Exercises — 3

Reading suggestion:

P. Schneider—Extragalactic Astronomy Sections 1.3 (Telescopes) and 3.1-3.4 (The world of Galaxies)

1. Telescopes across the spectrum

—What are advantages and challenges observing in the X-ray, UV, optical, IR and radio?

—What are typical telescopes operating at this wavelength? What are their instruments and where are they located?

—What can we learn about galaxies observing them in the X-ray, UV, optical, IR and radio?

Analytical Exercises — 3

2. Central surface brightness of disk galaxies. Consider a spiral galaxy with central surface brightness mu = 21.5mag/arcsec^2 at the distance of the Virgo cluster, i.e. D=16 Mpc. With the absolute magnitude of the Sun in the B-band of $M_{sun,B}$ = 5.54, calculate the central surface brightness of the galaxy in solar luminosities per pc^2.

Analytical Exercises — 3

3. The implications of flat rotation curves of spirals. We saw that the rotation curves of the MW (and other spiral galaxies) is flat, V(r) ~ const.

a) Why was this surprising at discovery?

b) Which rotation curve would you qualitatively expect for an exponential mass profile of a spiral and considering Newton's law/Kepler rotation?

c) Assume a spherically symmetric density distribution rho(r). Determine the functional form of rho(r) which yields a flat rotation curve. Compare that to the shape of the density distribution of baryonic/luminous matter of spirals.

d) Assume you know $M_{lum}(r)$ and the measured total rotation velocity V(r). How can you estimate the dark matter mass at a given radius $M_{dm}(r)$?