

Program: Galaxies course 2006-2007

- **General introduction to galaxies:** morphological classification; the Hubble sequence: properties of each class, physical considerations, time dependence.
Ref: SG Sec.1.3; BM Sec.4.1
- **Stellar populations:** Colour-magnitude diagram, examples for clusters; effects of age and metallicity; initial mass function and stellar luminosity function; luminosity and colour evolution of single stellar populations.
Ref: SG Sec.2.1, 2.2; BM Sec.3.6, 5.1, 5.4, 6.1.2, 6.1.3, 6.1.4, 6.1.5, 6.2.1
- **Cosmic distance scale:** absolute and relative distance indicators; examples; caveats.
Ref: BM Sec.7.2, 7.3, 7.4
- **The Milky Way**
 - **Spatial distribution of stars and components:** luminosity function near the Sun; thin and thick disk: characteristics and tracers; halo and bulge: general properties. Population I and II.
Ref: SG Sec. 2.2; 2.3; BM: Ch. 10; MB: Ch. 4

- **The Milky Way (cont.)**

- **Internal kinematics:** reference frames and the LSR; Galactic rotation; Oort constants; the solar motion; motions of nearby disk stars (Schwarzschild distribution; streams). Kinematics of thick disk, halo and bulge.

Ref: SG Sec. 2.2; 2.3; BM: Ch. 10.; MB: Ch. 6, 7

- **Dynamics and kinematics of gas:** distribution of HI and CO; determination of the rotation curve; implications.

Ref: SG Sec. 2.3; BM Sec. 9.1, 9.2

- **Introduction to Galactic Dynamics:**

- **Motion under gravity:** Relation between gravitational potential and mass density; spherical systems and Newton's theorems; strong and weak encounters and timescales.

Ref: SG Sec. 3.1, 3.2

- **Orbits of disk stars:** effective potential; conserved quantities; epicycles; relation between epicyclic frequency and Oort constants.

Ref: SG Sec. 3.3

- **Chemical evolution:** closed-box; evolution of the metal content; the G dwarf problem; extensions of simple model: outflows and accretion.
Ref: SG Sec. 4.3.2; BM 5.3
- **Disk galaxies:** photometry; surface brightness: distributions, dust, decomposition: bulges and disks; spiral structure. HI observations: distribution and velocity fields, rotation curves, mass distribution. Correlations between parameters; Tully-Fisher.
Ref: SG Ch. 5; BM 4.4
- **Elliptical galaxies:** surface brightness distributions; PSF, isophotes and shapes; internal kinematics; scaling relations: Faber-Jackson, the fundamental plane; stellar populations. Dark-matter and black holes.
Ref: SG Ch 6; BM 4.3
- **AGNs:** generalities; classes of AGNs; physical paradigm; unification scheme.
Ref: SG Sec. 8.1; BM 4.6

SG: Sparke & Gallagher "Galaxies in the Universe", Cambridge Univ. Press

BM: Binney & Merrifield "Galactic Astronomy", Princeton

MB: Mihalas & Binney "Galactic Astronomy: Structure and kinematics", Freeman