A next-gen program for chemical enrichment evolution of dwarf satellite galaxy (ProCEEDS) models

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Introduction

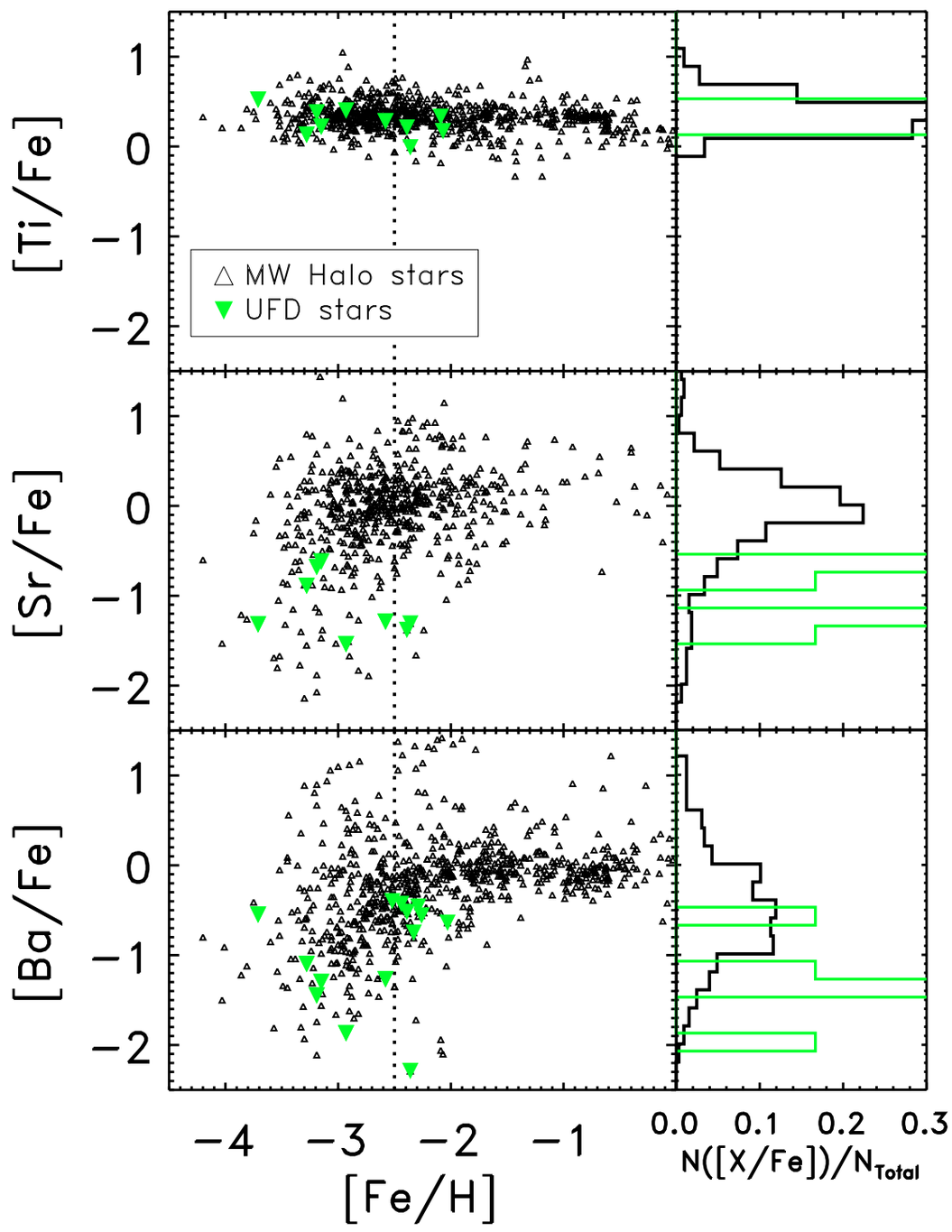
- Motivation: Why do we need next-gen chemical evolution SAMs?

