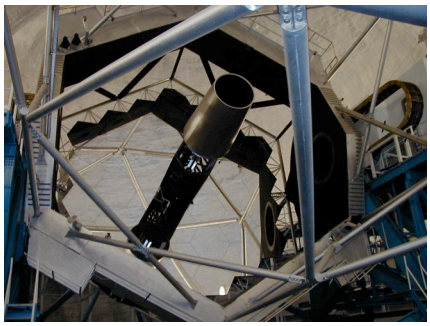


The longer the focal length, the higher the magnification

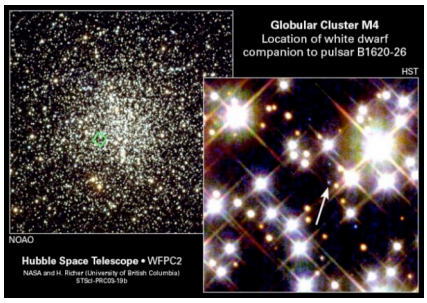
Modern astronomy: instead of an eyepiece, a Charge-Coupled Device (CCD)



Keck Telescopes (Reflectors): 10 meter diameter



Resolution: How small detail can you see with a telescope?



Resolution: smallest angle measurable

Angle=wavelength/diameter(telescope)
(radians)

Radio Telescopes

Wavelength large (1cm – 1 meter typically) so D has to be ***HUGE***

Radio Interferometers:

The ultimate in angular resolution

Final topic: the disappearing night sky:
The US by night; where is it dark?