Main Sequence to Starburst Transitioning galaxies

GRB hosts at redshift ~ 2

(ApJ, 2023, 952, 125N)

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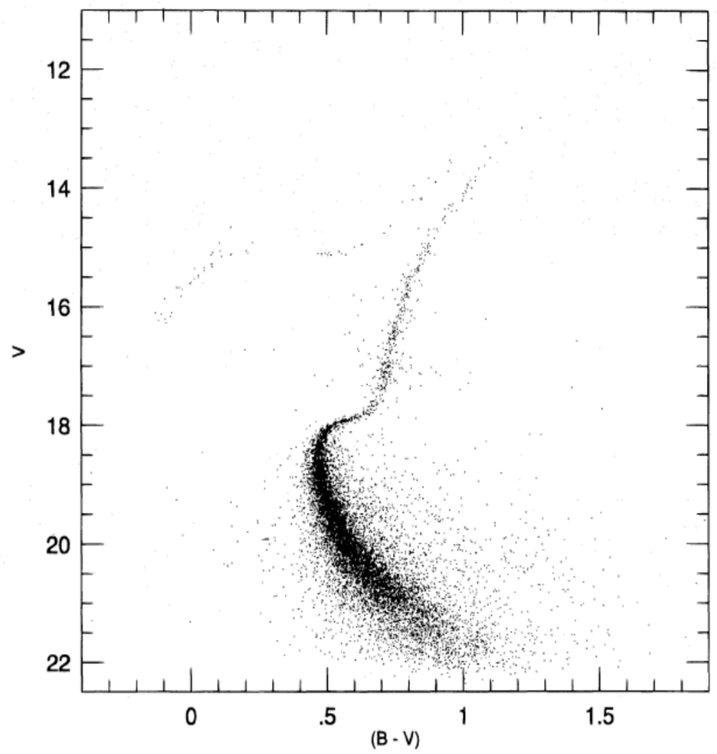
Michał Michałowski, Ricard Rizzo, Agata Karska, Jesper Rasmussen, Jesper Sollerman, Jens Hjort, Andrea Rossi, Martin Solar, Radosław Wróblewski, and Aleksandra Leśniewska

Layout

1) Main Sequence
2) Gamma-ray burst
3) Motivations
4) Results

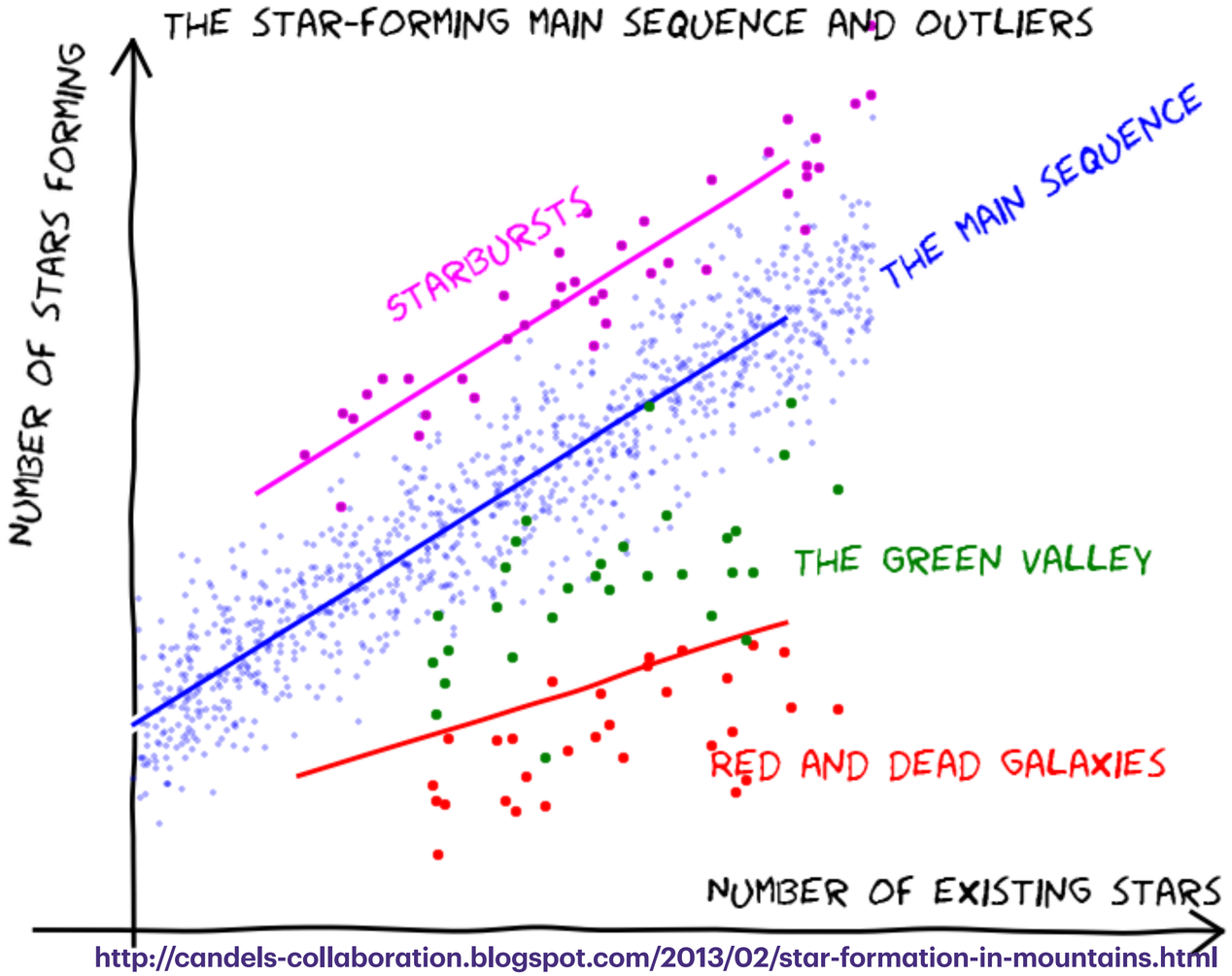
Main Sequence

of Star Forming Galaxies (not Main Sequence Stars)

