The Origin Of The Mass-Metallicity Relation For GRB Host Galaxies

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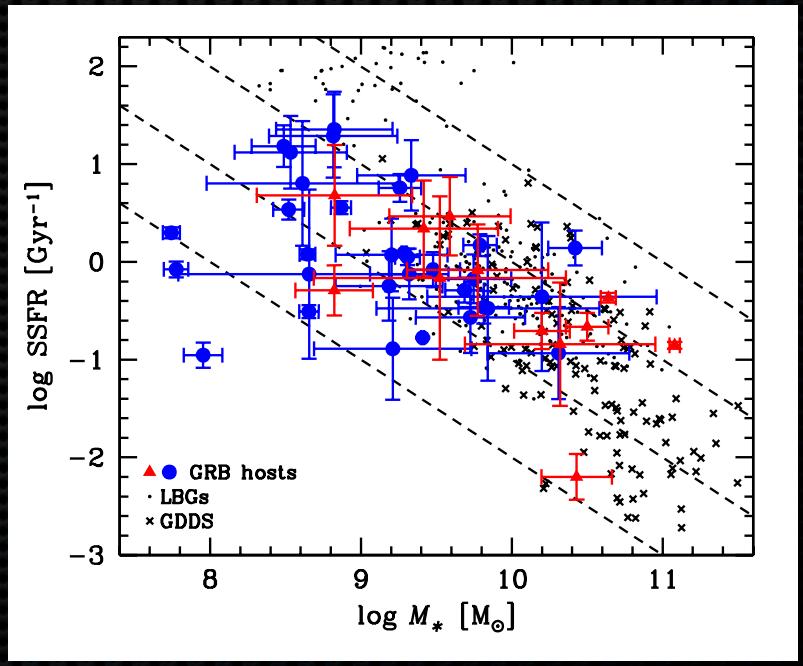
Host Galaxy Demographics

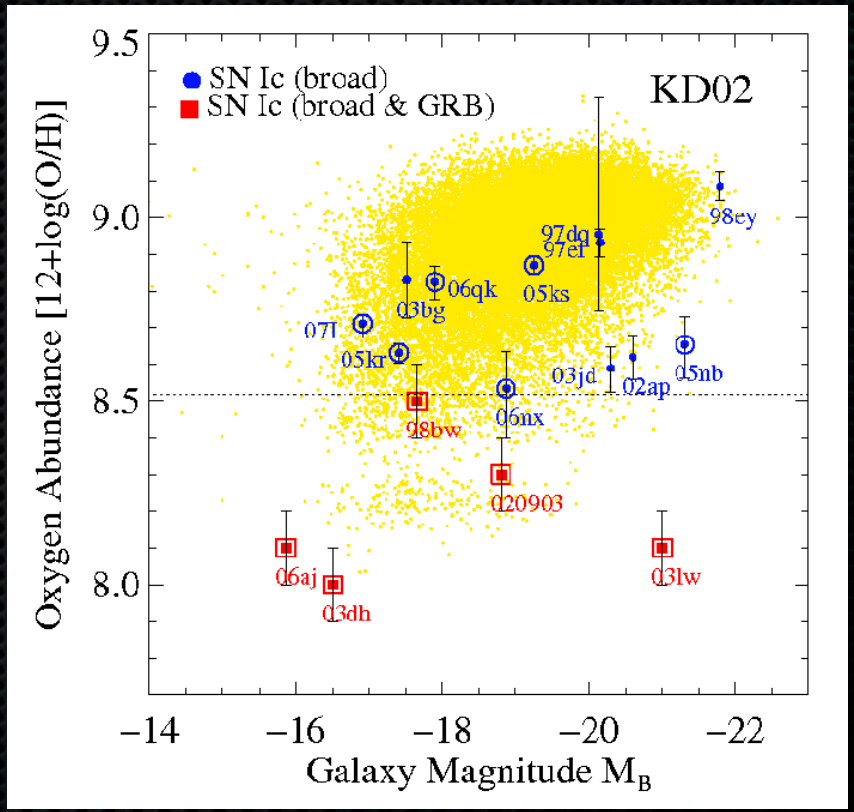
- Fainter, bluer, low mass
  - Fruchter et al. 1999, 2006
    Tanvir et al. 2002
    Bloom et al. 2002
    Castro Ceron et al. 2006, 2008
- High SSFR
  - Christensen et al. 2004
    Savaglio et al. 2008
- Traces overall cosmic SFR
  - Jakobsson et al. 2006
    Guetta & Piran 2007