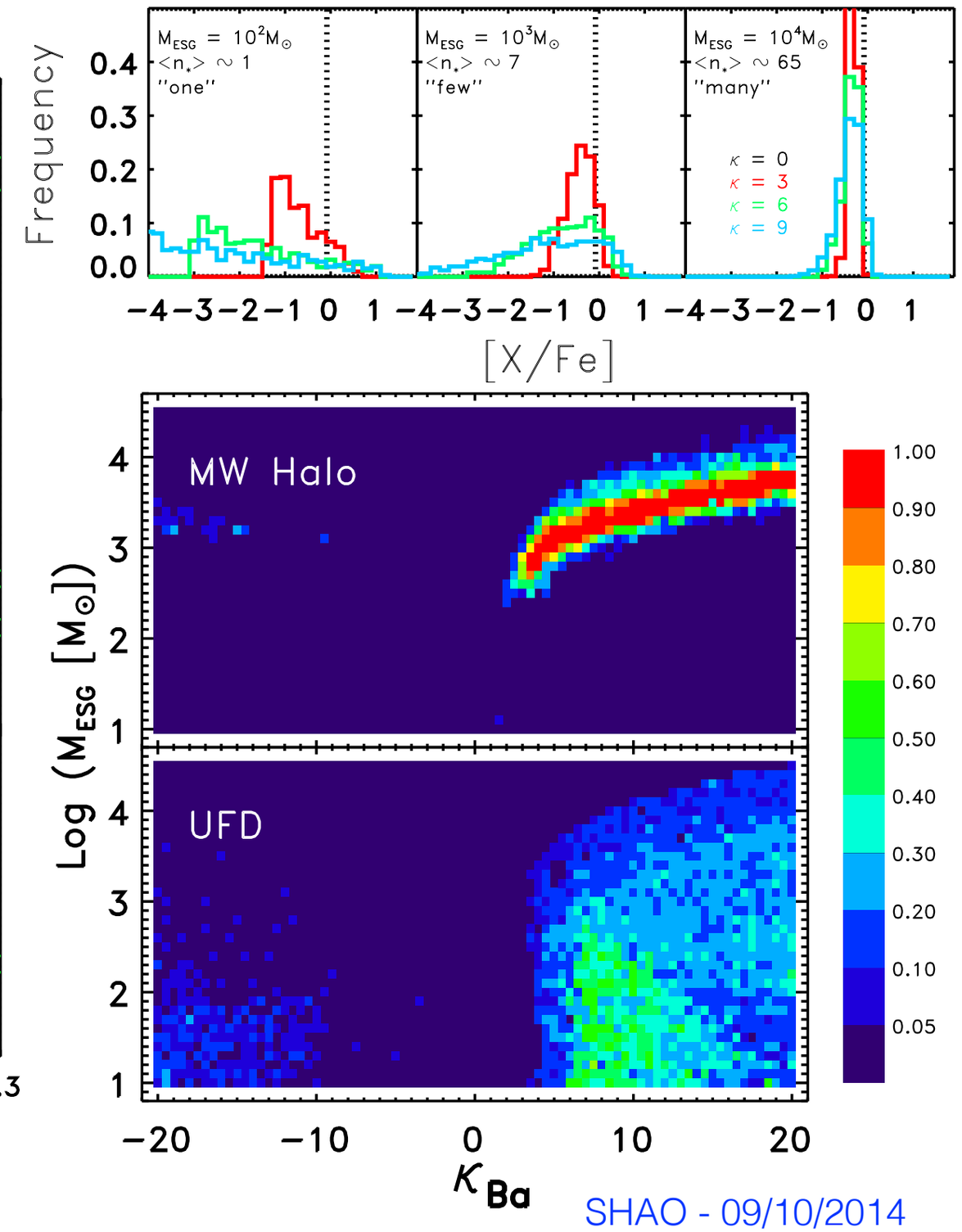
- Development: How do we create these models? How are they different from previous models?

- Implementation: How do we compare these models with real data?

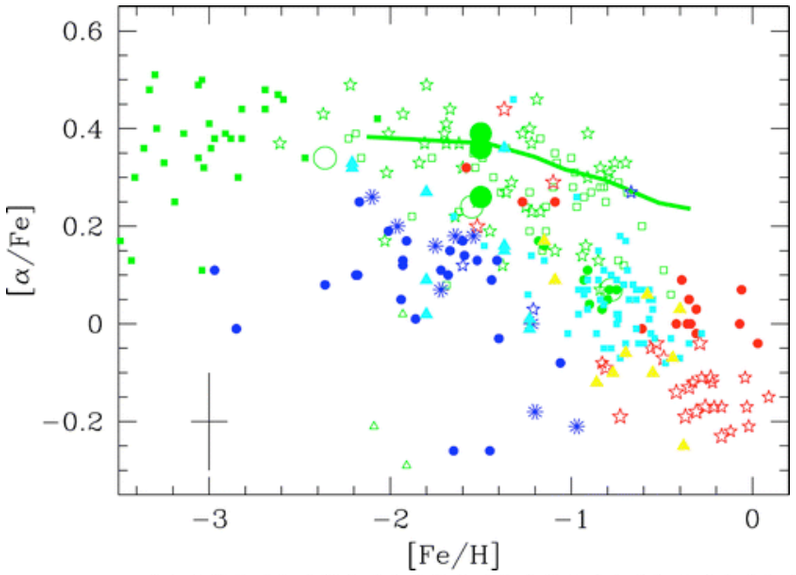
Motivation

Lee et al. (2013)