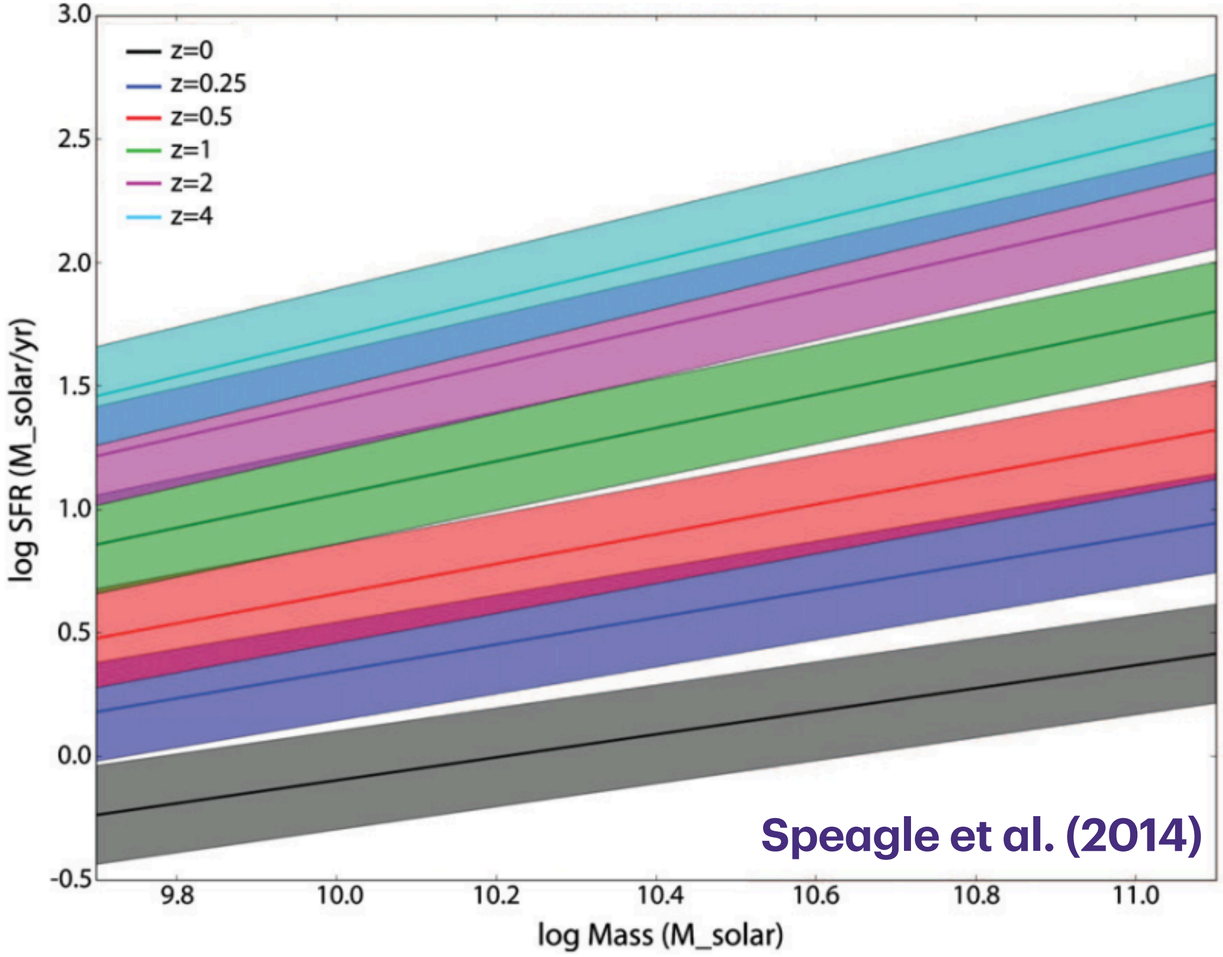


CMD (Sandquist et al. 1996) of M5 (NGC 5904)

Main Sequence

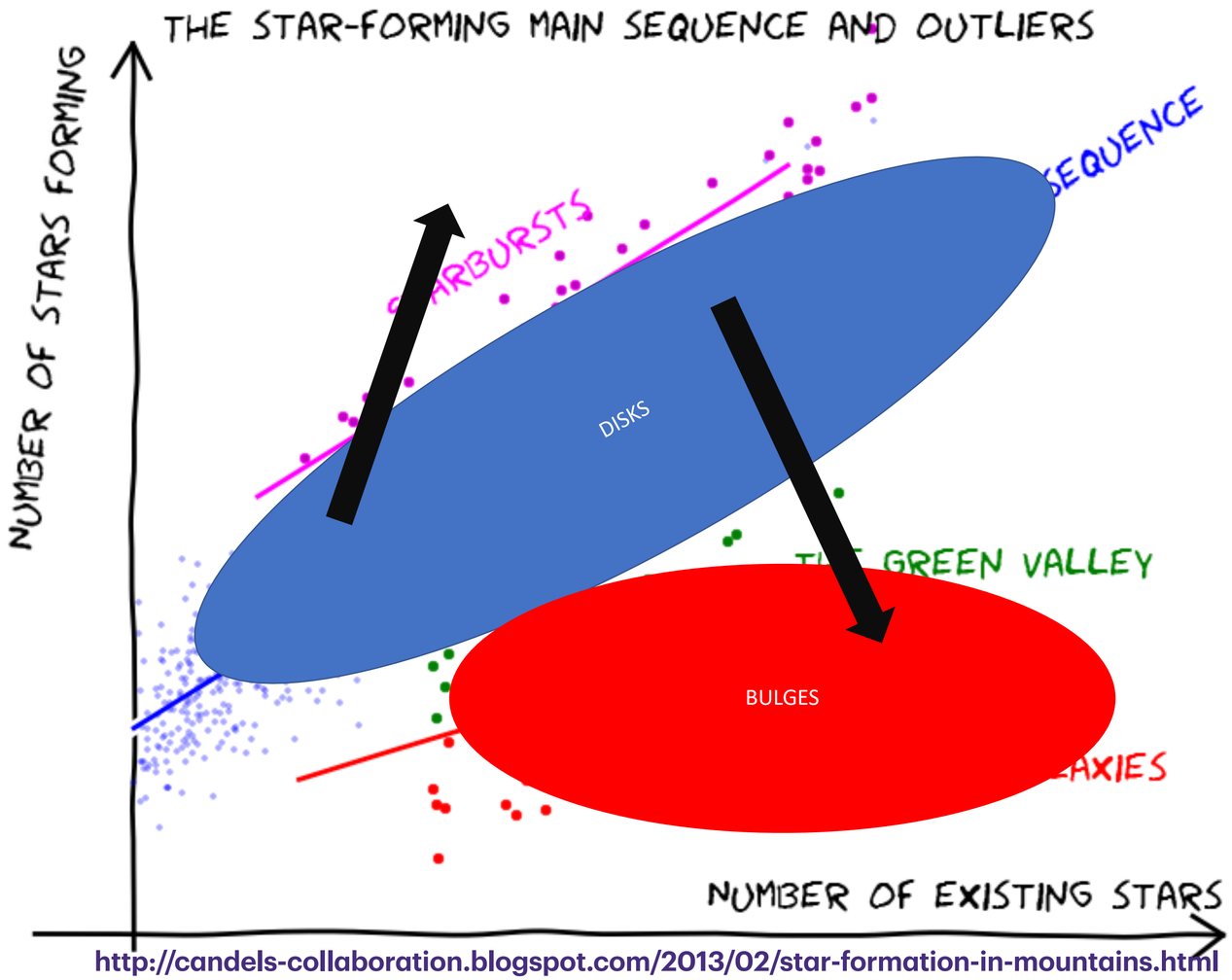


http://candels-collaboration.blogspot.com/2013/02/star-formation-in-mountains.html



Speagle et al. (2014)

