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RECOVERING AGES & METALLICITIES OF STELLAR HALOS WITH WFIRST

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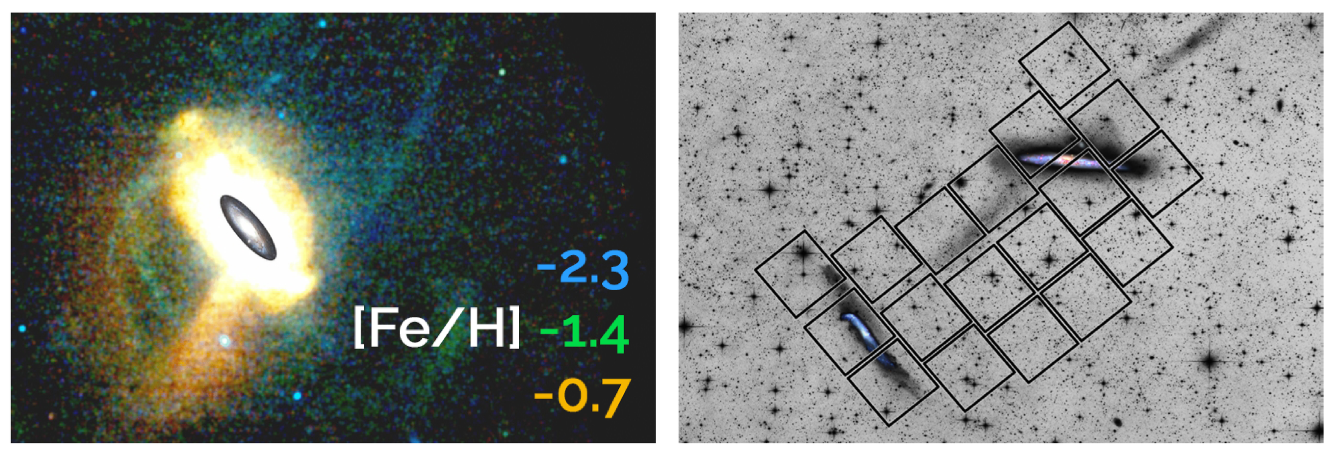
INTRODUCTION

Ground-based surveys such as SDSS and PandAS have revealed rich substructure in Local Group galactic halos. WFIRST has the potential to extend such studies out to the entire Local Volume. Here we present simulations of WFIRST's ability to measure ages and metallicities of resolved stellar populations such as one might find in stellar halos.



Left: Map of stellar streams in M31 color-coded by metallicity, adapted from Martin et al. 2013.
Right: NGC 4631 & NGC 4656 with WFI footprint superimposed, adapted from Martinez-Delgado et al. 2015.

