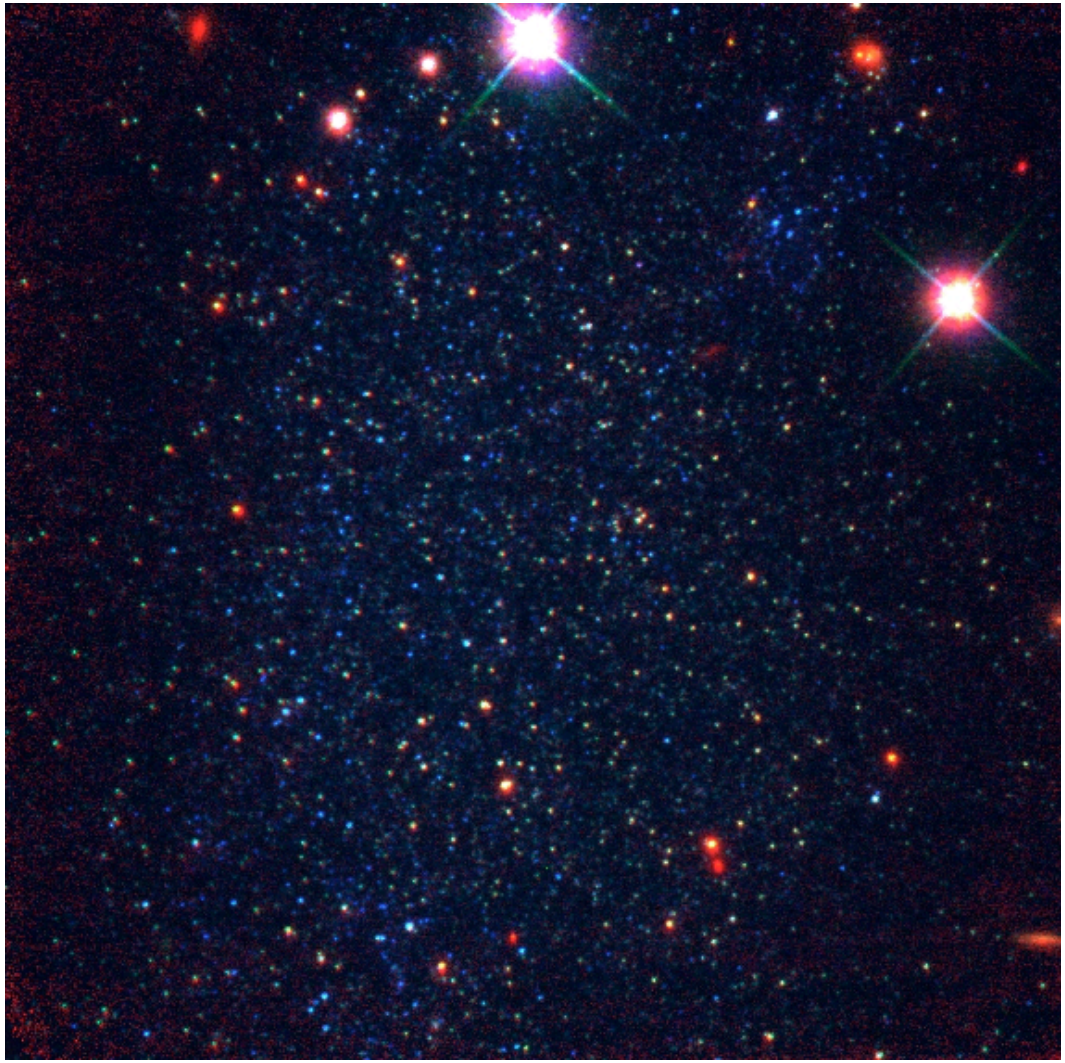
Constraining the Numbers, Luminosities, and Colors of Evolved Stars within Nearby Galaxies

