

DEX Science Cases -- Stars

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Possible Stellar Science

- Mass of the dark matter halo from field blue horizontal branch stars
- Exploration of two-component halo
- Discovery of Low Luminosity, stellar streams

Mass of Milky Way Dark Matter Halo

- Xue et al. (2008, ApJ 684, 1143) used 2400 BHB stars from SDSS to compute the circular velocity curve at a galactocentric radius of 60 kpc.
- Found that the circular velocity falls slightly from 220 km/s
- $M(<60 \text{ kpc}) = (4.0 \pm 0.7) \times 10^{11} M_{\text{solar}}$
- $M_{\text{vir}} = 1.0^{+0.3}_{-0.2} \times 10^{12} M_{\text{solar}}$

Figure 12 from Xue *et al.* (2008)

Solid line modeled escape velocity and dashed line modeled circular velocity for SDSS sample

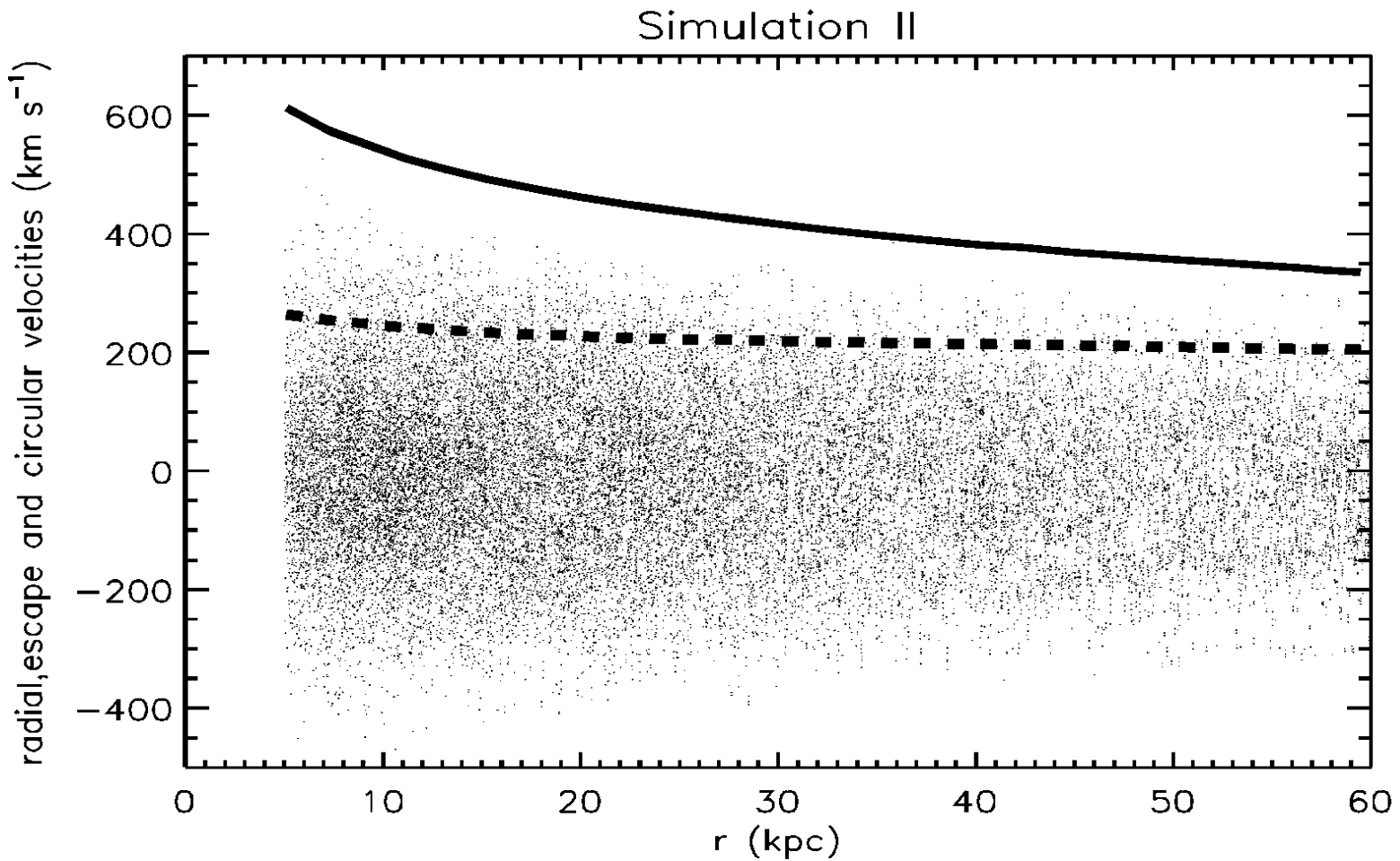
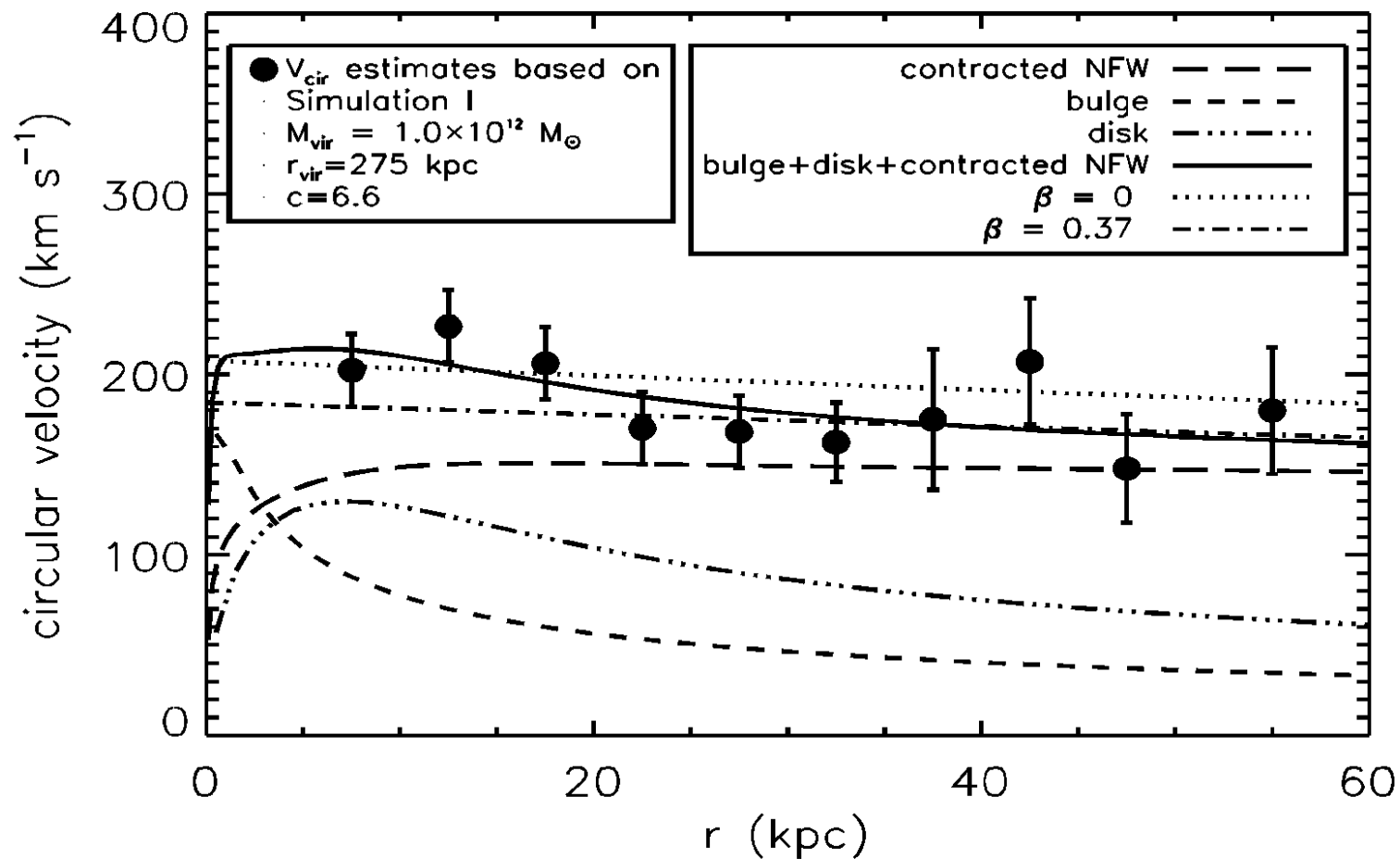
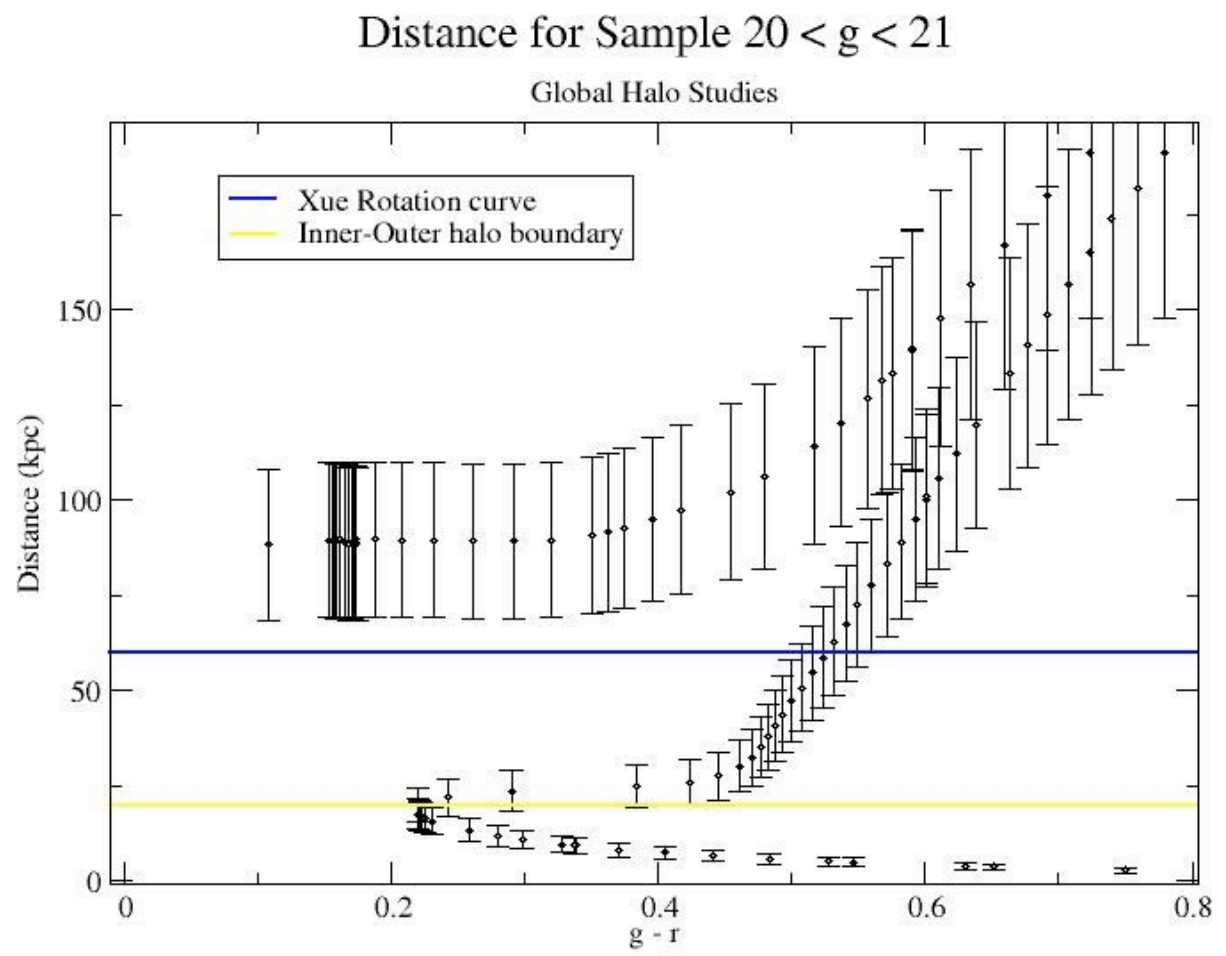