Main Sequence



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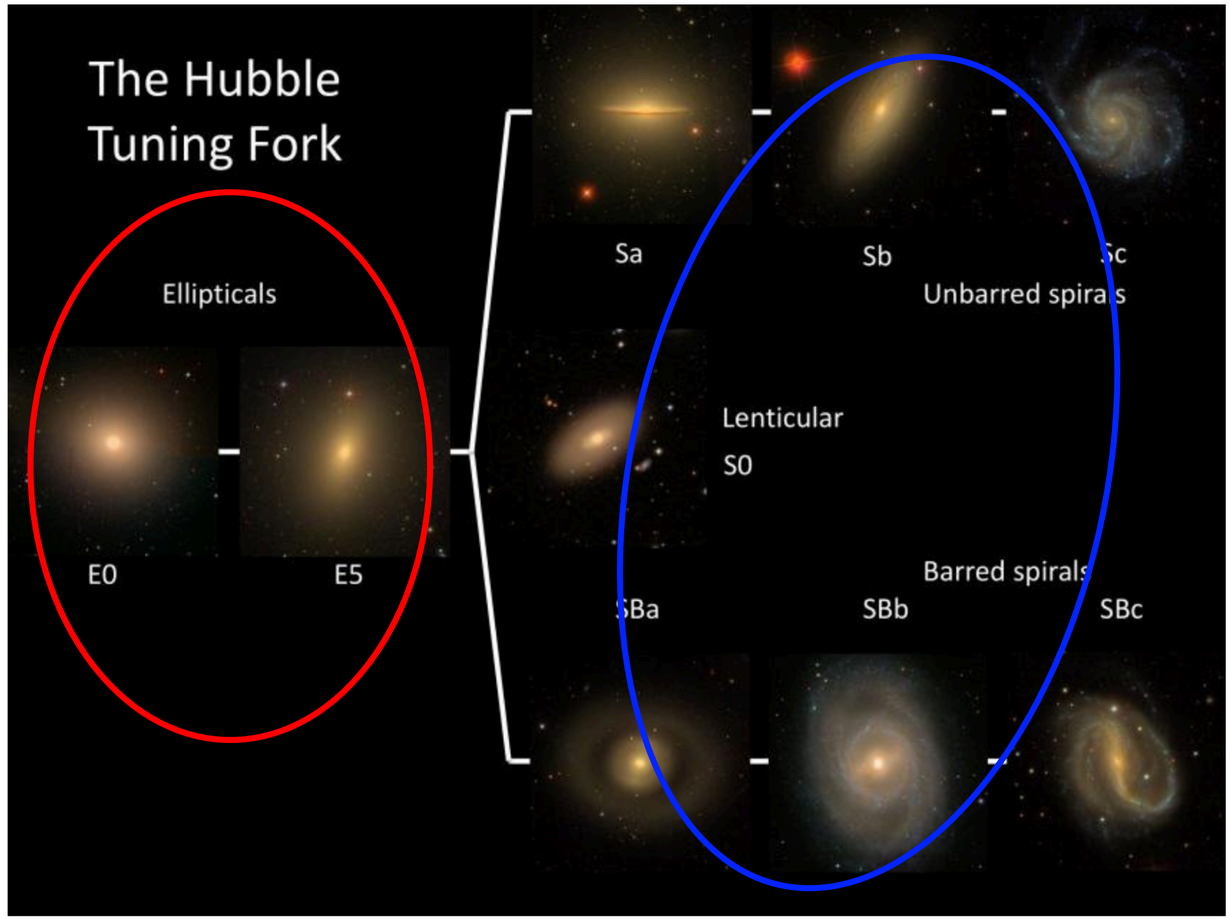
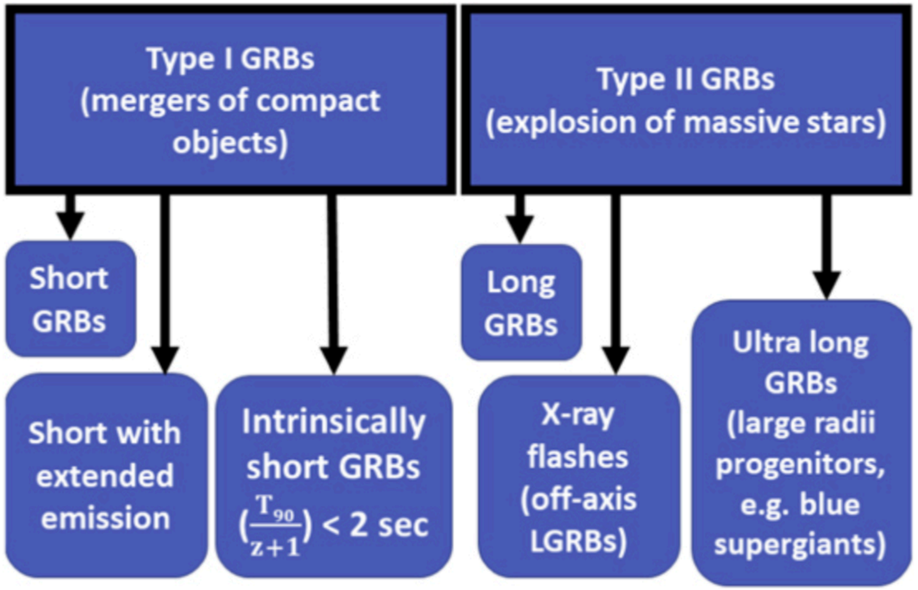