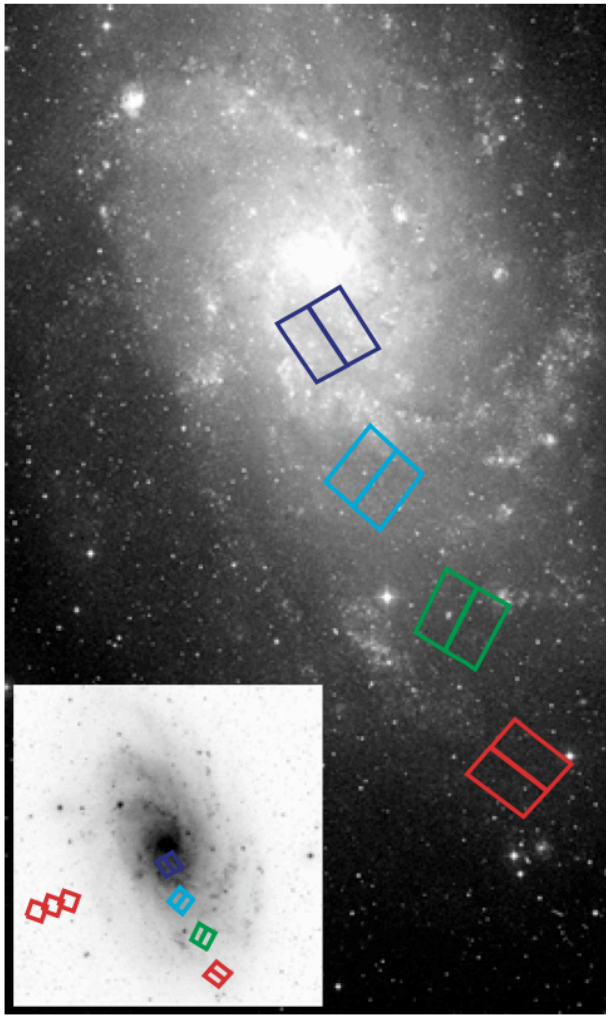
Jason Melbourne (Caltech)

Ben Williams and Julianne Dalcanton (University of Washington)

