Cosmology
Galactic Structure

Luminosity function of galaxies

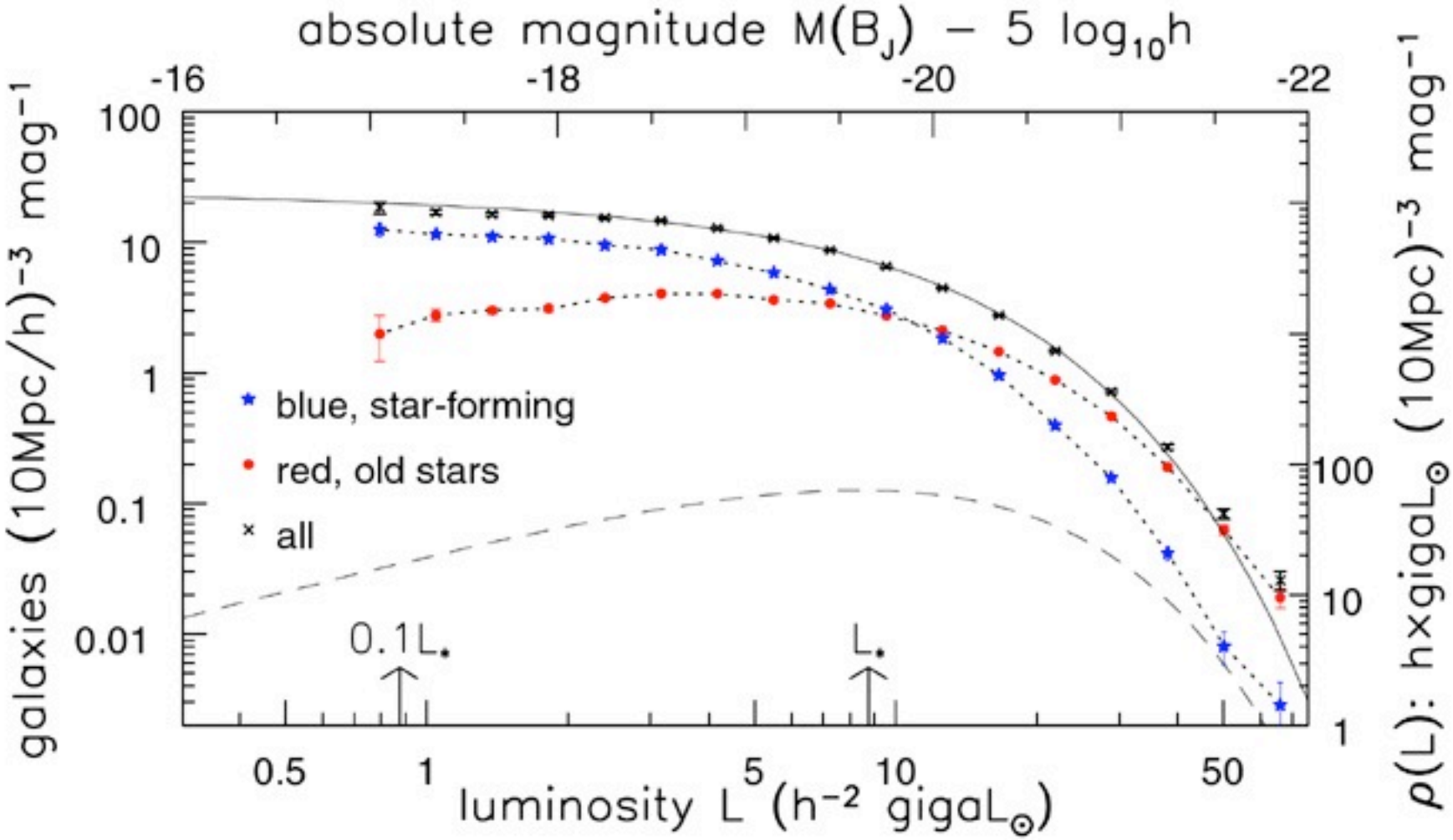
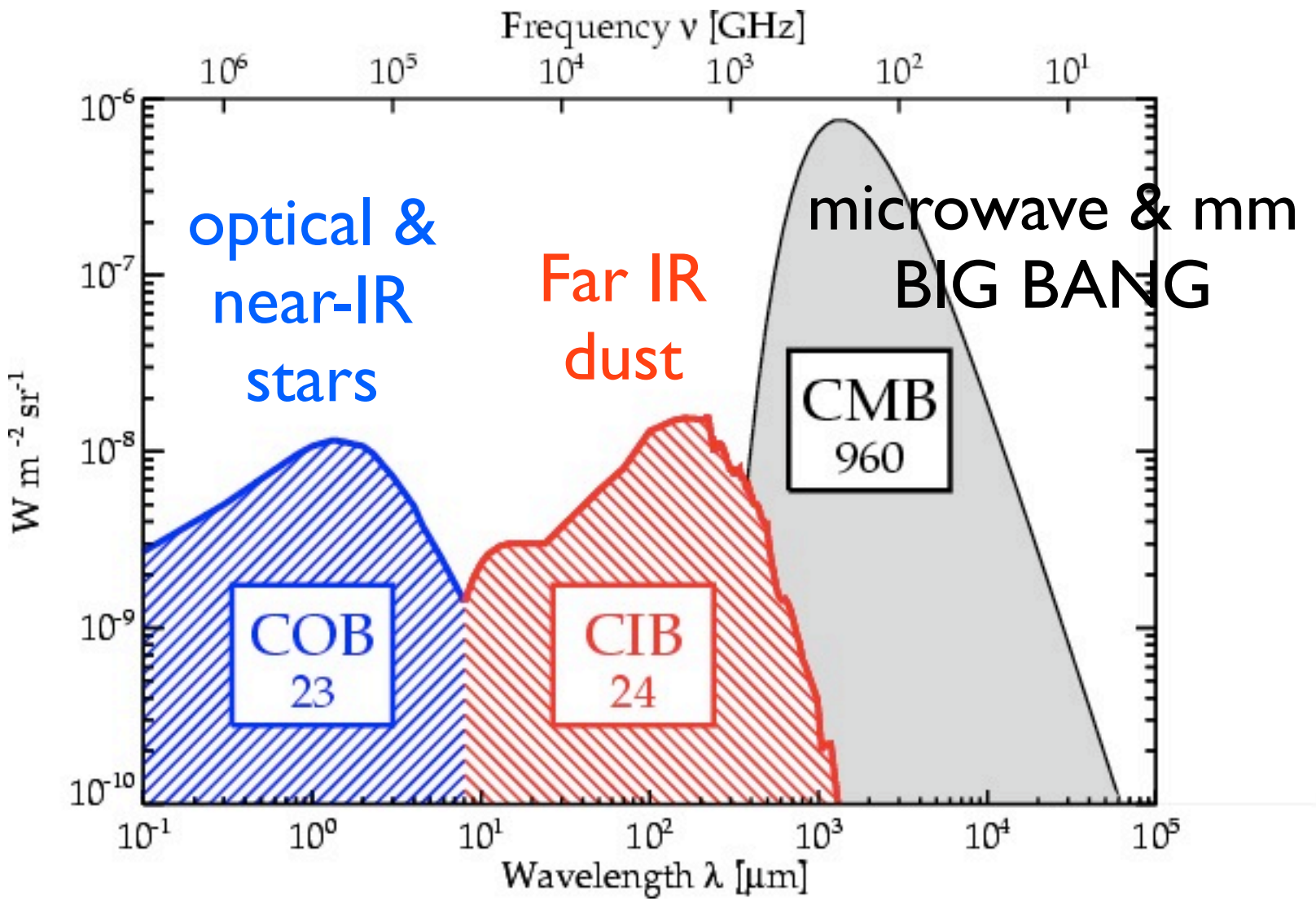