Savaglio et al. 2008

Host Galaxy Metallicities

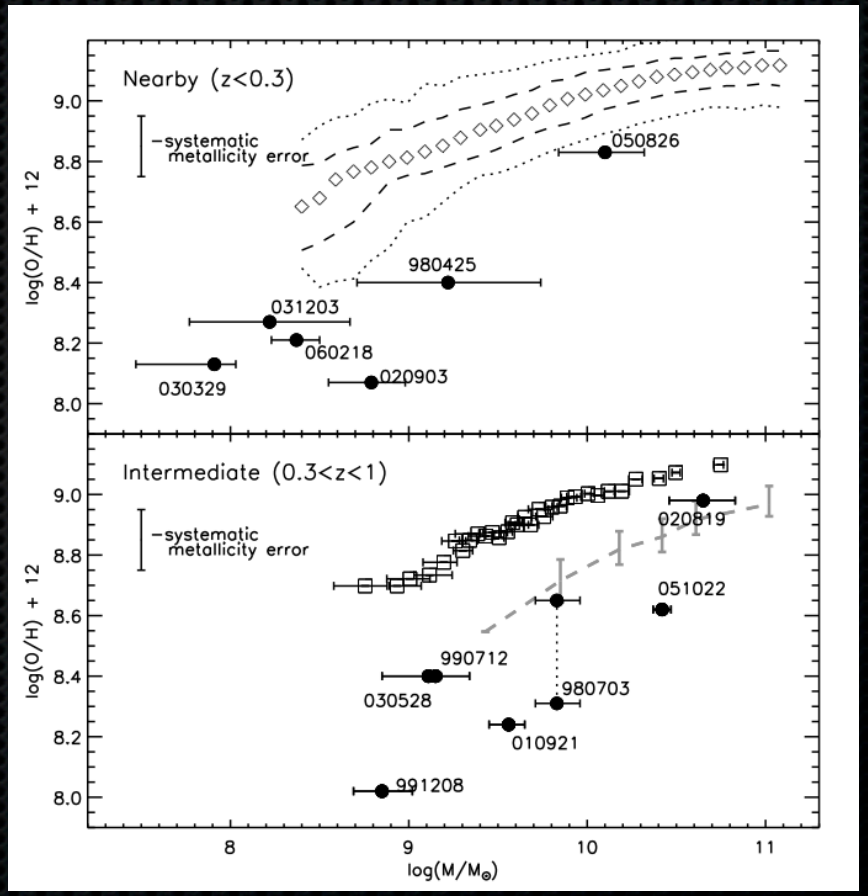
- Tend to be metal poor
  - Sollerman et al. 2005
    Fynbo et al. 2006
    Prochaska et al. 2007
    Stanek et al. 2007
- Evidence for a bias?
  - Modjaz et al. 2008
    $12+\log(O/H)_{KD02} \sim 8.5$
- Theoretical justification
  - Collapsar model