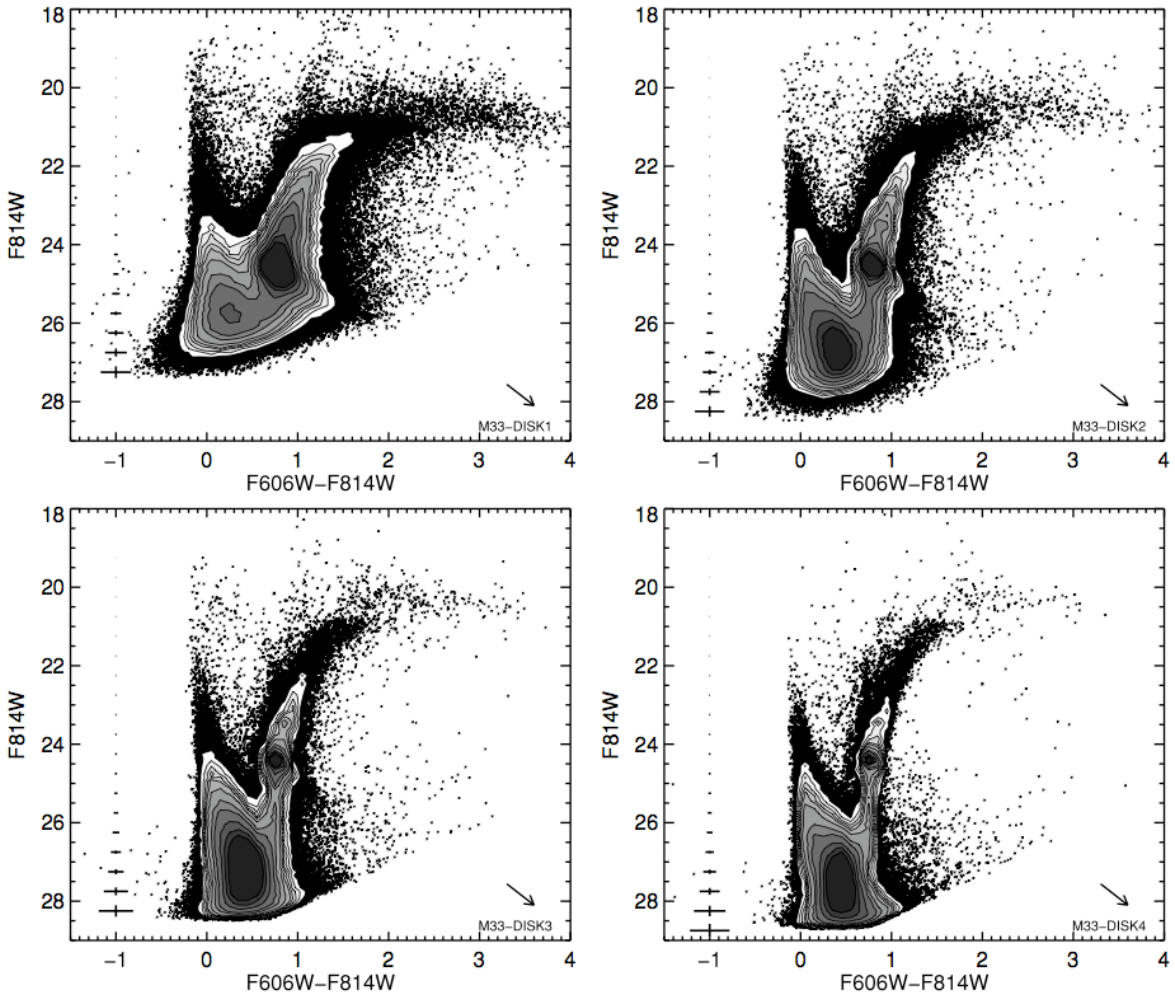


Nearby (2.5 Mpc) Dwarf Irregular Galaxy KKH 98 HST F475W (Blue), HST F814W (Green), Keck AO K-band (red)

The Colors and Magnitudes of Stars Can be Used to Reconstruct the Star Formation Histories of Galaxies

