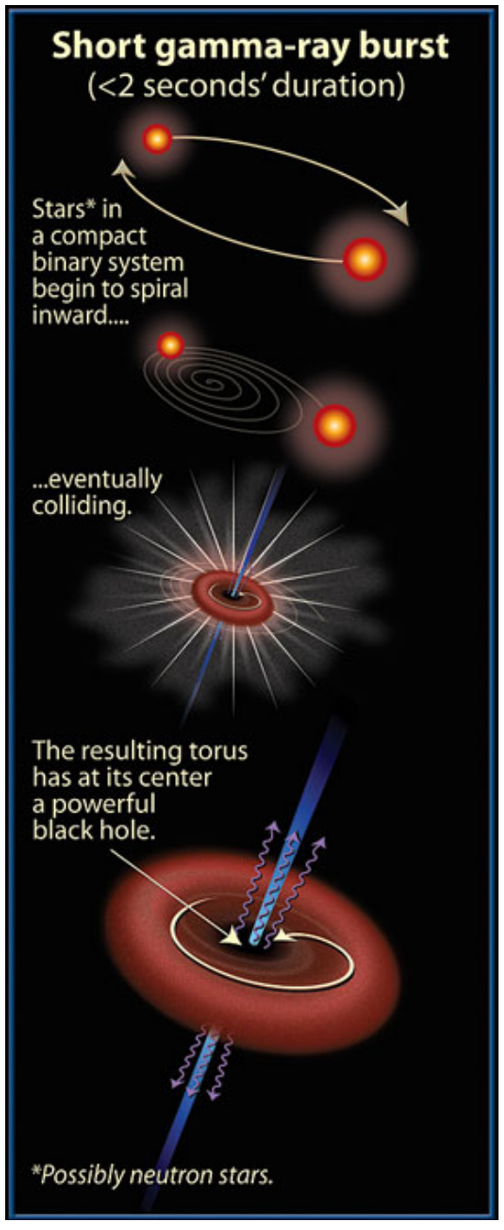
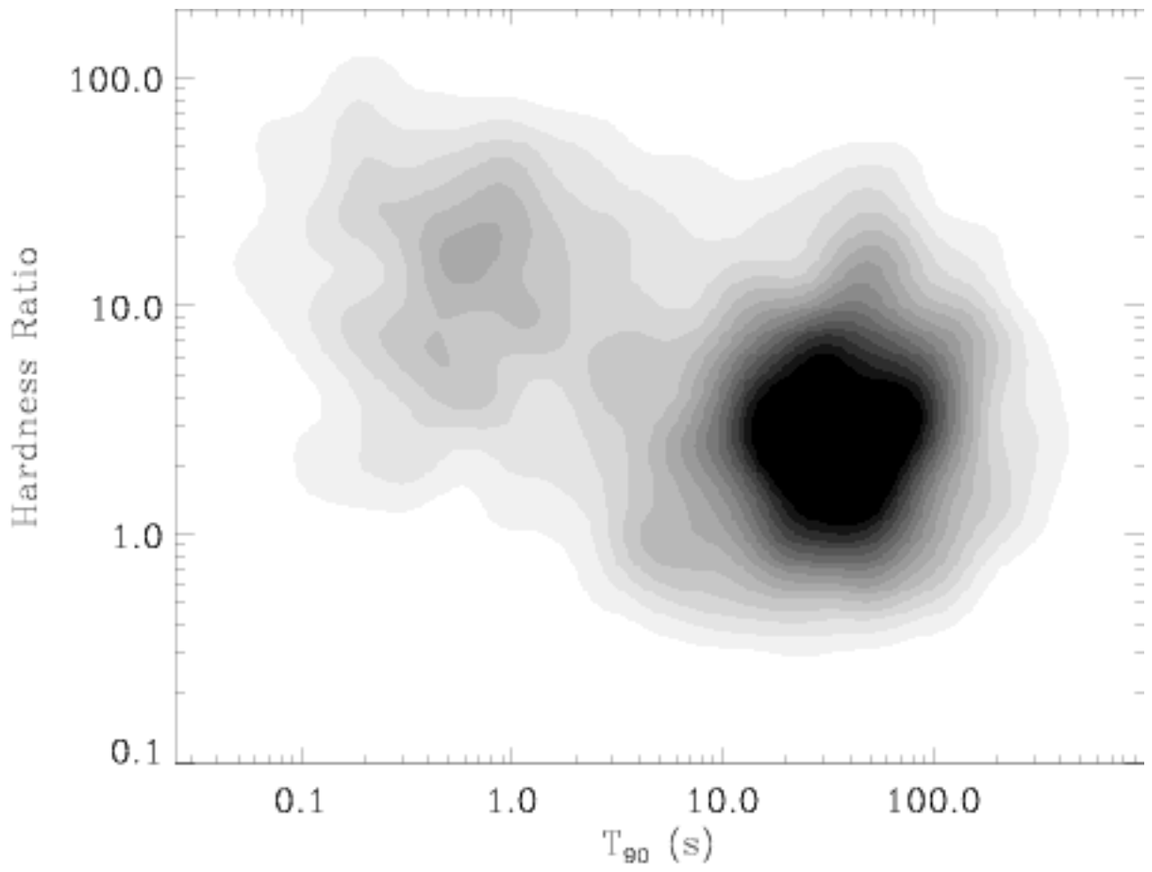
the nurseries of the brightest explosions in the Universe

