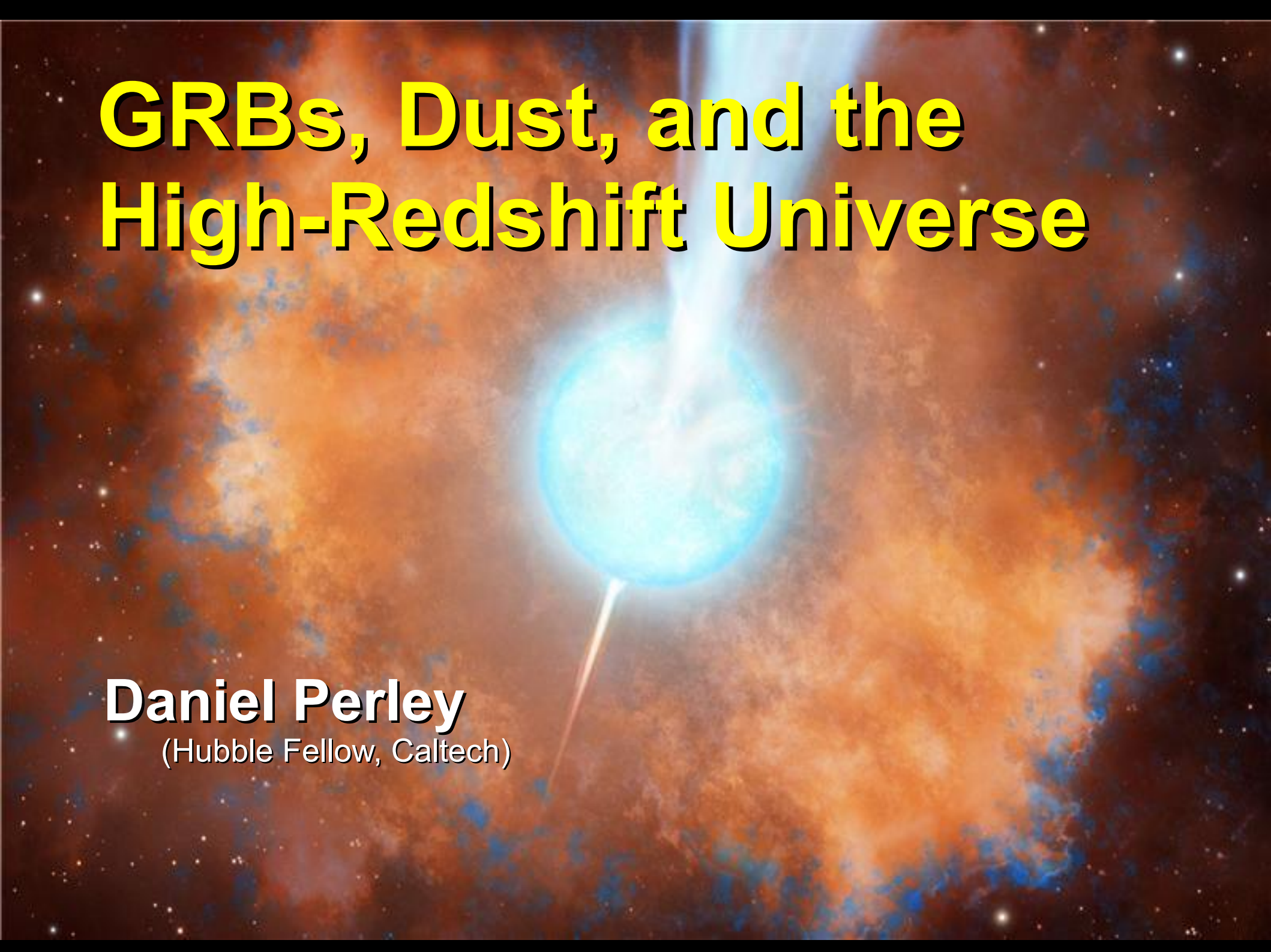
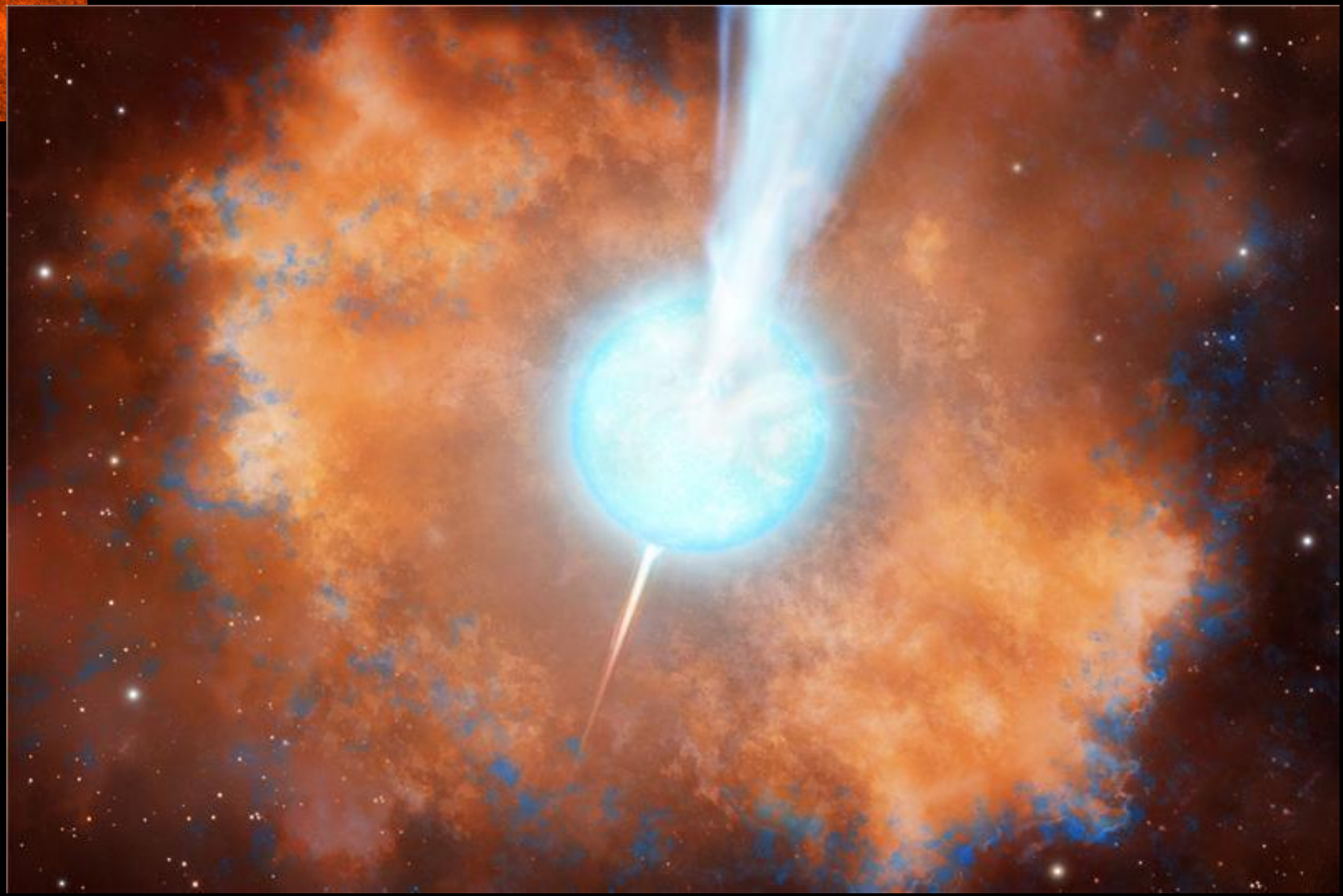