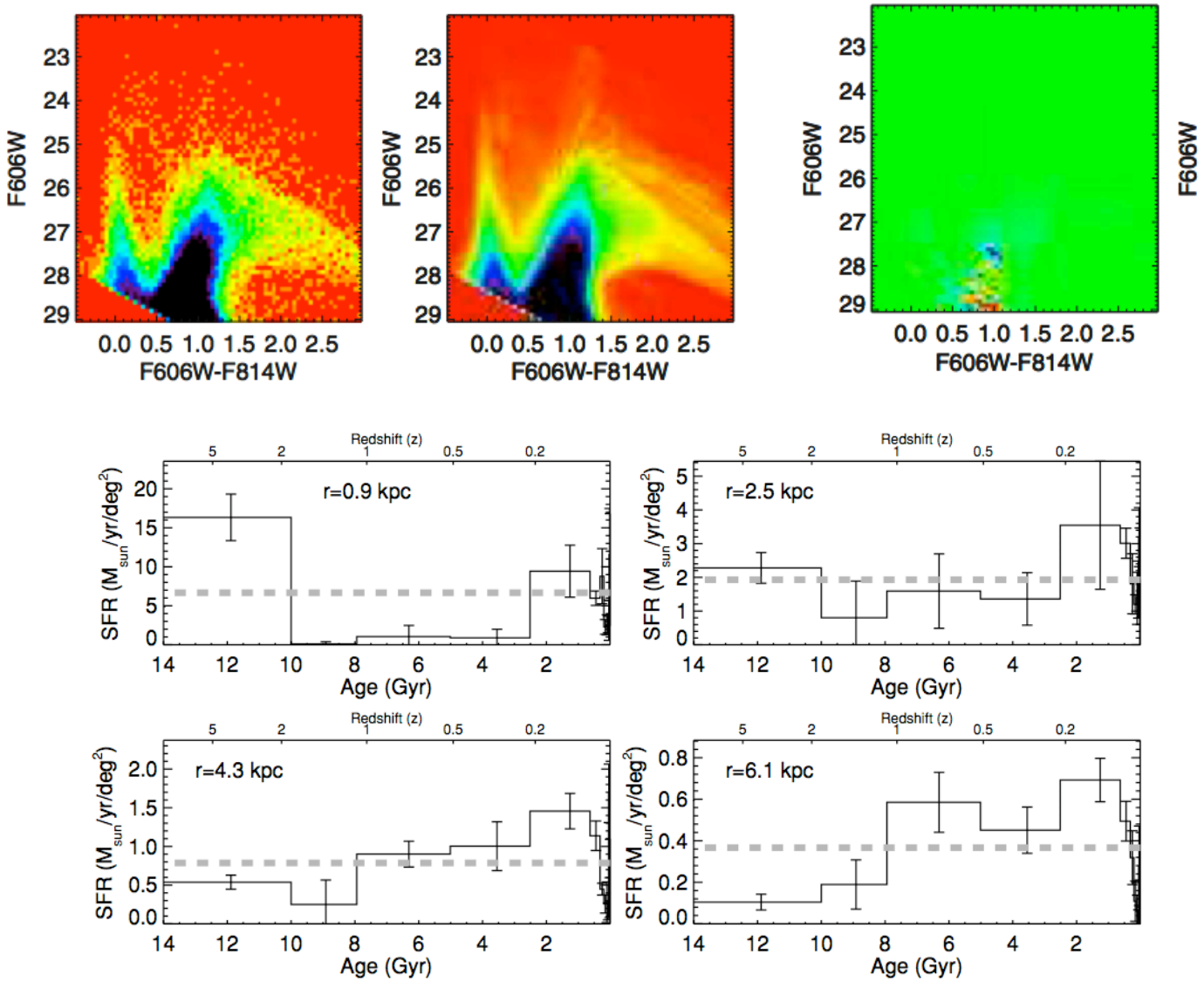


M33 HST ACS fields



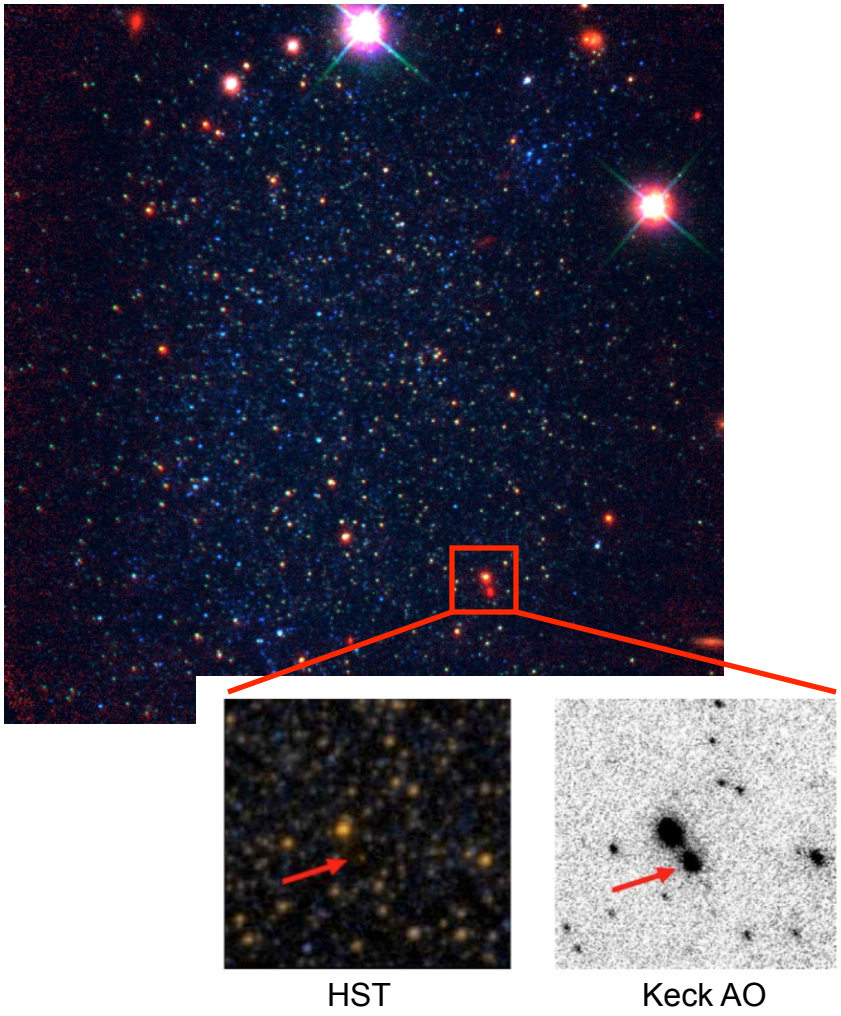
Williams et al. 2009

