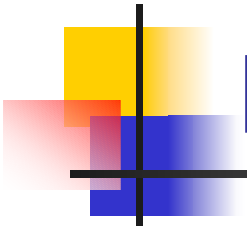
Galaxies

November 13, 2002

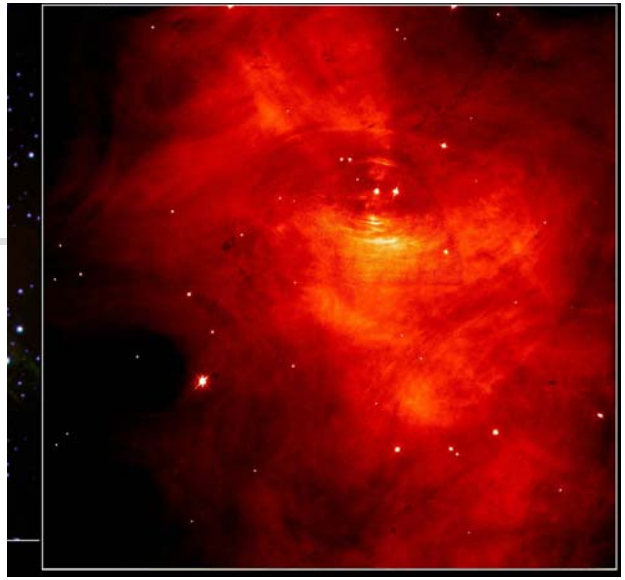
1) Exam postview
2) Introduction to Galaxies
3) Types of Galaxies
4) The Milky Way



Exam #2

- Sorry about all the confusion
- Exams available at back of room
- Score is on 2nd page
- Exam average was a 75%

Messier Objects

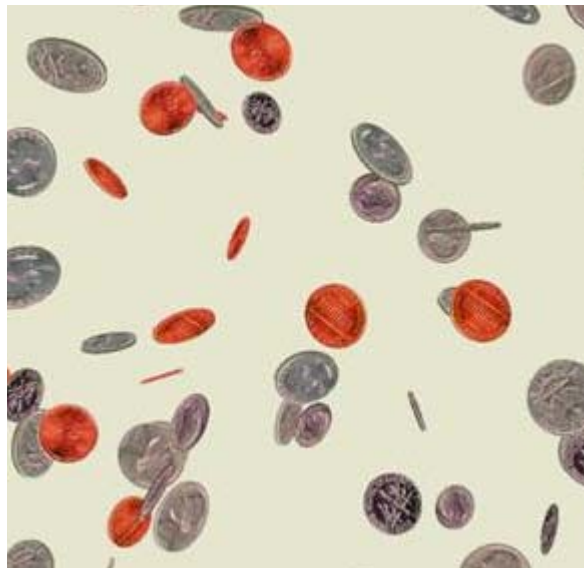


M1 – Crab Nebular

- 1784 – Charles Messier
  - he was a comet hunter
- Identified 103 objects in the sky which were not stars
  - these were fuzzy objects
  - he identified them so they would not be mistaken for comets
- These were actually galaxies, globular clusters and such
  - far away
- Now a very useful list of interesting objects for amateur astronomers to look at

Looking at Distant Objects

- Objects look different depending on how they are viewed
- We are unable to "walk around" an object which is millions of lightyears away
- So we have to try to interpret what we see
  - compare to objects oriented differently



Galaxies

- Galaxies are large collections of stars
  - millions and billions of stars
- The Milky Way is our own galaxy
- There are hundreds of billions of galaxies in the Universe
- Millions to hundreds of billions of stars in each galaxy

Types of Galaxies

- Three main types of galaxies
  - based on shape
- Spiral
  - rotating disk (with arms)
- Elliptical
  - oval disk of stars
  - more chaotic motion
- Irregular
  - none of the above

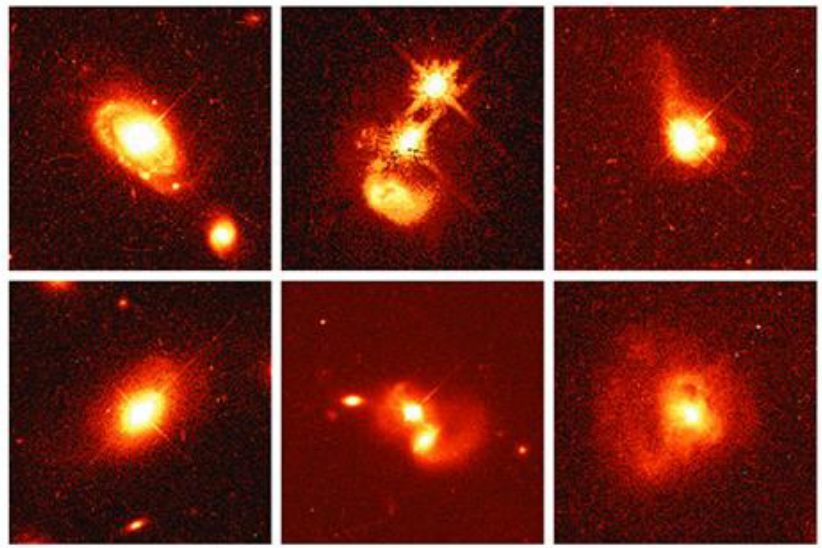
Active Galactic Nuclei

- Some galaxies have supermassive black holes at the center
- If material is falling into the black hole, enormous amounts of energy are released
  - accretion disk
- Can shine with a luminosity of 1-100 million Suns!
- Quasars are a type of AGN