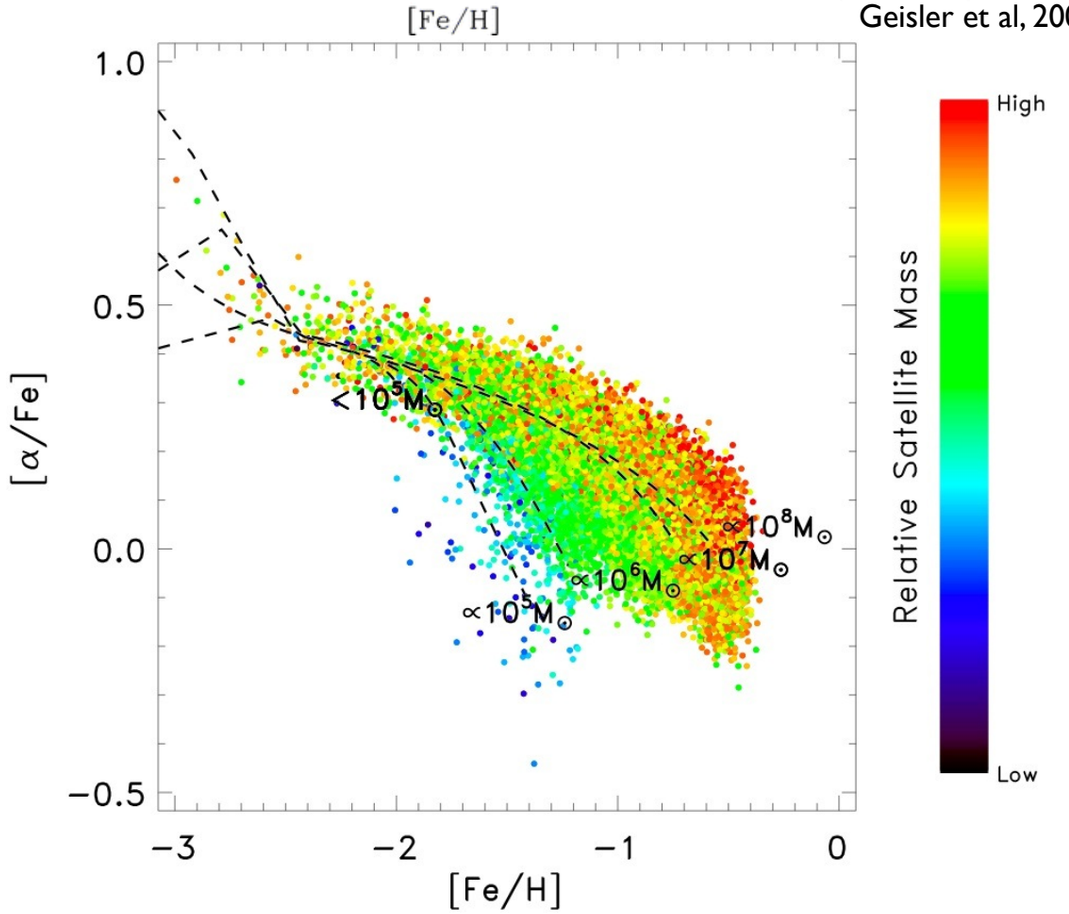


Motivation

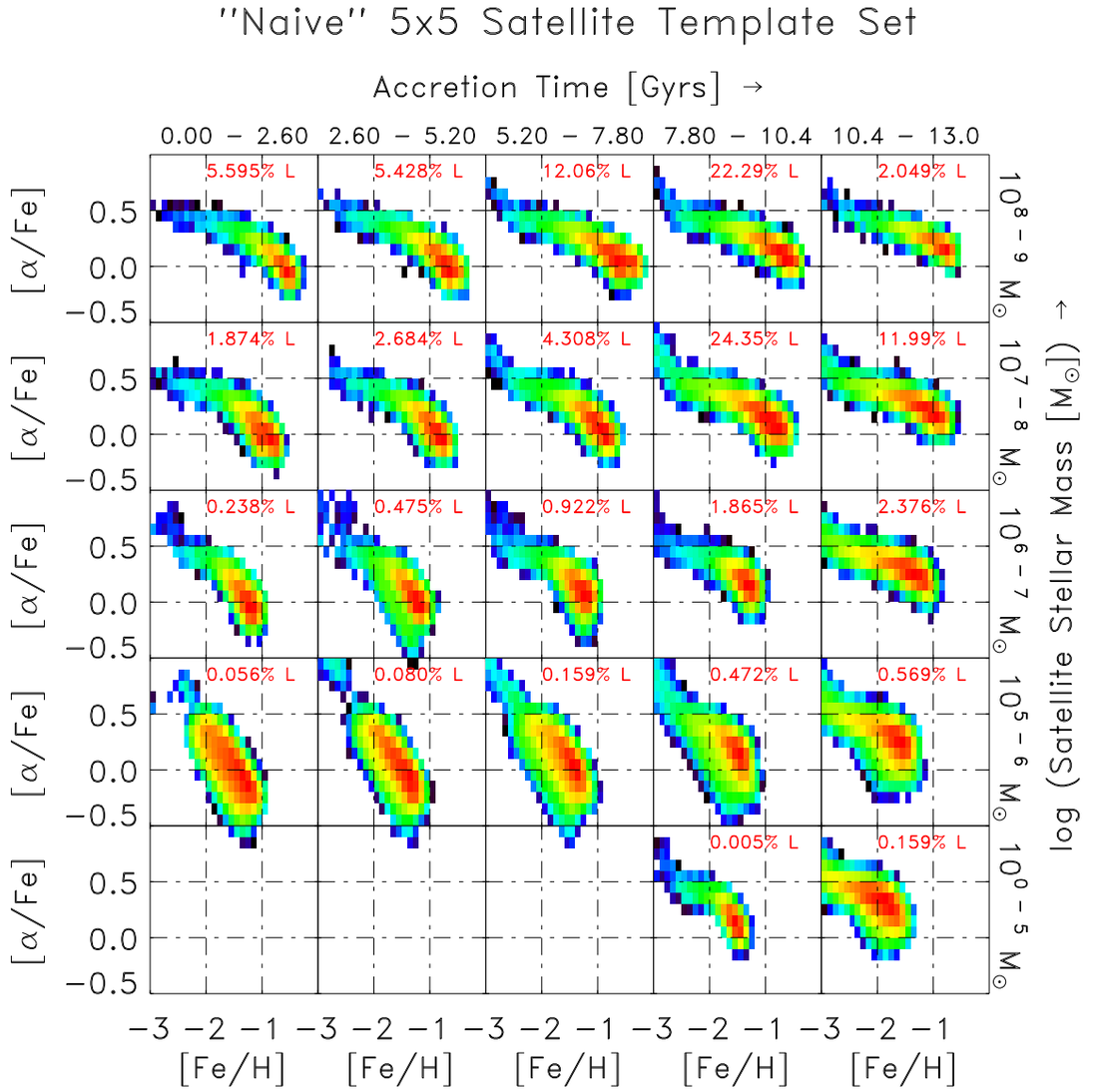


green - halo
blue - low mass dSph
yellow - dIrr
red - Sgr