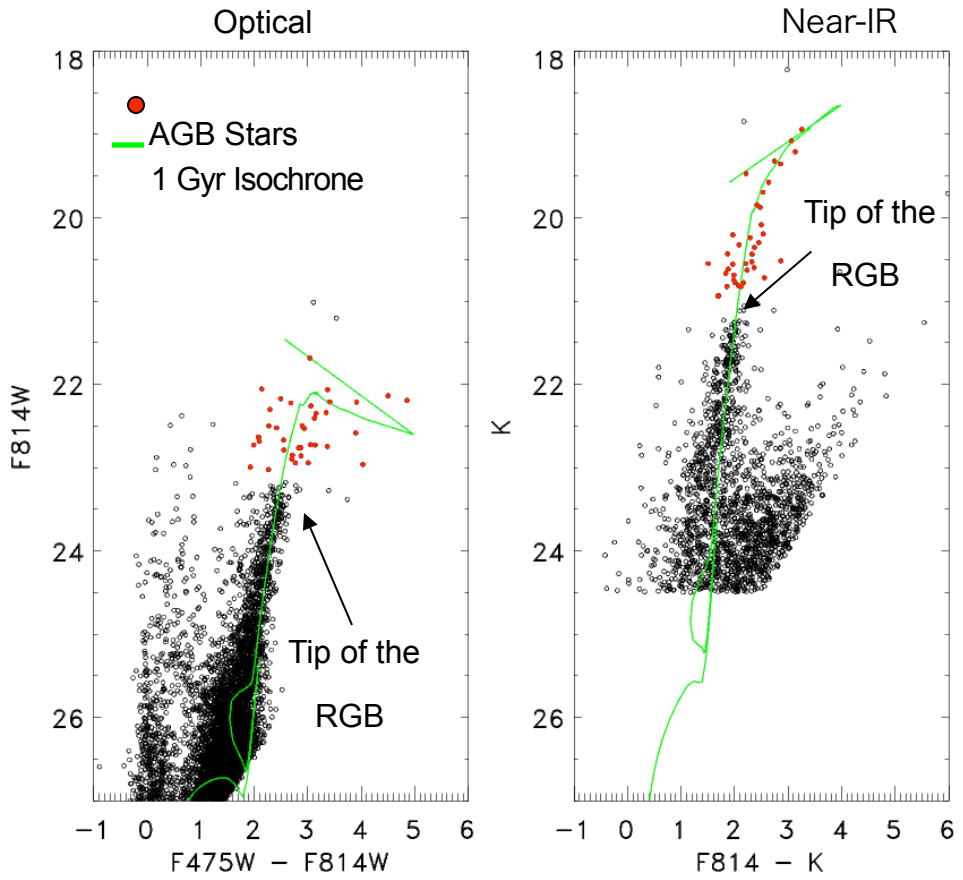
The Colors and Magnitudes of Stars Can be Used to Reconstruct the Star Formation Histories of Galaxies