Figure 17 from Xue et al. (2008) showing modeled mass components. Extending the distance of the sample would help to constrain mass determination



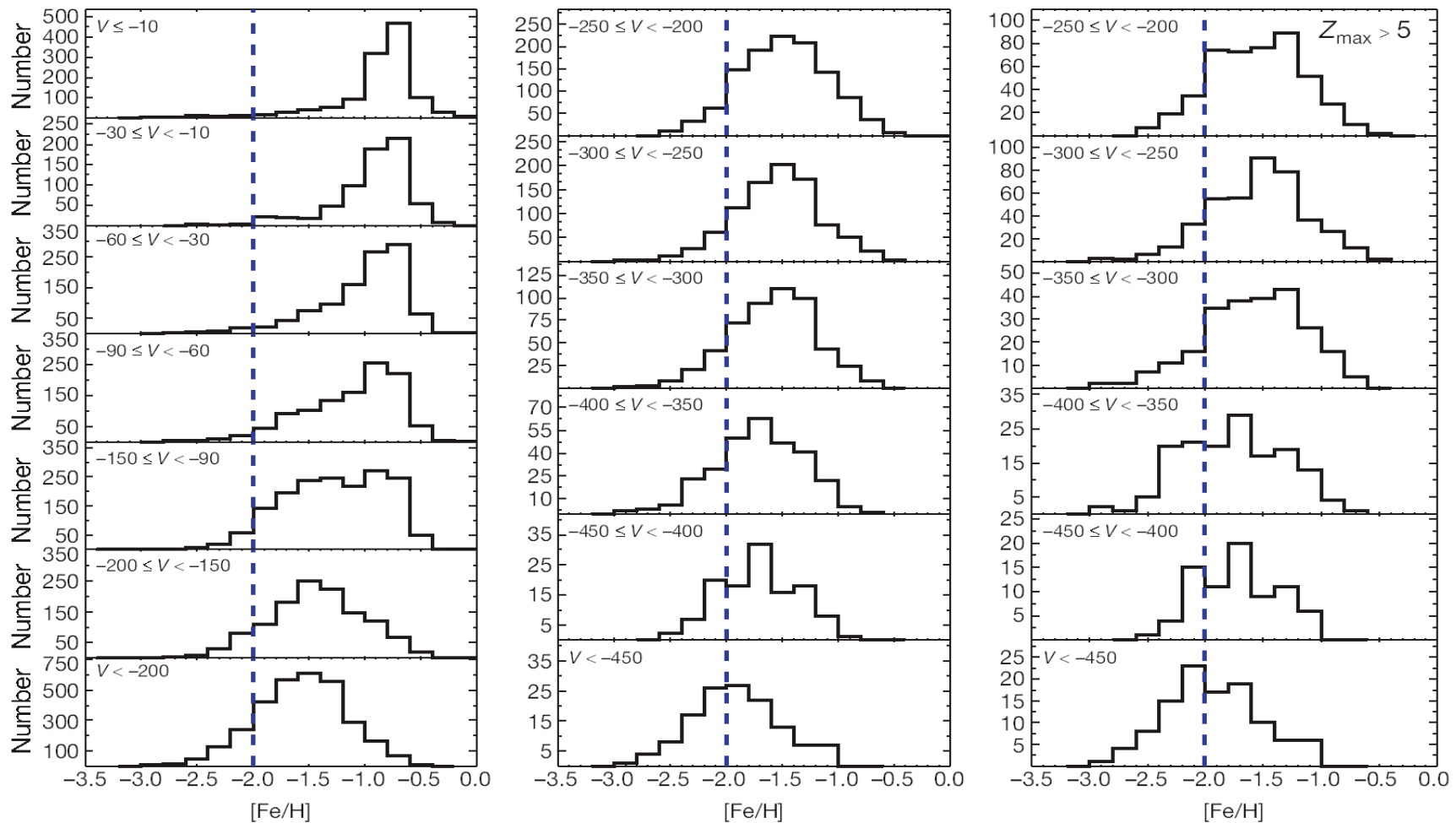
Plot showing distances for possible sample from DEX program with error bars spanning distance for the given magnitude range. Blue line is sample distance for Xue et al. study.