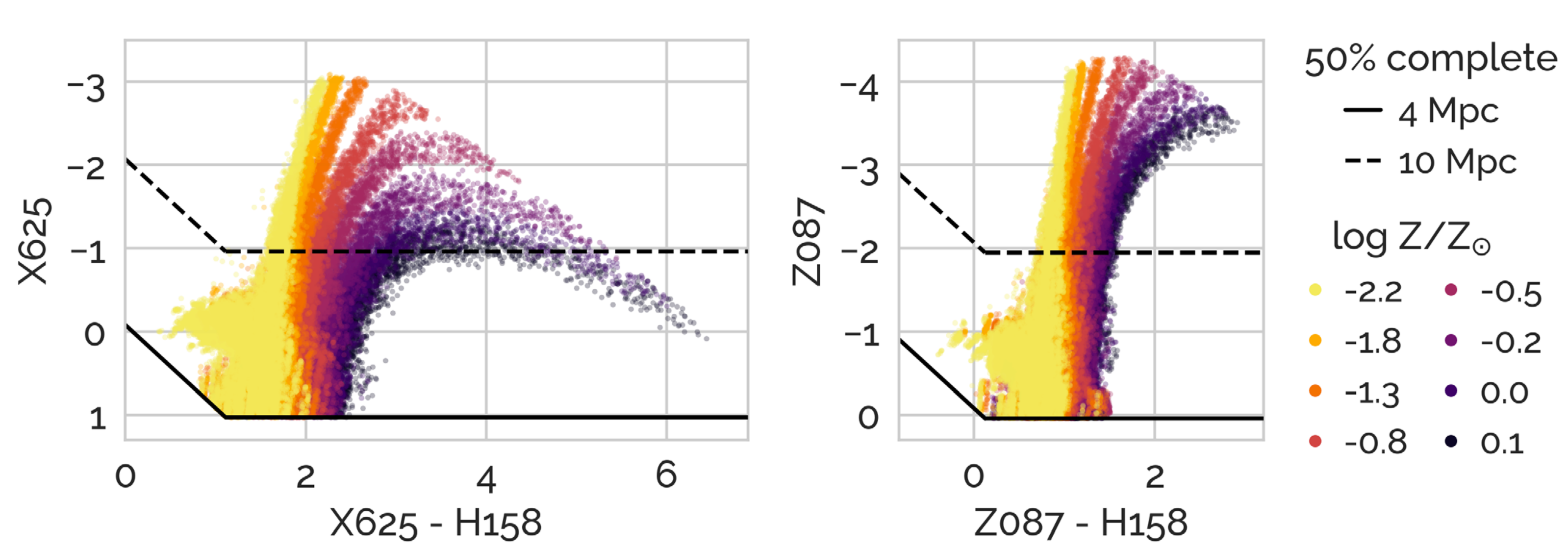
SIMULATION SETUP

We simulate two-band WFI photometry of single-age, single-metallicity stellar populations at fixed stellar mass (10^7 $M_\odot$) and a range of distances, ages, and metallicities, and perform star formation history fits using MATCH (Dolphin 2002). All simulations and fitting use MIST isochrones (Dotter 2016).

Quantity	Range
Distance	4 - 10 Mpc
Age	2 - 13 Gyr
Metallicity	-2.2 - 0.1 dex

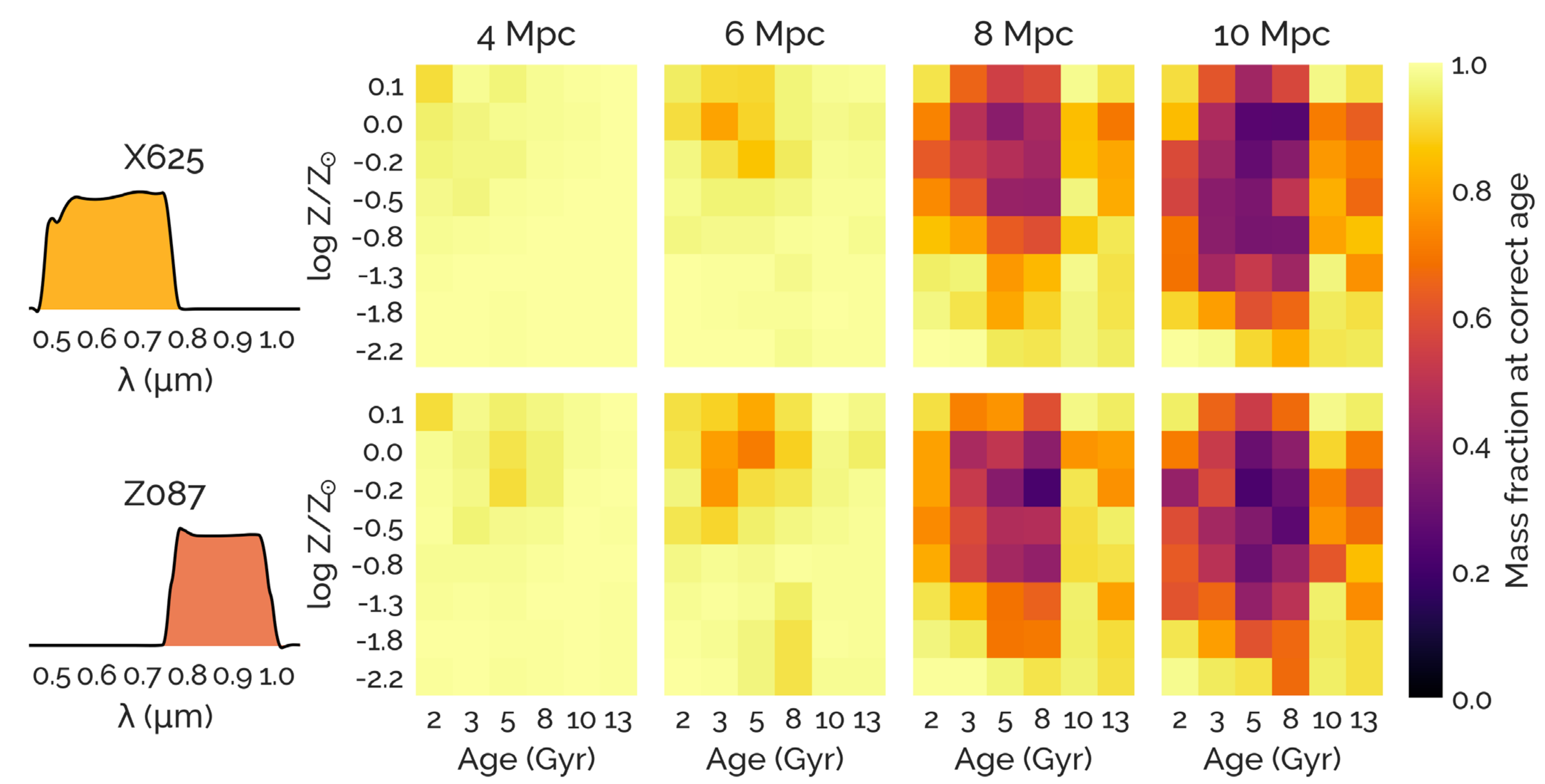
Filter	50% complete (Vegamag)	5σ exposure time (hr)
X625	29.5	< 5.5
Z087	28	3.3
H158	27.5	6.6

