

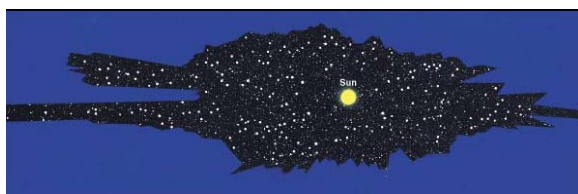
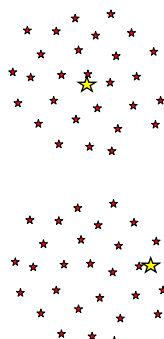
# The Milky Way [14]



Galileo first discovered that the MW is made up of stars.



Counting Stars:



Sun near center of small universe.

(Herschel, 1784)

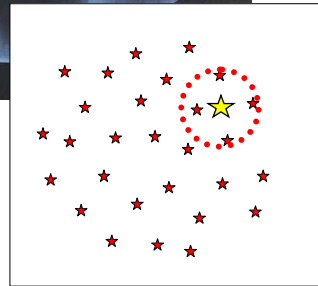
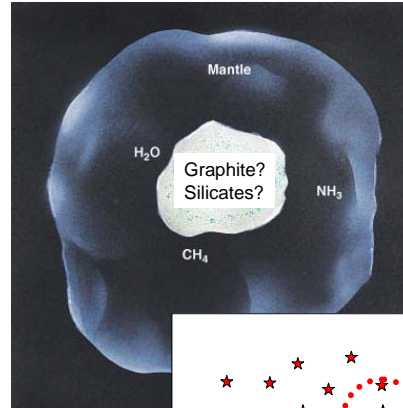
Mapping our Galaxy up until ~1920



Lick 36" Refractor  
1888

## Dust

- Dust = tiny grains
  - $10^{-8}$  to  $10^{-7}$  m.
- Built up of molecules of most common elements after hydrogen and helium.
- Absorb light
  - Absorb strongest in **blue**, less in **infra-red**.

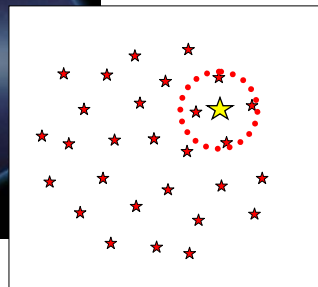


## The Milky Way

- Visible light:

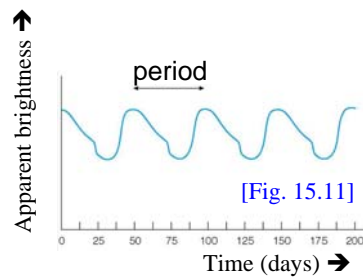
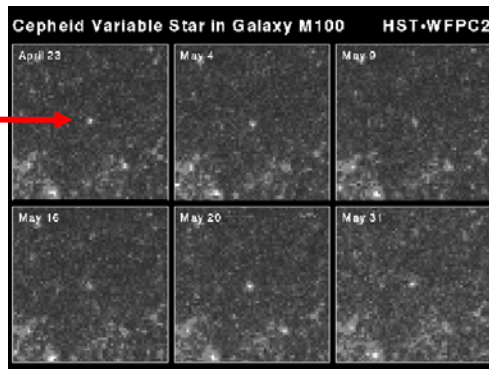
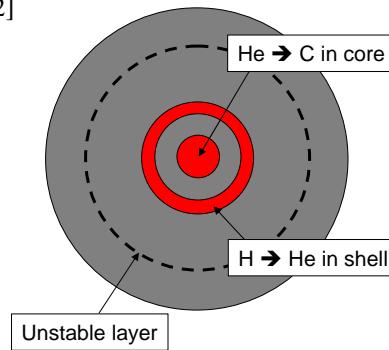


- Infrared:



## Pulsating Variable Stars [15.2]

- These stars regularly expand & contract.
- Like a big spring.  
Change in size →  
change in temperature  
change in luminosity



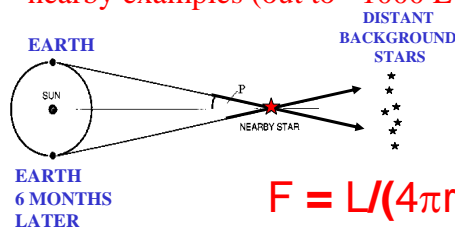
## Measuring Distances with Pulsating Variable Stars

- Period-Flux correlation seen in Large Magellanic Cloud



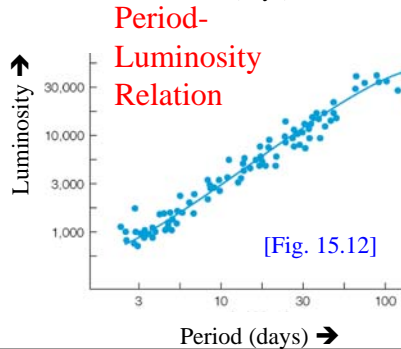
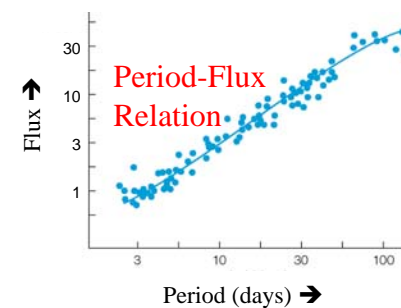
10 billion stars  
all at same  
distance.