cyan - LMC

(data compilation from Geisler et al, 2007)

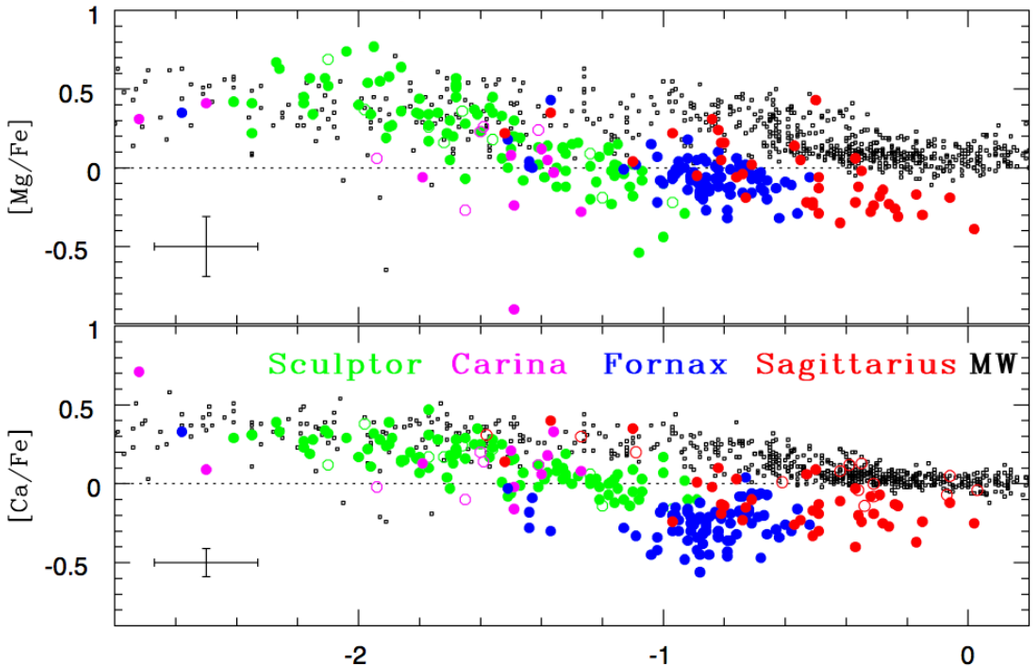


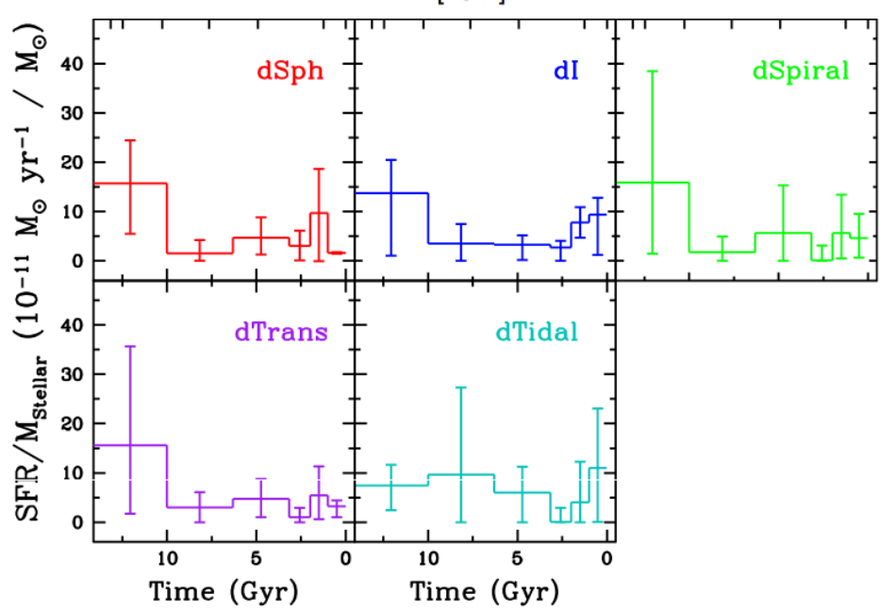
Lee et al. (in prep)