Fig 1.16 'Galaxies in the Universe' Sparke/Gallagher CUP 2007

Often approximated by Schechter form

photon energy



Hubble Law: $v = H_0 D$

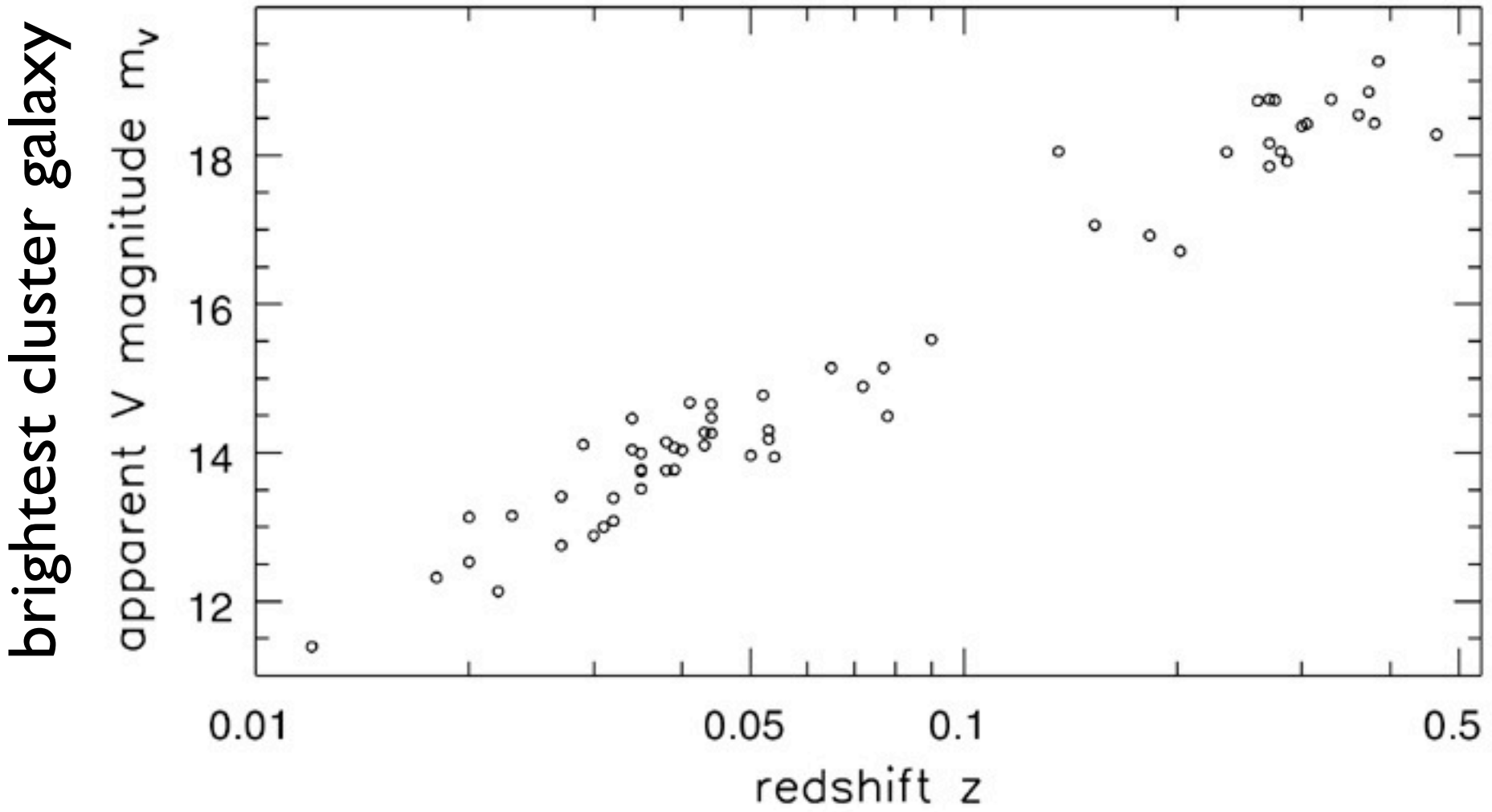


Fig 1.17 'Galaxies in the Universe' Sparke/Gallagher CUP 2007

