Lecture 2 – Disk and Bulge of the Milky Way

The disk and bulge make up the optically visible portion of the Galaxy, as well as the portion most easily observed in other wavelengths.
Optical light from the disk is dominated by bright, blue, hot, young stars – Population I.
    bright, blue, young stars responsible for most of luminosity, only a fraction of mass
    predominately located in open clusters, OB associations and HII regions
Optical light from the bulge is dominated by less bright, red, cooler, older stars – Population II.

Where are Population III stars?

Gas makes up ~10% of disk's mass – ISM composed of clouds *vs.* intercloud medium

disk made up of overlapping components {table 2.1 of Sparke and Gallagher, p.64}
ages of stars: thin disk < few Gyr, thick disk ~10 Gyr
vertical motion corresponds to time spent above/below plane of disk
scale heights: molecular gas 0.07 kpc, HI gas 0.13 kpc, thin disk 0.3 kpc, thick disk 1.5 kpc
scale height (distance where density changes by factor of *e*), $n(z) = n_0 e^{-|z|/h}$ (see Harwitt 4.8, p.112)
explain thick *vs.* thin disk differences: collapse of disk through time or perturbation (then & now)

Warped disk, observed in HI as well as by motion of stars in thick disk

Formation of spiral structure
    differential rotation creates winding (ZG p.279)
    density wave
        but not clear what creates density wave

Bulge is highly obscured, only mapped at longer wavelengths
bulge stars almost all ancient (some replenishment and mixing of stars from other components),
 but **not** all low metallicity (intense, early star formation enriched early generations at beginning)
 distribution of stars is **not** described by exponential scale height

bar traced via
    luminous Red Giants & Asymptotic Giant Branch (AGB) stars (JL fig1.31, p. 49)
    modeling of COBE results (WH fig6.5, p.104)
    {H.T. Freudenreich 1998 ApJ 492,495; 1999 Am Sci 87/5 418}

spheroidal component = bulge + stellar halo
    old stars (roughly age of universe, with possibility of ages older than universe!)
    red giants, horizontal branch, RR Lyrae

Atlas of galactic neutral hydrogen, Hartmann, Dap & Burton, W. B, (Bonn), 1997 Cambridge Univ. Press, ISBN 0521471117