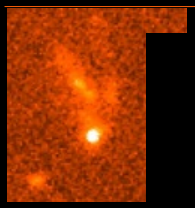
GRBs, Dust, and the High-Redshift Universe

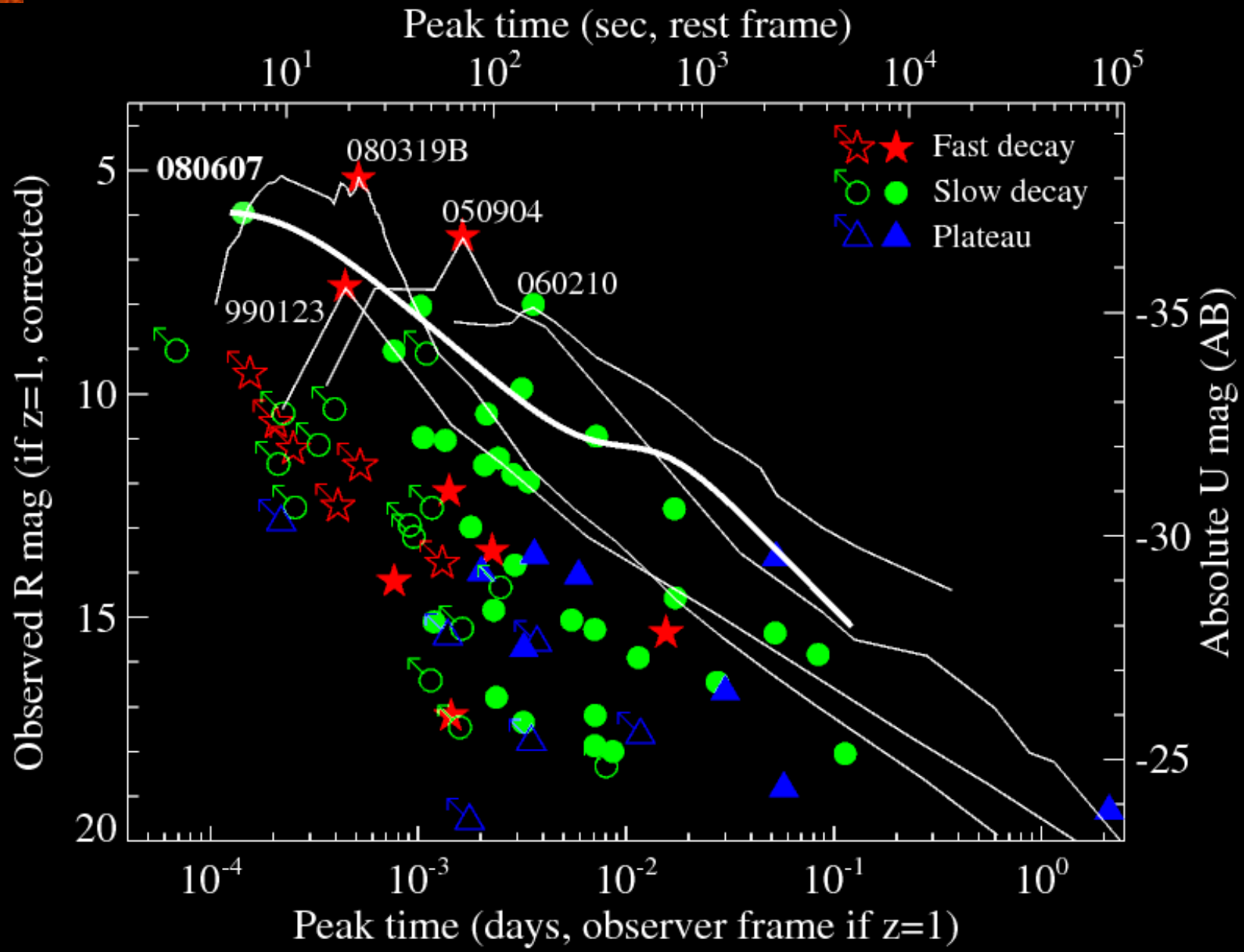
Daniel Perley
(Hubble Fellow, Caltech)

