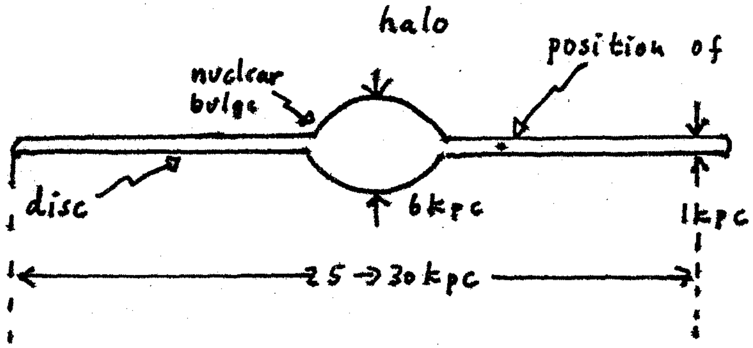
"Our" Galaxy

Mass $\sim 1.1 \times 10^{11}\, M_{\odot} = 2.2 \times 10^{41}$ kg, Thickness = 1000 pc (1 pc = 206000 A.U.)

Diameter ~ 25000 pc, Distance of the Sun from the centre ~ 8200 pc,

Period of revolution of the Sun about the centre = 2.2×10^{8} yr,

Distance of the Sun above the galactic plane = 8 pc, Diameter of the bulge ~ 6 kpc

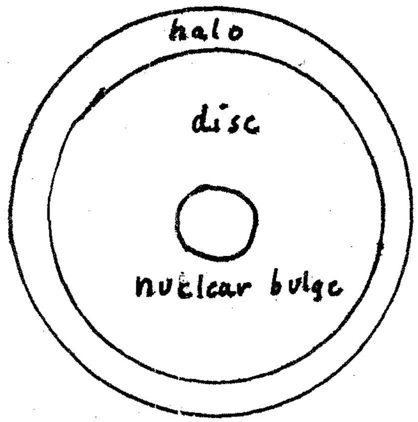


Problems

(a) The outer parts of the Milky Way are relatively dim and hard to define.

(b) We are located <u>within</u> the disc of the Milky Way.

(c) A good deal is thought to be made up of so-called <u>dark matter</u> that does not emit light or any other kind of radiation that has yet been detected.



(c) continued. Dark matter is not merely invisible. Thus, whereas "ordinary" matter consists largely of baryons (protons, neutrons and related particles), dark matter is thought to consist, at least in part, of other, more exotic, types of particle.

Gravitational influences suggest that the dark matter associated with the Milky Way is substantial; perhaps ten times greater than the total mass of detectable matter.

The halo and bulge are roughly spherical; sometimes regarded as a single component — the <u>Galactic spheroid</u>.

Is the bulge really a distinct structural component or simply a central concentration of the halo? There is no doubt about the separateness of the disc.

DF
2016, May 19

Calculating the mean density of "our" Galaxy

The total mass of the stars $\approx 2.2 \times 10^{41}$ kg

The volume of the disc $=$ area $\times$ thickness

$= \pi r^2 \times$ thickness

$= \pi \times (15\ \text{kpc})^2 \times 1\ \text{kpc}$

$= 710\ (\text{kpc})^3$

The volume of the bulge

$= \frac{4}{3}\pi \times (3\ \text{kpc})^3$

$\approx 4 \times 27\ (\text{kpc})^3$

$\approx 108\ (\text{kpc})^3$

$\Rightarrow$ Total volume of the disc + bulge

$= 710\ (\text{kpc})^3 + 108\ (\text{kpc})^3$

$= 818\ (\text{kpc})^3$

Mean density (i)

$$= \frac{2.2 \times 10^{41}\ \text{kg}}{818\ (\text{kpc})^3}$$

$= 2.7 \times 10^{38}\ \text{kg}\ (\text{kpc})^{-3}$

Mean density (ii)

$$= \frac{2.2 \times 10^{41}\ \text{kg}}{818 \times 1000 \times 1000 \times 1000\ (\text{pc})^3}$$

$$= \frac{2.2 \times 10^{41}\ \text{kg}}{8.18 \times 10^{11}\ (\text{pc})^3}$$

$= 0.2(7) \times 10^{30}\ \text{kg}\ (\text{pc})^{-3}$

$= 2.7 \times 10^{29}\ \text{kg}\ (\text{pc})^{-3}$ **

JFRF!

Mean density (iii):

$1\ \text{pc} = 31 \times 10^{15}$ m

$\therefore (1\ \text{pc})^3 = (31 \times 10^{15}\ \text{m})^3$

$\approx 3 \times 10^{49}\ \text{m}^3$

$\therefore$ mean density (iii)

$$= \frac{2.2 \times 10^{41}\ \text{kg}}{3 \times 10^{49}\ \text{m}^3}$$

$= 7.3 \times 10^{-9}\ \text{kg m}^{-3}$

** ≈ 0.14 Solar masses $(\text{pc})^{-3}$

DF

2012, April 14