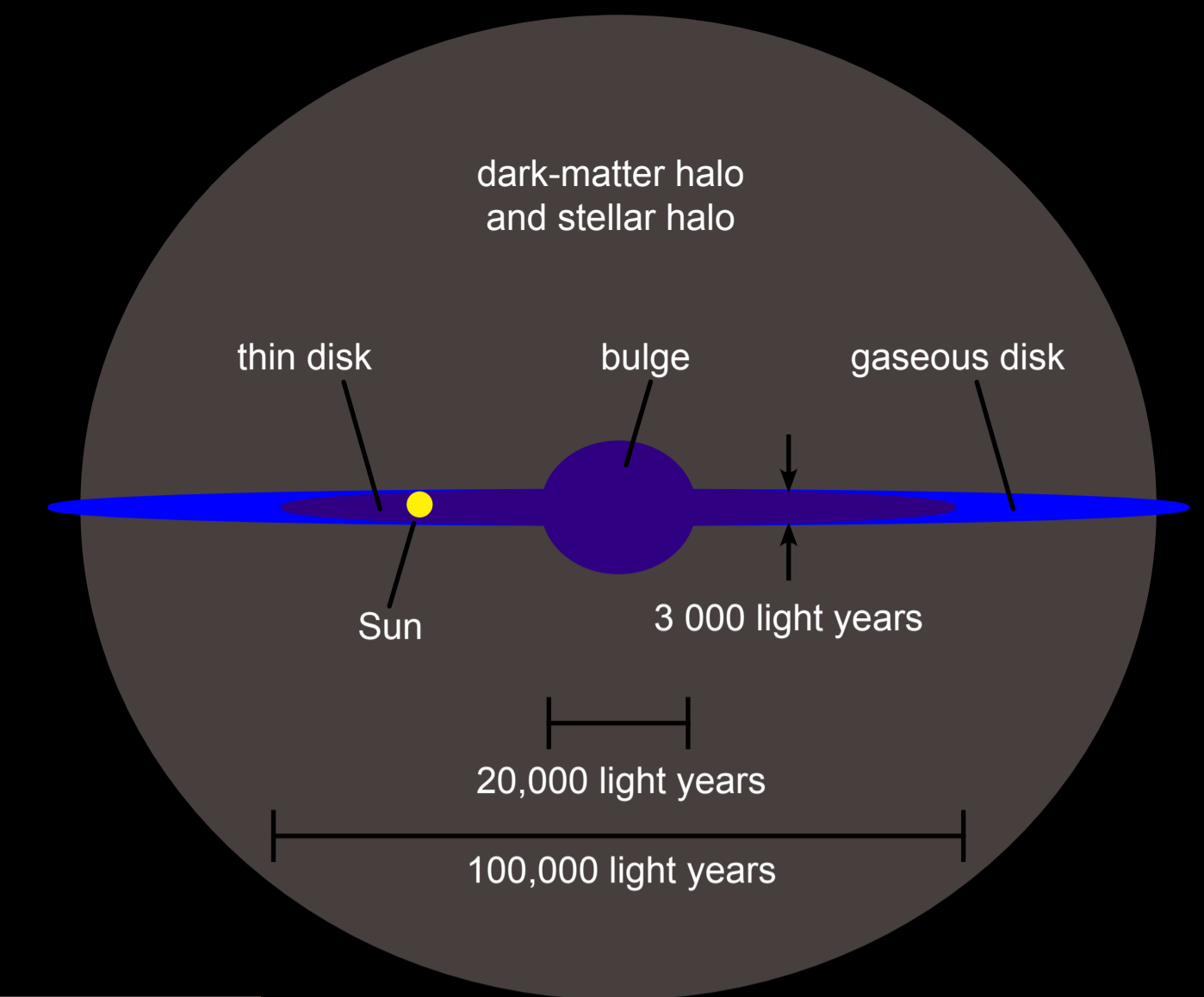


The Milky Way

The Milky Way – our home galaxy – is a barred spiral galaxy.

It has four major structural parts: a dark-matter halo, a disc, a stellar halo, and a central bulge. 90% of the Milky Way's mass is in the form of stars; 10% is gas and about 0.1% is dust.

The Sun lies 26,000 ly from the centre of the Galaxy, in the local Orion spur, which is roughly halfway between the Sagittarius Arm and the Perseus Arm.



thin disc

Shape: spiral arms
 Size: 100 000 light years, 3 000 ly thick
 Consists of stars and gas, (70% H, 28% He), and dust ("smoke particles", micron-sized graphite and silicate with icy mantles of water, ammonia, or carbon monoxide)
 Stars: very youngest stars, Population I (e.g. Sun); O and B Associations; stars in spiral arms; open clusters. Mass of stars: $10^{11} M_{\odot}$
 Gas: Hydrogen occurs as molecules (H₂), atoms (H I) or ions (H II). Large H II regions; dense and diffuse clouds. Mass of gas: $10^{10} M_{\odot}$. Mass of dust: $10^8 M_{\odot}$.

thick disc

Shape: flat disc
 Size: 100 000 ly, 6 500 ly thick
 Consists of stars and little or no gas.
 Stars: old, intermediate Population stars; and globular clusters. Mass of all the stars: $10^{10} M_{\odot}$.

stellar halo

Shape: egg-shaped
 Size: 130 000 ly
 Consists of stars and a tenuous hot (10^6 K) corona of gas.
 Stars: the oldest stars known, Population II (low metallicity); globular clusters (total 10^7 stars, 1% of the halo stars). Mass of stars: $10^9 M_{\odot}$
 Gas: very little gas, some high-velocity clouds.

central bulge

Shape: fat cigar
 Size: 20 000 ly
 Consists of stars and gas.
 Stars: oldest stars (but with solar metallicity). Mass of stars and gas: $10^{10} M_{\odot}$
 Nucleus: At the centre lies Sagittarius A*, a $3 \times 10^6 M_{\odot}$ black hole.

Open clusters: 5-10 light years in size, consists of 10s to 100s of young stars, sometimes with surrounding gas clouds. These clusters have short lives, from a million to a billion years. About 1 100 open clusters have been found. Famous examples include the Pleiades and the Jewel Box.

OB Associations: 300-1500 light years across, consisting of 10-100 young, very bright (O- and B-type) stars and gas. They only exist for a few million years before dissipating. Most of the stars in our Galaxy were formed in such associations. Some 70 OB associations have been catalogued.

H II regions: also called emission nebulae, these are large glowing hydrogen clouds, from one to a hundred light years across, ionized by UV photons from O- and B-type stars. Famous examples include the eta Carinae Nebula, the Orion Nebula, and the Tarantula Nebula.

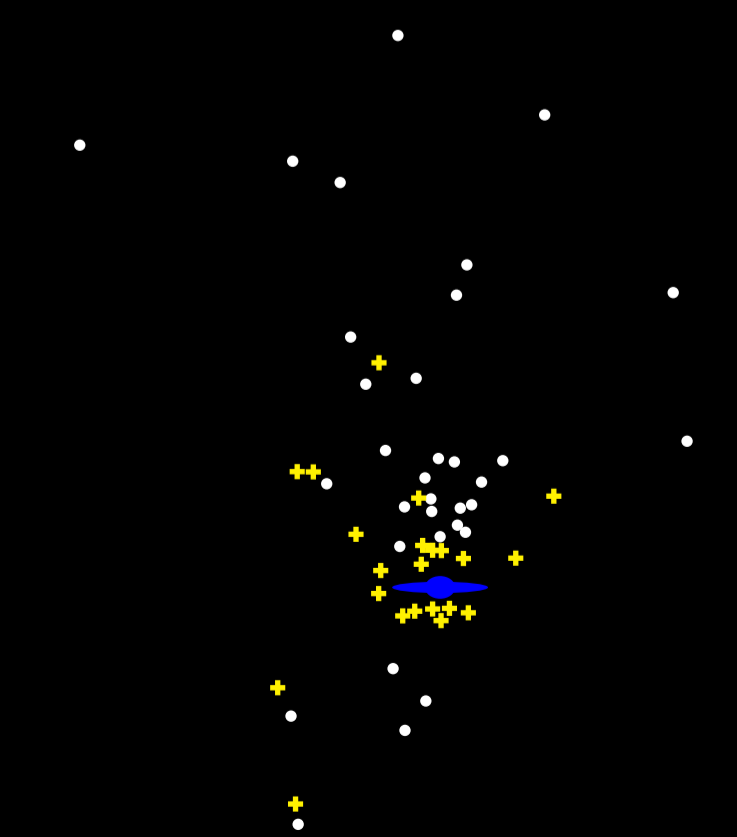
Globular clusters: between 10,000 and 1,000,000 old (10^{10} y) stars in a sphere up to 160 light years across. At the centre of a globular cluster, the stars are about 0.2 light years apart. One-third of all globulars are found in the thick disc of the Galaxy, while two-thirds occur in the halo. About 150 globular clusters are known. Famous examples include Omega Centauri and 47 Tucanae.

Metallicity (Z): the fraction of a star's mass that is made up of elements heavier than helium. The Sun has $Z=0.02$, meaning 2% of the Sun's mass consists of elements other than hydrogen and helium.

Population I: Young stars with $Z=0.01$ to 0.04.

Population II: Oldest known stars ($Z < 0.002$ in halo, $Z \sim 0.02$ in the bulge).

Intermediate population: Old stars found in the thick disk; $Z = 0.002$ to 0.01.



In orbit around the Milky Way: dwarf satellite galaxies (white dots) and distant globular clusters (yellow crosses)

Distance from the Sun:

- 1 Orion Nebula (M 42) = 6 mm
- 2 Eta Carinae Nebula = 3,5 mm
- 3 Large Magellanic Cloud = 72 cm
- 4 Small Magellanic Cloud = 90 cm
- 5 Andromeda Galaxy (M 31) = 11 m
- 6 NGC 253 (Silver Coin) = 52 m
- 7 NGC 5128 (Centaurus A) = 63 m
- 8 Virgo Galaxy Cluster = 267 m

Edge of observable Universe = 42 km

30,000 light years 1mm = 220 light years