Gamma-ray burst

Gerardo and Aditya yesterday talks

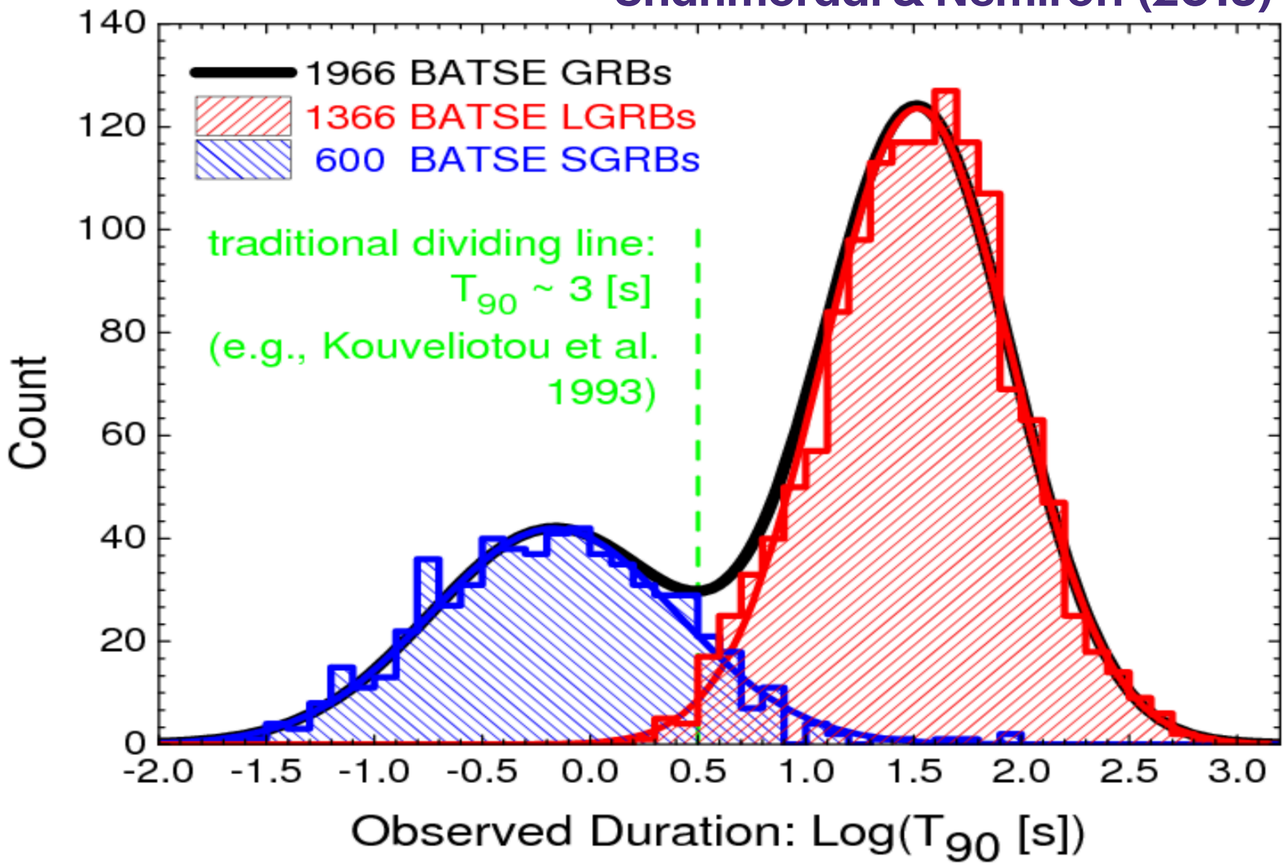
Short GRB: NS-NS/NS-BH

Long GRB: SNe explosion



Maria G. Dainotti *et al* (2023)

Shahmoradi & Nemiroff (2015)

