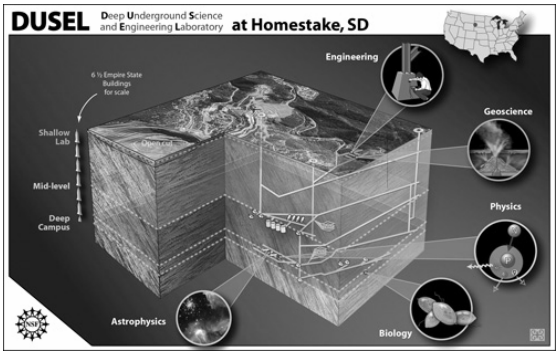
ASTR 1020: Stars & Galaxies

March 19, 2008

- Reading: Chapter 20, sections 20.3.
- **Meet Friday at Fiske Planetarium – *Hubble's Expanding Universe*** (bring your clicker)

Astronomy in the News

Jill Hulley



Today's Class

Chapter 20:

- Galaxies
- Mapping the Universe: measuring distances to galaxies

UKS 17

A Universe Full of Galaxies

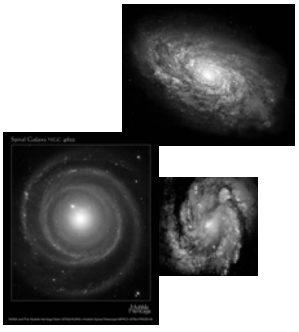
- Galaxies are classified into basic types
- Use both shapes and star properties
- Sizes range from giants, through biggish (like the Milky Way), through dwarfs

Spirals ~80% of galaxies

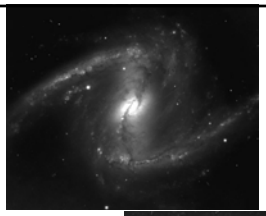
- Disks (spiral arms)

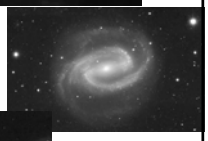
AND

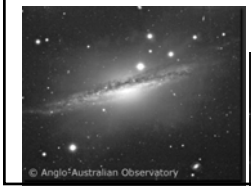
- Spheroids (central bulges + halos)



- Some have "bars" across the centers

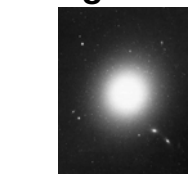






Elliptical ~15% of galaxies

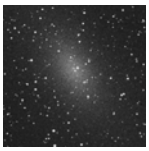
- Round or slightly flattened
- Very little cold gas (no 21-cm emission), dust, or young stars
- Reddish/yellow color = old stars (red giants, red main sequence)

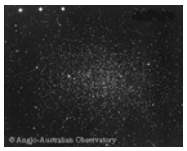


Dwarf ellipticals

Most common type of galaxy?

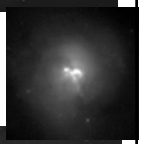
- Only know nearby ones (faint!)

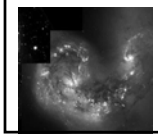


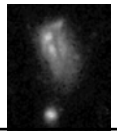


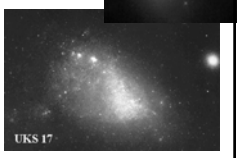
Irregulars

- Galaxies in formation?
- Or Transition?
- Often LOTS of star formation!



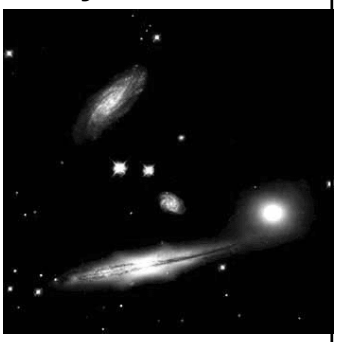




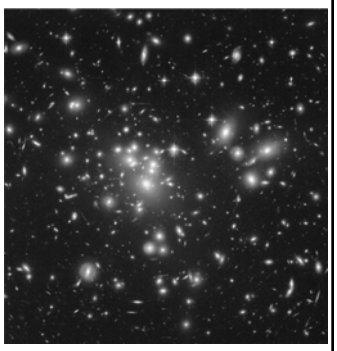


Where they live

- Spirals– mostly in groups (3-10 galaxies)

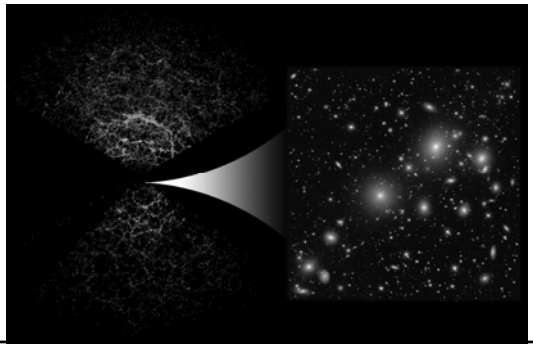


- Ellipticals– more often in dense clusters of galaxies (100's – 1000's)
- Why? Chapter 21…



A dense Galaxy Cluster

The Big Picture- the universe is filled with a network of galaxies in groups and clusters



Mapping the Universe: We need Distances to Galaxies!

So far– Parallax

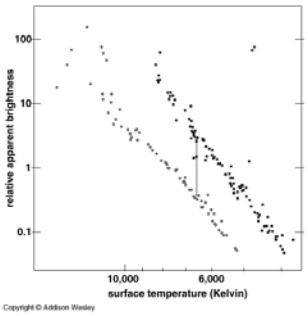
New methods: standard candles

1.) Make some measure of an object which identifies its luminosity

2.) Use this luminosity and measure apparent brightness to infer distance to it

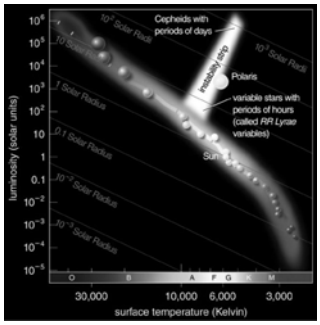
1.) Main sequence fitting

- Start with a cluster distance known via parallax (upper)
- Compare with other clusters (lower)
- Which is more distant- the upper or lower?

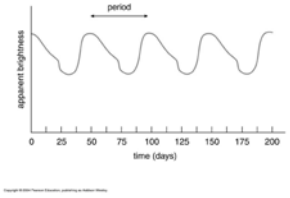


2.) Cepheid Stars

- Region on the HR diagram with large, bright stars
- Outer regions are unstable and tend to pulsate
- See Chapter 15: pulsating variable stars



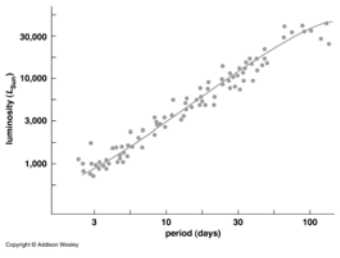
- Star expands and contracts, getting brighter and fainter
- Period = one whole cycle



Cepheid Stars

- Period-luminosity relationship
- Overall brighter Cepheids have longer periods

(elephants and hummingbirds)



- **Clicker Question:** Two Cepheid stars, Fred and Barney, have the same apparent brightness. Fred has a period of 5 days, and Barney of 10 days. Which is closer?

a) Fred
b) Barney

- **A) Fred**
- Fred has a shorter period and so must be less luminous (hummingbird)
- Less luminous but the same apparent brightness means that Fred is closer to us

Cepheids as Standard Candles

- Measure period of variability
- From period-luminosity relation, infer the luminosity
- Compare with apparent brightness and determine distance