Astro 150: Milky Way II

Outline:

• population I + population II stars
• galactic center
Spiral structure of our galaxy:

- What does it look like?

Optical:
HII-regions, clusters of O, B stars

Problem: can’t see very far in optical

21 cm line redshifted
1940 Walter Baade:
He noted that stars in nearby galaxies were segregated by color

- **Red stars are concentrated in the bulges and halos of galaxies**
  → Population II
- **Blue stars are concentrated in their disks and especially in the Spiral arms**
  → Population I
Distribution of Stars in our Galaxy:

Pop I:
- young, $10^6 - 10^9$ y
- blue
- lie in disk
- circular orbit
- chemical composition like the Sun

Pop II:
- old, $> 10^{10}$ y
- red
- move along elliptical orbits, tilted to the galactic disk
- less metal than Sun
Distribution of Stars in our Galaxy:

Open clusters:
- stars are scattered loosely
- most of them lie in disk
- form when giant molecular clouds move into the galaxy’s spiral arms
- located along spiral arms

Globular clusters:
- contain far more stars
- denser
- located in the halo and nucleus of galaxy
Distribution of Stars in our Galaxy: Conclusion

**Pop II:**
probably formed in a major burst at the time of the galaxy’s birth during its initial collapse

explains the differences in:
- Age
- chemical composition
- color
- orbits

**Pop I:**
formed much later and continues forming even today
Galactic Center:

Sagittarius

- 8.5 kpc away in constellation Sagittarius
- region approx. 100 pc across
- 1.3 degree across
- GC hidden in optical by dust
- IR, radio & gamma-ray obs.
IR observations: IR observations indicate that stars within the central pc of the GC become highly packed → 10 million stars per pc$^3$ (in our neighborhood ~ 0.2/pc$^3$)

radio observations indicate the presence of a supermassive black hole with > 2 million solar masses within central 0.1 pc!!!!!!

Black hole: Rs = 0.04 AU

Tilted rotating ring
Sagittarius A*

X-ray image with radio contours

- powerful radio source
- perhaps a 10 million solar mass BH
- Sagittarius A* may be an accretion disk around a supermassive black hole

0.3 pc