Motivation

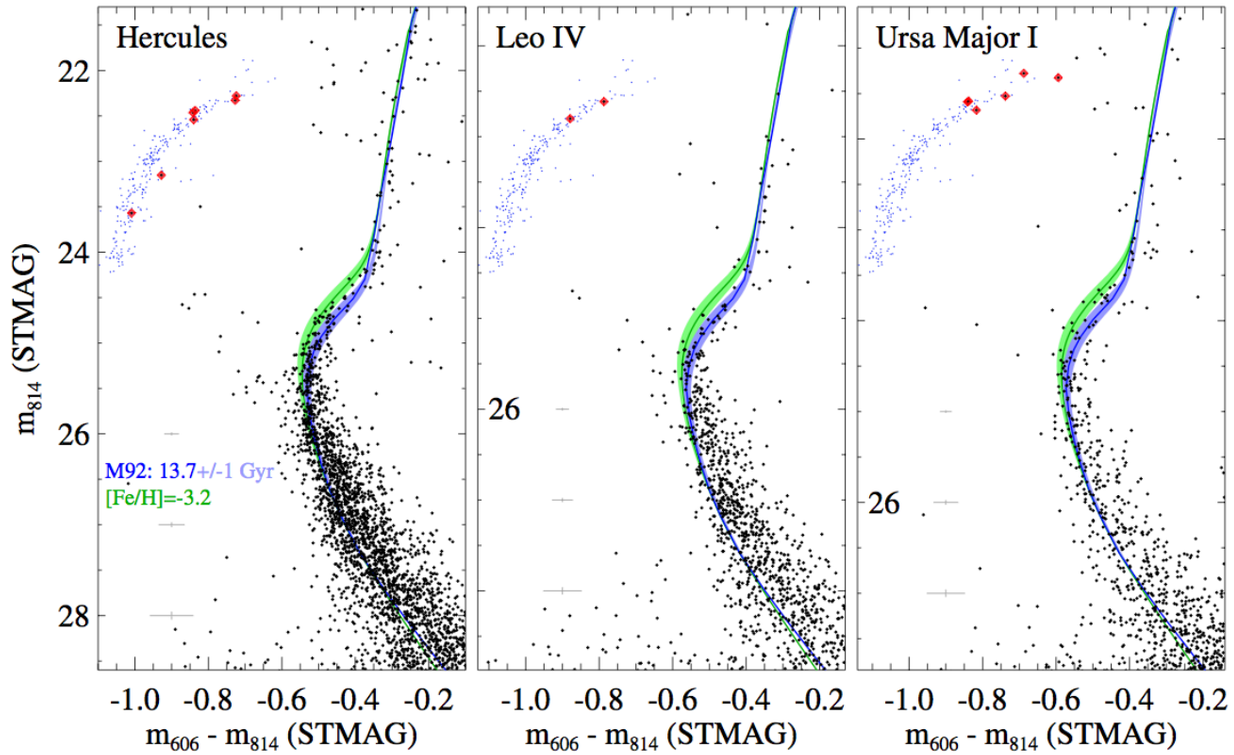
Tolstoy et al. (2009)





Weisz et al. (2011)