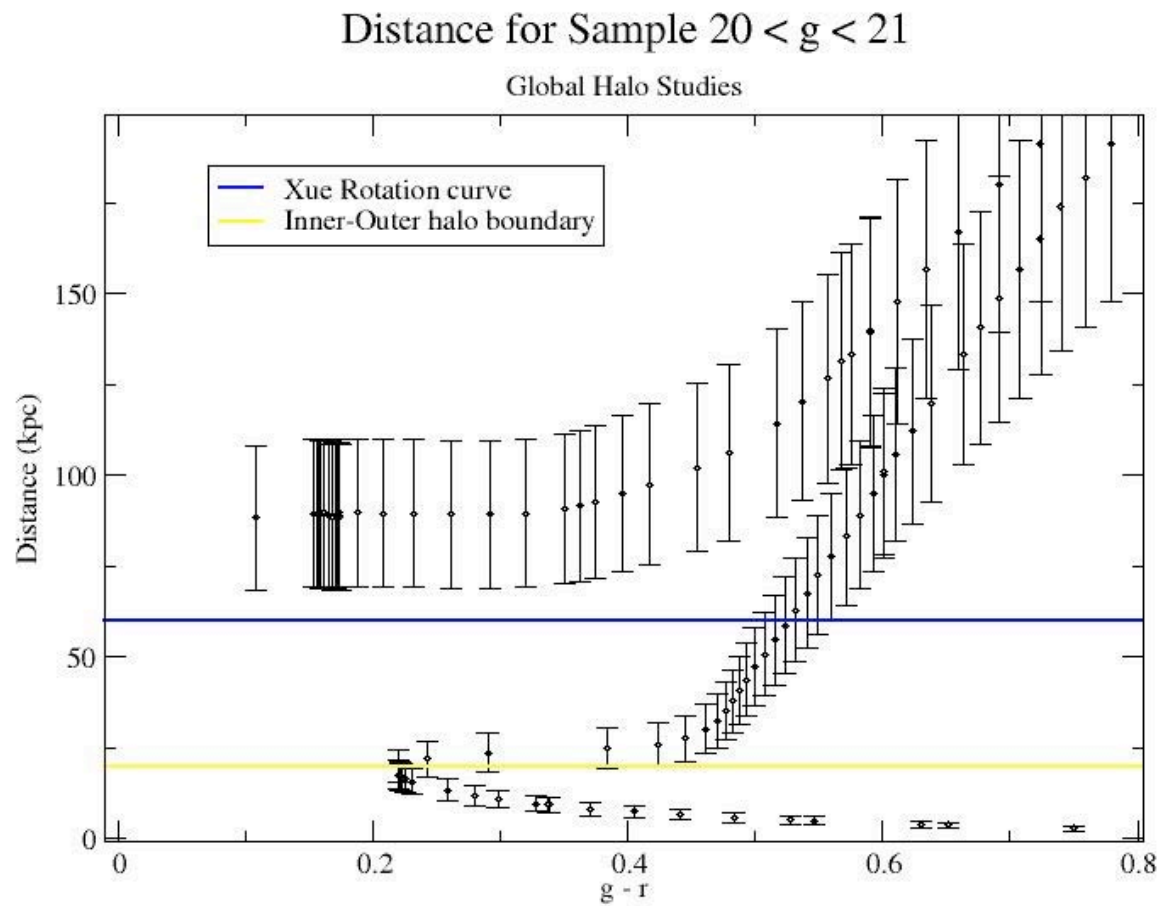
Probing the two-component halo

- Carollo et al. (2007, Nature, 450, 1020) used a local sample of SDSS stars with full space motions to identify a dichotomy in the halo. The results indicated that the inner halo dominates the stellar sample to galactocentric distances of 15 kpc, is flattened and has a mean metallicity of $\langle[\text{Fe}/\text{H}]\rangle = -1.6$. The outer halo is spherically distributed, in net retrograde rotation and has a mean metallicity of $\langle[\text{Fe}/\text{H}]\rangle = -2.2$.
- The expectation is that the outer halo formed through accumulation of cannibalized systems.

Figure 2 from Carollo et al. showing the trend toward lower metallicities as a function of velocity and distance.