GRBs: Massive Stellar Core Collapse



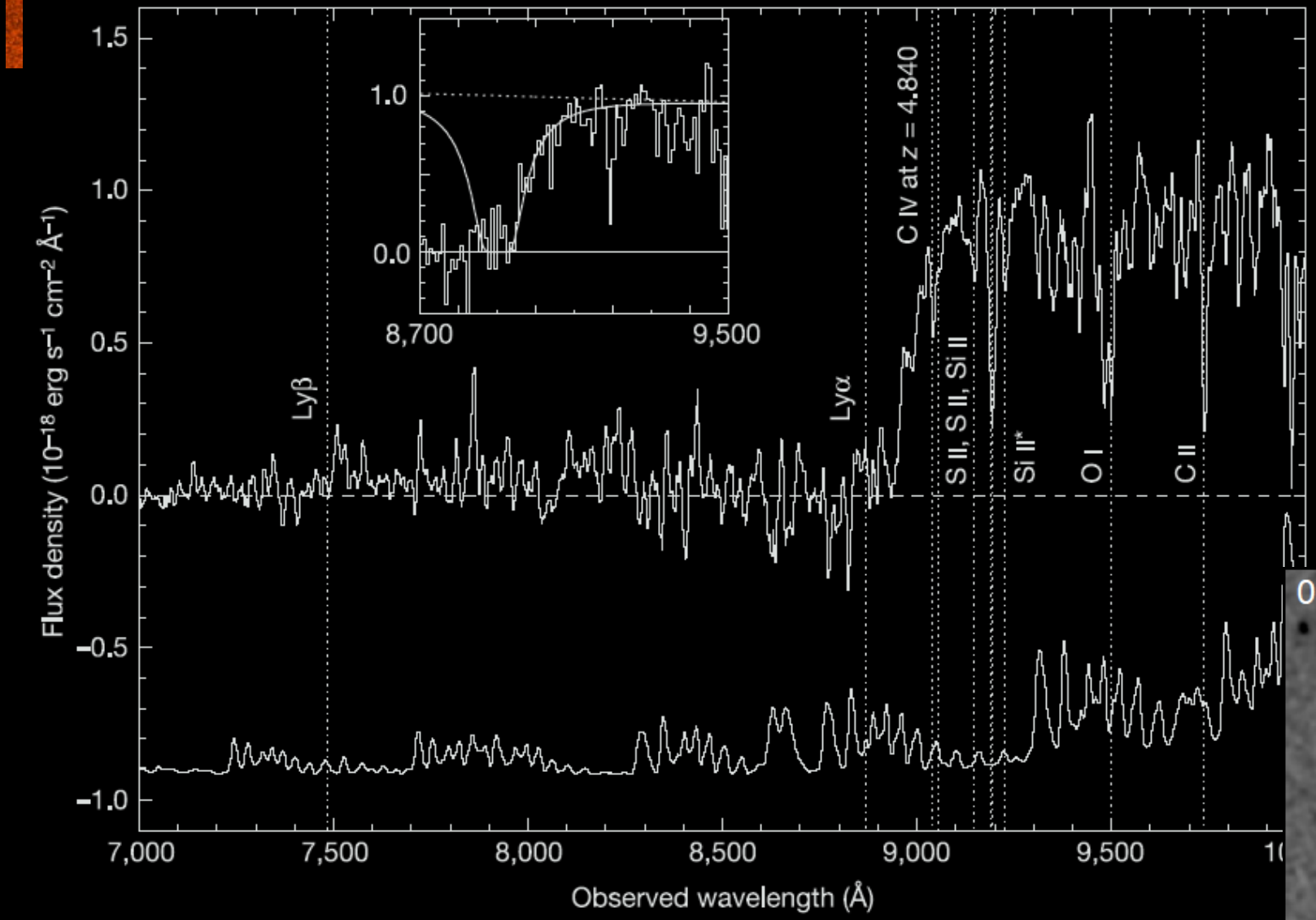
Extremely Luminous Transients





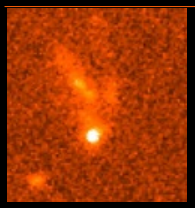
GRBs as Probes

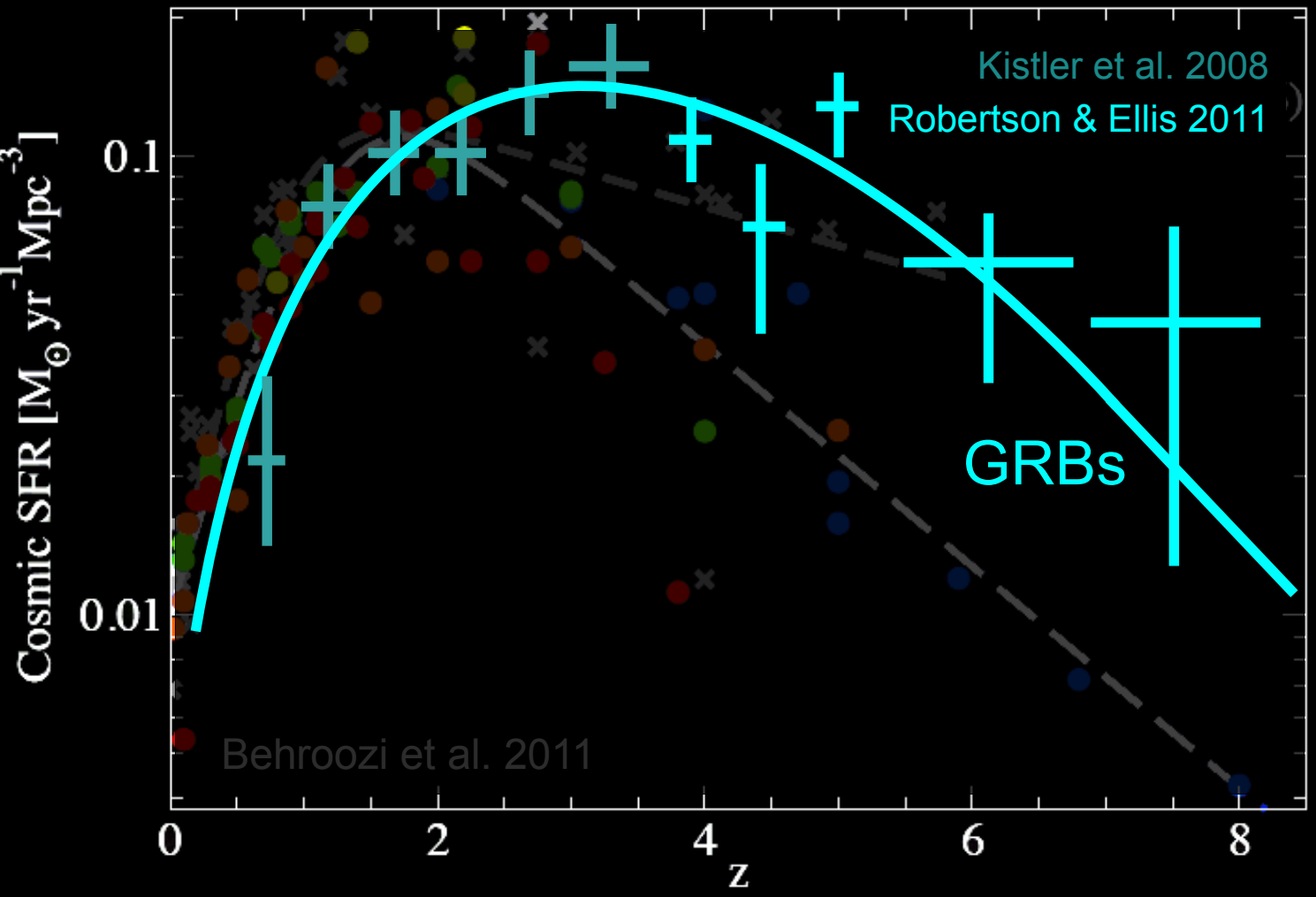
GRB 050904 (z=6.295)