Modjaz et al. 2008

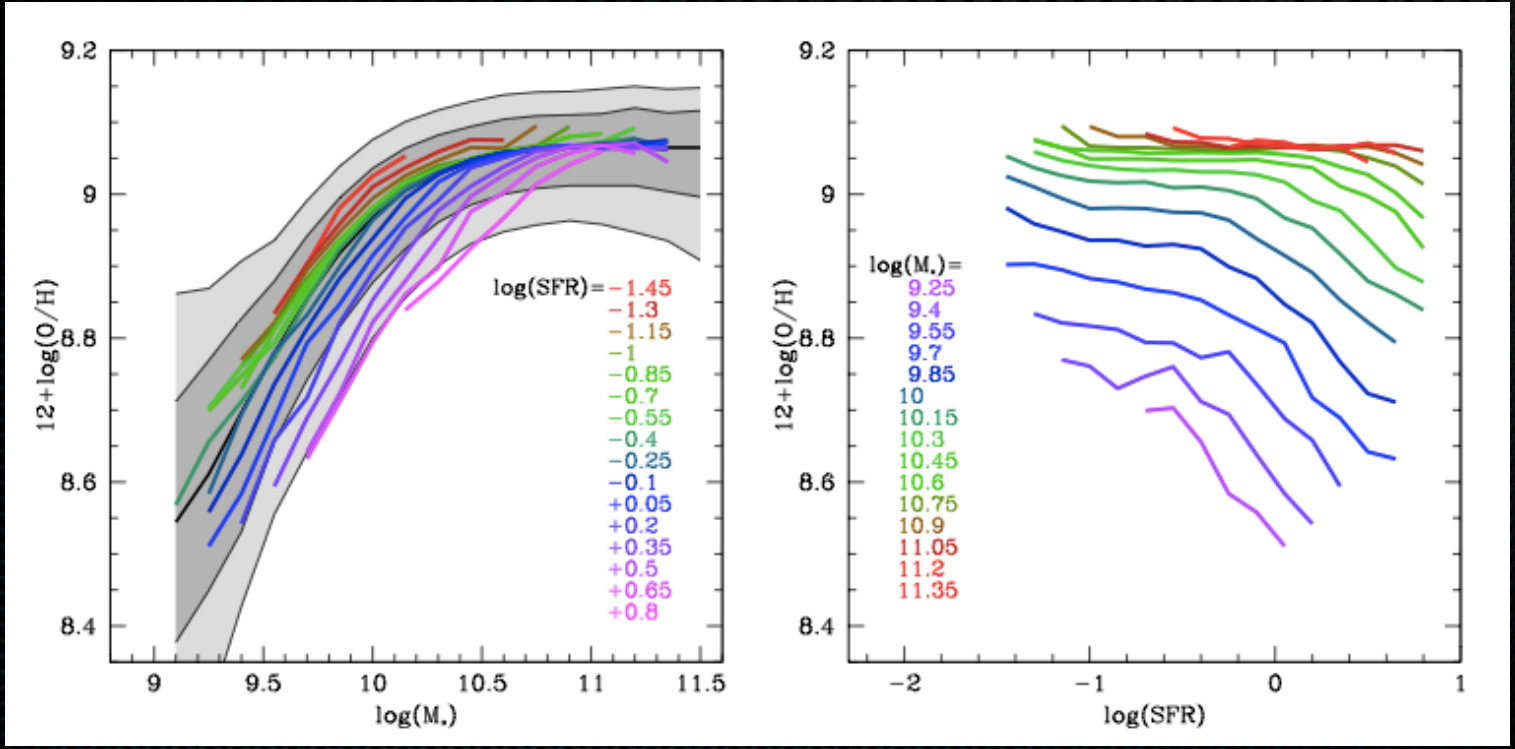
Host Galaxy M-Z Relation

- Mass-Metallicity Relation
  - Tremonti et al. 2004
  - High mass galaxies contain higher metallicities
  - More stars produce more metals + feedback processes
- Host galaxies fall below the M-Z relation for star forming galaxies
- Show no sign of string Z “cut-off”



Levesque et al. 2010 (arXiv:1006.3560v1)