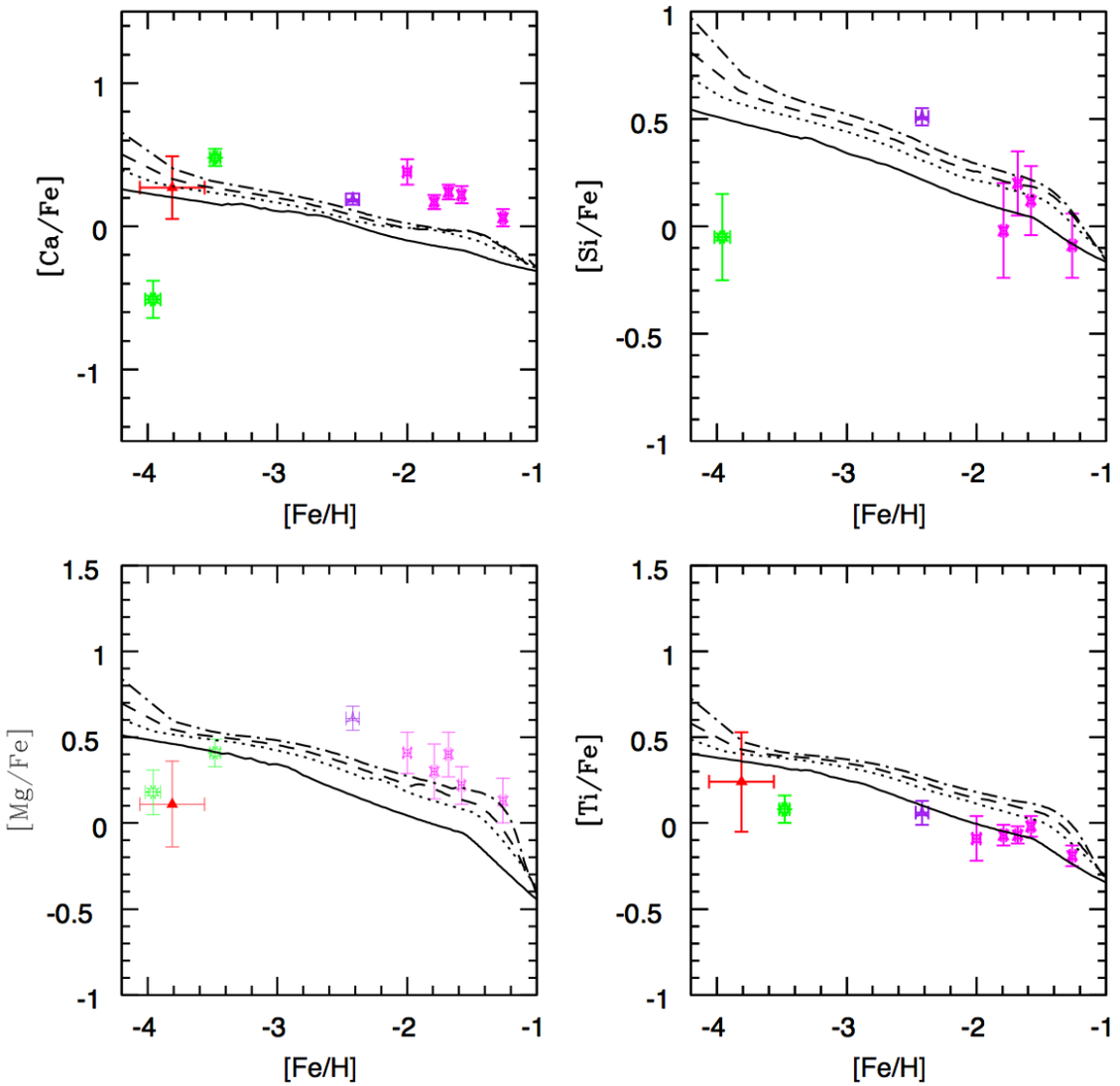
Brown et al. (2012)



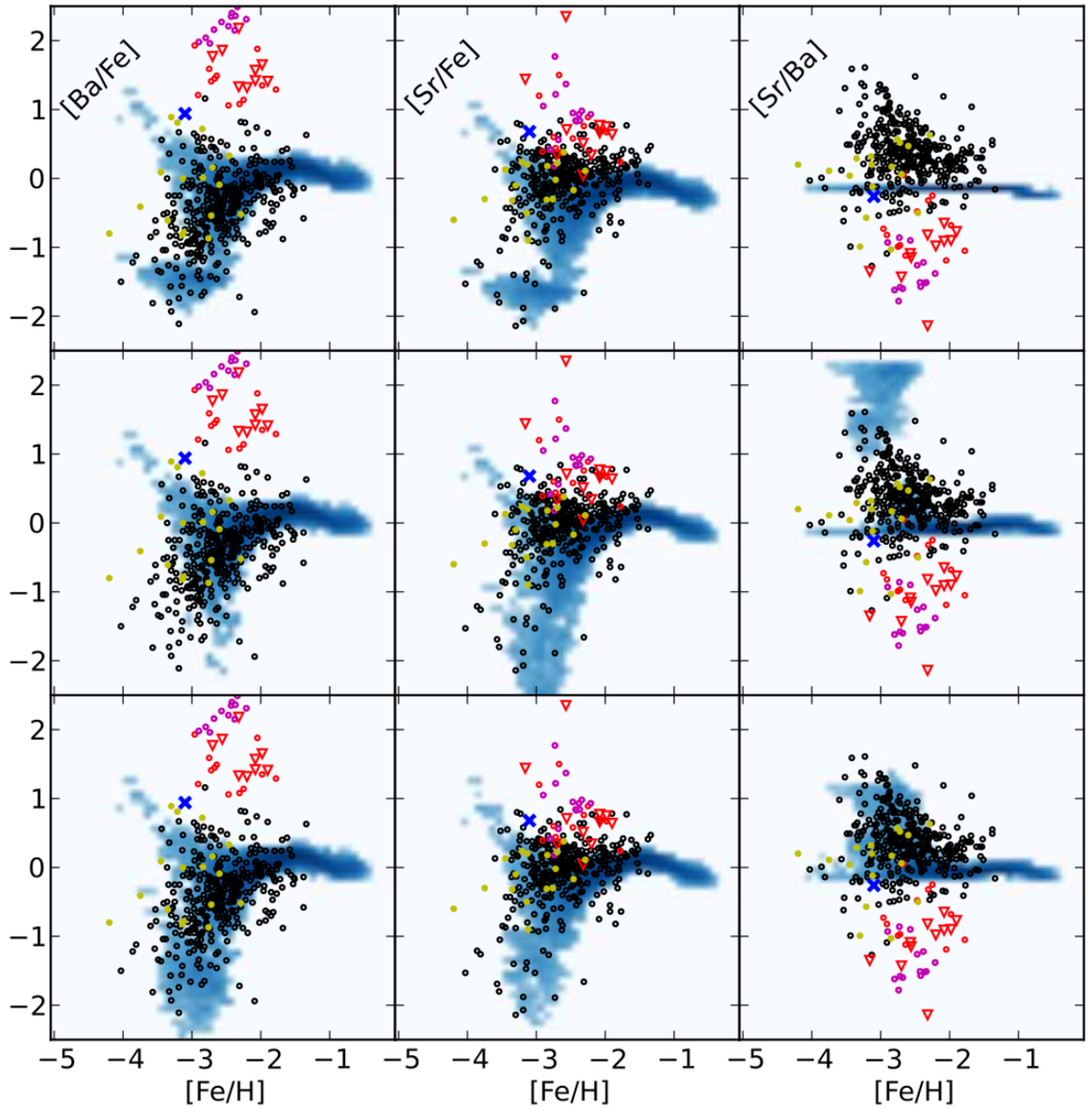
- SFHs from CMD analysis is limited for early star formation in terms of age resolution (~ 0.5 - 1 Gyrs)
- Chemical evolution SAMs that can used to determine the early epochs of dwarf galaxy SFHs ➜ age resolution of ~ 0.05 - 0.1 Gyrs