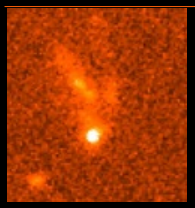
Kawai+2006

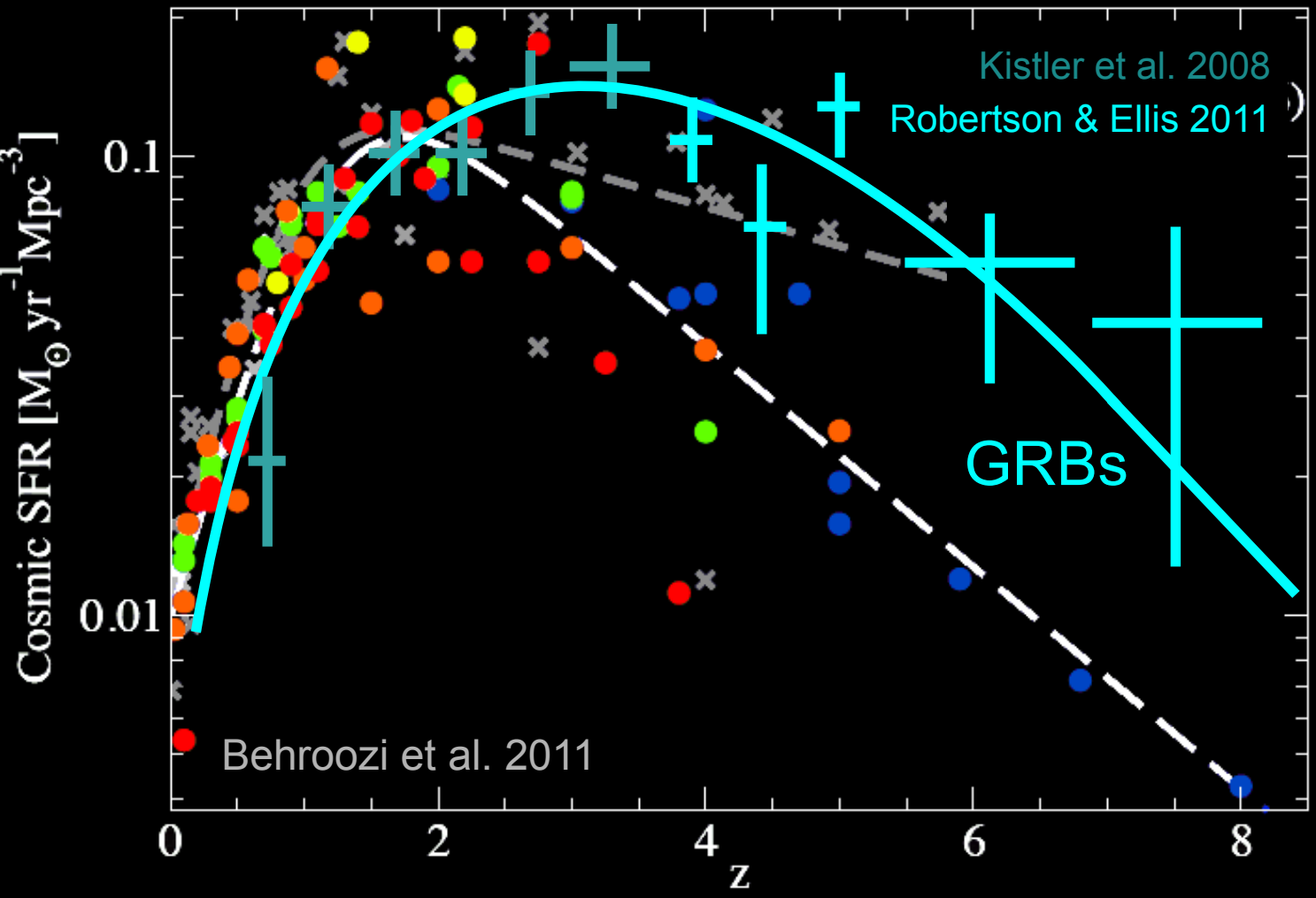
GRB Populations as SFR Tracers





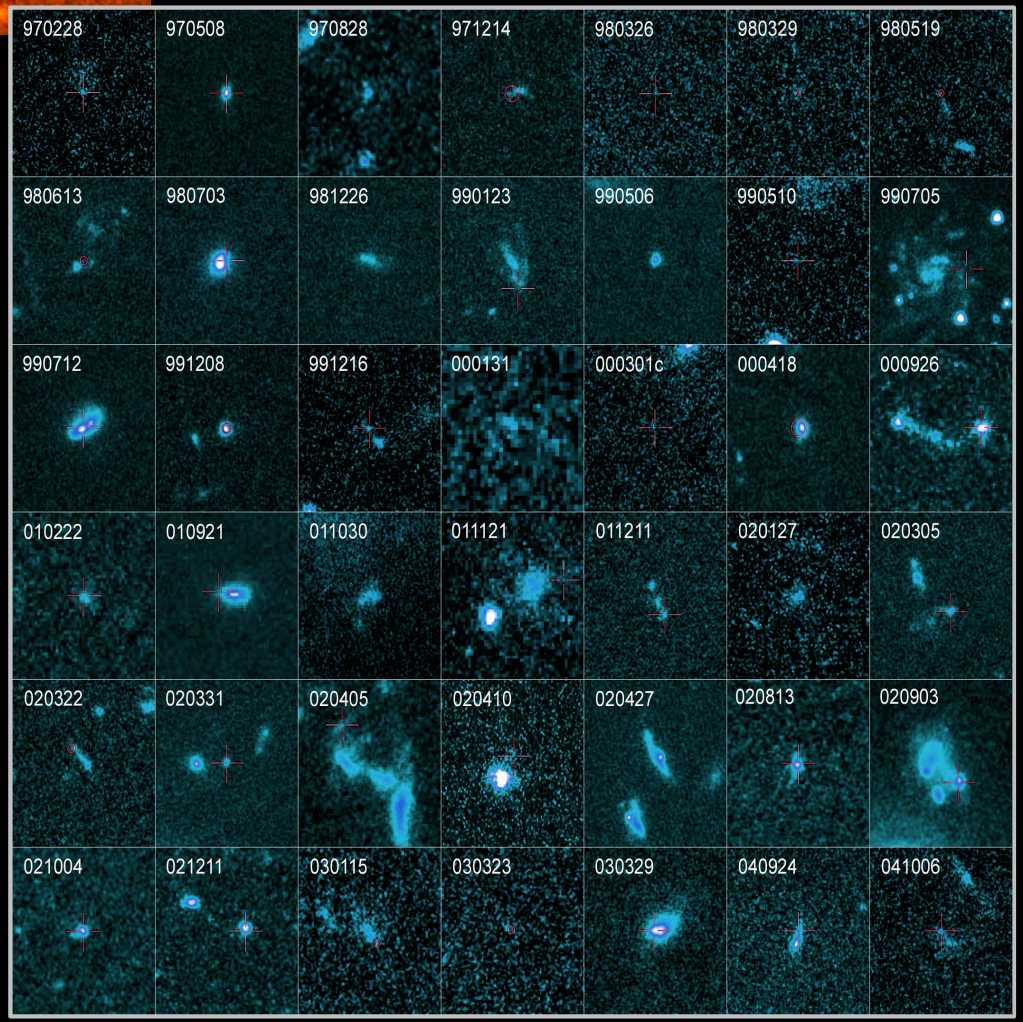
GRB Populations as SFR Tracers