We choose X625 and Z087 as blue filters for their complementary strengths; X625 provides color separation, and Z087 provides depth. We choose H158 as the red filter for its low background.

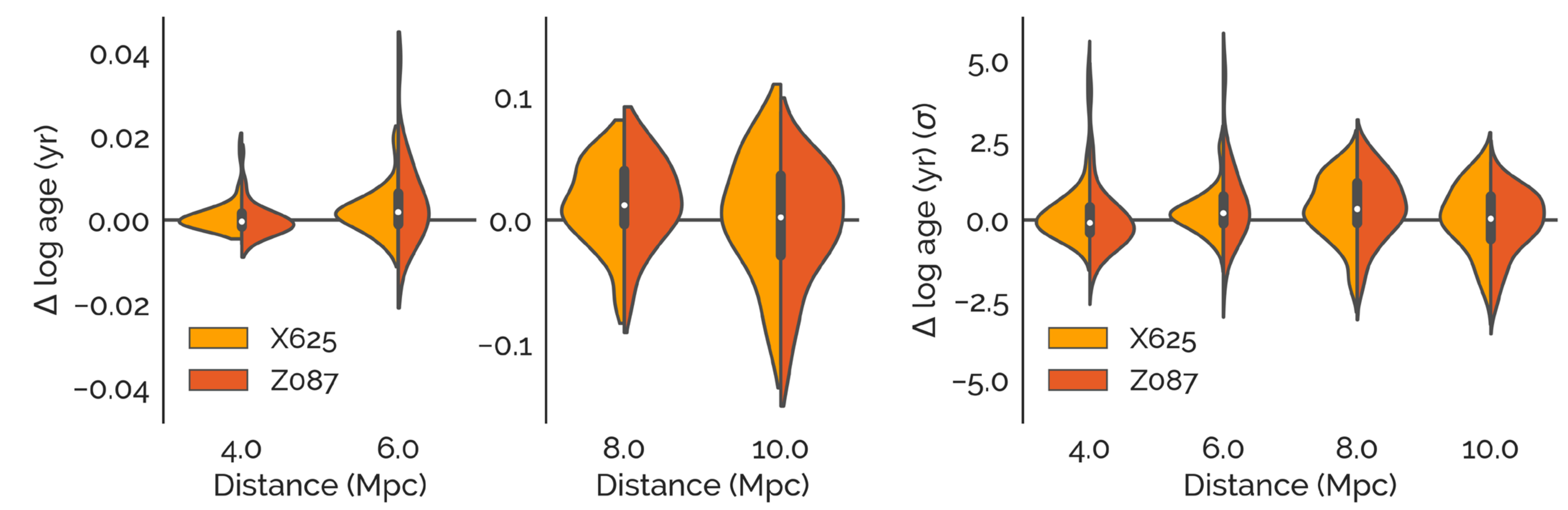


Absolute-magnitude CMDs of example simulated populations at 8 Gyr, with color indicating metallicity. Solid and dashed lines mark 50% completeness limits at 4 and 10 Mpc respectively.

AGE RECOVERY

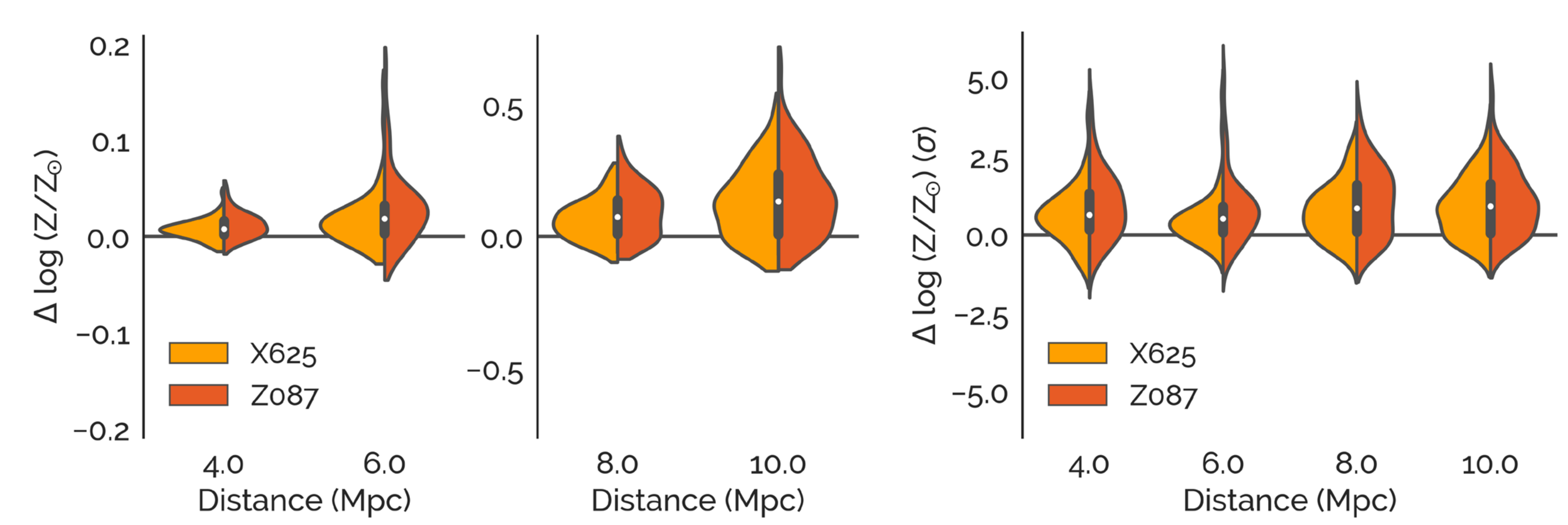


Grids showing the fraction of stellar mass from SFH fits measured to be within ±0.1 dex of the input age of each simulated population. Filter performance is comparable at our chosen depths, although X625 performs marginally better at nearby distances.



Left: Violin plots of differences between the mass-weighted average of the recovered ages and the input ages by filter and distance.
Right: Same as left, but normalized by standard deviation to emphasize relative performances of X625 and Z087 at each distance.