- Calibrate by measuring parallax of nearby examples (out to ~1000 LY)

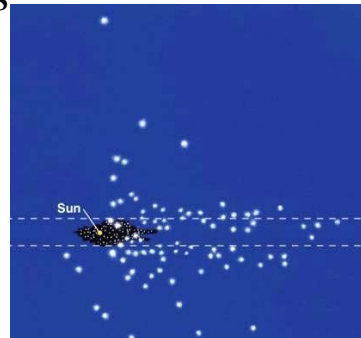


$$F = L / (4\pi r^2)$$

$$L = F \times (4\pi r^2)$$

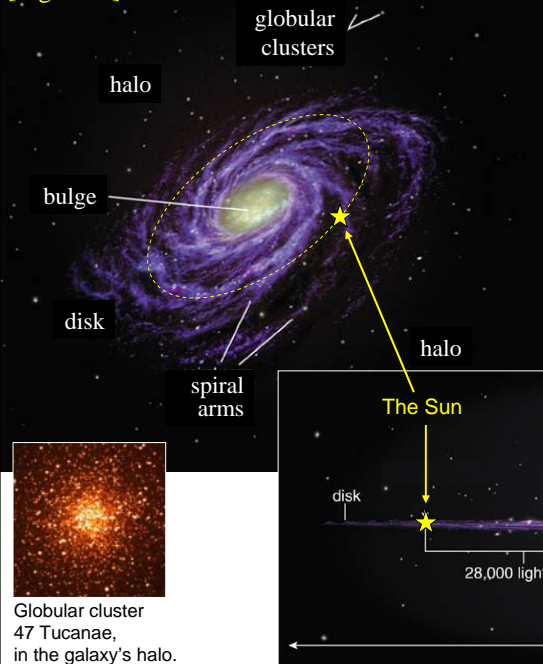


## Mapping our Galaxy with globular clusters



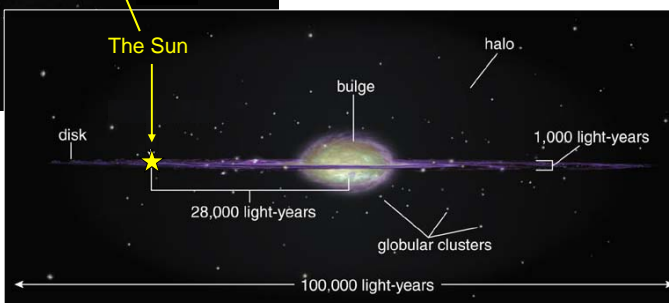
- Globular Clusters offer key breakthrough (in ~1920).
  - Distances from pulsating variables.
  - Spherical distribution in space.
  - Sun very far away from center.

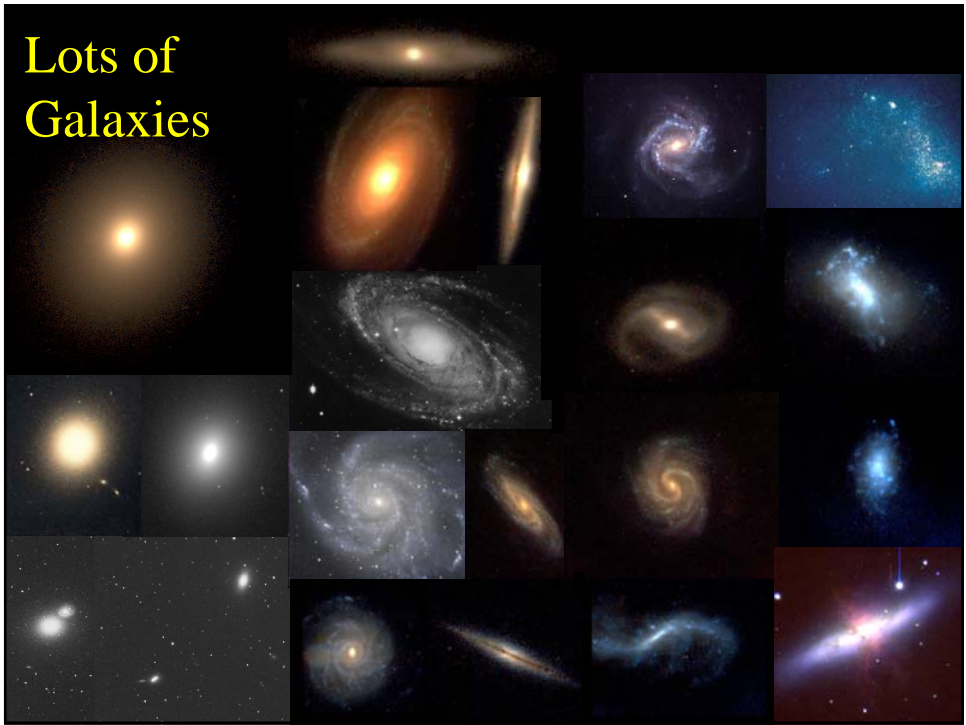
[Fig. 14.1]



## The Milky Way

- Gas, large fraction of stars in thin disk
  - ~1000 LY thick
  - Spiral structure
- Spherical halo
  - ~150 globular clusters
  - Spherical distribution of stars
- Nuclear bulge





## The Types of Galaxies [15.1]

**Ellipticals**

rounder appearance ←

E0      E5

- E0 = round → E7 = elongated

**Spirals** [Fig. 15.7]

Sa      Sb      Sc

← larger bulge, less dusty gas, tighter spiral arms

S0

**Barred Spirals**

SBa      SBb      SBc

**Irregulars**

Hubble class:

Ellipticals

Spirals (Sa → Sc, SBa → SBc):

- Central concentration
- Tightness of arms
- Smoothness of arms