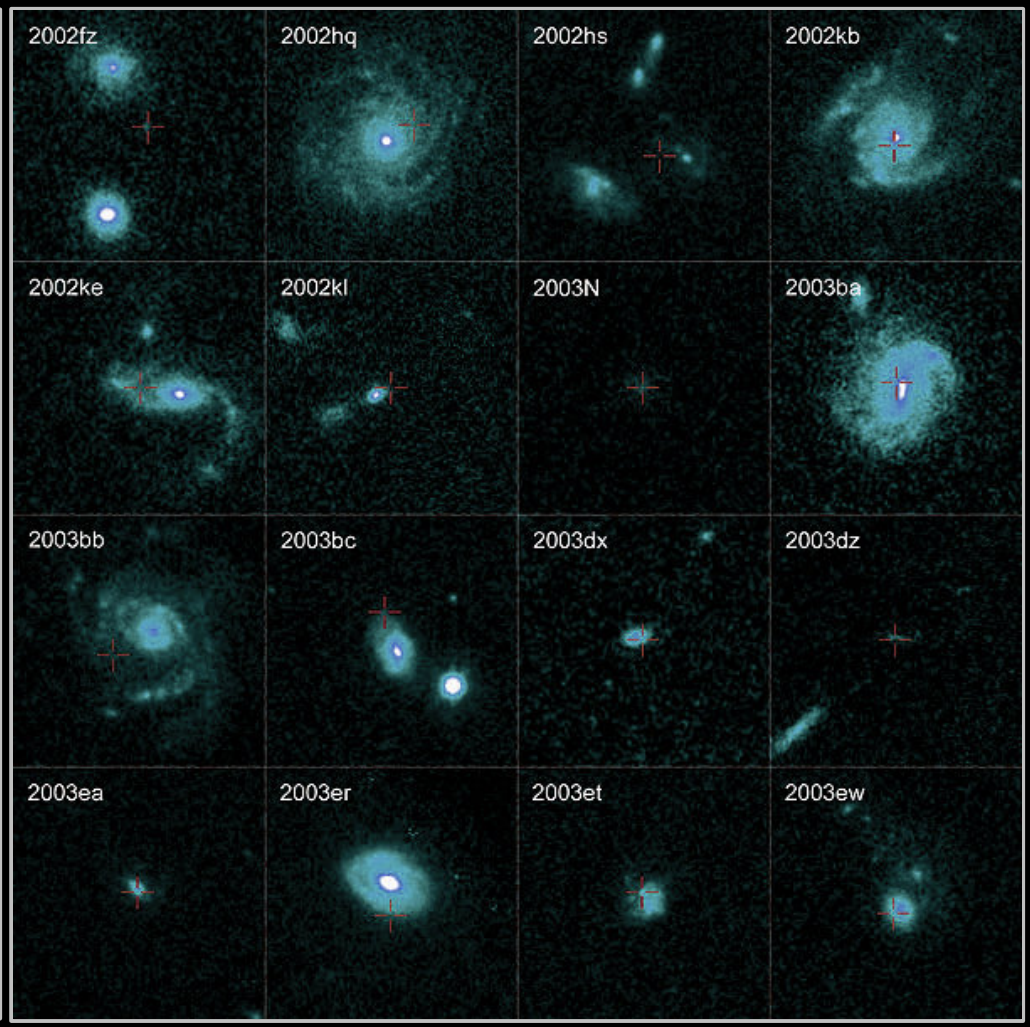


GRB hosts vs. SN hosts

GRB host galaxies (irregular, young)

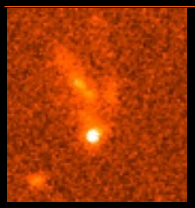


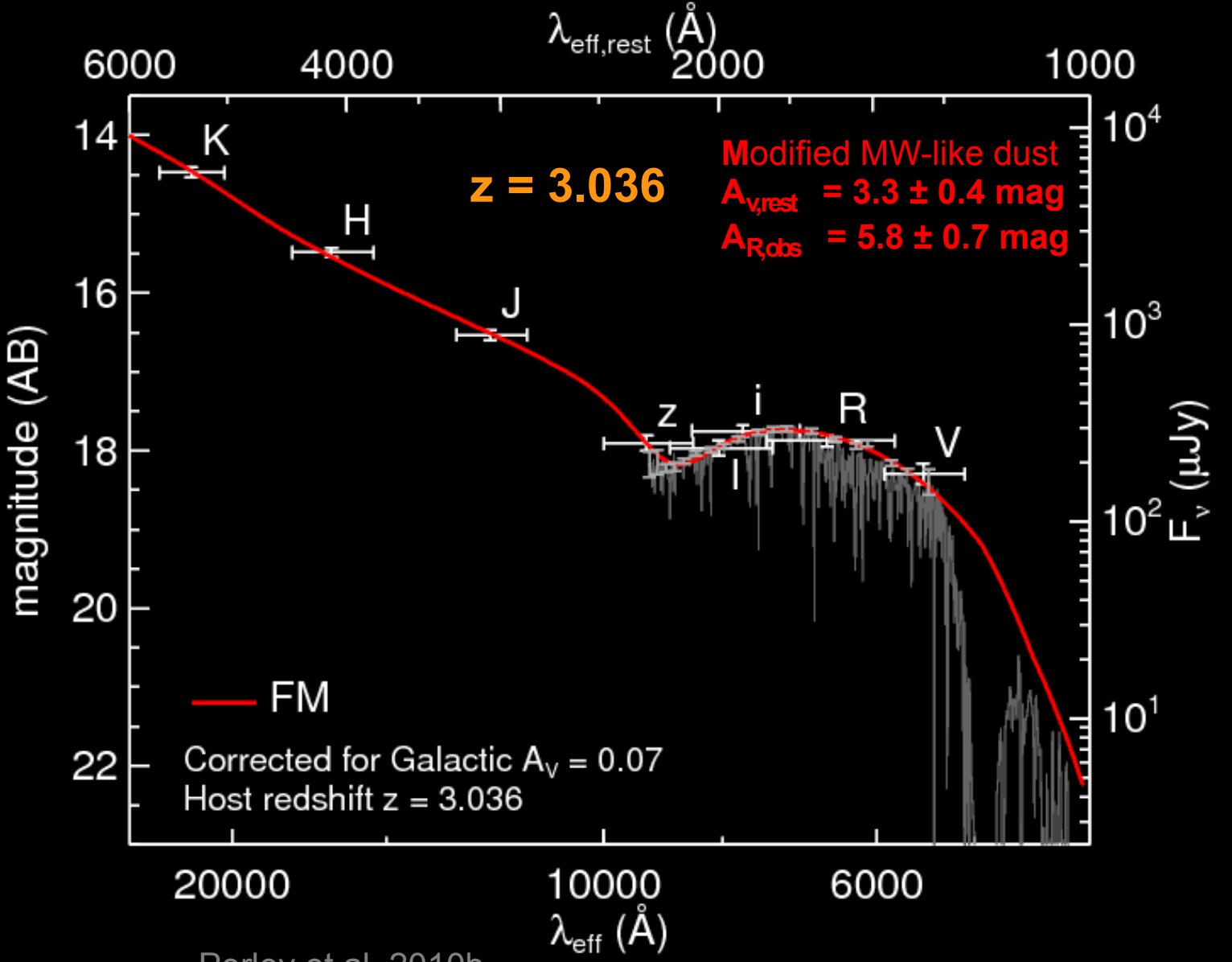
SN host galaxies (spiral, mature)