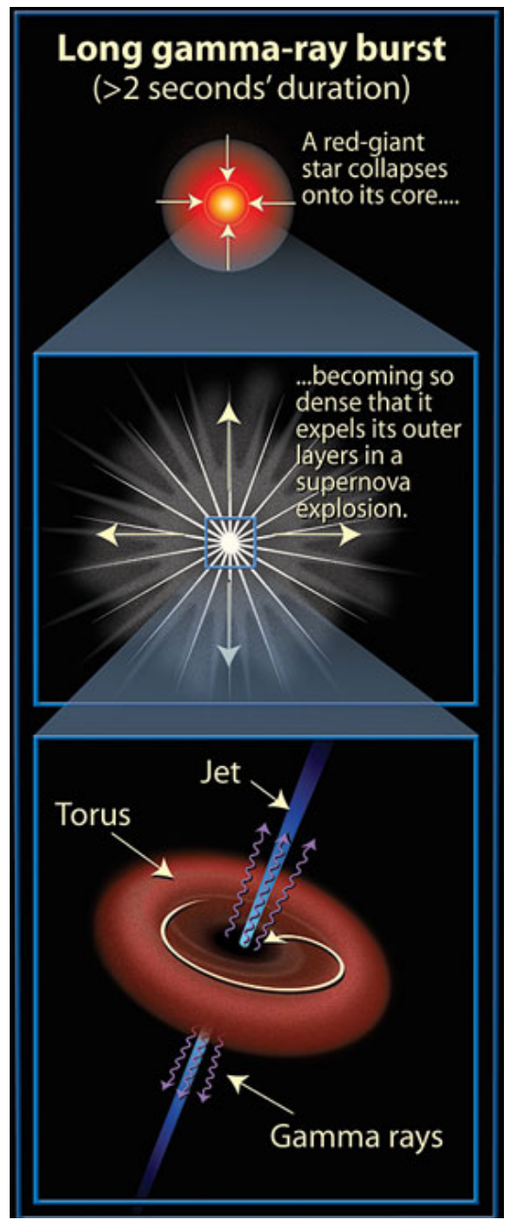
by Ruben Salvaterra

with S. Vergani, J. Japelj and many others

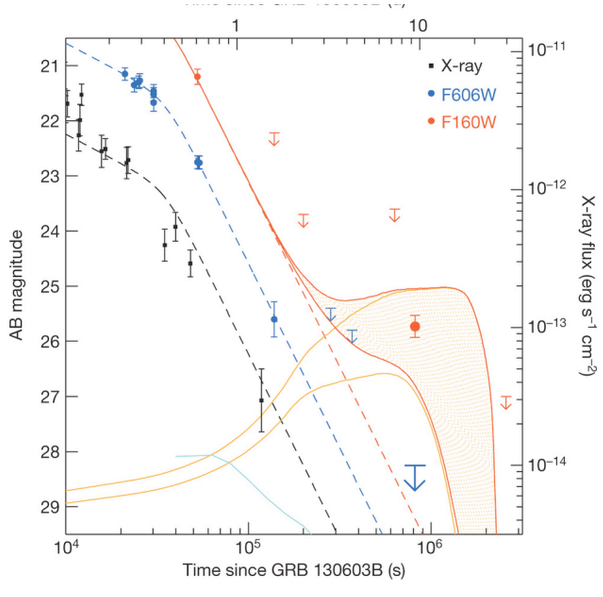
long and short GRBs





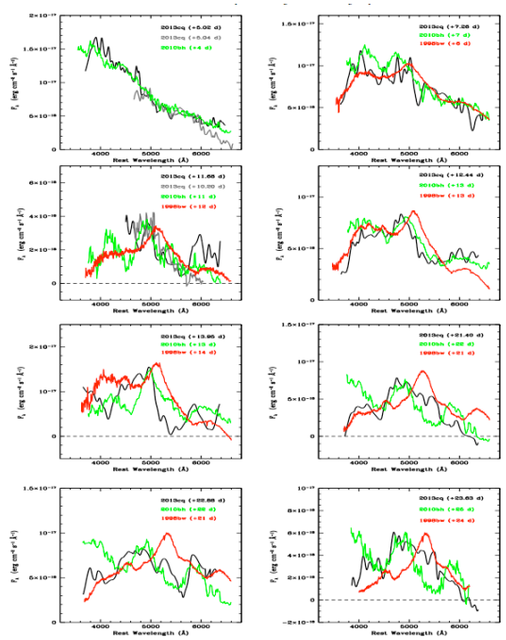


GRB 130603B



Tanvir et al. 2014

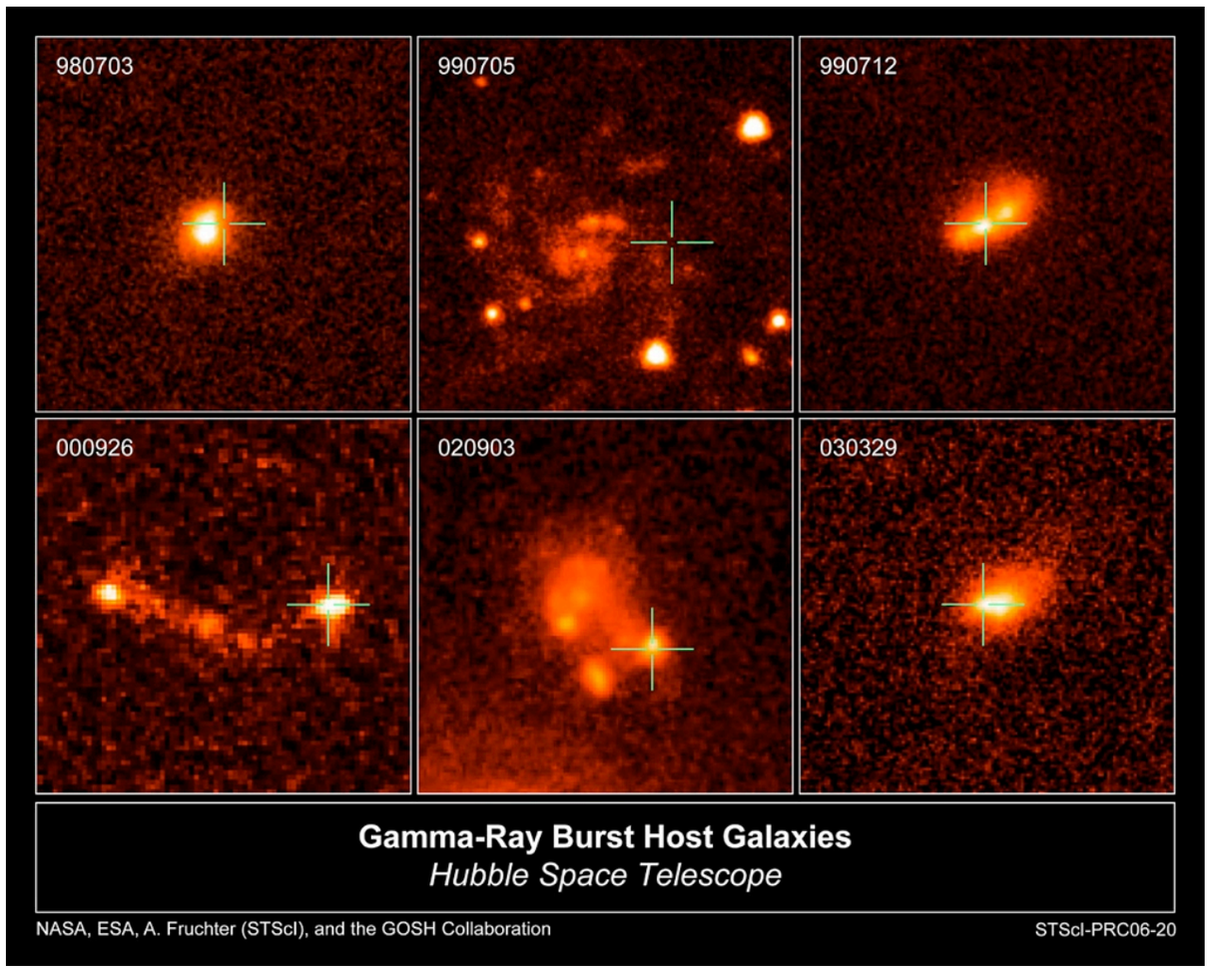
GRB 130427A

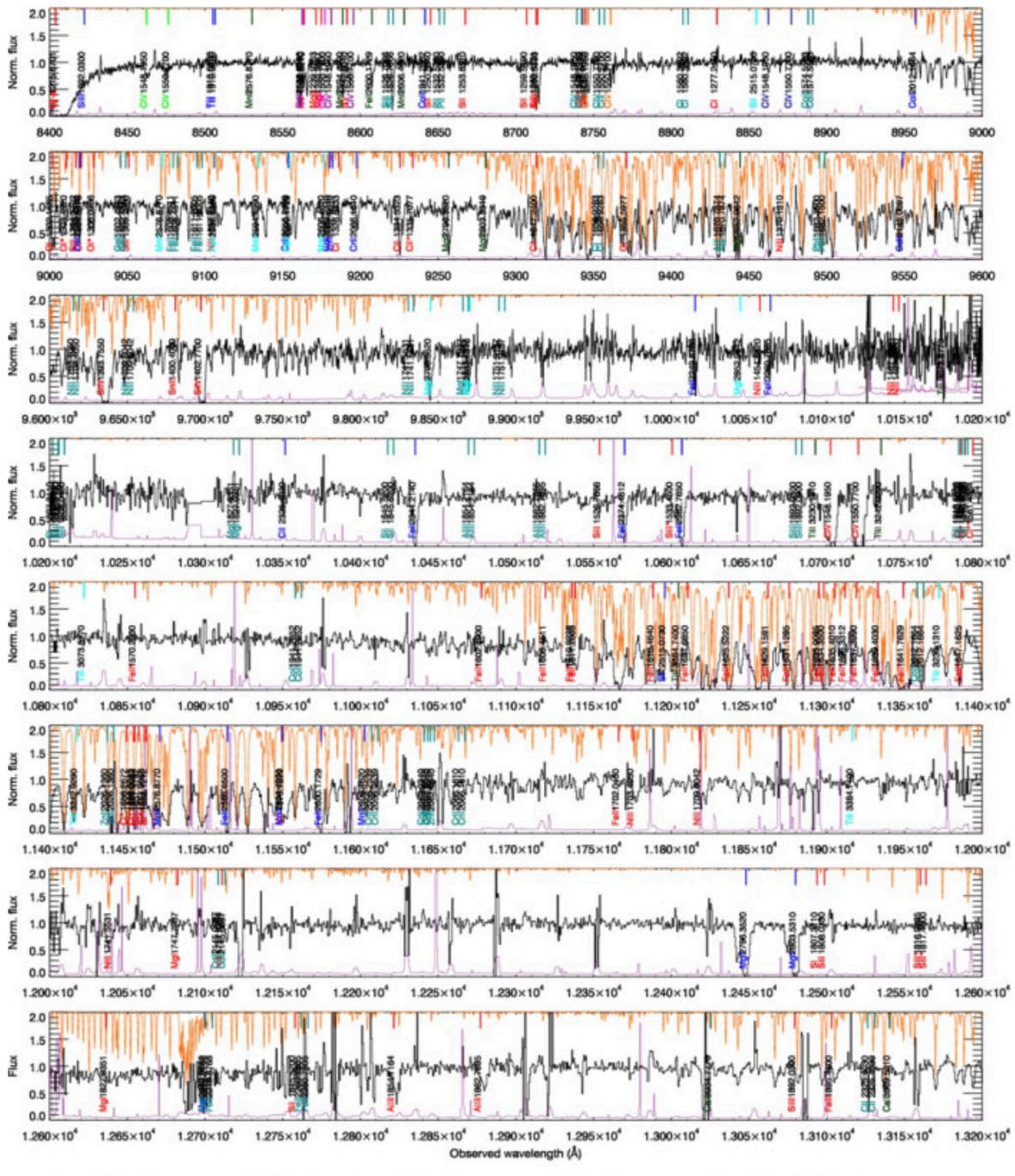


Melandri et al. 2014

what GRBs can do for galaxies?