Williams et al. 2009

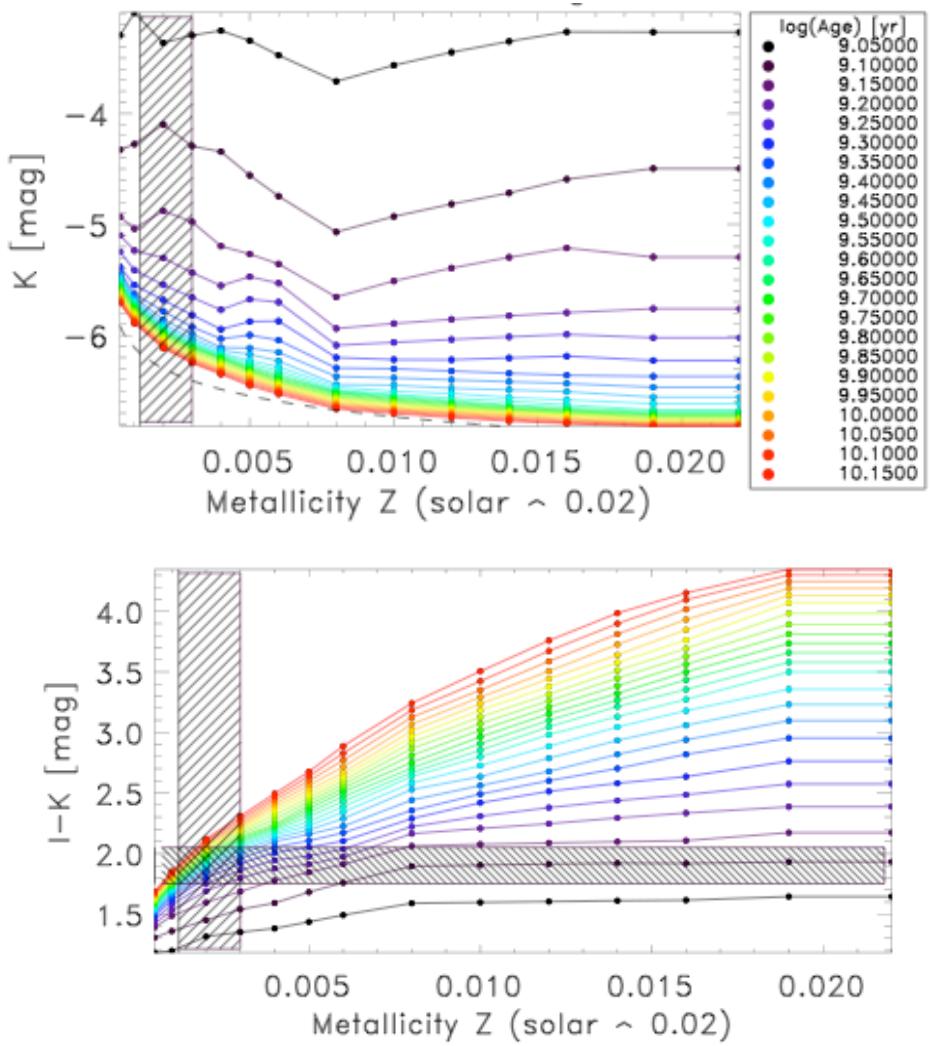
In the Near-IR, Constraints on Star Formation History Come From the Asymptotic Giant Branch (AGB) and the Tip of the Red Giant Branch (TRGB)





Melbourne et al. in Preparation

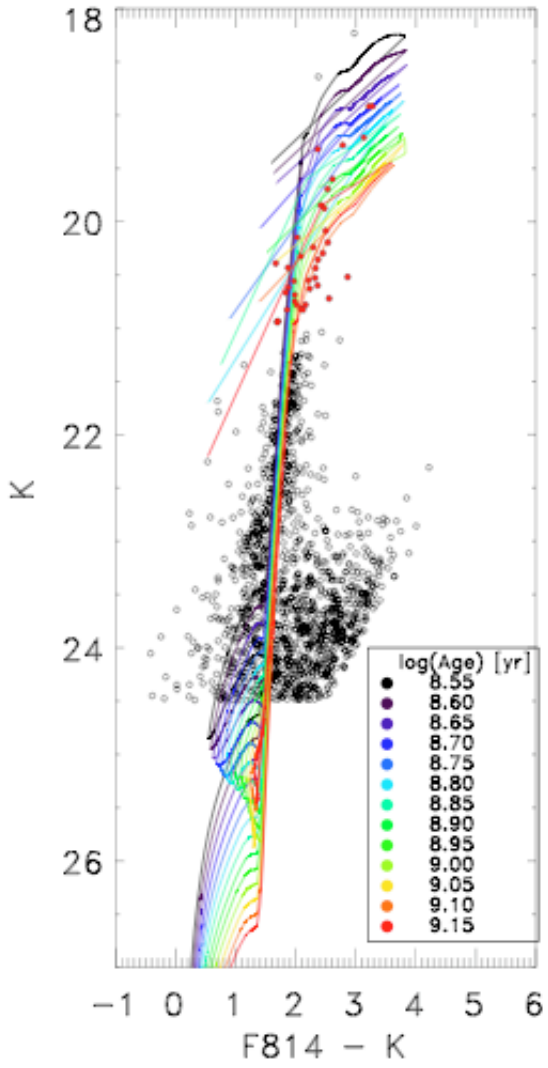
The Color and Magnitude of the TRGB Indicates the Age of the Onset of Star Formation