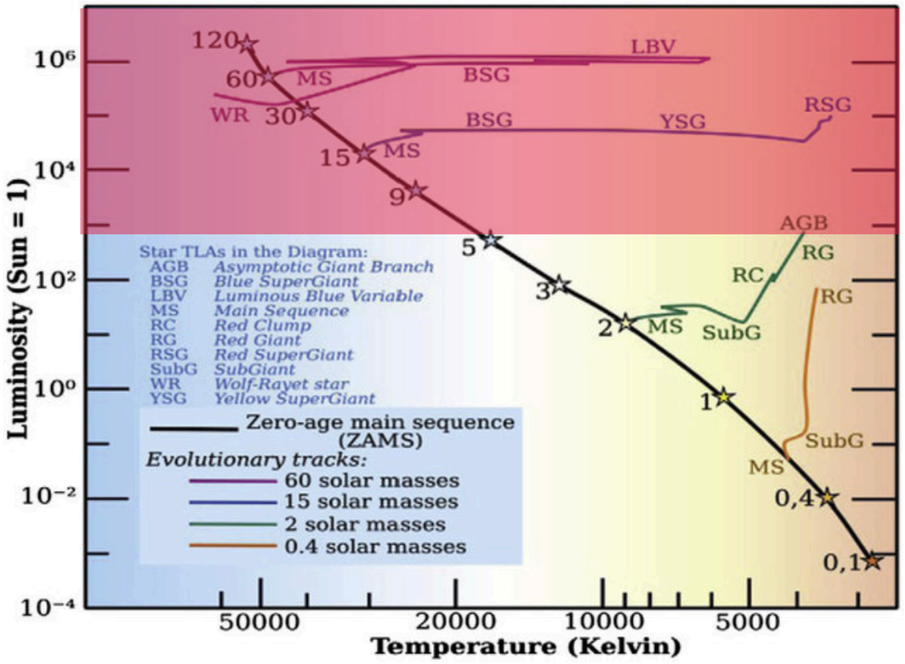


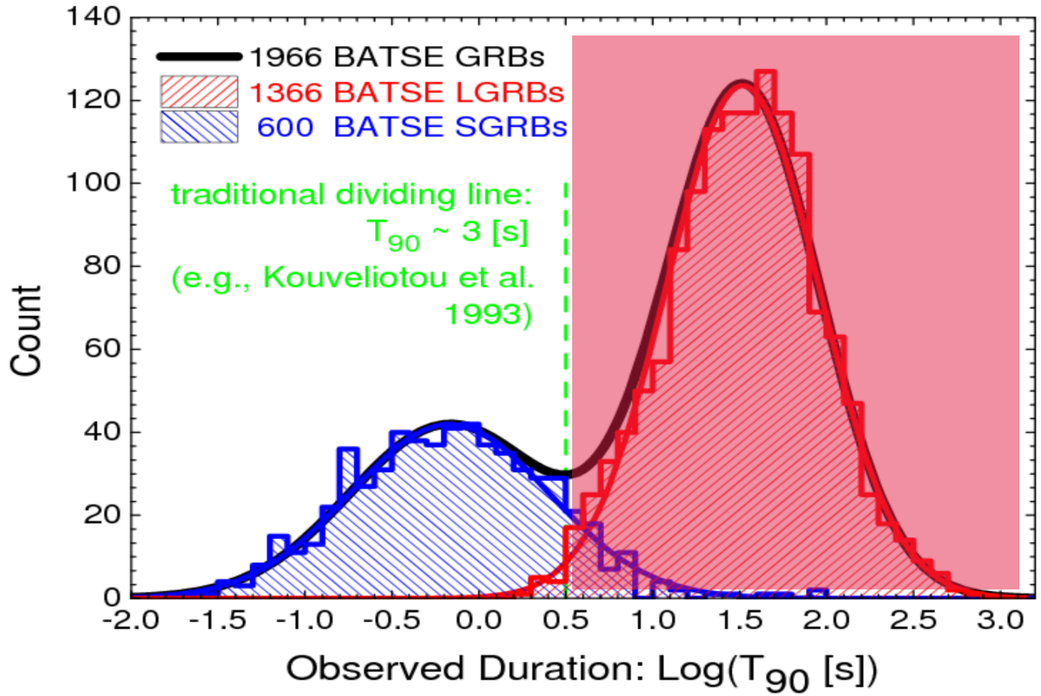
Gamma-ray burst

Chasing recent star-formation in GRB host galaxies

Long GRBs origniate in explosions of short-lived massive (>8 Msun) stars

Hjort+03, Stanek+03



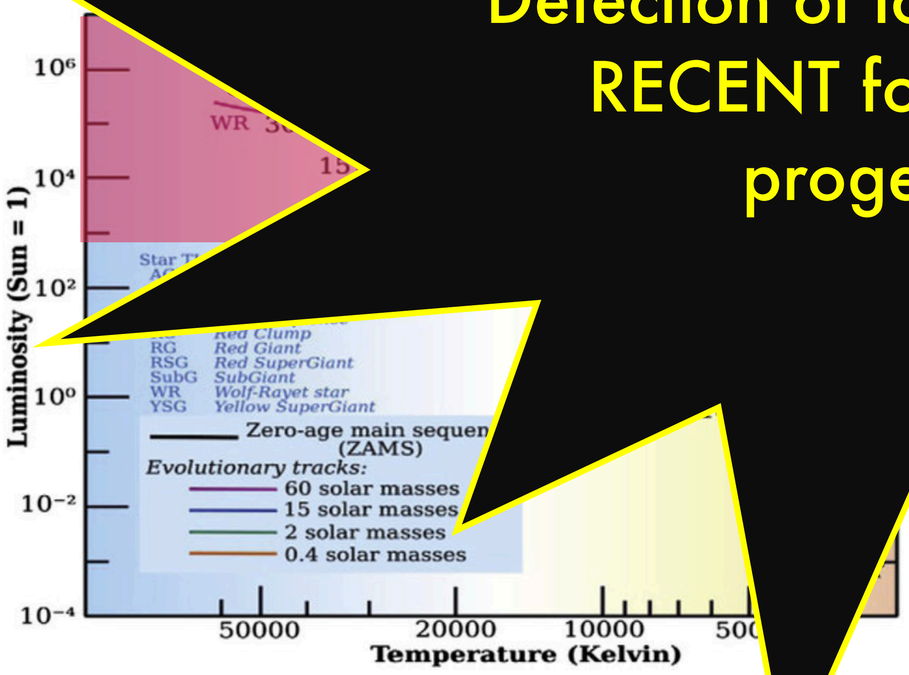


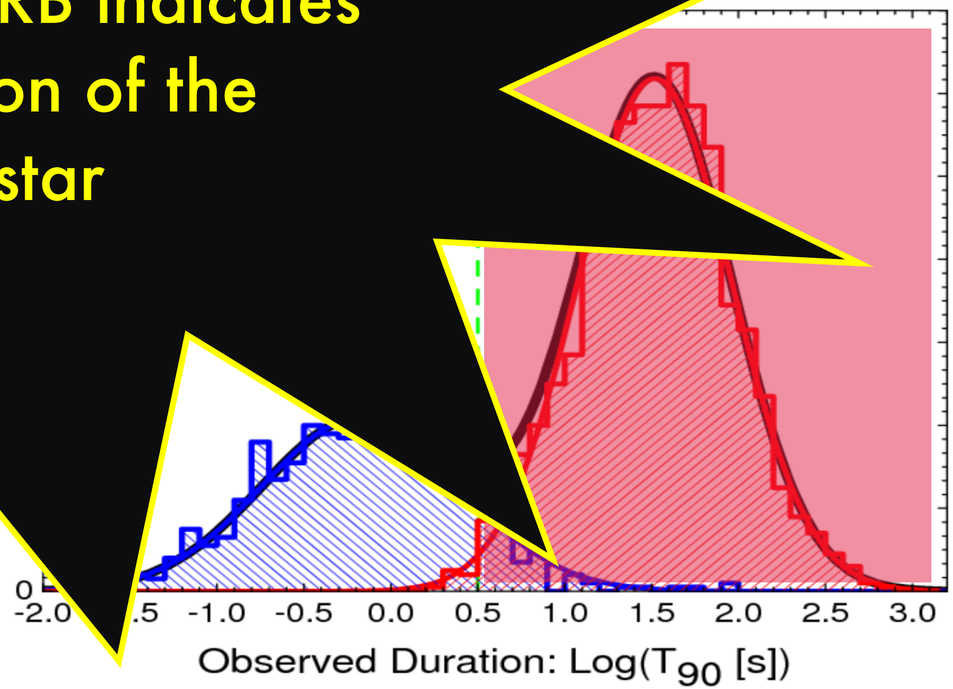
Gamma-ray burst

Cha[illegible] recent sta[illegible]rmatio[illegible] GRB host galaxies

Long GRBs o[illegible] (>8 Msun) stars

Detection of long GRB indicates
RECENT formation of the
progenitor star





Motivations

1) To test whether GRB hosts are similar to other galaxies
2) How the GRB, gas content and SFR are connected

Sample Selection

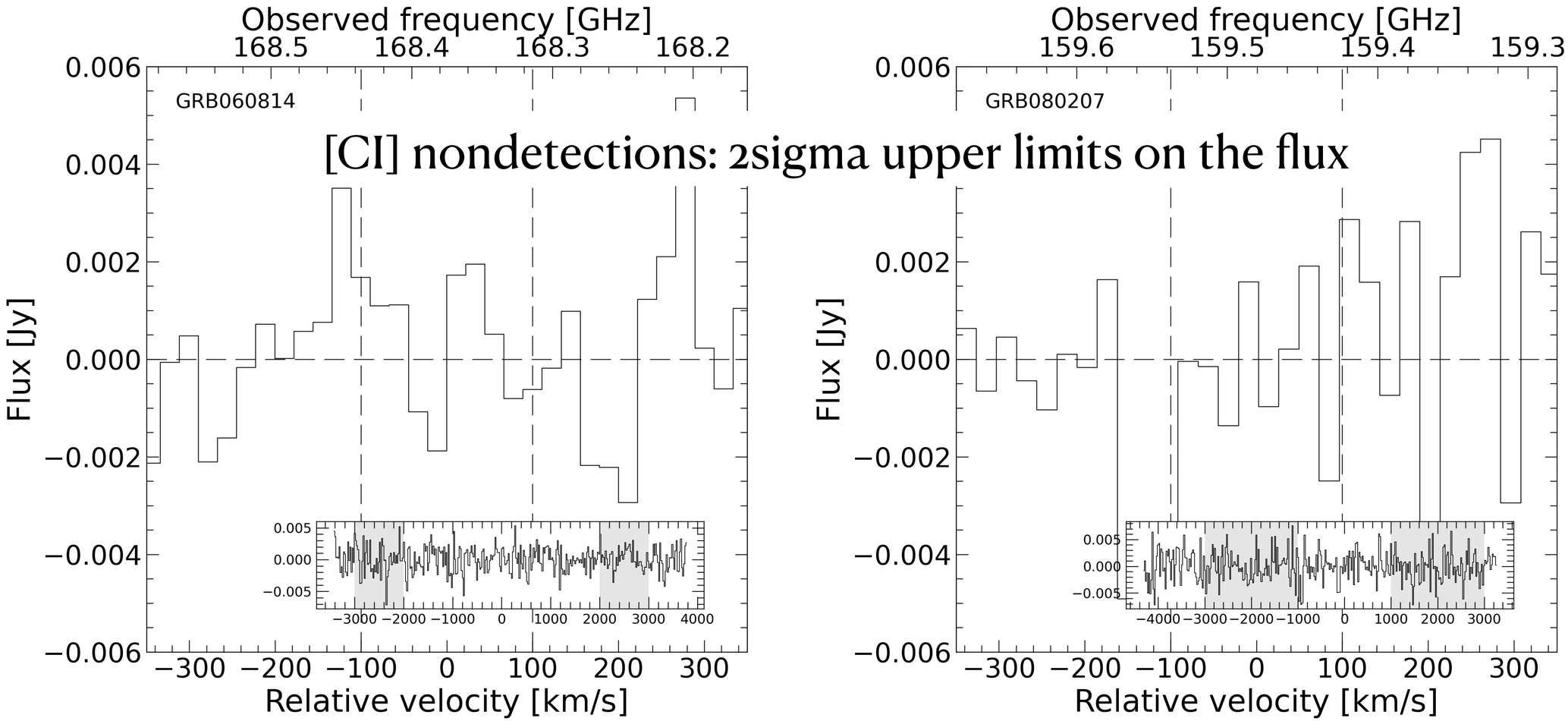
1) Availability of IR or radio detections: SFR estimators
2) Spectroscopic Redsfhit: to assure that neutral carbon [CI](1-0) could be observed

1) Seven potential targets
   (GRB ~~051006, 051022~~, 060814, 061121, 080207, 100316D, and ~~111005A~~)
2) Two telescopes: APEX, and IRAM.
3) Between 13h and 17h on-source.

APEX: GRB 061121 and 100316D — upper limits not sufficiently constraining.

