Measuring metallicity from colors

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

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 ~0.6
- Roughly follows DeV profile ($r^{1/4}$ law)
- Baade's window.
  - $-1 < [\text{Fe/H}] < +1$
  - $\sim 10^{10} \text{M}_\odot$
- Expanding 3kpc arm
  - HI feature
  - $V_r = -50 \text{ km/s}$
  - Elliptical orbit due to bar

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
    - $-2.5 < [\text{Fe/H}] < -0.8$
    - Spherical distribution around galactic center
    - No net rotation
  - Younger
    - (~12 Gy, ~ same as thick disk)
    - [Fe/H] > -0.8
    - Compare to thick disk $-0.6 < [\text{Fe/H}] < -0.4$
    - Flattened
    - Show net rotation $\Rightarrow$ part of thick disk??

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