Astronomy 114

Lecture 31: Galactic Distances and Large-Scale Structure

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UMass/Astronomy Department
Announcements

- Exam #2 redux: due Friday (27 Apr)
- PS#7: due next Monday (30 Apr)
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- No class Wednesday 2 May …
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- Distances to galaxies . . .
  - Galaxies, Chap. 26

- By the end of next week . . .
  - Quasars and “Active” Galaxies, Chap. 27
Hubble Tuning Fork Diagram

Ellipticals
E0  E4  E7  S0 or Sb0  Lenticular galaxy

Normal spirals
Sa  Sb

Irregulars
Sb

SBa  Sb B barred spirals

SBc

Sa  Sb  Sc

SBa  Sb B barred spirals

SBc

E0  E3  S0
Classification depends on waveband

Spiral galaxy: M81

- **X-ray**
- **UV**
- **Visible**
- **Near IR**
- **Far IR**
Dwarf galaxies: $10^6$ to $10^8$ stars
Other types of Galaxies

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- Interacting: Tidal Effects, Tails (pairs)
- QSO: quasi-stellar-object, galactic nucleus?
Nearby Galaxies

LMC, SMC:
- D \sim 50 \text{ kpc}

M31 (Andromeda):
- D \sim 700 \text{ kpc}

Virgo Cluster:
- D \sim 20,000 \text{ kpc} = 20 \text{ Mpc}

Coma Cluster:
- D \sim 100 \text{ Mpc}

Hercules Cluster:
- D \sim 200 \text{ Mpc}
The Local Group
The Local Group
Clusters of Galaxies

- The Local Group is just outside the Virgo Cluster
- Poor clusters have $\sim 10$ galaxies
- Rich clusters have $\sim 10,000$ galaxies
- Size of rich clusters: $\sim 10$ Mpc
- Millions of clusters in the Universe
Virgo cluster

- 10 degrees across on the sky.
- more than 1000 galaxies in this cluster
- distance 20 Megaparsecs = 65 million light years.
- The light you see was emitted from the stars in the Virgo cluster at the time of the extinction of the dinosaurs on Earth!
Virgo cluster
Abell clusters

The Virgo Cluster is not the only “rich cluster” in the sky, only the closest!

1957: George Abell compiled a catalog of 2700 rich clusters of galaxies

Virgo is closest Abell cluster
Abell clusters
Coma cluster

Nearby star in our Galaxy

NGC 4889

NGC 4874

100 Mpc
Hercules cluster

200 Mpc
Superclusters

- Clusters of clusters
- The Local Group is part of the Virgo Supercluster
- Large scale structures containing many clusters have been found
- Does clustering continue forever in the Universe?