Results

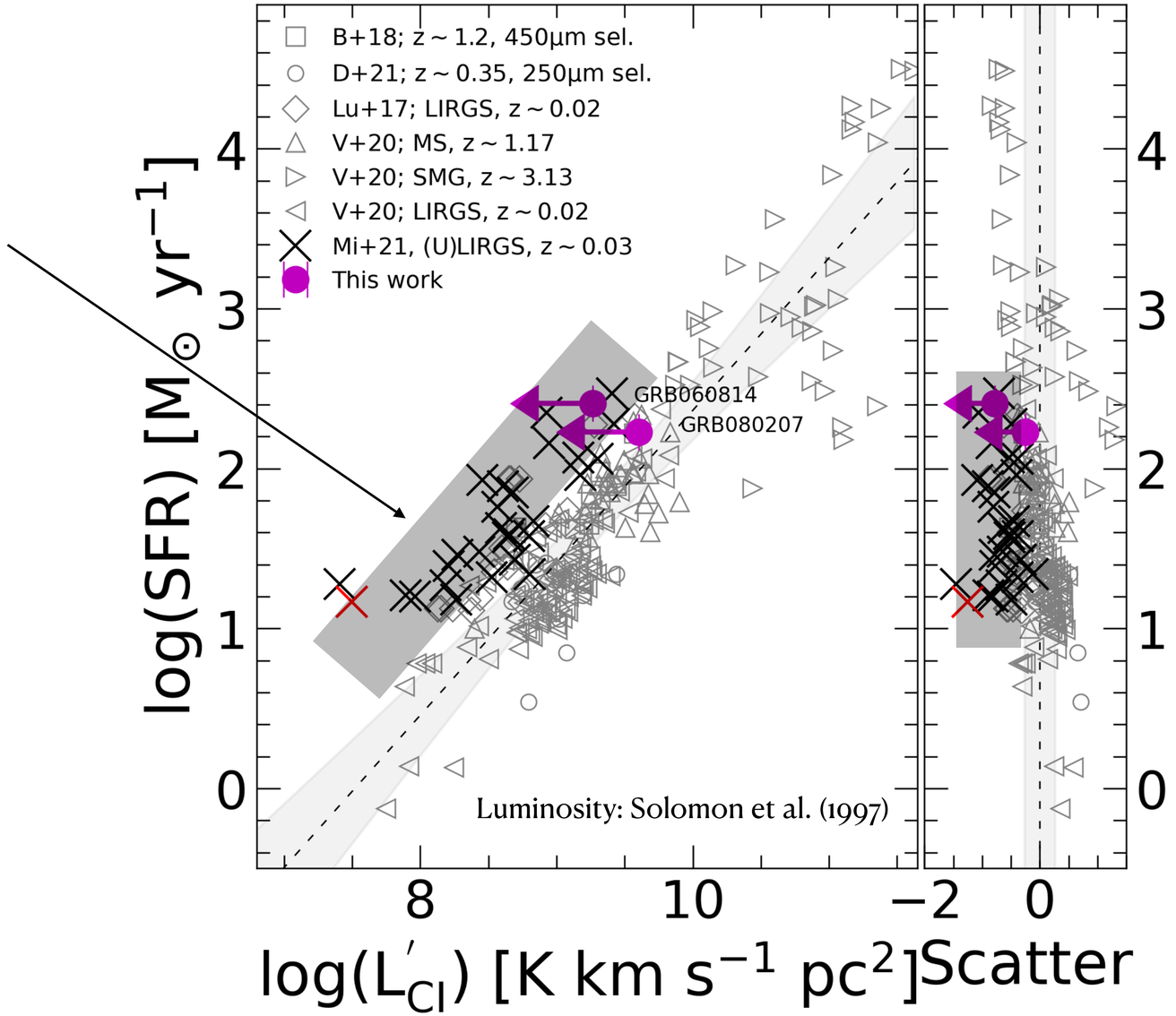
IRAM: GRB 060814 and 080207



[CI] nondetections: 2sigma upper limits on the flux

Results

[CI] nondetections:
upper limits L[CI] — smiliar to local *merging* ULIRGS



Results

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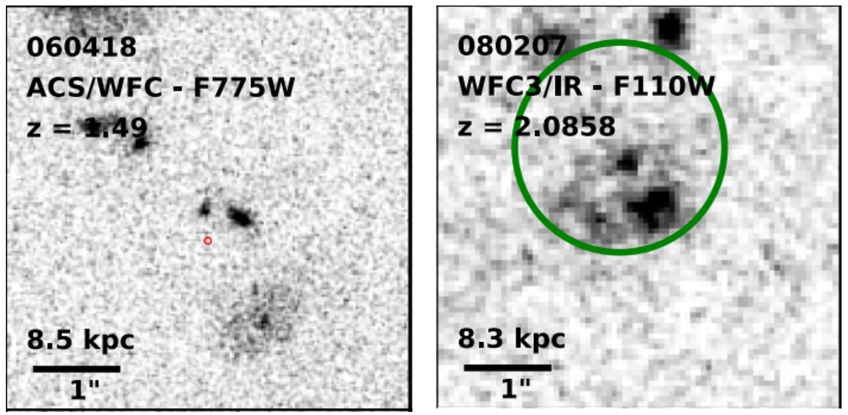
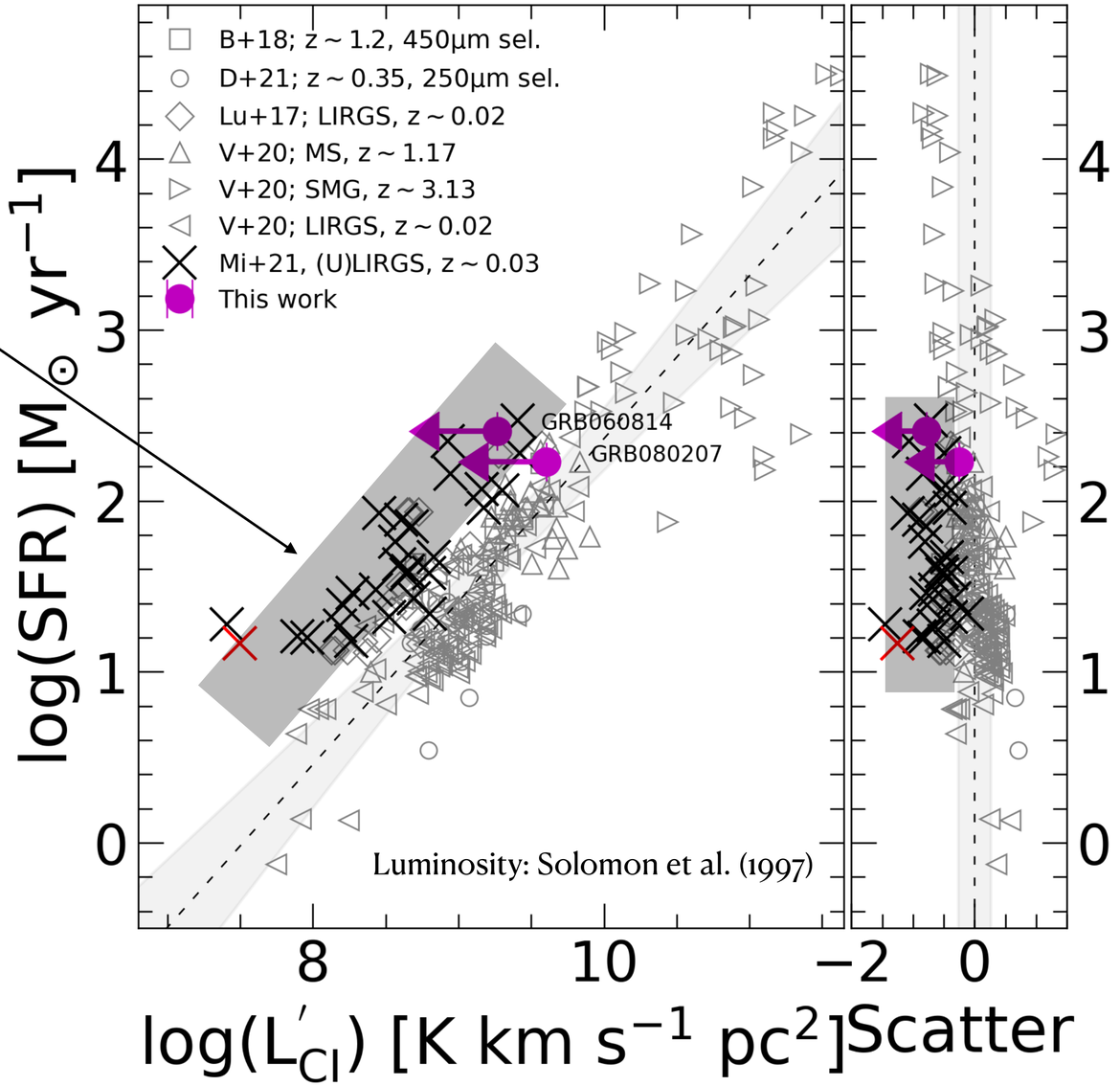
HST high-res images — *possible mergers*