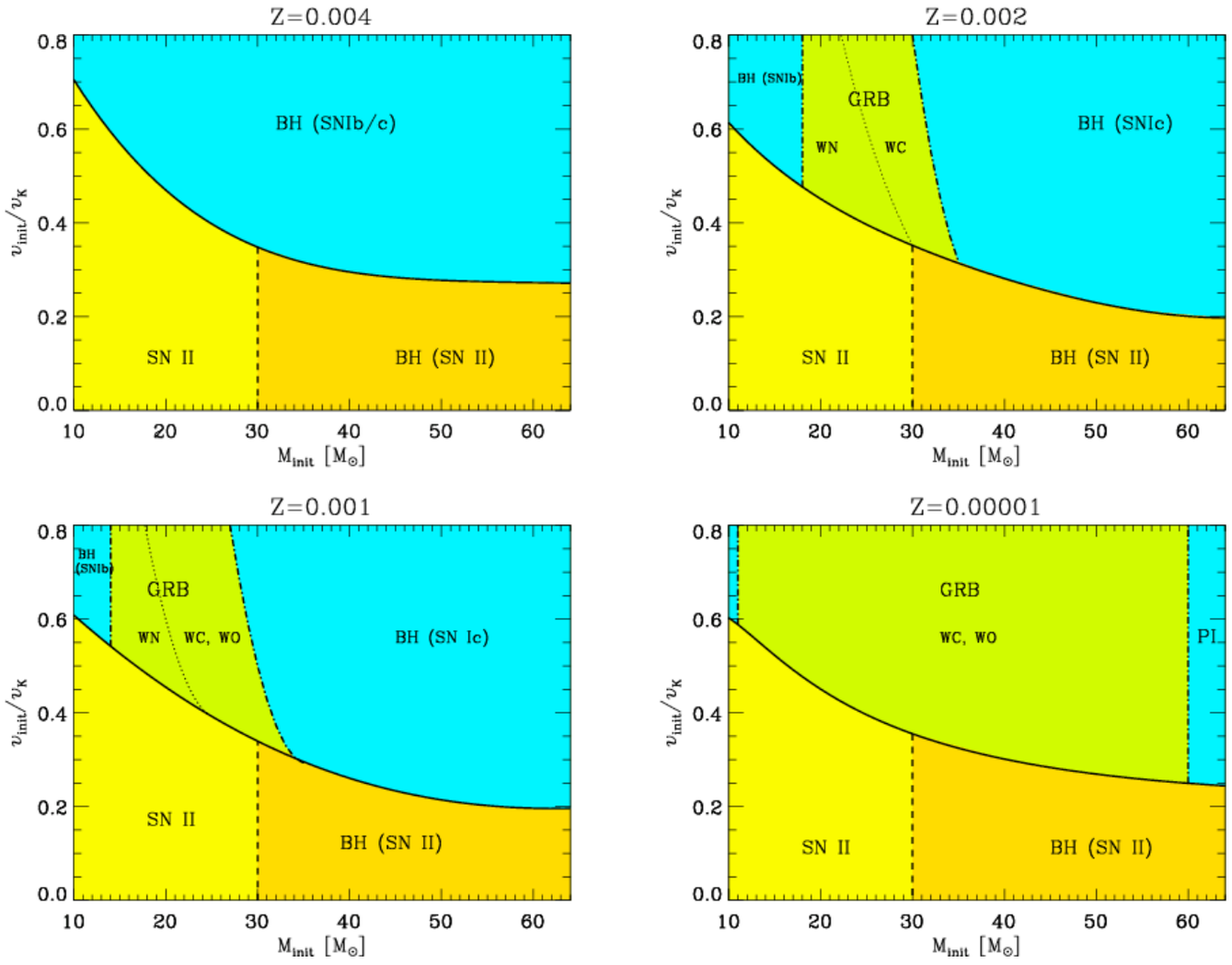
- provide an unbiased (???), small sample of galaxies
  - X-/gamma-ray selected
  - extend the LF towards faint/low mass
  - ...
- extend the cosmic SFR to higher z
- provide ISM metallicity at high-z
- complementary to normal surveys

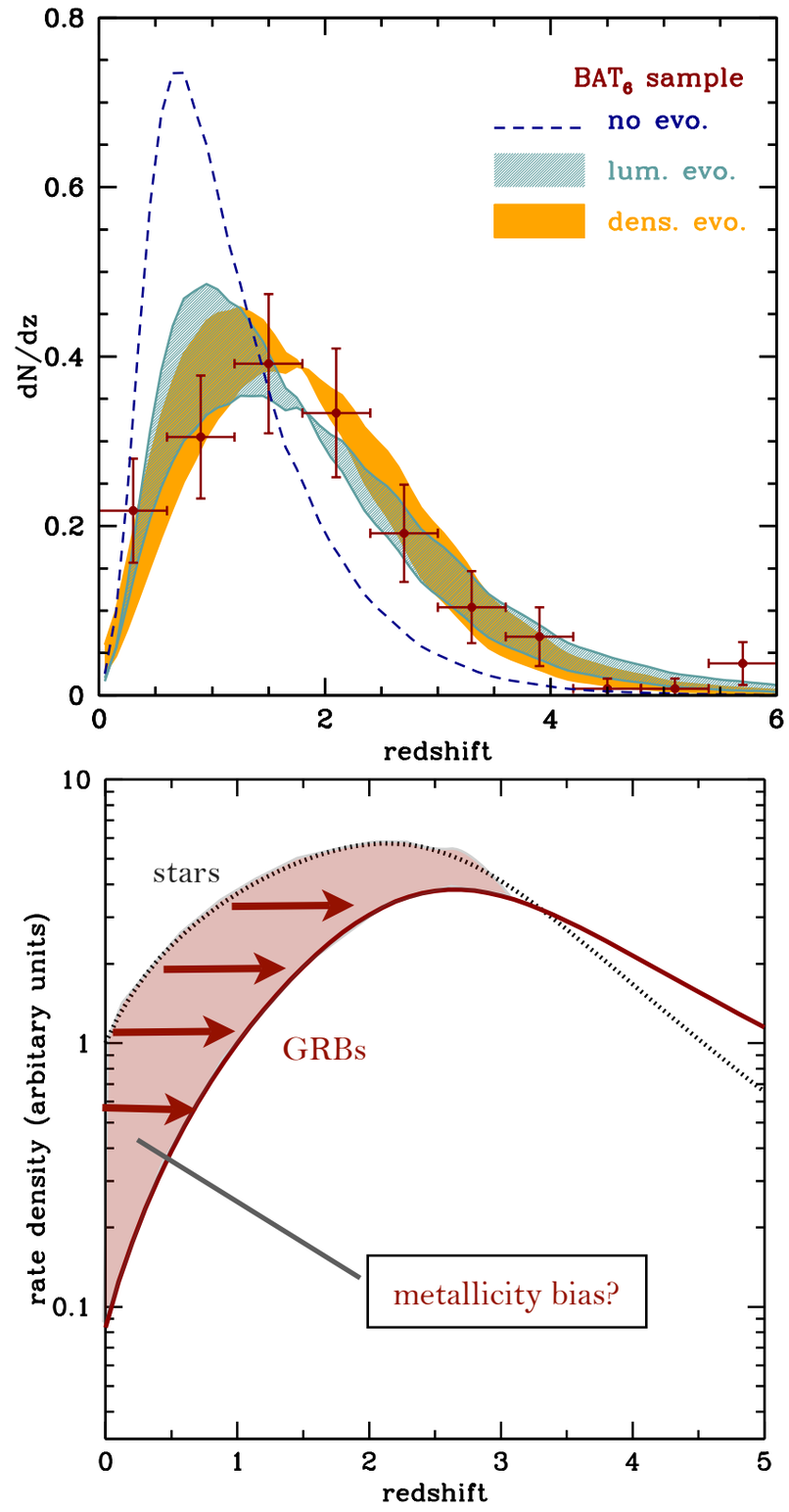




what galaxies can do for GRBs?

collapsar models require a metallicity threshold for GRB formation





note that this has an effect on previous slide points...