Fruchter+ 2006

Heavily Obscured GRB 080607





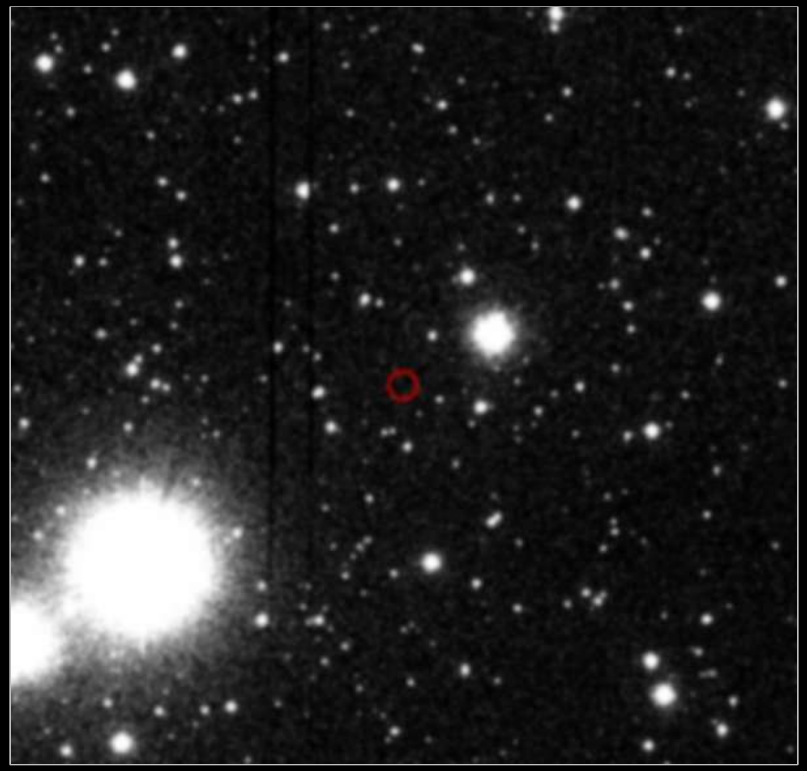
Perley et al. 2010b

Dark GRBs

~25% of GRBs are **dark**:
No optical afterglow,
even with early follow-up. ⟶

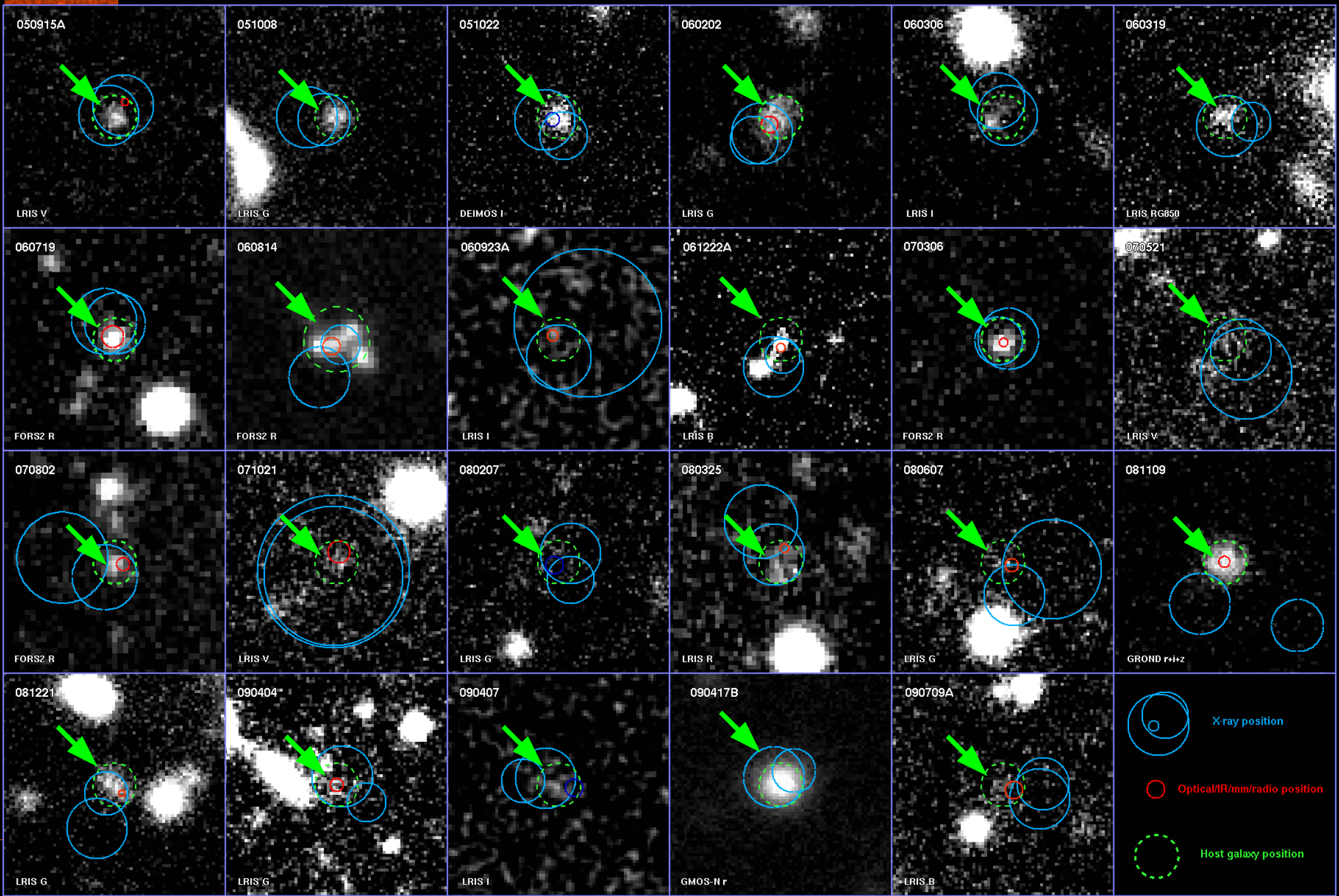
• Can't identify host without X-ray or radio follow-up.

• Can't measure redshift without large ground-based telescopes.