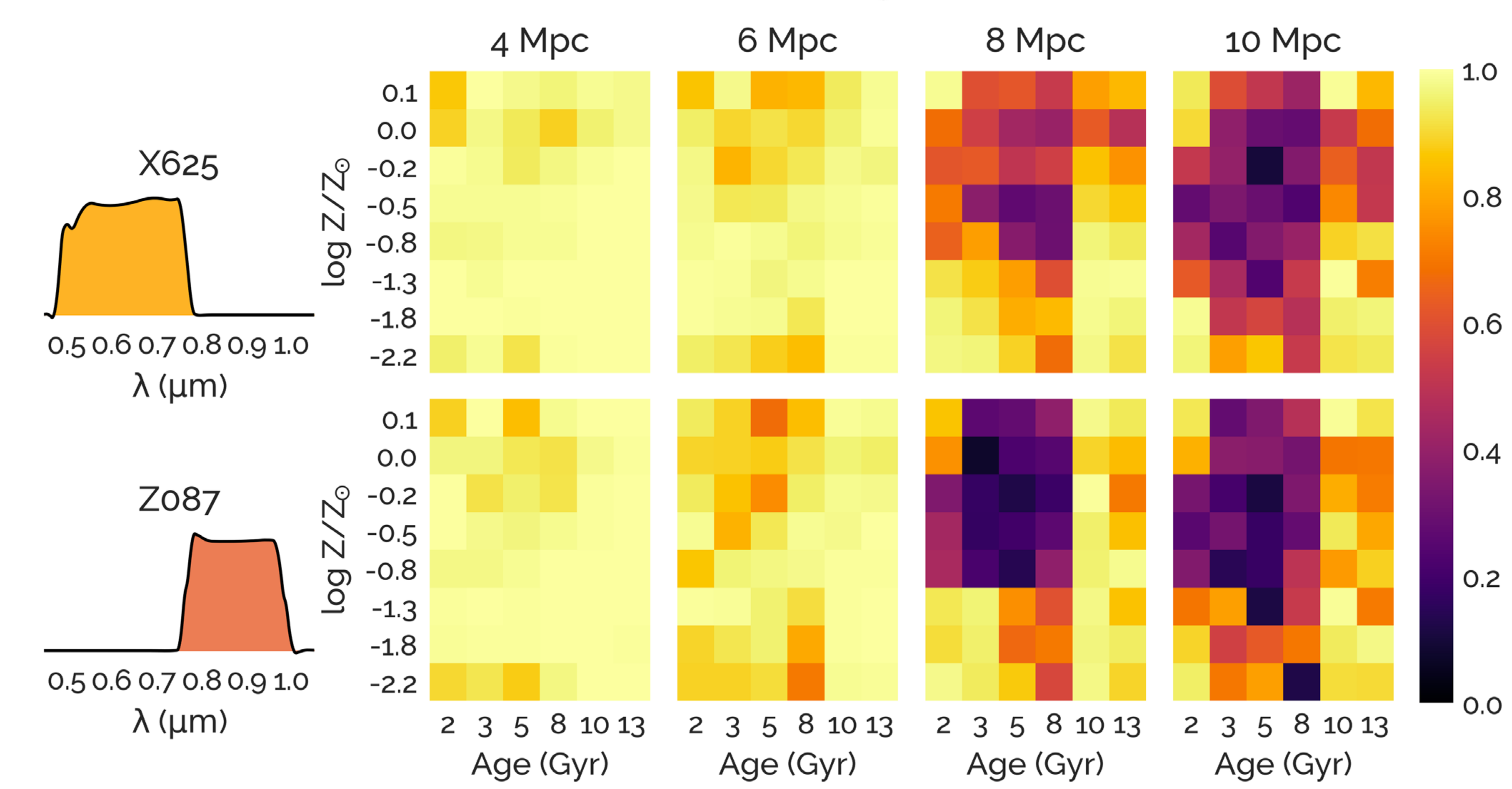
METALLICITY RECOVERY

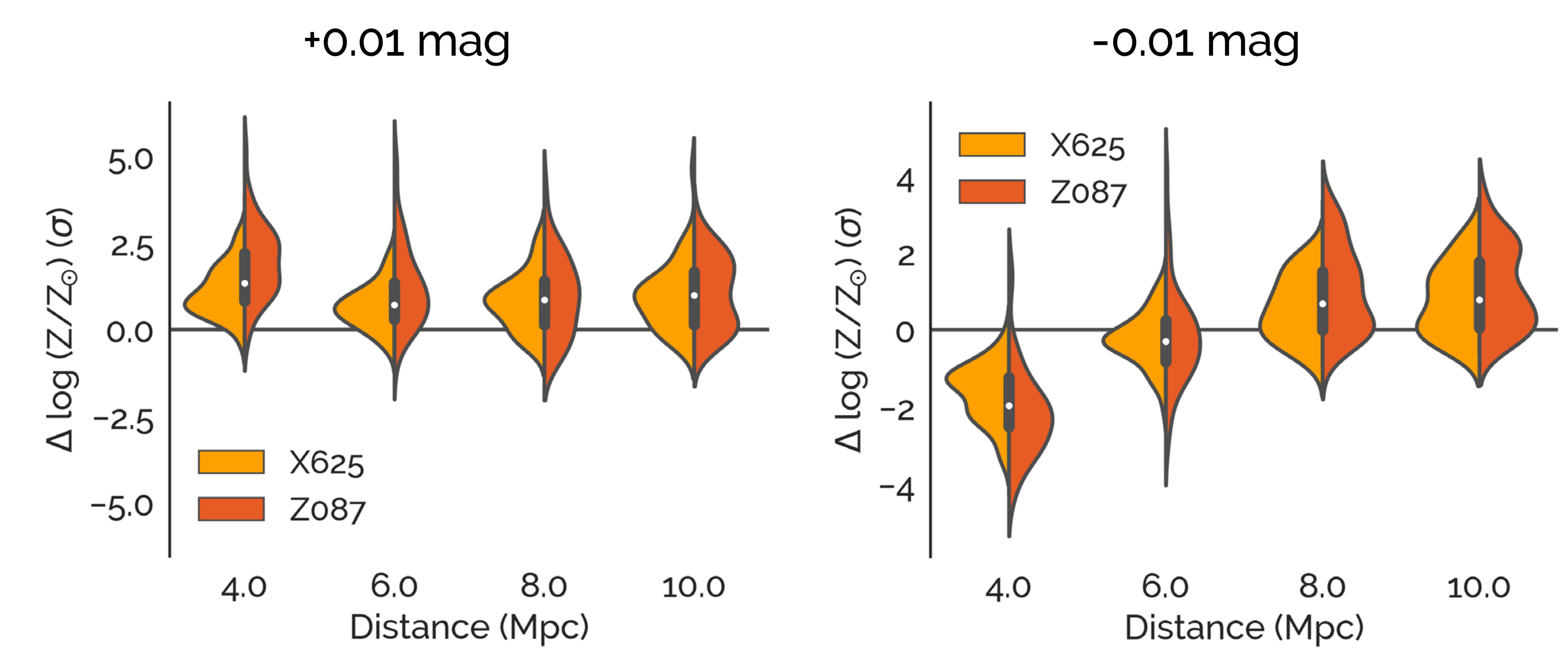


Left: Violin plots of differences between the mass-weighted average of recovered metallicities and input metallicities by filter and distance.
Right: Same as left, but normalized by standard deviation to emphasize relative performances of X625 and Z087 at each distance.

SYSTEMATIC ERRORS

We introduce photometric offsets of ±0.01 mag to each blue filter to test robustness to systematics. X625 performs significantly better than Z087 with systematics due to X625's strong color separation.





FUTURE WORK

- Perform simultaneous SFH fits of X625 and Z087 CMDs to optimize depth and color separation
- More thorough treatment of systematics
- Test different stellar model suites independently & against each other (e.g., simulate a population with MIST, fit SFH with PARSEC, & vice versa)
- Vary total stellar mass/number of stars

REFERENCES

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