Blanchard et al. (2016)



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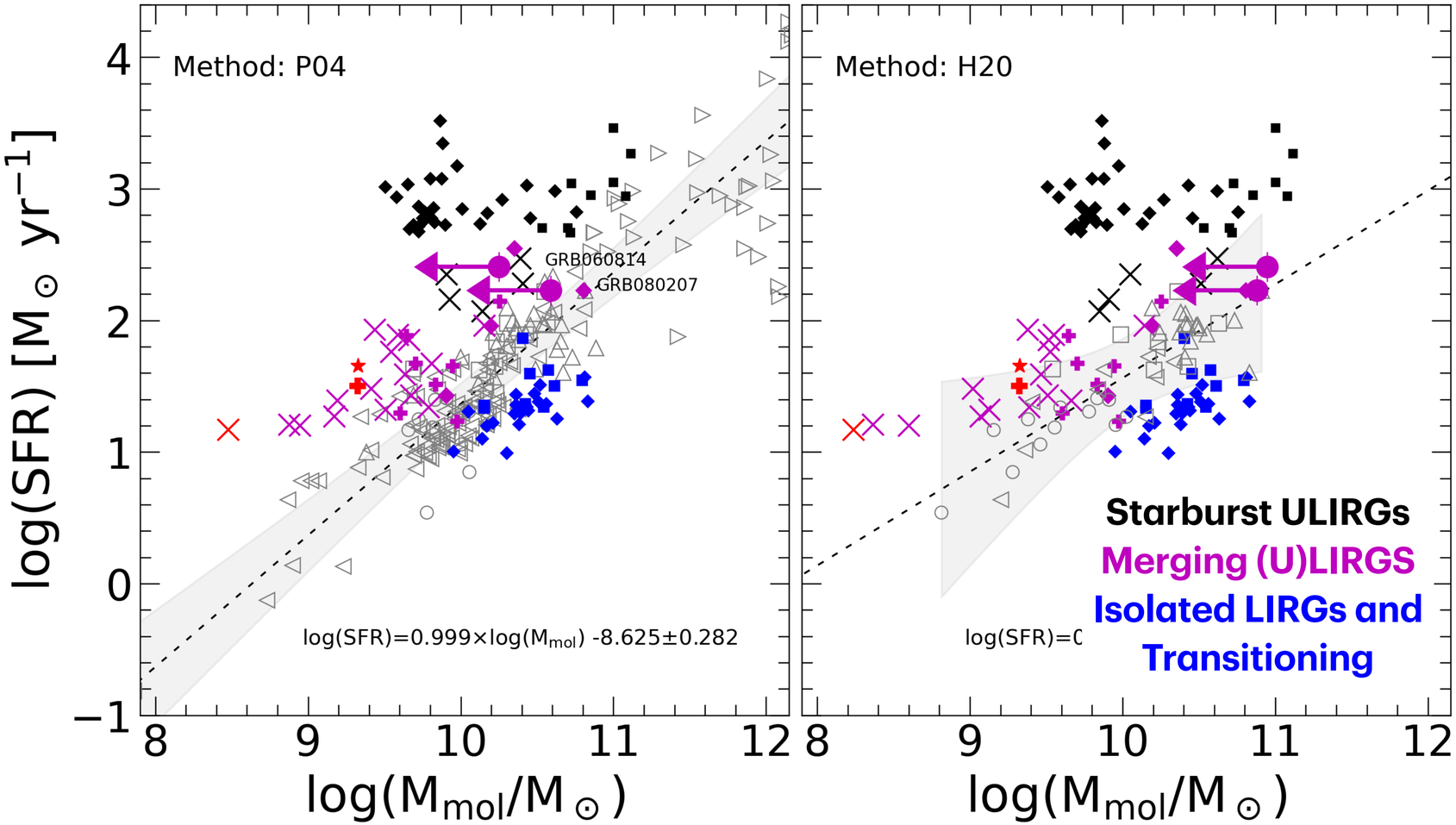


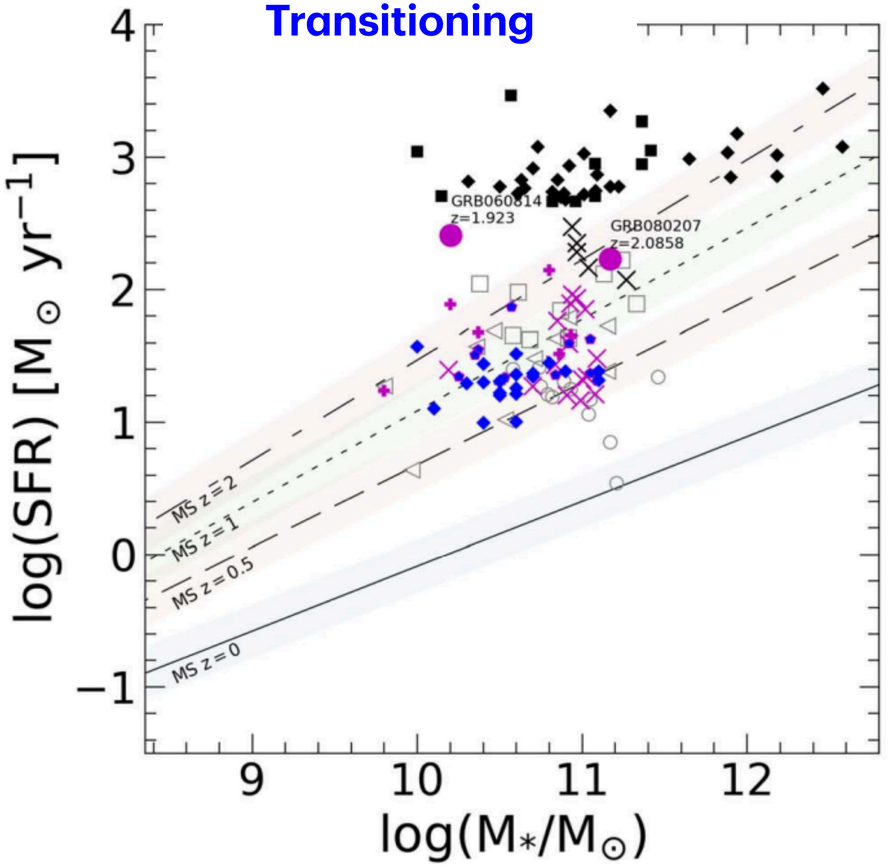
[CI] nondetections —> low [CI] mass (flux)