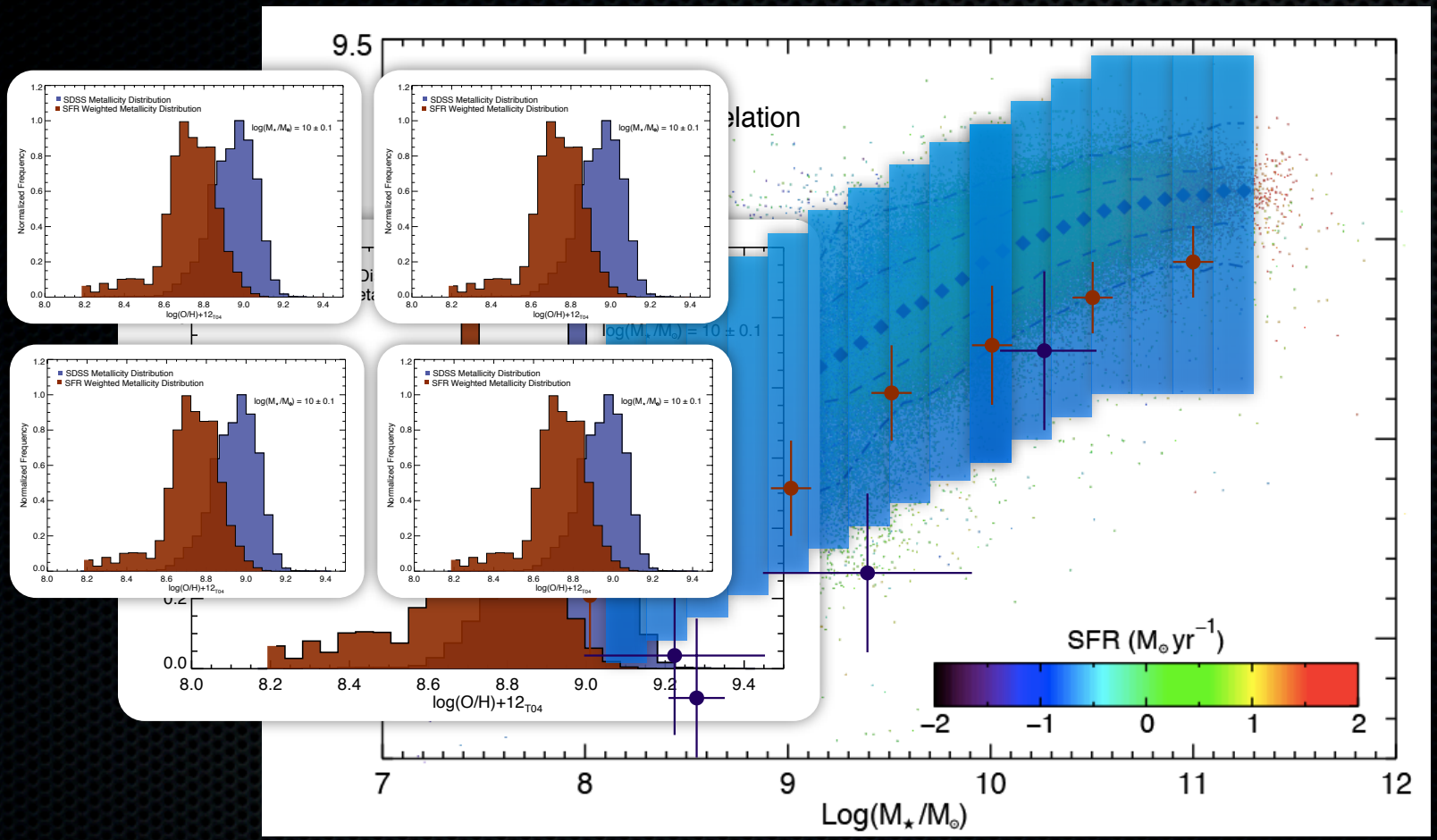
SFR-Z Relation



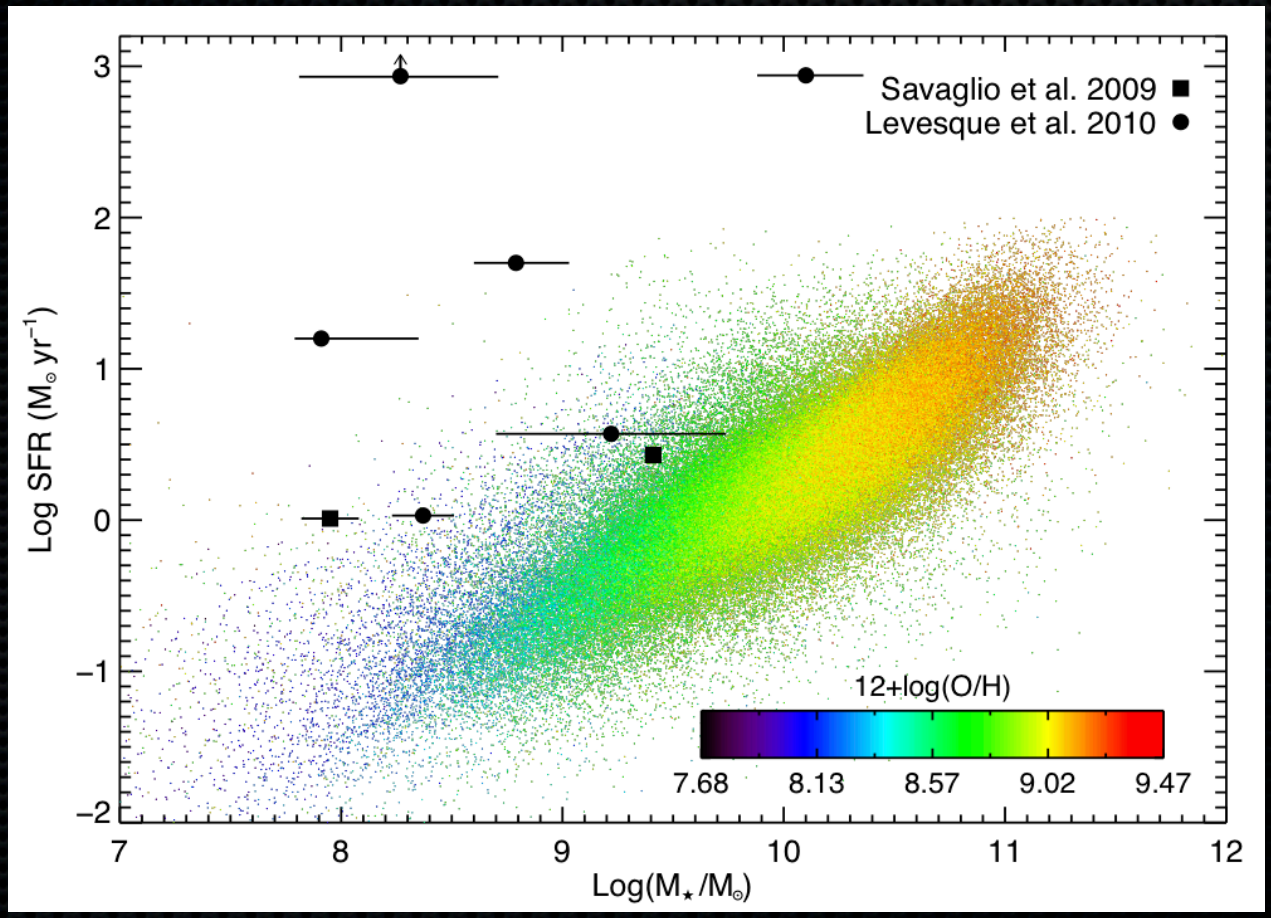
Mannucci et al. 2010

- SFR-Z relation: Lower metallicity galaxies produce more stars for their given galaxy mass

SFR Weighted M-Z Relation



GRB Host Galaxy SFR



Conclusions

- The GRB defined M-Z relation is offset to lower metallicities
- An anti-correlation between SFR-Z would explain this trend
- Lower metallicity galaxies produce more stars then their higher metallicity counterparts for a given galaxy mass
- GRB closely trace SFR and should produce a M-Z relation biased towards lower Z, higher SFR galaxies
- This trend should be true of all transient events that trace the SFR, including core collapse SNe, but not SN Ia!