Palomar 60-inch follow-up of GRB 061222A
~10 minutes after burst

Hosts of Dust-Obscured GRBs



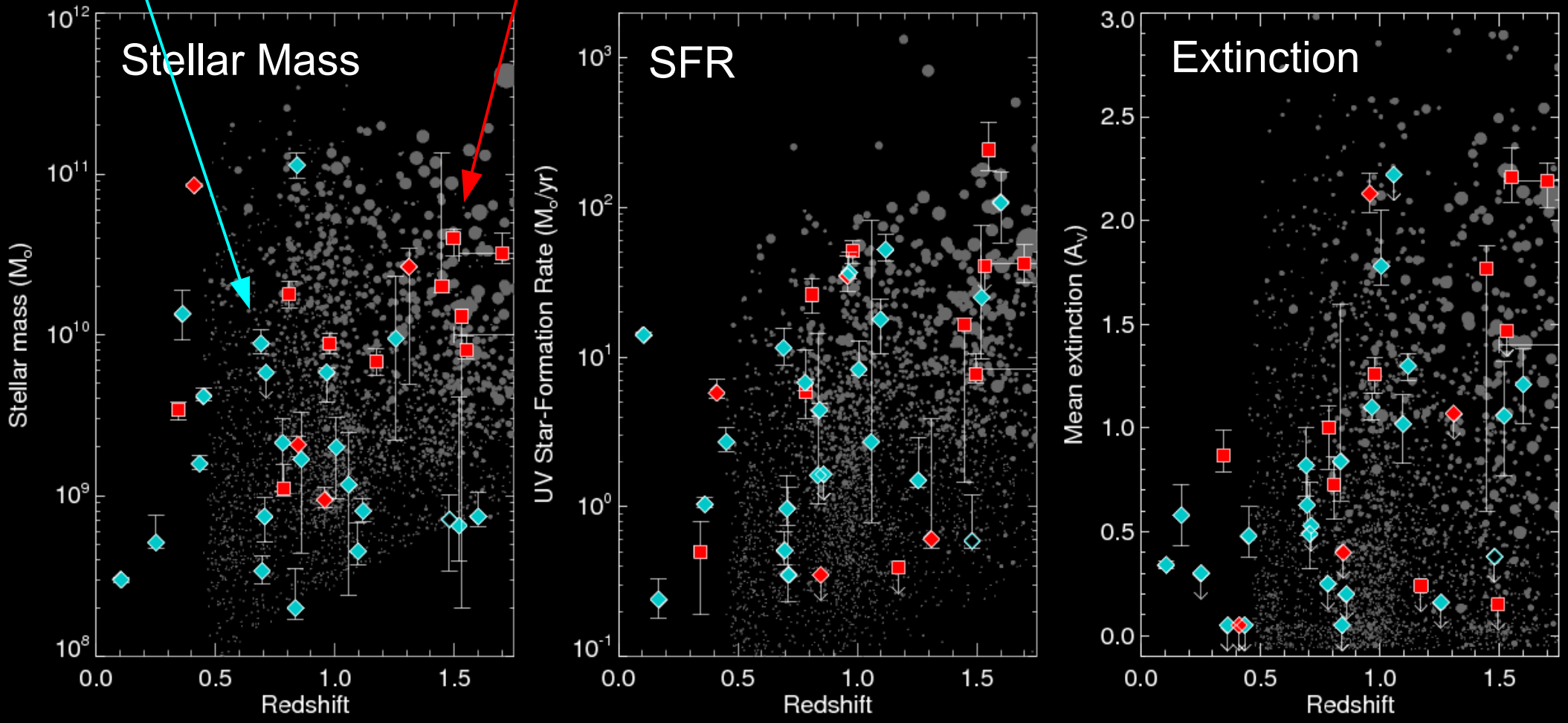
GRB hosts vs. Field Galaxies

GRBs sample “all” types of star-forming galaxies, and dusty GRBs prefer dustier, more massive, more star-forming hosts...

“ordinary” mildly obscured GRBs

heavily obscured GRBs

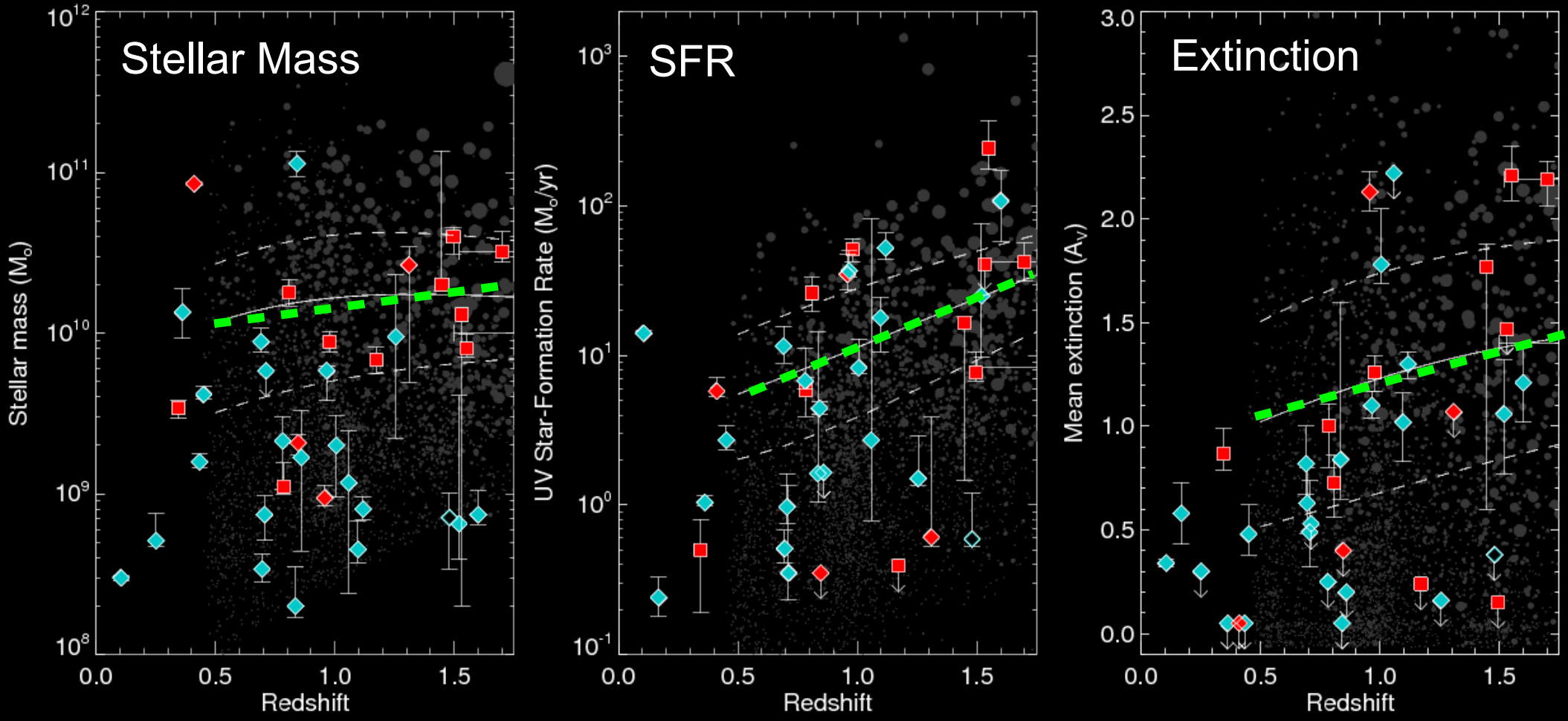
Grey points: K-selected field galaxies (Kajisawa et al. 2011)



GRB hosts vs. Field Galaxies

GRBs overall still strongly trend towards low-mass, low-dust, high-sSFR systems.