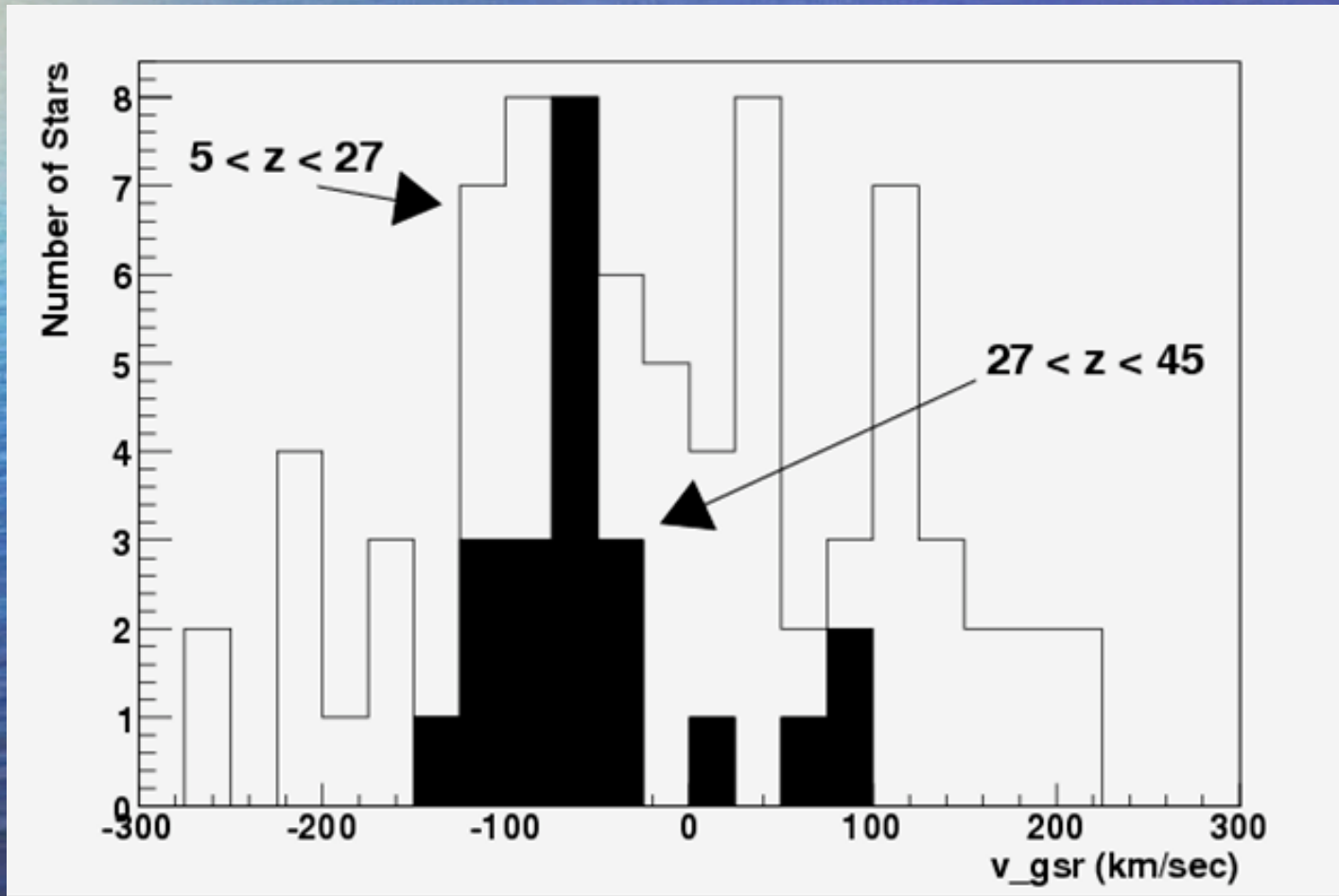
Potential DEX sample indicates that the MS-TO can be reached at a distance consistent with the outer halo ($D = 20$ kpc). This could supply an extremely large in situ sample with which to test the Carollo *et al.* results.



Halo substructure in the direction of the North Galactic Cap.

- The area of sky covered by the DEX program is a particularly interesting area for stellar research. The North Galactic cap is the location of the descending, leading arm of the Sagittarius stream and is expected to include the much less populated trailing arm. It is also the location of the Virgo overdensity.