Important events in the history of the Universe

Big Bang Nucleosynthesis
X = 3/4, Y = 1/4
~ 3 minutes

First Galaxies ~0.7 Gyr
Reionization z ~ 6

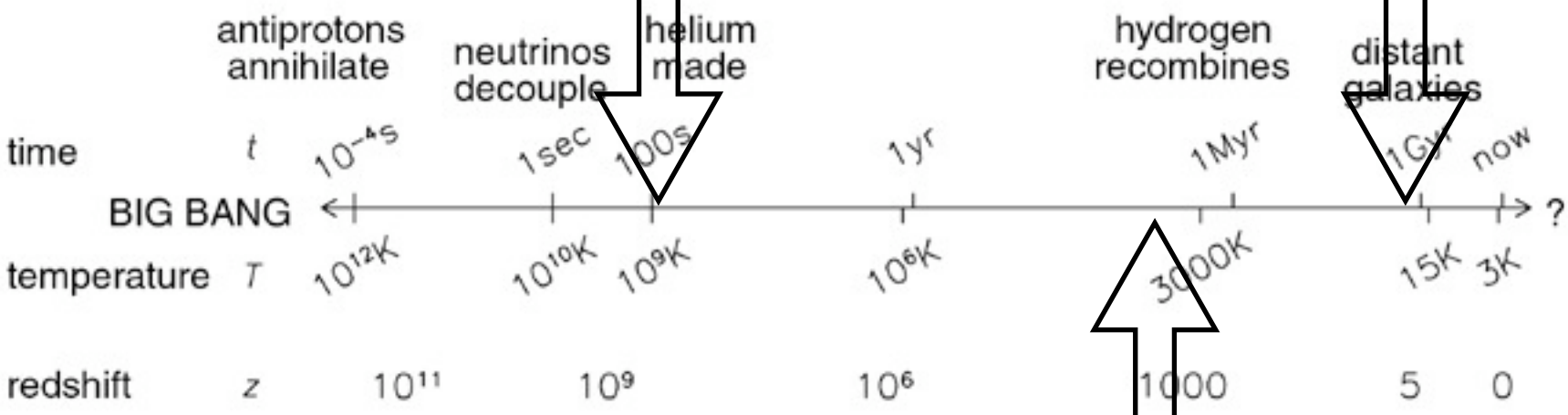


Fig 1.18 'Galaxies in the Universe' Sparke/Gallagher CUP 2007