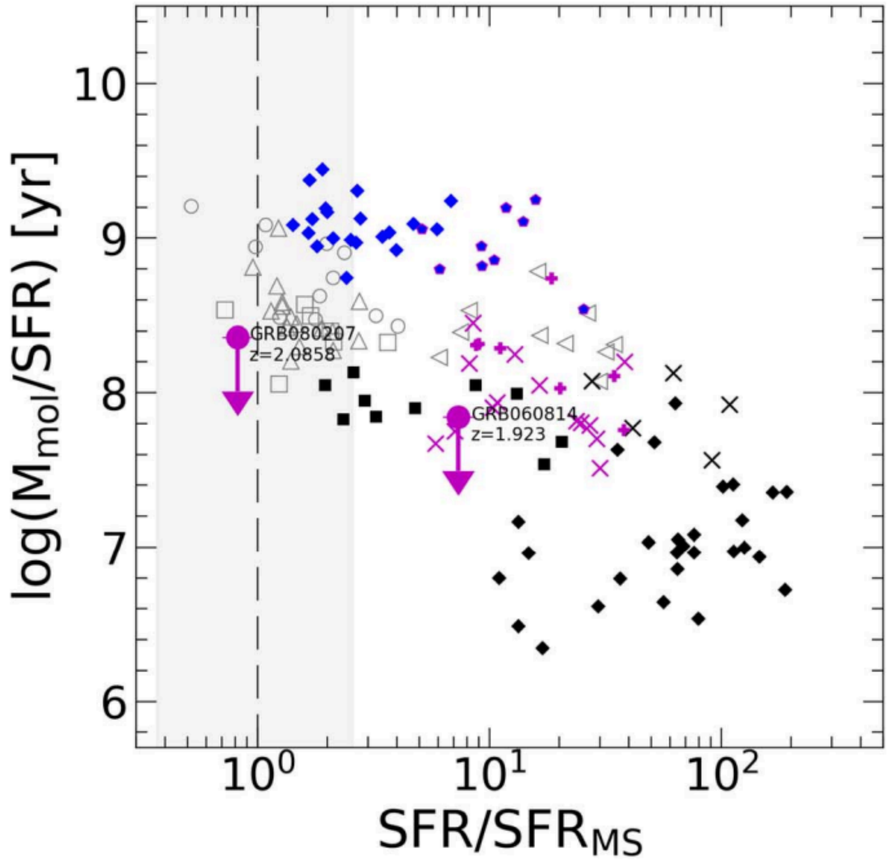
Independently of the method:
For the same molecular mass
we have a wide spread in SFR.

Molecular Masses: Papadopoulous et al. (2004); Heinz & Watson (2020)

Results

Starburst ULIRGs
Merging (U)LIRGS
Isolated LIRGs and Transitioning

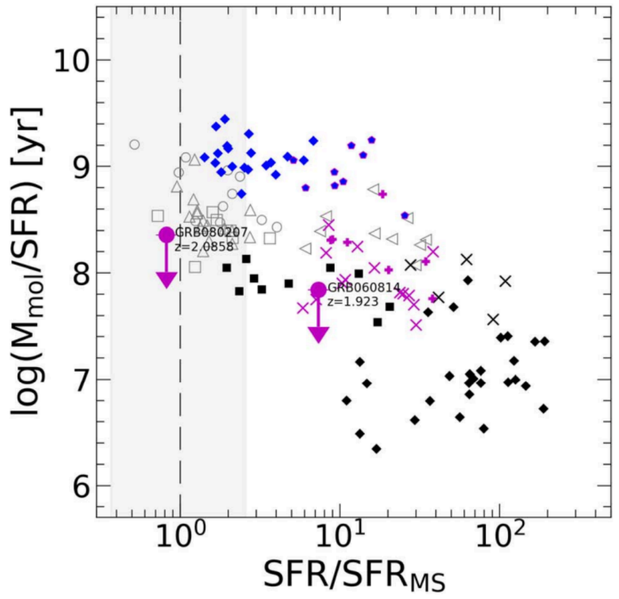




Depletion time decrease with increasing distance form the MS. This correlates with a different stages found in galaxy evolution.

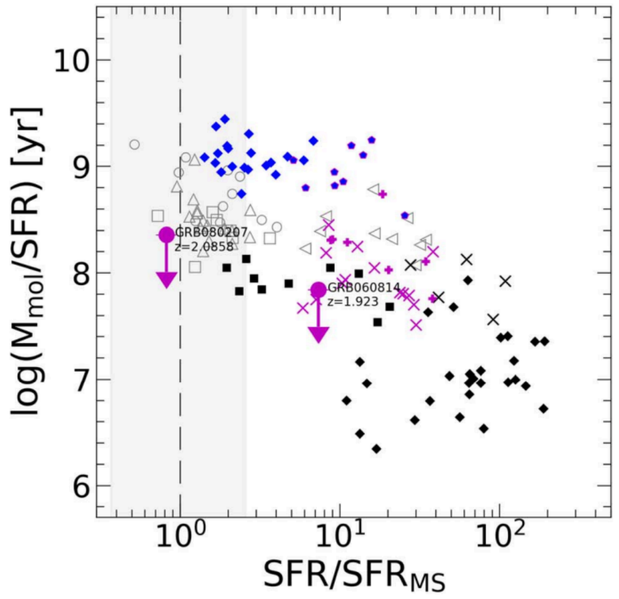
From isolated LIRGS, isolated transitioning, through transitioning merging ULIRGS, to starbursts.

Two nonexclusive scenarios



1) **Our GRB hosts are at their tarnsition toward starburst phase**
   (moderate distance form MS, short dep. times)
2) **[CI]-dark objects** Michiyama et al. (2020)
   [CI]/CO < 0.1, from PDR models high H densities (>10^5-10^6 cm^-3)

Two nonexclusive scenarios



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and one rejected

1) **Our GRB hosts are in the post starburst phase**
   Spectra of young stellar populations — no Balmer absorption lines

Conclusions

Using GRB as a tracer of recent star formation we found [CI]-dark galaxies that are in their transition from MS to starburst phase at z~2.

We have no evidence for a difference between a GRB host and other SFGs.

Our GRB hosts are a high-z analogues of local transitioning and [CI]-dark galaxies

Read the paper here: