

Lecture 1 – Basic Structure of the Milky Way

Galactic astronomy is recent field of study, extragalactic astrophysics is even more recent.

early 1800's -- evidence stars were distant Suns, few times 10^5 AU to nearby stars

1832 - Bessel measured 0.32 arcseconds of parallax for 61 Cyg

1839 - Henderson measured ~ 1 arcsecond parallax for Alpha Centauri

1840 - Henderson measured 0.26 arcseconds parallax to Vega

early 1900's -- evidence "spiral nebulae" are distant galaxies ("island universes")

Milky Way Galaxy - system of stars, gas&dust, and dark matter bound by mutual gravitational attraction

Galactos - greek root for milk

Before telescope, unable to resolve Milky Way into separate stars

Multiwavelength Milky Way (<http://adc.gsfc.nasa.gov/mw/>)

NASA Lambda 3D-models (http://lambda.gsfc.nasa.gov/product/cobe/vrml_models.cfm)

Disk: stars, gas & dust distributed in disk- Herschel ~ 1785

relative distance from center of Galaxy - Shapley 1917

Galactic coordinates: latitude (b) and longitude (l)

spiral structure

multiple phases of gas - ionized, neutral, and molecular -- 20% luminous/observable mass is gas

barred spiral, with warped disk {see DIRBE/COBE images, Freudenreich}

diameter of gaseous disk greater than stellar disk

scale height of disk(s) -- thin (blue stars and cold gas) vs. thicker (red stars and warm gas)

mass interior to Sun's orbit

Halo: dominated by dark matter, Galaxy's total mass $\sim 10x$ greater than of stars, gas&dust

stars traced by globular clusters, out to 0.1Mly, or even 0.3 Mly (LMC ~ 0.18 Mly)

slightly oblate (vs. prolate, $b/a \sim 0.8$) spheroid for halo traceable by stars

Luminosity of halo $\sim 2 \times 10^9$ Lsun

Luminous mass of halo $\sim 25 \times 10^9$ Msun

Total mass of halo $> \sim 250 \times 10^9$ Msun

Bulge: $\sim 10 \times 10^9$ Msun

bar points within 13 degrees of Sun's location

possible that almost all of bulge is associated with bar

just outside bar ($r \sim 5$ kpc) is ring of dense molecular gas, probably result of resonance with bar

Nucleus: mostly obscured by large column density of gas&dust, exceptions include Baade's window

multiple phases of gas - ionized, neutral, and molecular