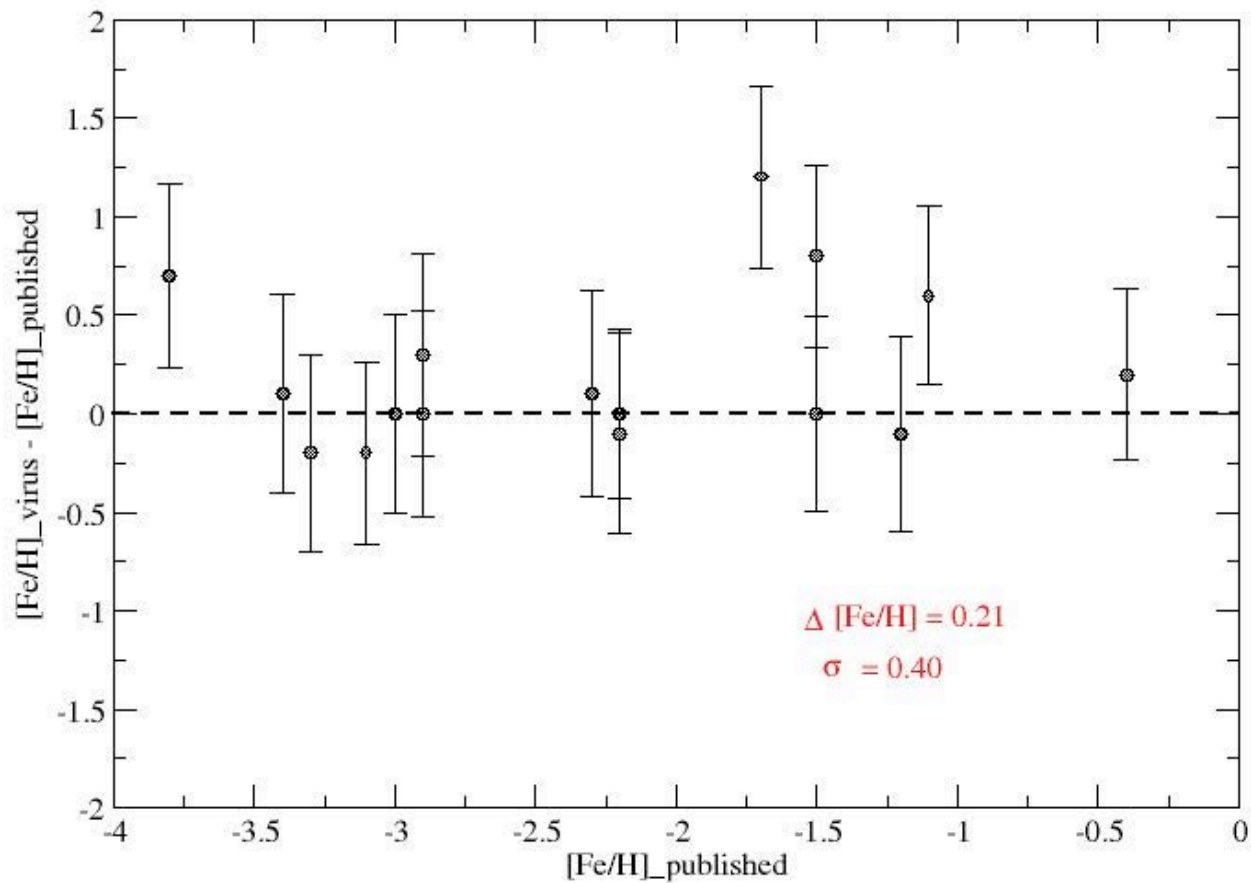
RR Lyrae candidates from Wilhelm et al. near the North Polar cap region. The excess of negative velocity stars at large z -height is from the leading arm of the Sagittarius stream. The trailing arm, which is not well constrained is expected to have positive velocities and be located at $20 < z < 25$ kpcs.



Implications

- The potential exists to nearly double the distance of the BHB sample and determine better the decline in the circular velocity curve as a function of galactocentric distance
- Requirements include radial velocities that are precise as possible.
- SNR ~ 20 at CaII K in order to determine stellar parameters of T_{eff} , Logg and $[\text{Fe}/\text{H}]$ which are necessary for luminosity class determination and ultimately distance determination.

VIRUS-P standard star metallicity comparison for spectral-type K-F using KP-(J-K) relation from Rossi *et al.* (2005, AJ, 130, 2804).



Discussion

The image features a wide, deep blue ocean stretching to a clear horizon. The sky above is a lighter blue with wispy white clouds. On the left side, a faint rainbow is visible, its colors blending into the blue of the sea. The word "Discussion" is centered in the upper half of the image in a bold, yellow, sans-serif font with a thin black outline.