Proper Motions & Velocity Dispersions in Galactic Center

Ghez et al. 1998  Galactic center dynamics

- **Velocity Dispersion**

  - Graph showing velocity dispersion vs. radius in pc.

- **Proper Motions**

  - Graph showing ΔDEC and ΔRA from Sgr A* in arcsec.
Measures of Acceleration around the Galactic Center

Acceleration vectors define location of center (independently of radio source Sg A*) and provide improved mass estimate

Shea et al. (2003)


\[ M_{\text{BH}} = 4.1 \pm 0.6 \times 10^6 M_\odot \]
Galactic Bulge: Not a Homogeneous System

Over the past 20 years it has emerged that the Galactic bulge is not a uniform old miniature elliptical galaxy that pre-dates the disk.

It is clearly continuously growing with stars of a wide range of metallicities.

The strong correlation between bulge mass and black hole mass seen in local galaxies is poorly understood.

Figure 10.7 The distribution of 88 bulge K giants in [Fe/H]. [After McWilliam & Rich (1994)]
Edvardsson (1993) examined the vertical velocity distribution $v_z$ of stars as a function of their age and metallicity.

It is reasonable to assume that the highest velocity stars formed at a greater height from the Galactic plane so these correlations could suggest that metal-poor/old stars formed when the Galaxy was still collapsing.

Alternatively, the older stars may have been scattered to these orbits over time via interactions in the disk.
Galactic Globulars – Two Populations

Galactic Structure from surface photometry & globulars

10.5 The halo

Globular Clusters

\[ z \approx 2/0 \text{ it looks like disk glob} \]

\[ z_0 \approx 1 \text{ kpc} \rightarrow \text{ thick disk?} \]

Armandroff

Chapter 16: Components of the Milky Way

Bulge

Freudenreich (1998) Cobe/HI.

Triaxial G. Bulge

\[ B/D \approx 0.62 \times 10^{10} \]

\[ a = (1.69, 0.63, 0.42) \text{ kpc} \]