the BAT_6 sample

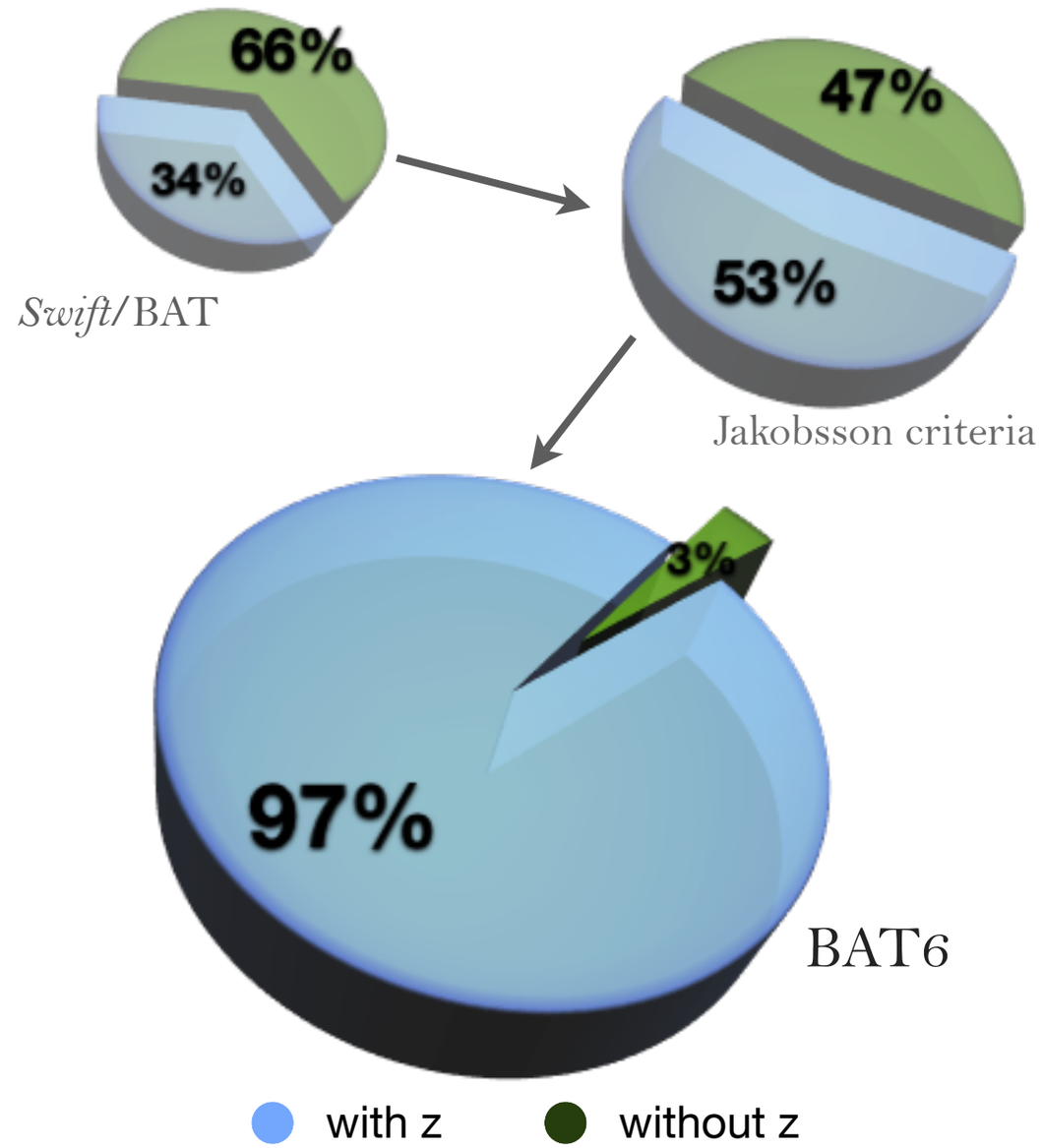
BAT_6 is a complete, flux limited sample of 58 long GRBs
all but two with measured redshift

selection from the Swift BAT database:

1. favorable observing condition:
    1. low Galactic extinction
    2. -70<deg<70
    3. away from Sun
    4. accurate position from XRT
    5. no bright nearby star
2. **peak flux > 2.6 ph s^{-1} cm^{-2} in the BAT band**

corresponding to a 6 times worst sensitivity with respect to Swift.

bias the z-dist. but in a controlled way

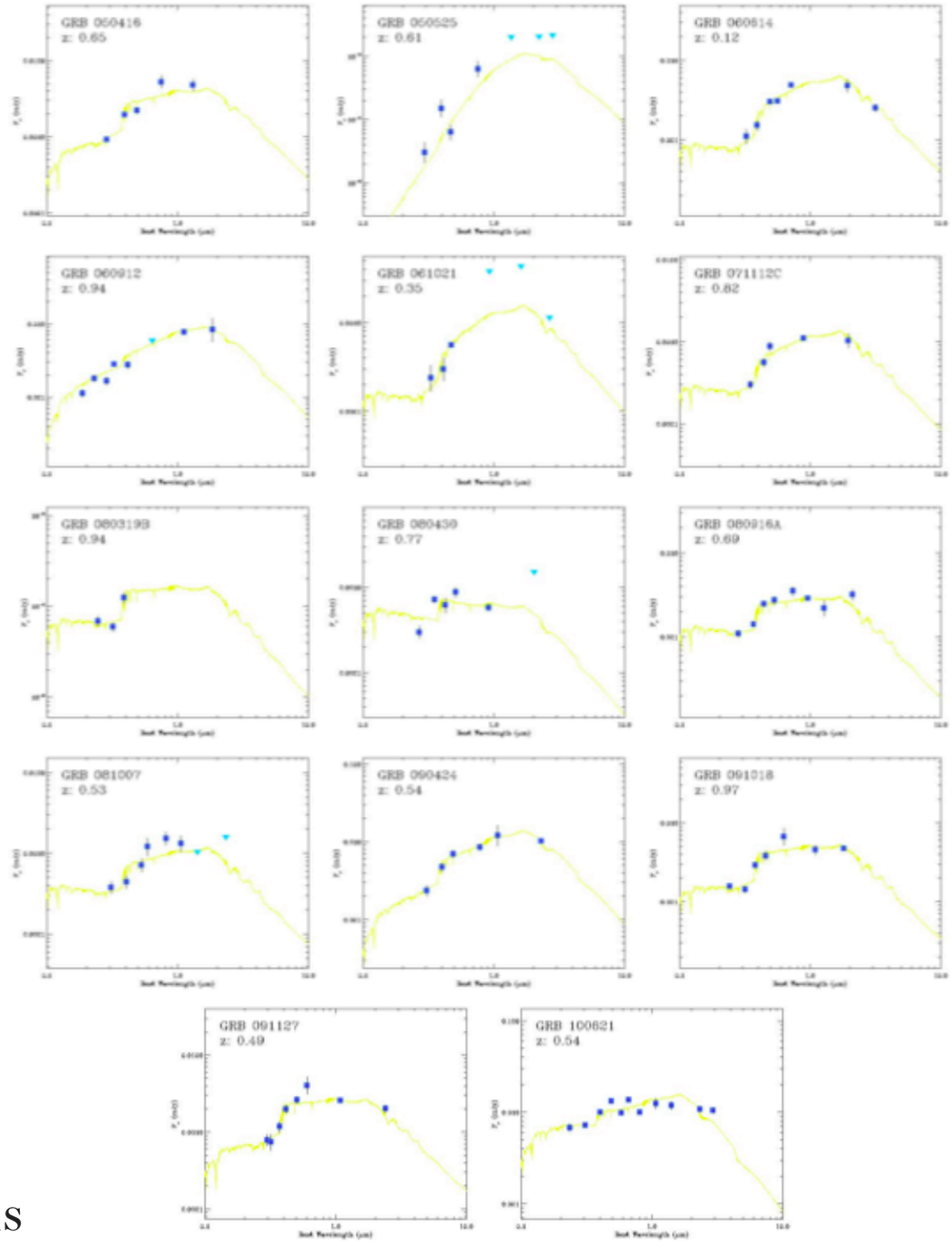


Salvaterra et al. 2012

the BAT6 hosts at z<1

14 GRBs at z<1 (<z>~0.6) in the sample for which we have measured:

- **rest frame K-band luminosity** from Spitzer photometry for all but 2 [all]
- **stellar masses** [all]
- **SFR** from Ha [all but 2 with upper limits]
- **AV** from Ha/Hb [all but 2, 3 tight upper limits]
- **metallicity** following Maiolino+08 and KK04 [all but 2]