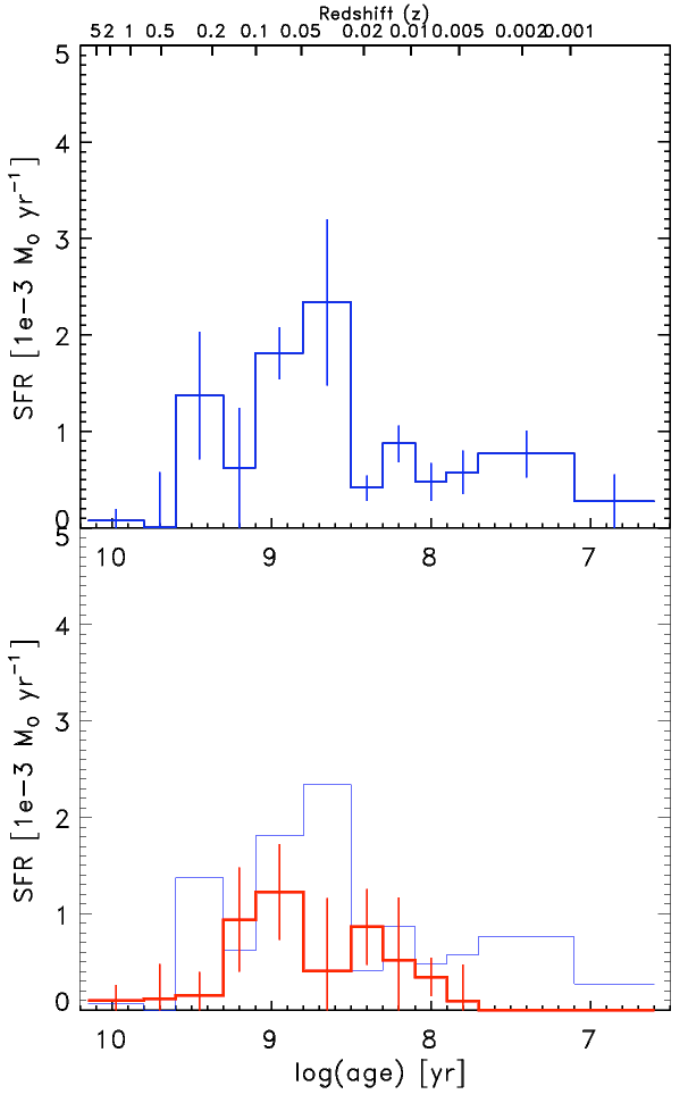
Melbourne et al. in Preparation

The AGB is a Great Indicator of the Star Formation History from 0.5 - 5 Gyrs

- Very Luminous in the Near-IR.
- Spatially sparse.
- Lie in Unique Sequences in Near-IR CMDs