Development

Vincenzo et al. (2014)



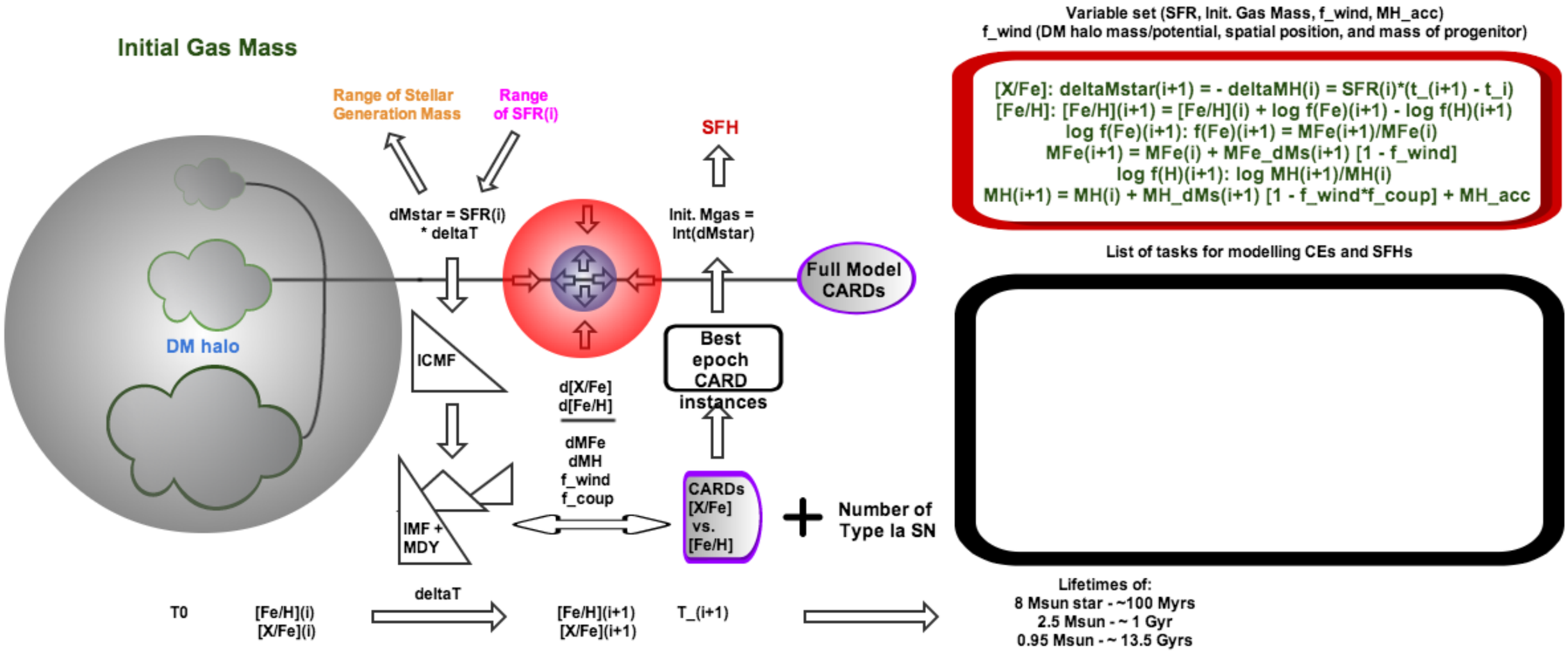
Cescutti & Chiappini (2013)



- Previous work does not attempt to use CARD densities to work out SFHs or work has aimed at deriving n-capture yields