Galaxy Collisions

- Occasionally galaxies collide
  - don't actually slam into each other
- Passage of one galaxy through/near another causes major "stirring"
  - due to gravity
- Causes new activity
  - star formation, AGNs,…

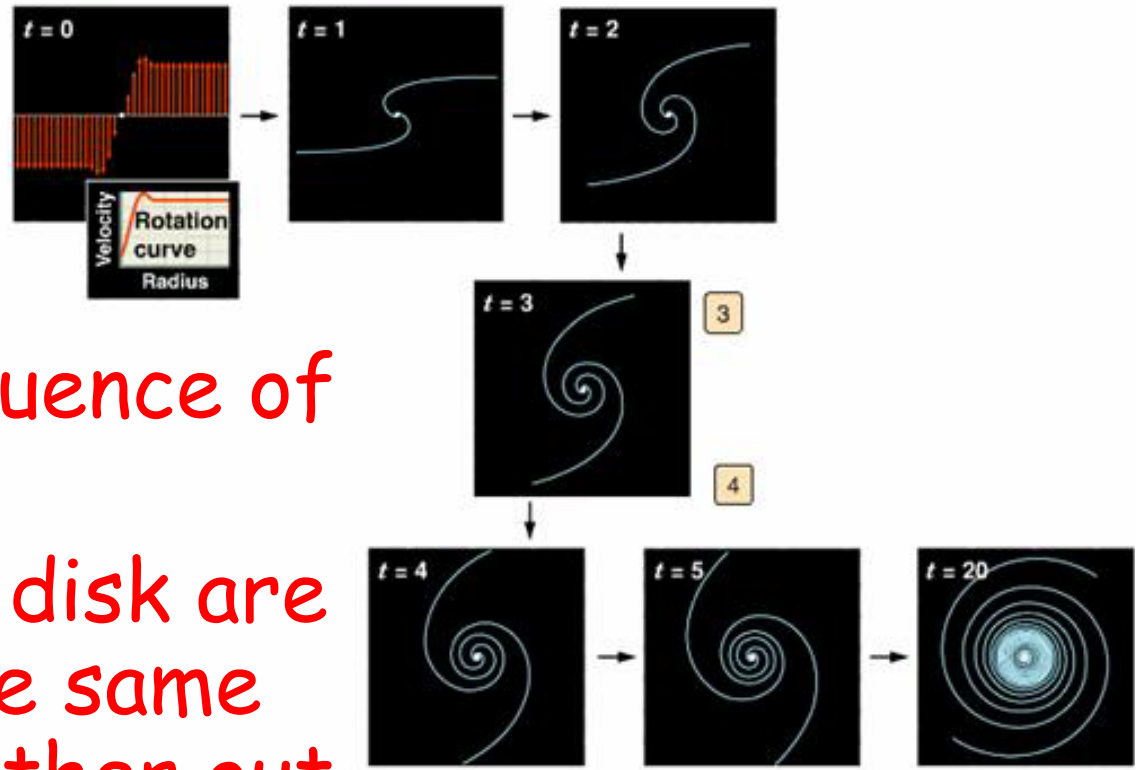
Think of walking around before a football game



Looking at the Milky Way

- Viewed as a bright band of star's across the sky
- Galactic center appears in the southern part of the sky (from the northern hemisphere
- Much of the Milky Way is blocked by dust
  - dark band through the middle of the Milky Way
- But we can study it in longer wavelengths
  - e.g. radio waves