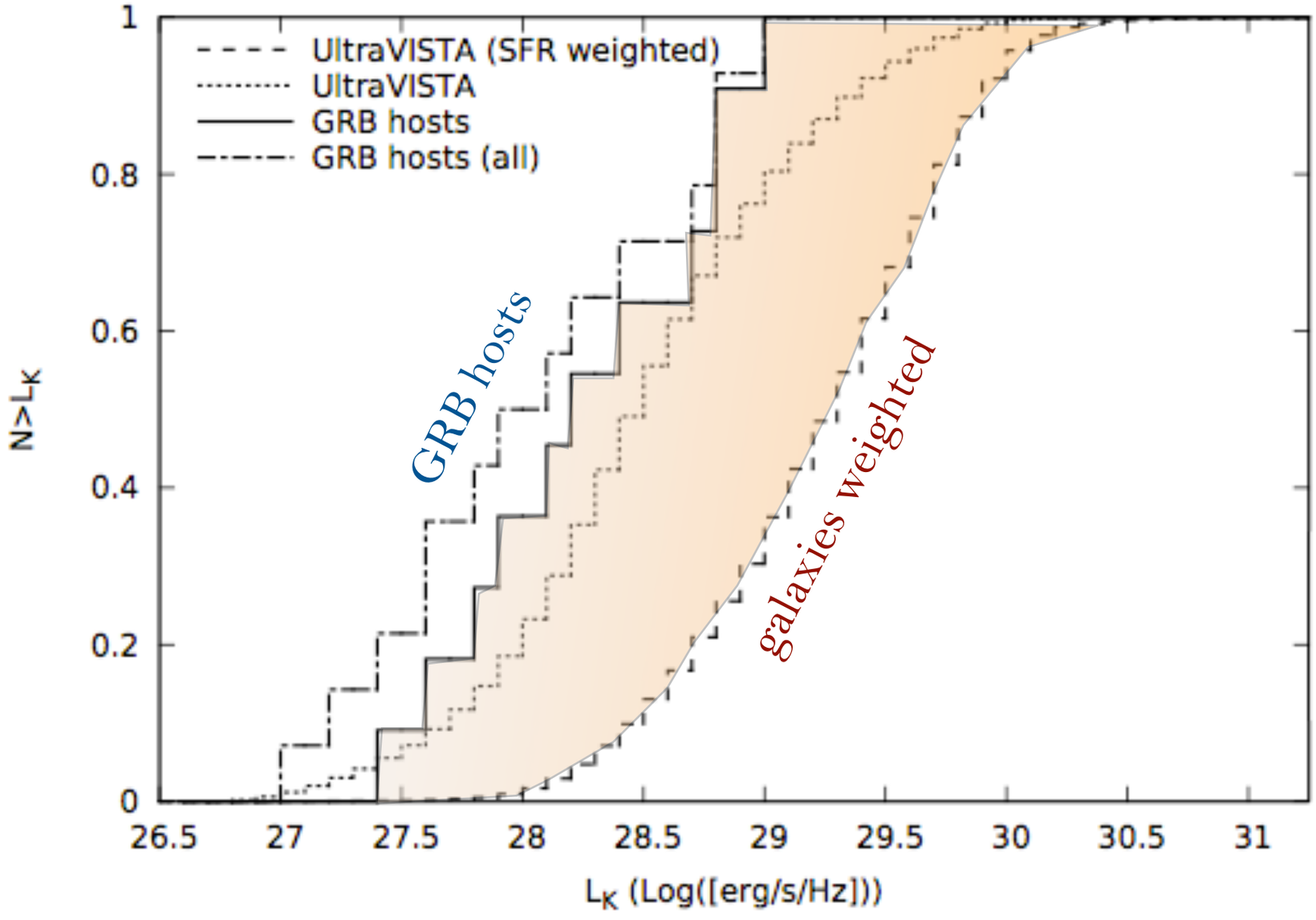


data obtained from archives and from dedicated proposals

VLT, HST, GROND, Spitzer, TNG, Gemini, GTC

K-band luminosities

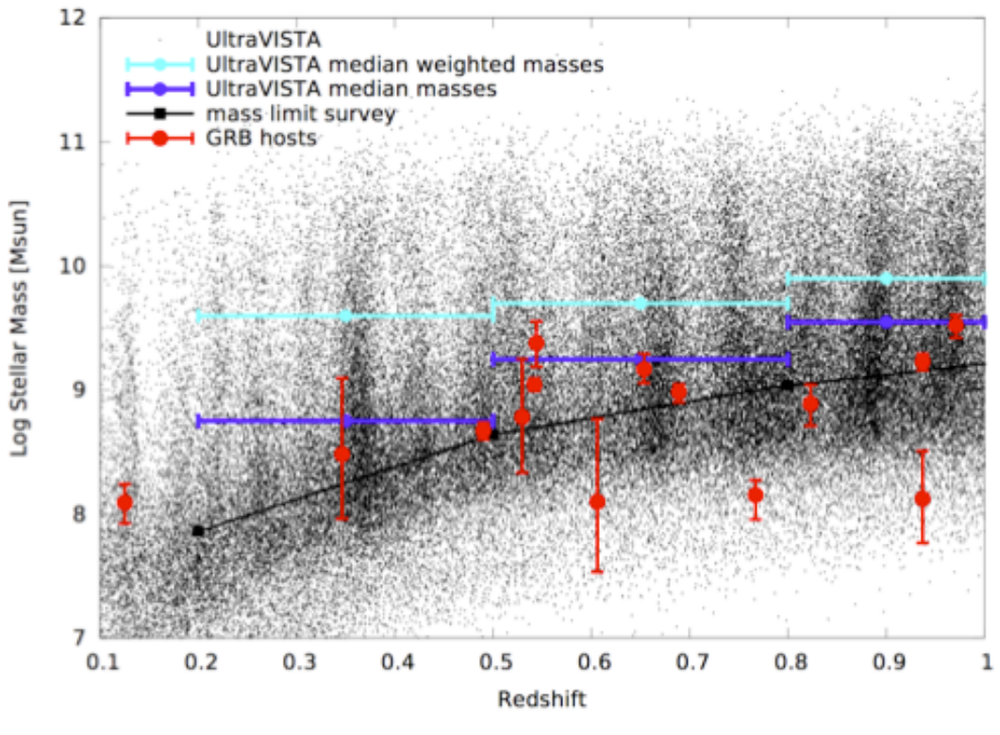
in order to account for the probability to host a GRB we have to weight field star forming galaxies for their star formation rate (assuming GRB ∝ SFR)



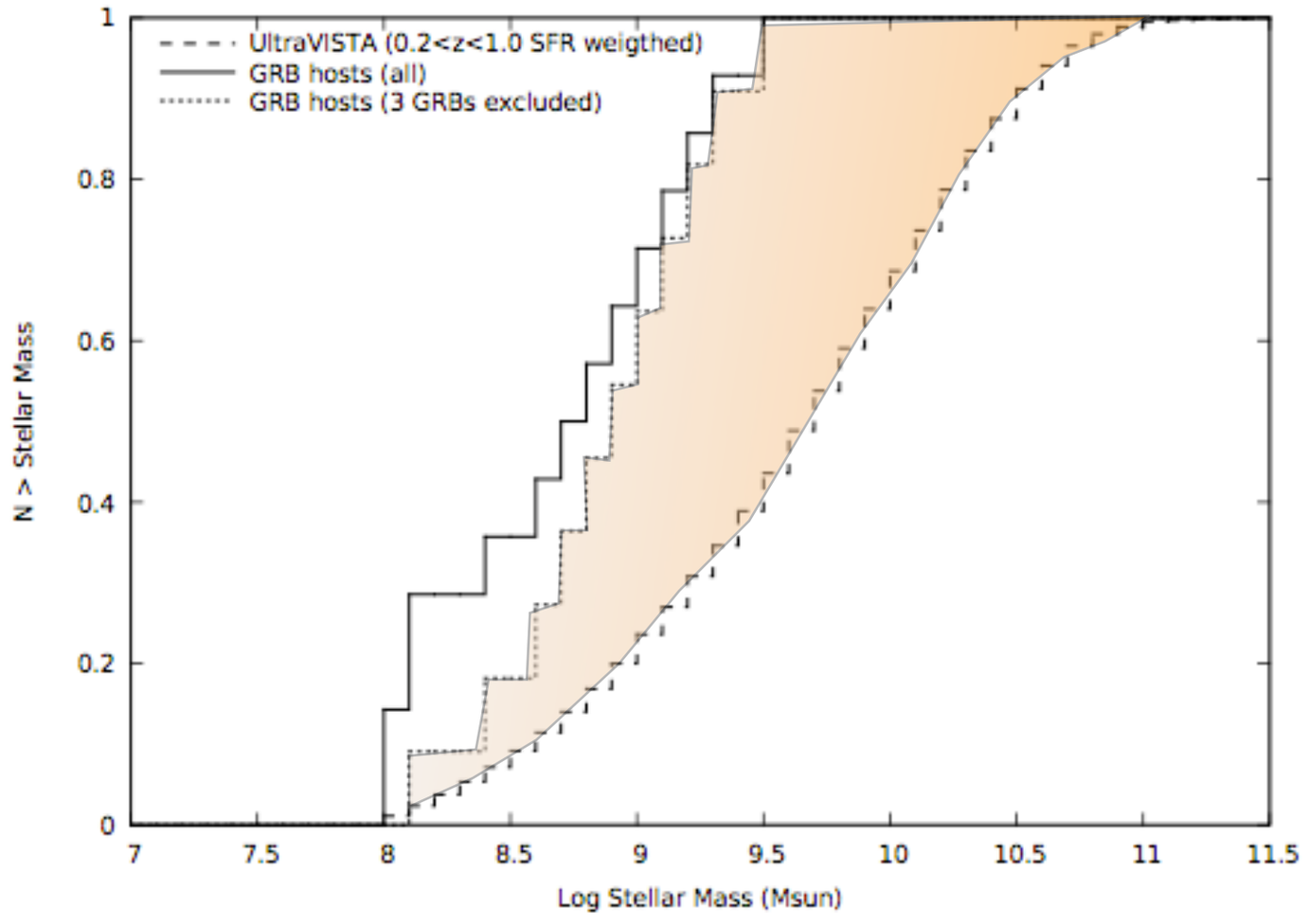
comparison sample ULTRAVista (Ilbert et al. 2013) m_K(AB)=24