Development

Star Formation Enrichment Cycle



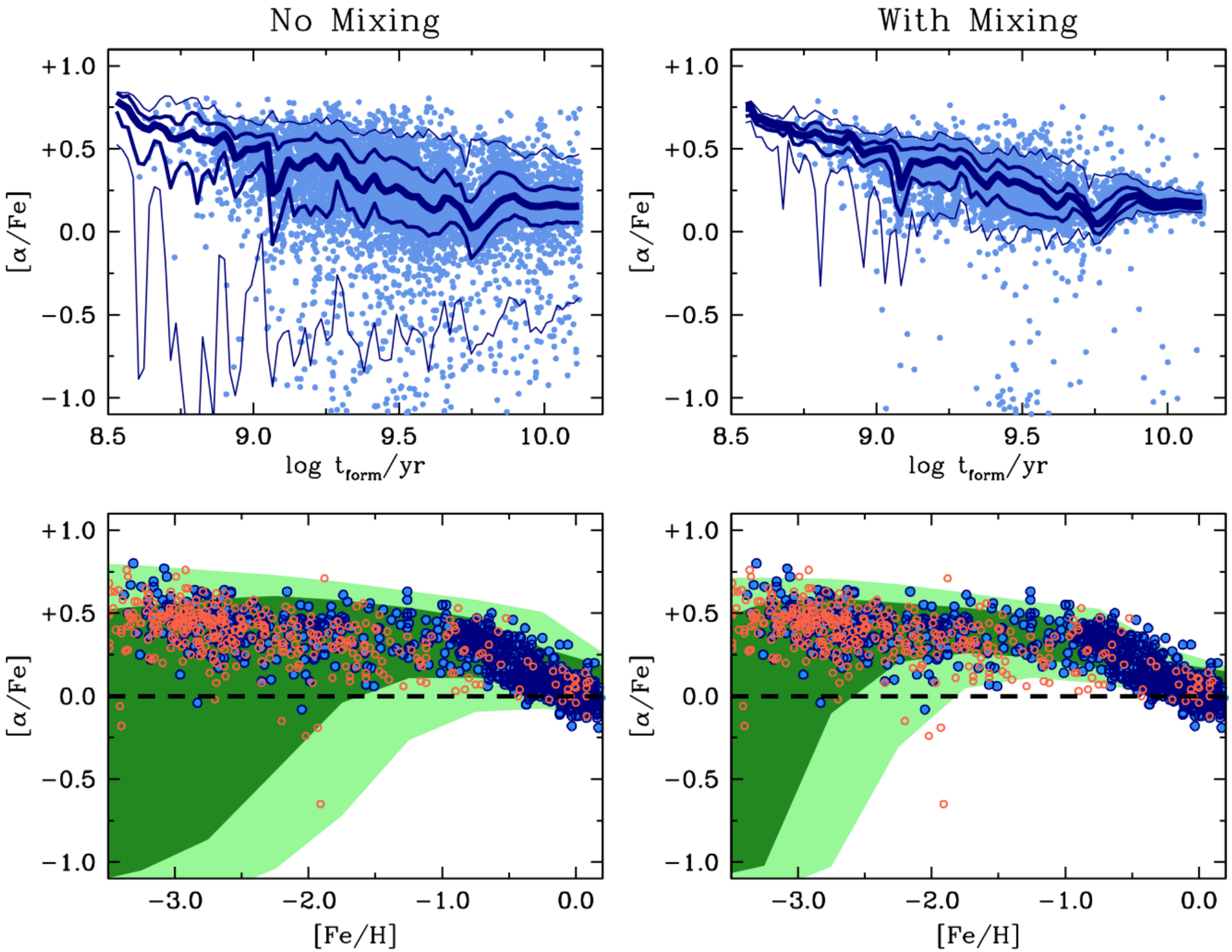
- Current work attempts to use CARD densities to work out SFHs and derive n-capture yields
- Main enrichment scheme for ICMF is similar to Bland-Hawthorn et al. (2010)
- Models of CARDs from stellar enrichment is integrated from Lee et al. (2013)

Development

- First step is to develop models for some of the UFD galaxies (SFH range ≤ 1-2 Gyr)
- Set a SFH (random, average, from CMD observations)
- Determine the stellar mass generation per enrichment epoch
- Find ICMF distributions across SFH
- Convolve with CARDs and stochastic spatial sampling of various density distributions to calculate enrichment history
- Sample “stars” from enrichment history to reveal the full CARDs for the SFH of the dwarf galaxy

Chalk / White board Time!!!

Implementation



S. Shen et al. (2014)

Implementation

- Comparing models to real data:
  - Iterative construction of model from comparison to real dwarf data (HARD to design!!!)
  - Statistical comparison of models to observed CARD density (HARD to populate parameter space!!!)
- Issues include properly assessing the effect of epoch resolution on the propagation of SNe in the ISM
  - SNe is “available” around 10 Myrs; however, most optimistic resolution for SF events is ~ 20-50 Myrs for current models
- Currently, each model would produce a realization of the underlying PMF or full CARDs of the dwarf
  - Can such a model be more general AND useful as dwarf templates?
  - How does one add these model CARD probability densities to create a generic distribution for certain galaxy attributes (total gas mass, gas density distribution, etc.)?

Questions/Comments?

Thanks for your attention!