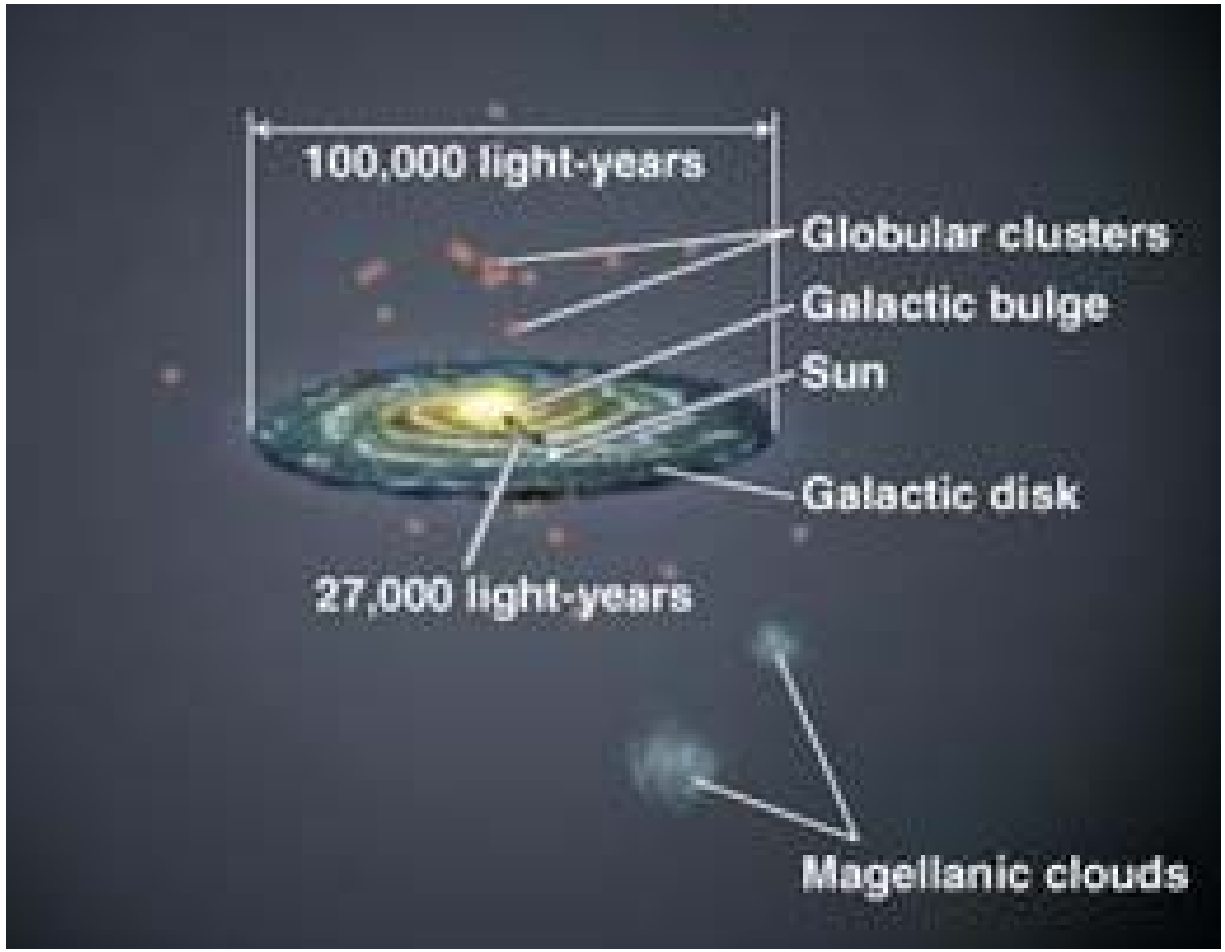
Spiral Galaxies



- Spiral arms are a natural consequence of some rotations
- If gas/dust in a disk are rotating with the same speed, stuff further out will take longer to go around
  - it will lag behind

Pieces of a Spiral Galaxy

- Disk
- Arms
- Bulge
  - barred?
  - black hole
- Halo
- Globular clusters

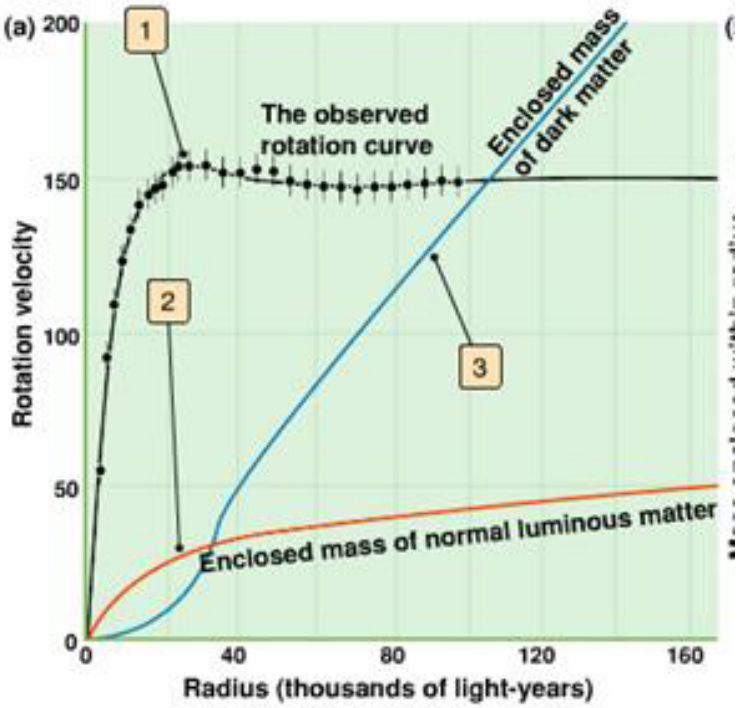


Globular Clusters

- Groups of old stars in the galactic halo
  - may have around 500,000 stars
  - may be around 15 lightyears across
- Formed before the galaxy
  - or at very early stages
- Orbiting the galaxy
- No new star formation going on
- Useful for studying the distribution of material in the galaxy
  - from gravity

Rotation Speeds of Galaxies

- Most of the visible material of a galaxy is near the center
  - material thins out as you move outward
- For spiral galaxies, this means stars farther out should be moving slower
- But we see them all moving with the same speed!
  - must have an explanation



Dark Matter!