Vergani et al. 2015

stellar masses



a few hosts are below/near the mass limit of ULTRAVista

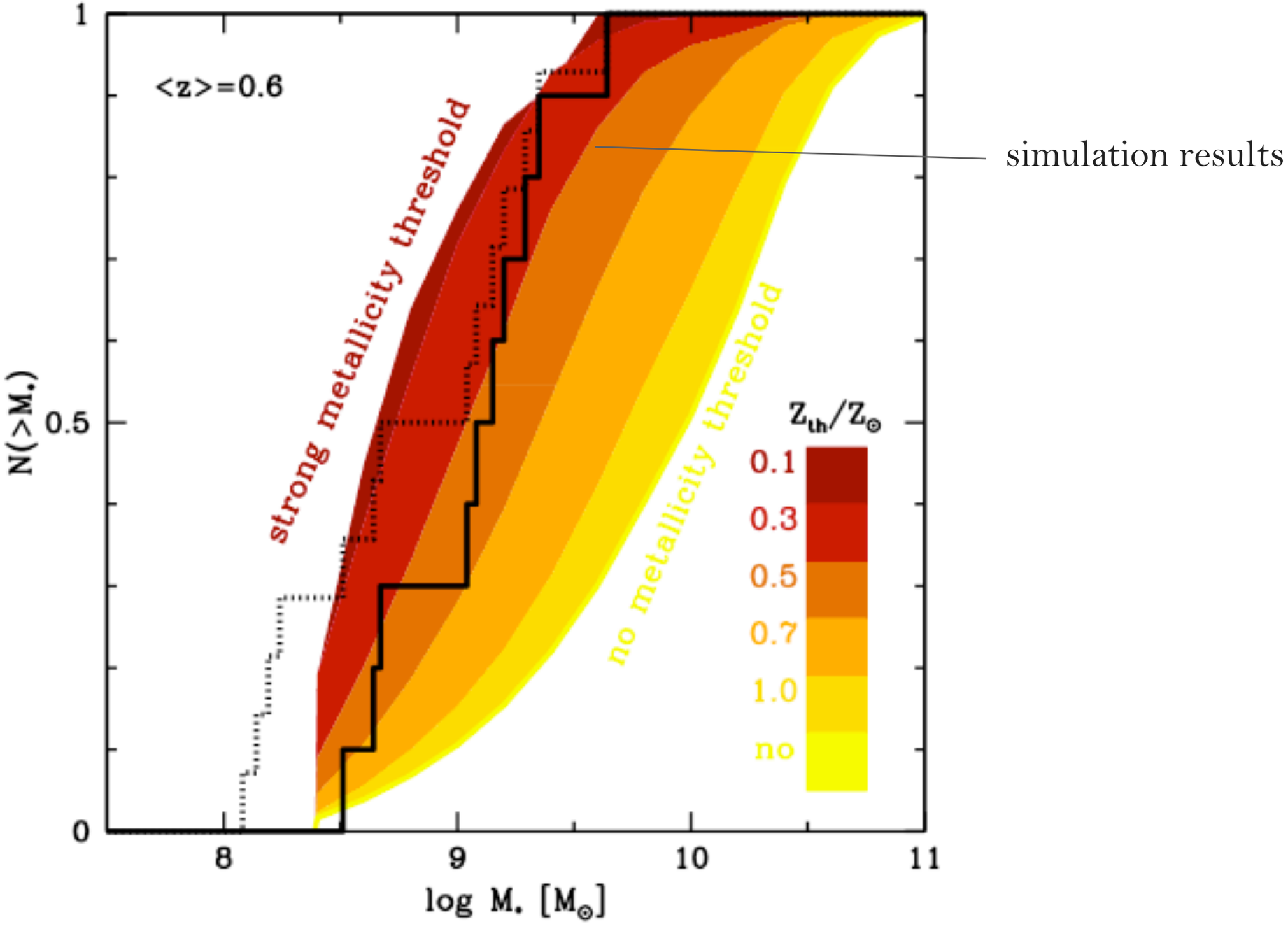


stellar masses are much lower than expected from galaxy surveys

comparison sample ULTRAVista (Ilbert et al. 2013) $m_K(AB)=24$

Vergani et al. 2015

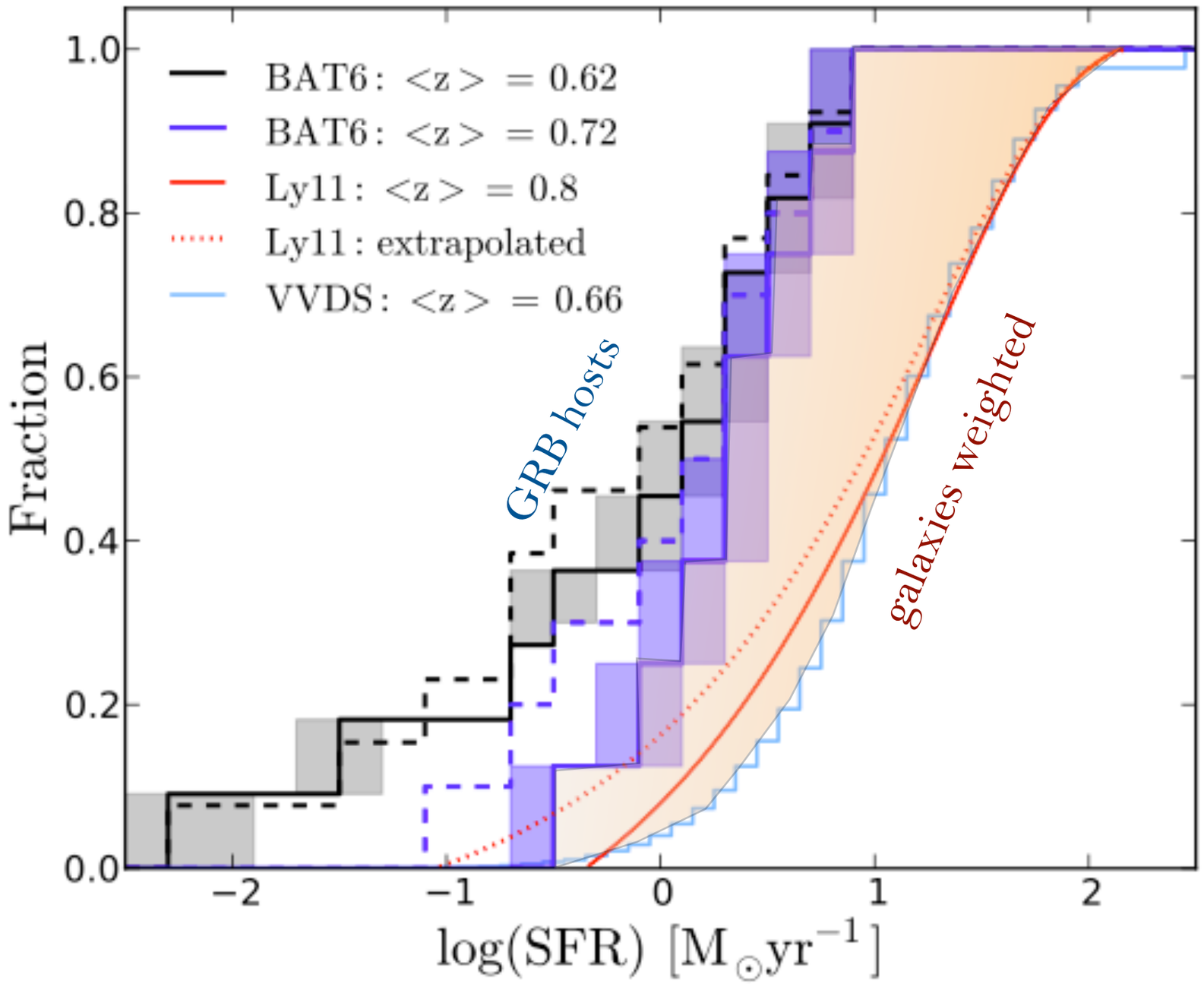
a metallicity bias?