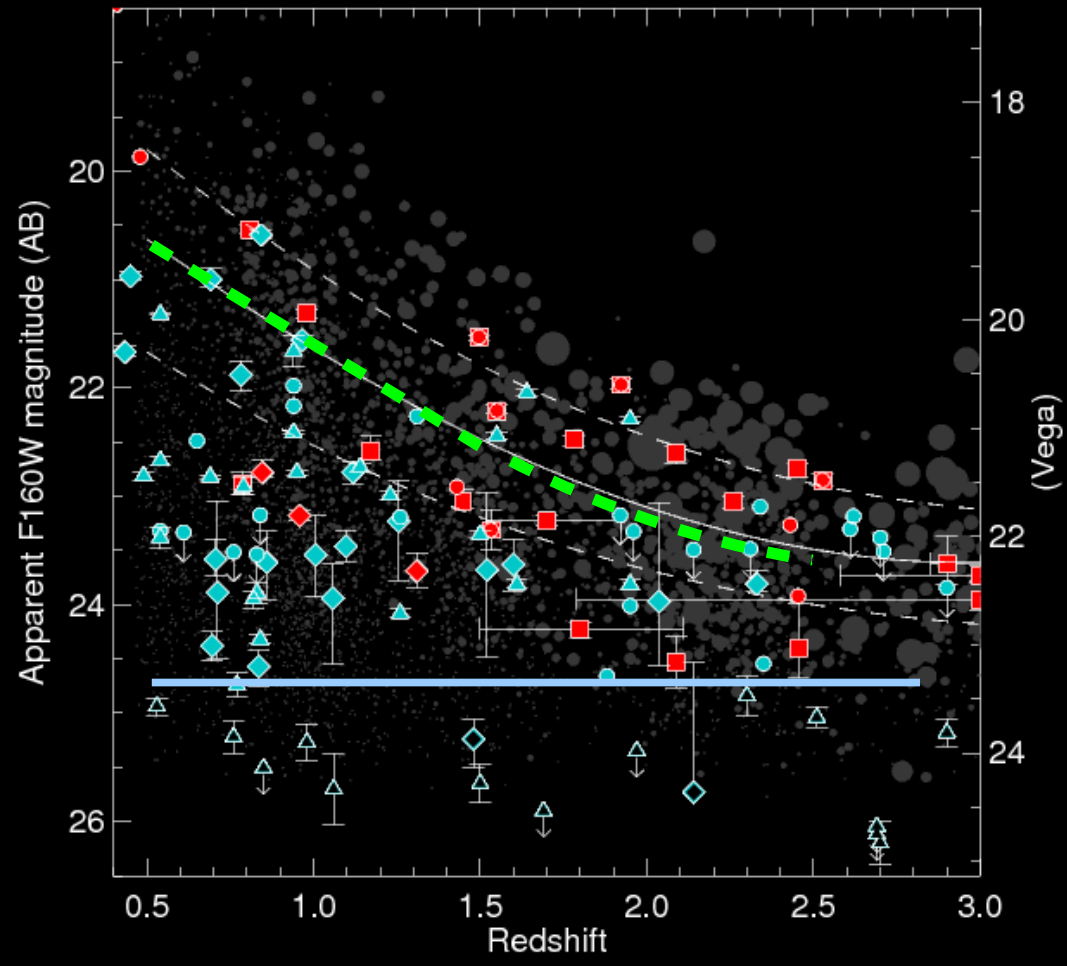
expected population median as a function of redshift for a uniform SFR-tracer

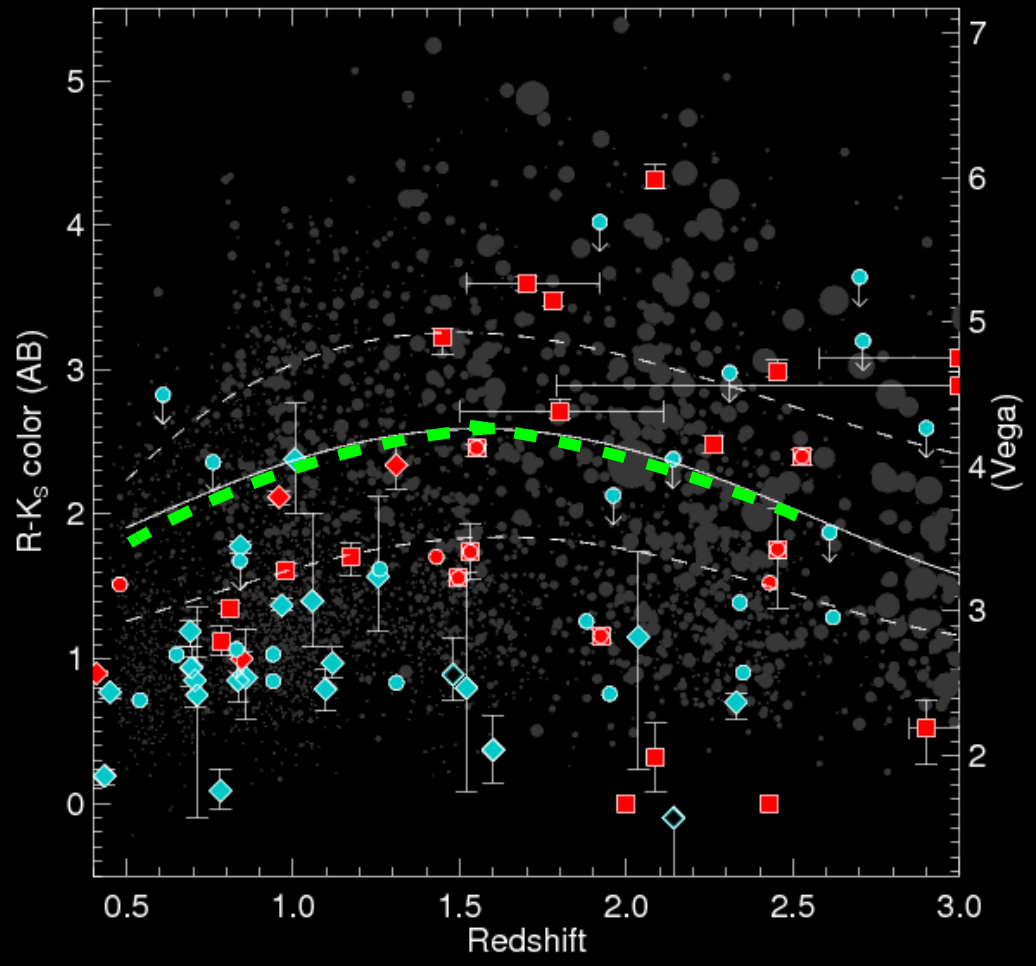


Moving to Higher Redshifts

Improvement at higher redshifts, but a preference for the faintest and bluest galaxies persists.

(Consistent with metallicity evolution?)





Other Interests...

Understanding the deviation: metallicity or something else?
- Constraints on the progenitor?
- Can we correct GRB rates → SFR calibrations?

Effects of *types* of dust. (Origin of 2175 Angstrom absorption feature?)

Multiwavelength view: abundance of submillimeter hosts

Links to other extreme transients (luminous SNe)