Cosmic Microwave Background
(peaks at 1.1 mm)
~ 380,000 yr

Schematic Milky Way

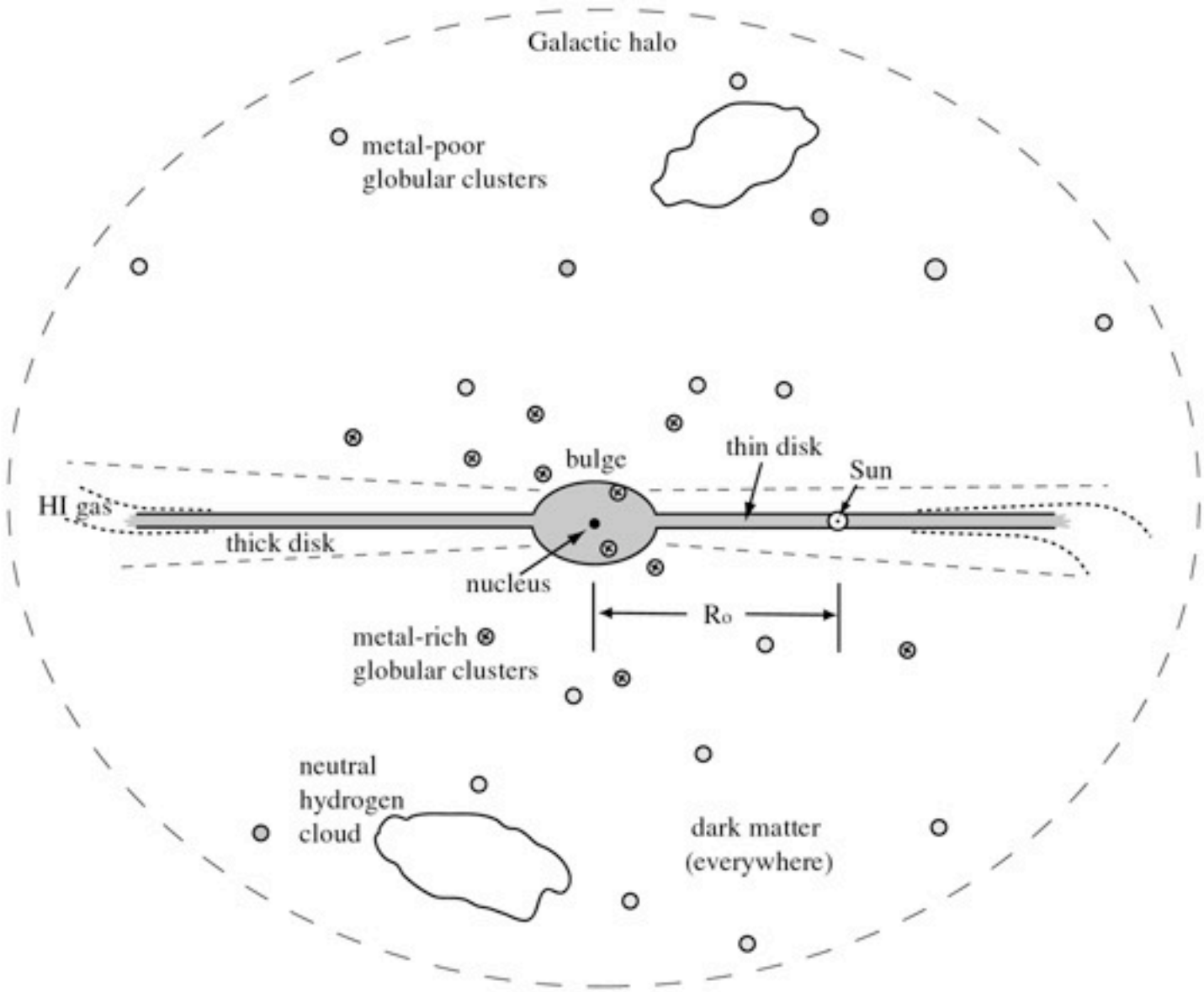


Fig 1.8 'Galaxies in the Universe' Sparke/Gallagher CUP 2007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Globular clusters