simulation results

Vergani et al. 2015, Campisi et al. 2009

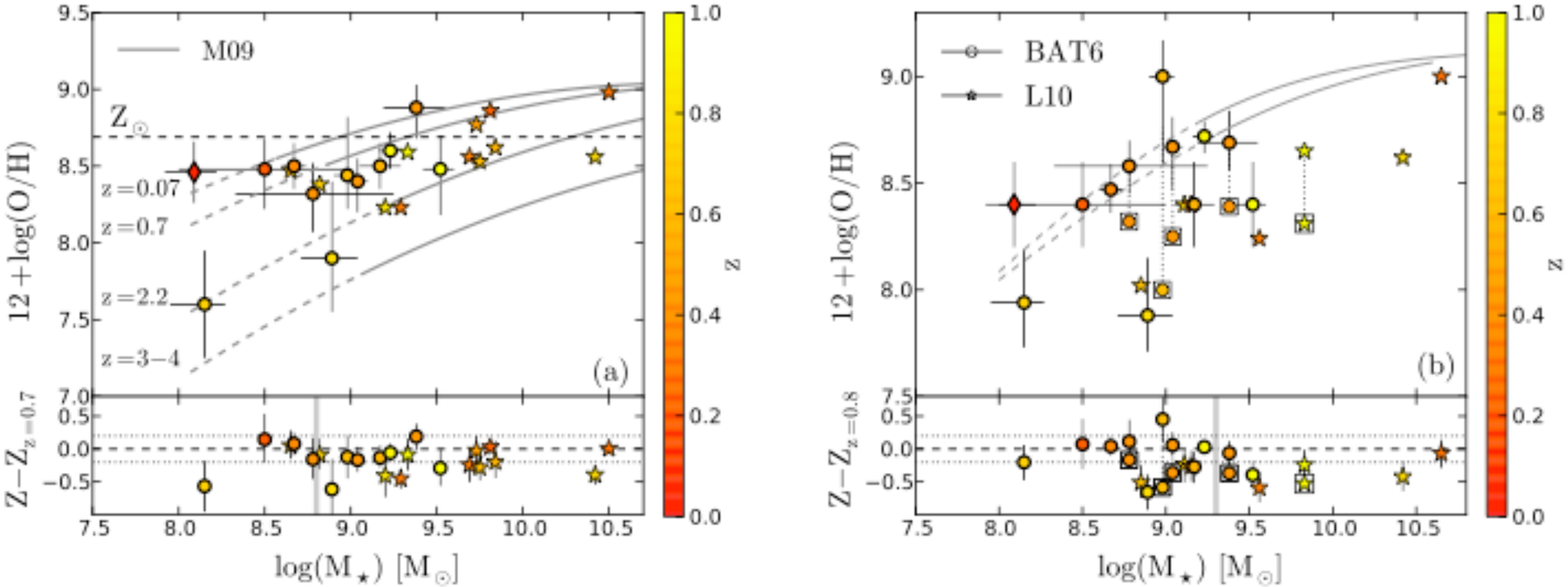
star formation rate



comparison sample from VVDS (LeFebre et al. 2013) i(AB)~24-24.7

Japelj et al. 2016

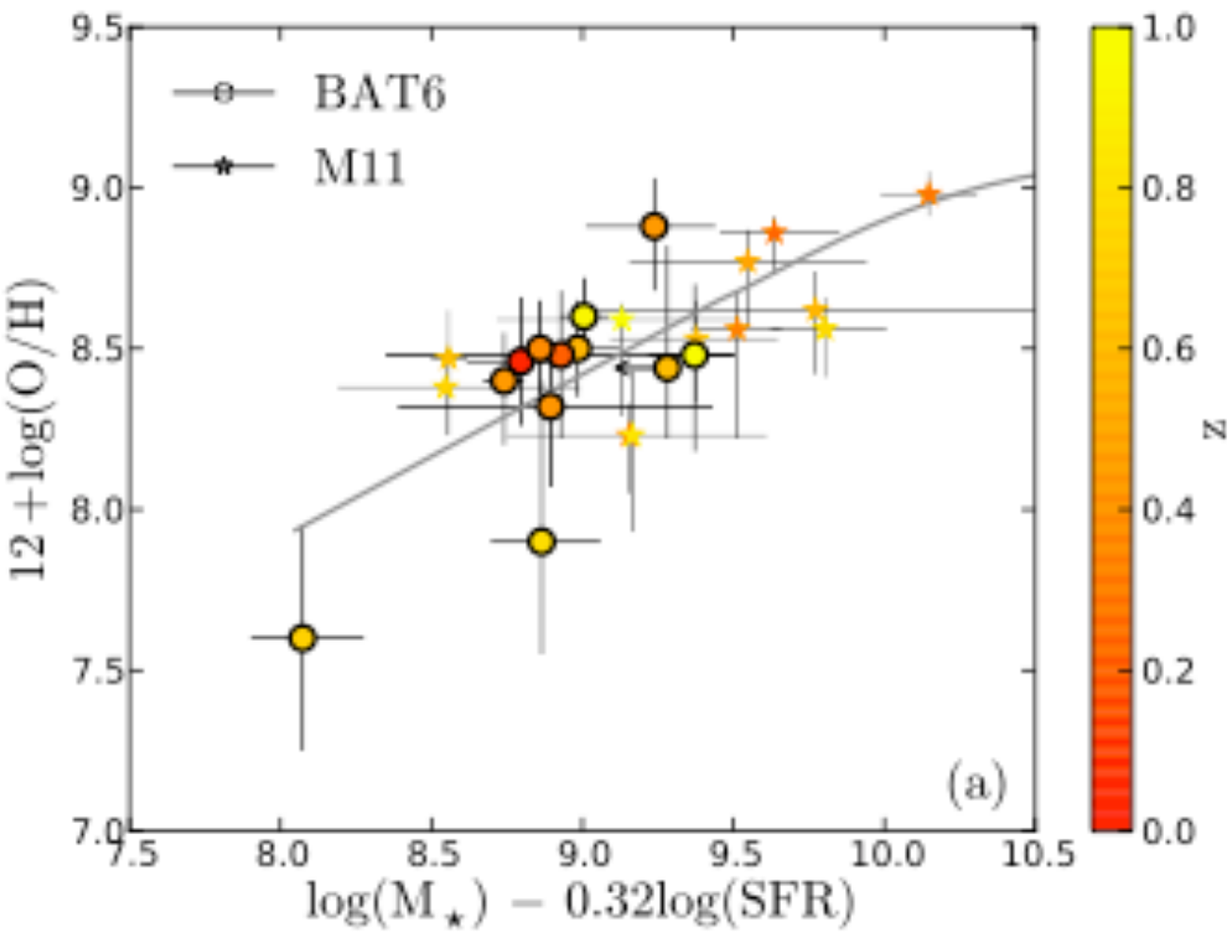
mass-metallicity relation

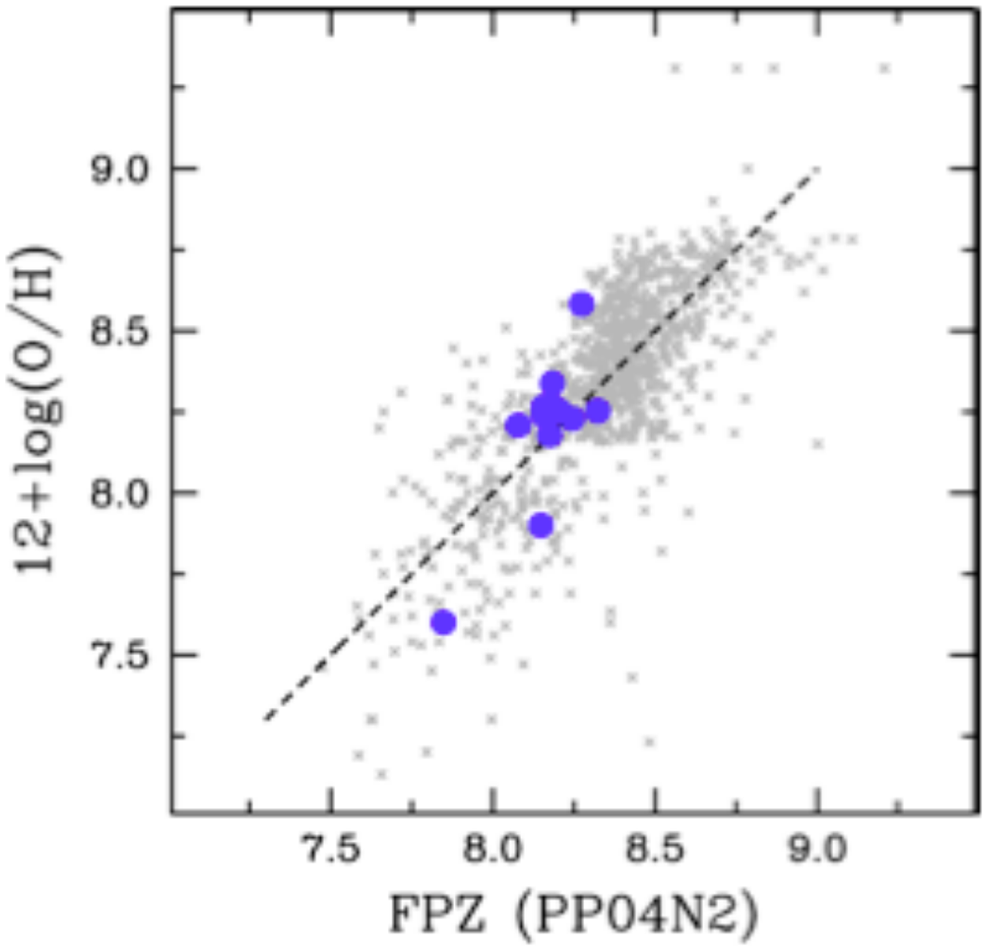


GRB hosts are consistent with the M-Z relation at z~0.7

Japelj et al. 2016

fundamental metallicity relations

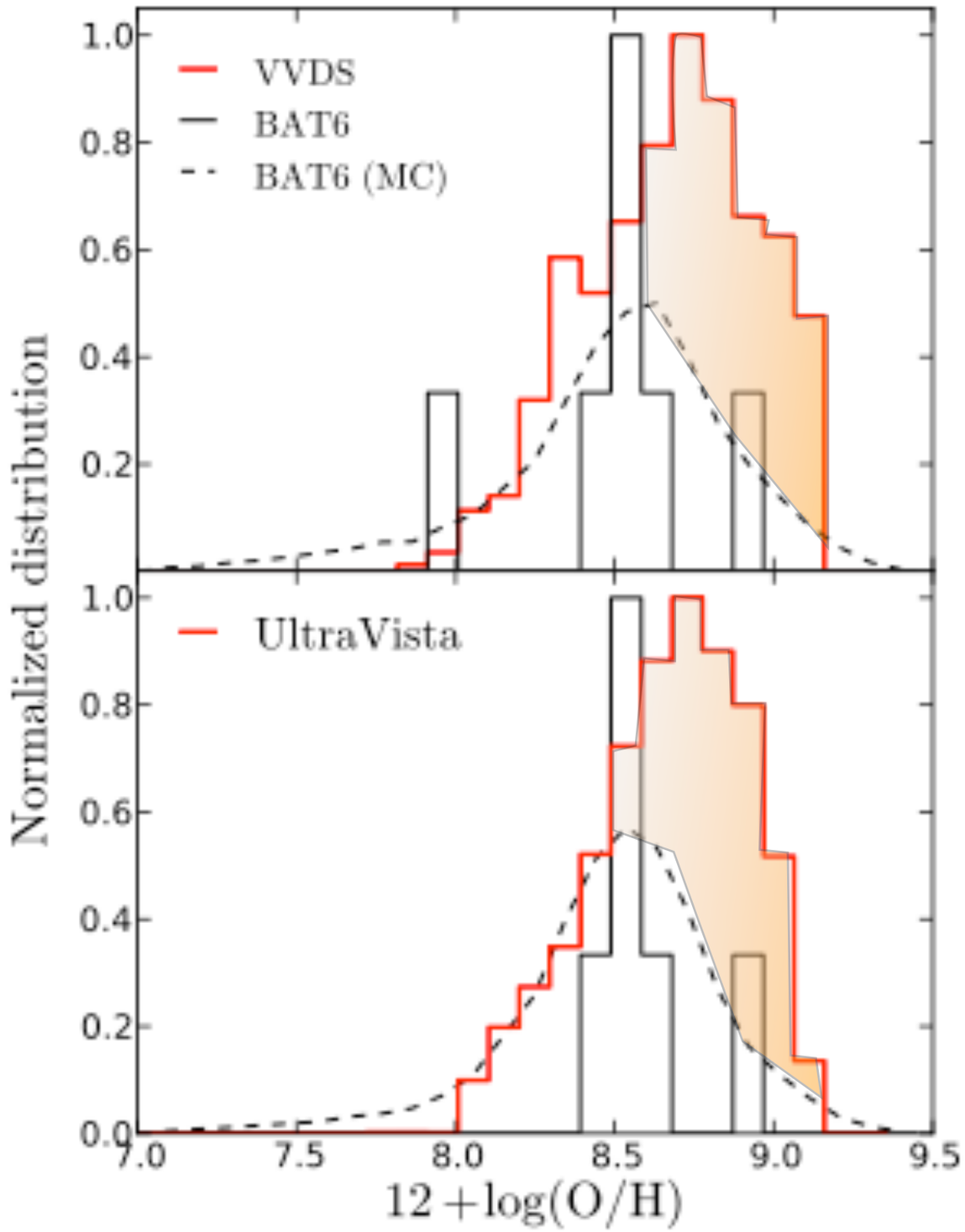