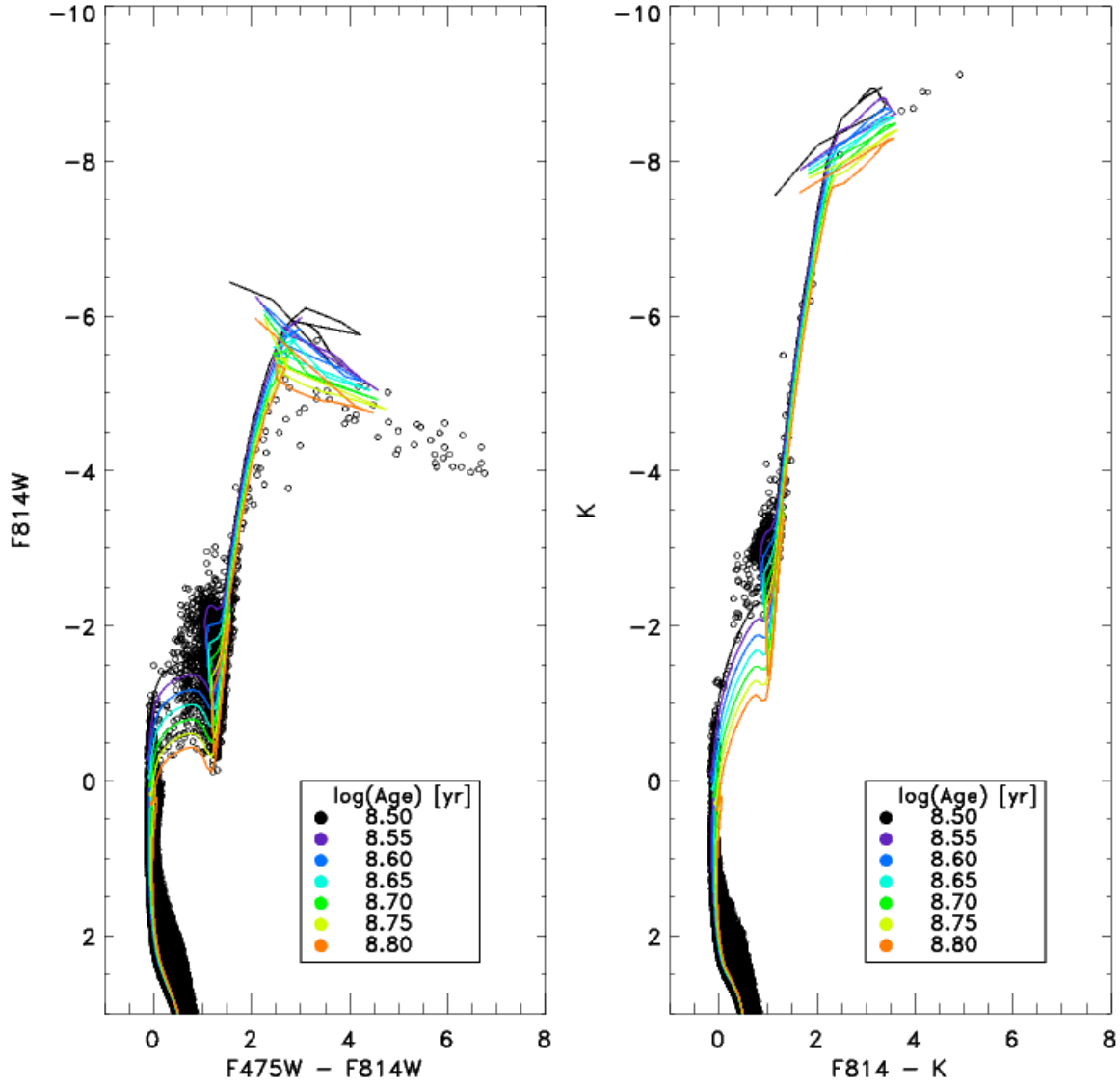


In KKH 98, the SFH Deduced from the Optical Data are a Good Match the SFH from the IR



Melbourne et al. in Preparation

Differences in SFH from Optical to IR Show Problem in Models of AGB



AGB Stars Have Huge Implications for High-z Galaxies

- Stellar masses are based on SED fitting especially at redder wavelengths (less affected by dust).
- AGB stars contribute negligible mass but significant luminosity.
- At the redder wavelengths, AGB in ~1 Gyr populations contribute 50% or more of the flux.
- If AGB not accounted for properly can get masses wrong by factors of two or more.
- Currently, best AGB models based on LMC, not a good fit to other galaxies.

Our Plans for Studying the AGB in Nearby Galaxies

- Keck AO of ANGST Dwarf Galaxies (J, K) - data in hand
- Keck AO of M 33 Clusters (J, K) - 2 nights in Fall 09
- WFC3 Snapshot ANGST galaxies (H) - proposal approved
- ADP Archival Spitzer Imaging of ANGST galaxies - Pending.

Summary

- Resolved photometry of stars can reveal star formation histories of nearby galaxies.
- This work can be done in the near-IR, where the IR bright stars are sufficiently sparse to resolve with Keck AO beyond 4 Mpc.
- The TRGB and AGB populations are important guide posts for stellar pops in the IR.
- To understand the high-z universe, and to take full advantage of JWST and AO on TMT, the AGB needs to be better constrained observationally across a wide range of star formation histories and metallicities.