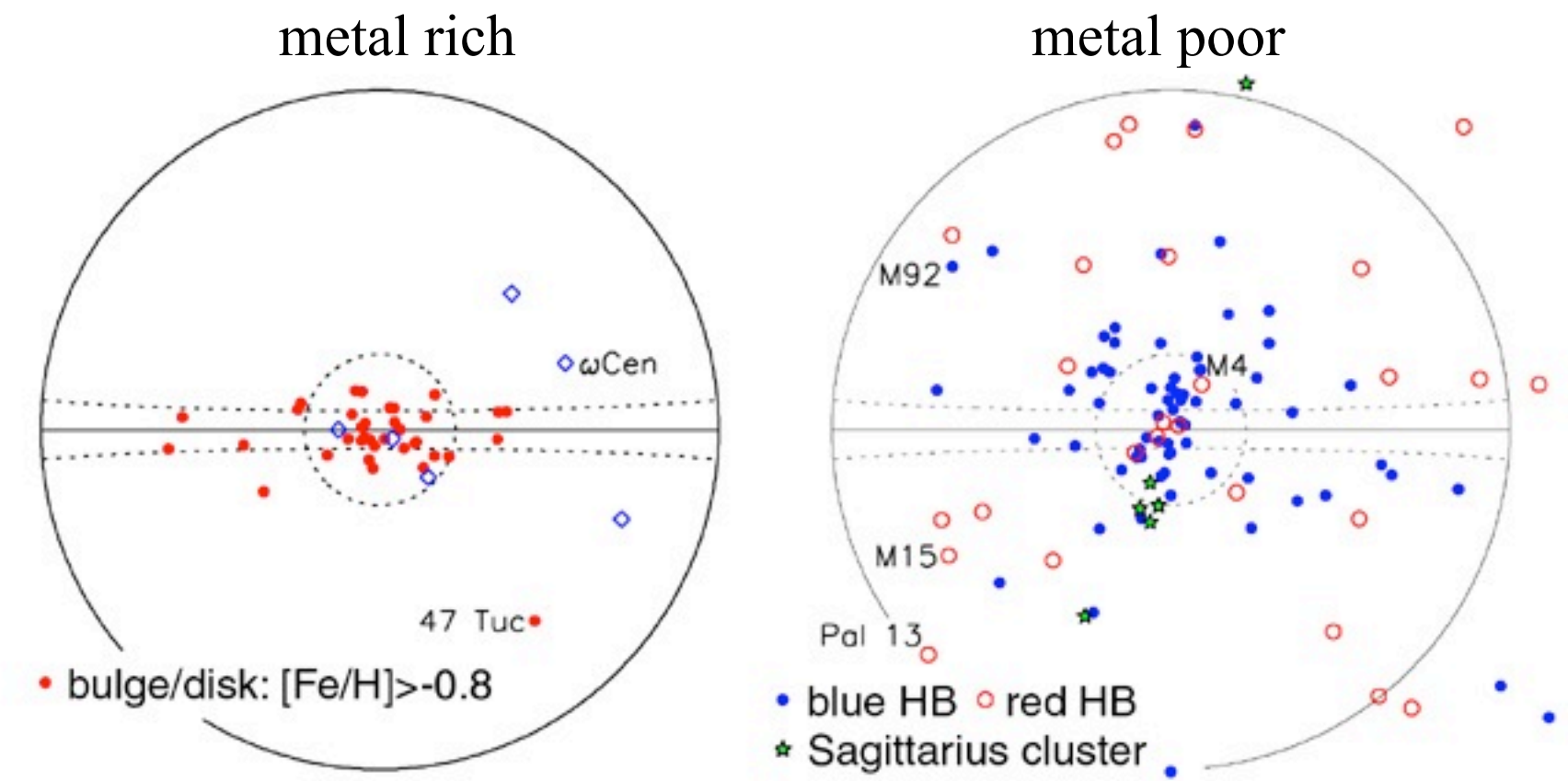
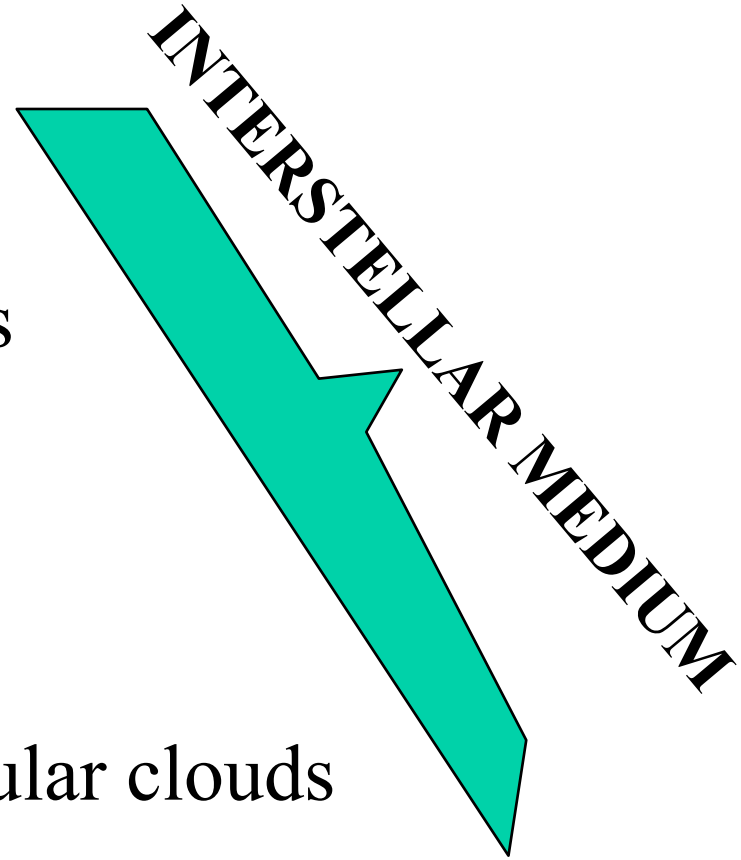