GRB hosts are consistent with the FMR and FPZ

Japelj et al. 2016

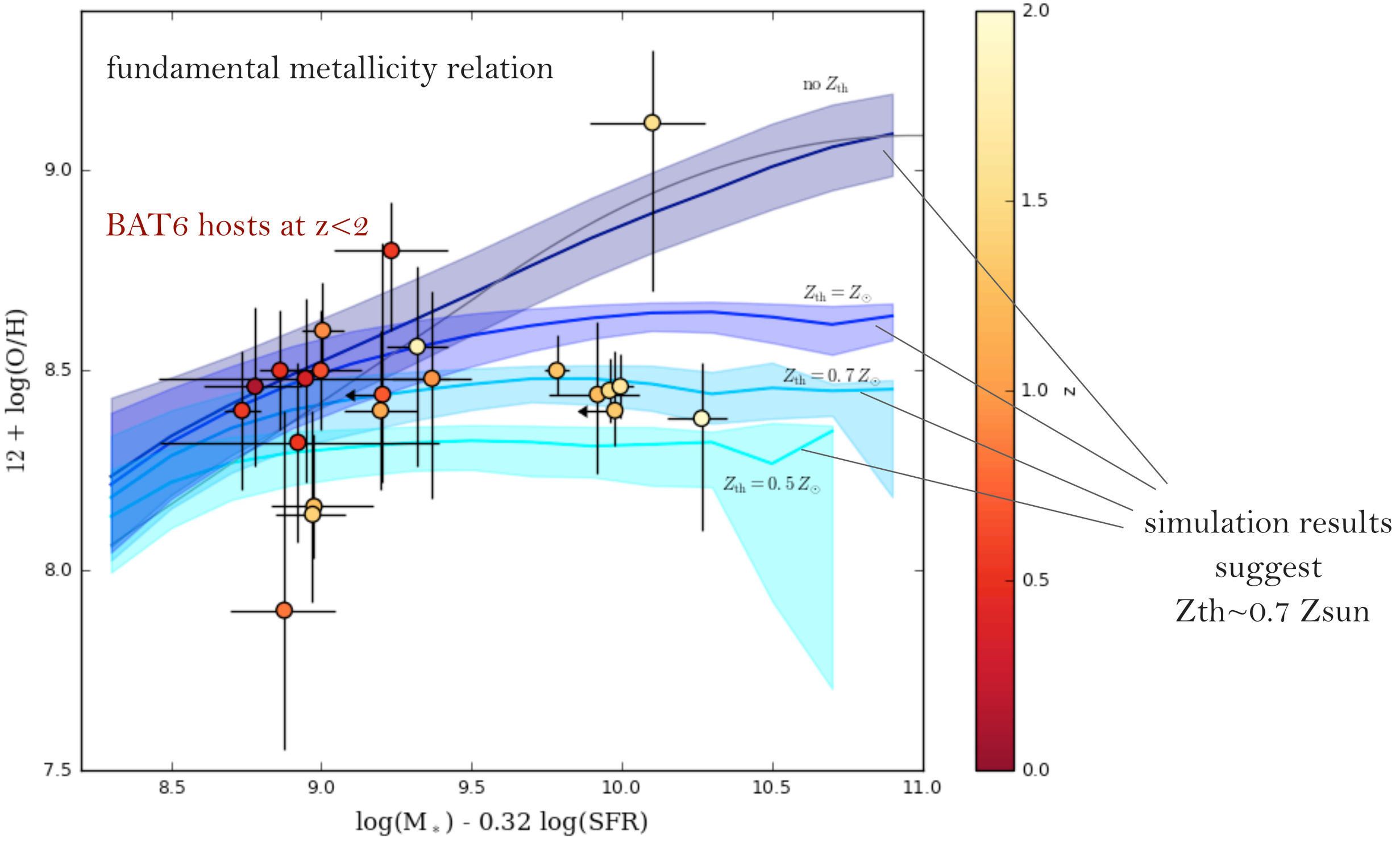
a metallicity bias II?



galaxy metallicities computed from FMR

Japelj et al. 2016

a metallicity bias III?



Vergani et al. 2016 submitted

conclusions

- GRBs select galaxies below current galaxy survey limits

- properties of BAT6 GRB hosts suggest a mild (Z~0.7 Zsun) metallicity bias

- we can safely use GRB at low masses and/or high-z to study galaxies in a complementary way to normal surveys