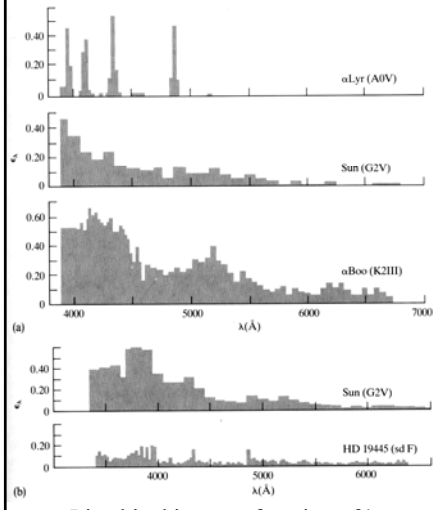


## Measuring metallicity from colors

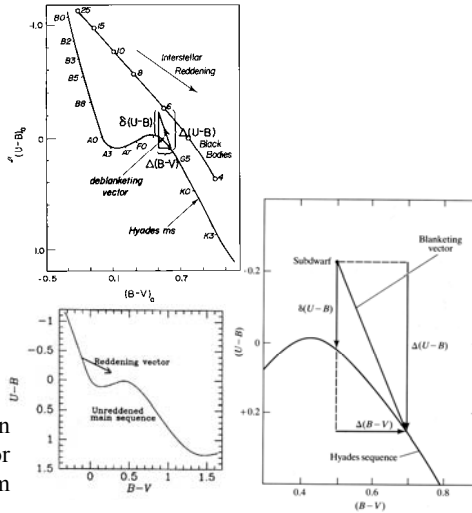


Line blocking as a function of  $\lambda$

Effect on color-color diagram

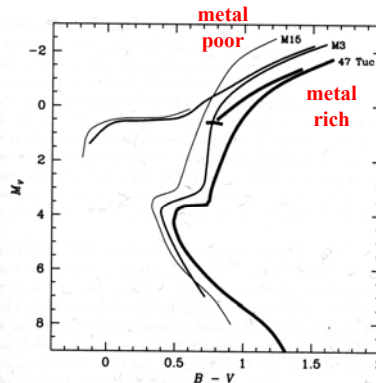
For main-sequence stars:

- More metals  $\rightarrow$  higher absorption coefficient.
- Line-blanketing vs. back-warming.

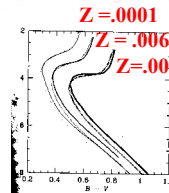
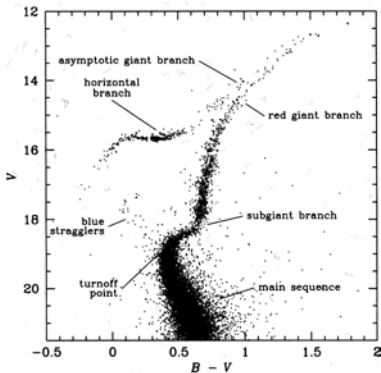


## Color of red-giant branch in globular clusters

Observed Z-dependence



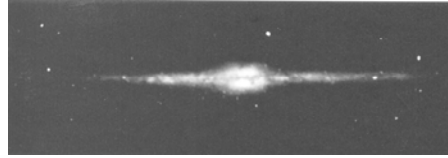
HR diagram for M3



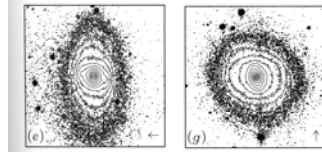
Theoretical isochrones, for  $Y = 0.2, 0.3$

All 14Gyr old

# Milky Way Bulge

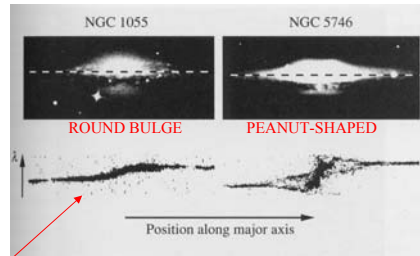


- Elongated... now thought to be a bar
  - From observations of Mira pulsating variables.
  - Minor/major  $\sim 0.6$
- Roughly follows DeV profile ( $r^{1/4}$  law)



SBO isophotes [BM] Fig 4.57

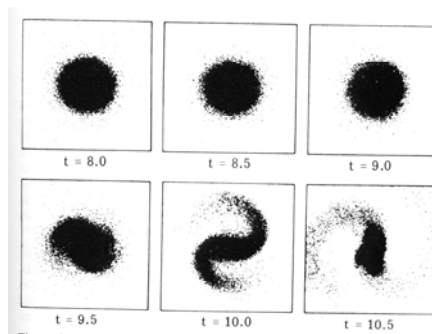
- Baade's window.
- $-1 < [Fe/H] < +1$
- $\sim 10^{10} M_{\odot}$
- Expanding 3kpc arm
  - HI feature
  - $V_r = -50$  km/s
  - Elliptical orbit due to bar



Kinematics of gas, in [NII]  
[BM] Fig 4.60

Long-slit spectrum

## Bars appear to be easily excited instability in disks



# Milky Way Halo

- Globular clusters + field stars
- Field stars = high velocity stars
- ~110 globular clusters known, in 2 different systems:
  - Older
    - $-2.5 < [\text{Fe}/\text{H}] < -0.8$
    - Spherical distribution around galactic center
    - No net rotation

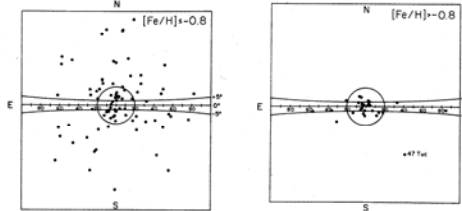


Fig 24.12

- Younger
  - (~12Gy, ~ same as thick disk)
  - $[\text{Fe}/\text{H}] > -0.8$
  - Compare to thick disk  $-0.6 < [\text{Fe}/\text{H}] < -0.4$
  - Flattened
  - Show net rotation => part of thick disk??

**Warning!**  
These are  
plots of  
directions in  
sky,  
NOT cross-  
sections of  
MW