Fig 2.15 (D. Mackey) 'Galaxies in the Universe' Sparke/Gallagher CUP 2007

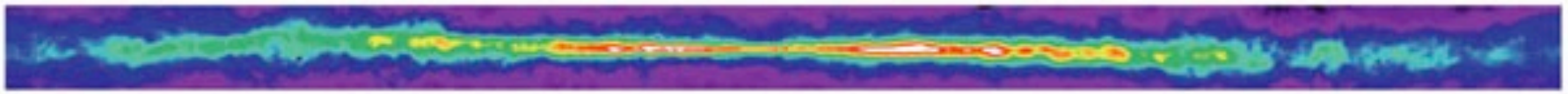
Galactic Structure

- Stars ~80% of mass
  - DISK ~80% of stars
  - BULGE ~20% of stars
- Gas ~20% of mass
  - atomic gas ("H I") ~2/3 of gas
  - molecular gas (H_2) ~1/3 of gas
  - hot, ionized gas ("H II")
- Dust
  - between stars
  - mostly in spiral arms & molecular clouds



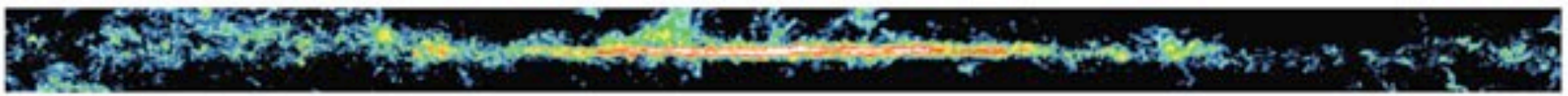
Milky Way Gas and Dust

radio (21 cm)
HI gas



a 21-cm radio emission from atomic hydrogen gas.

radio (CO)
molecular gas



b Radio emission from carbon monoxide reveals molecular clouds.

far-IR
dust

c Infrared (60–100 μm) emission from interstellar dust.

near-IR
stars

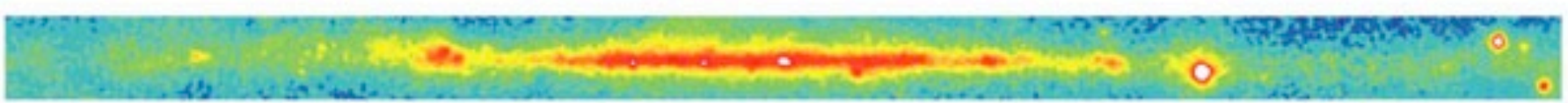
d Infrared (1–4 μm) emission from stars that penetrates most interstellar material.

Optical
stars & dust

e Visible light emitted by stars is scattered and absorbed by dust.

X-ray
hot gas

f X-ray emission from hot gas bubbles (diffuse blobs) and X-ray binaries (pointlike sources).



g Gamma-ray emission from collisions of cosmic rays with atomic nuclei in interstellar clouds.