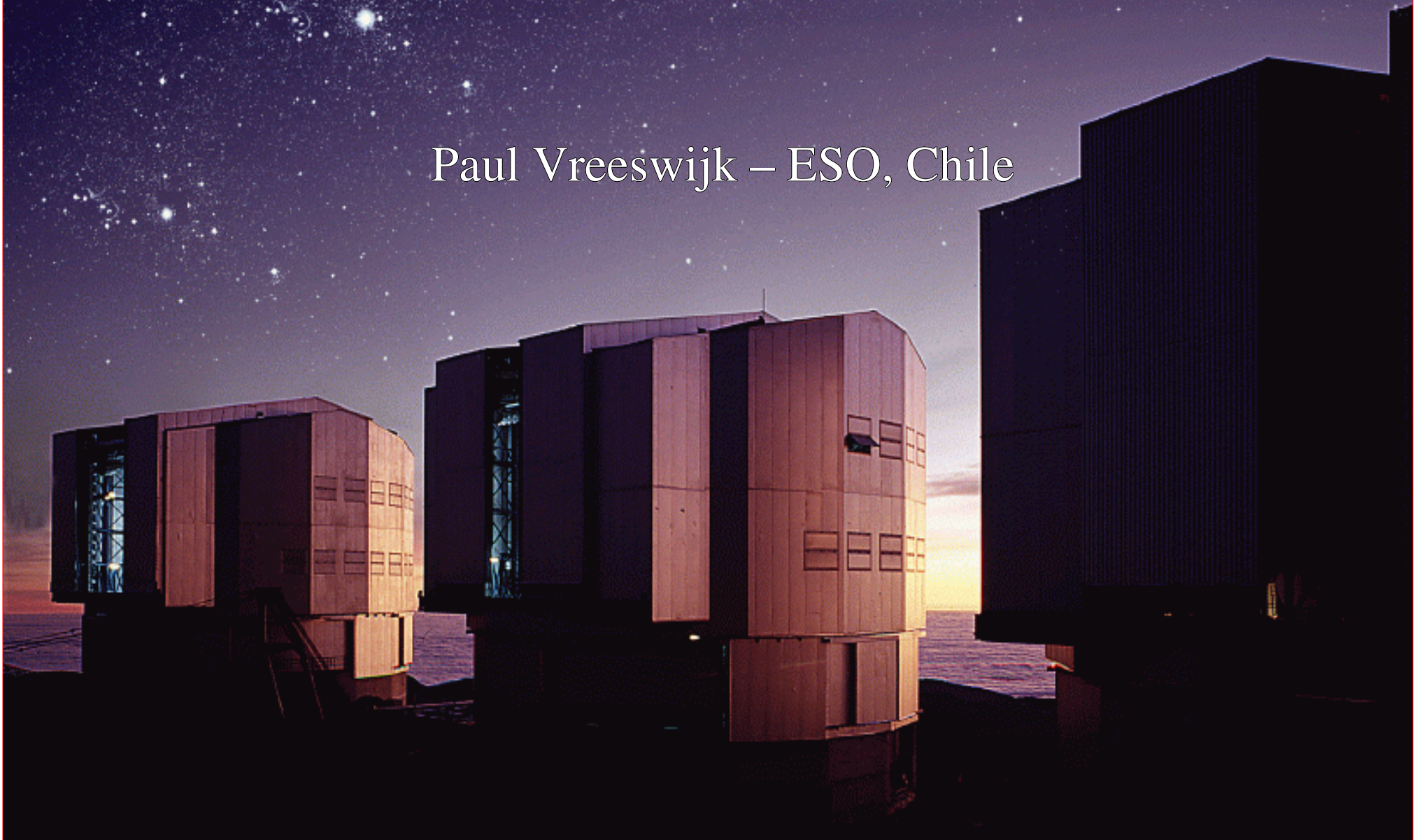
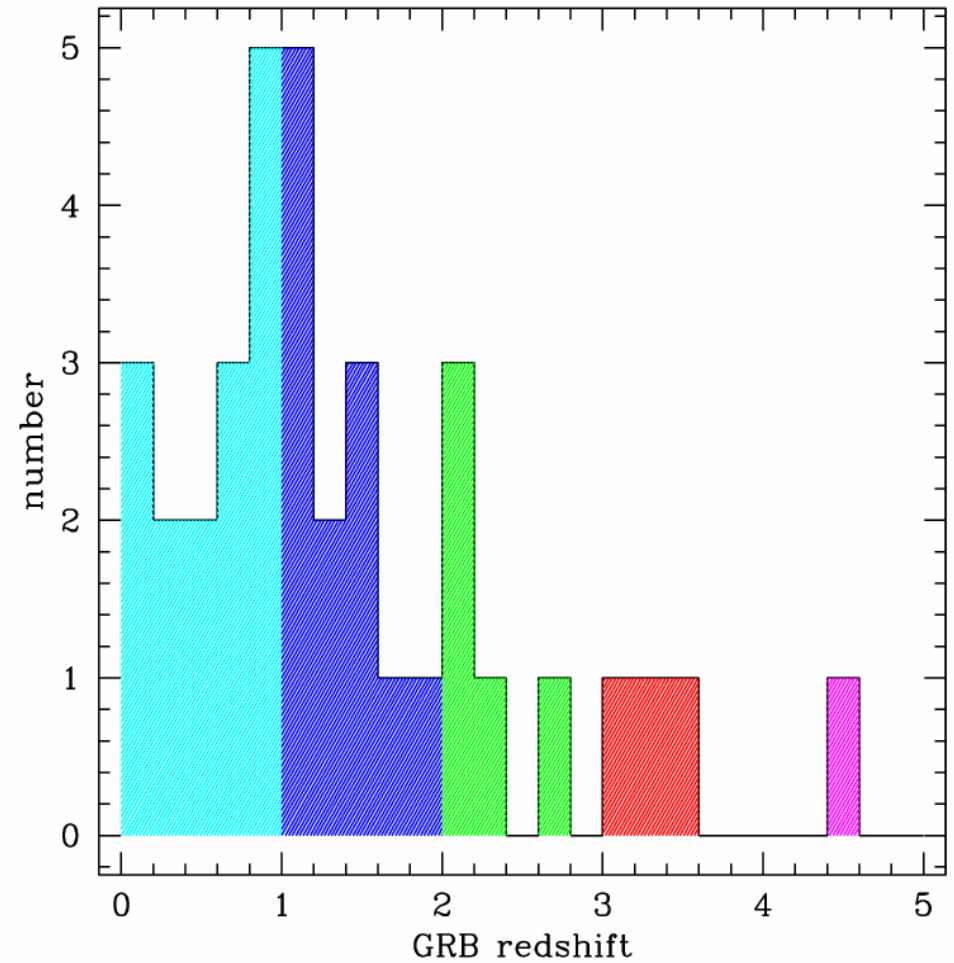
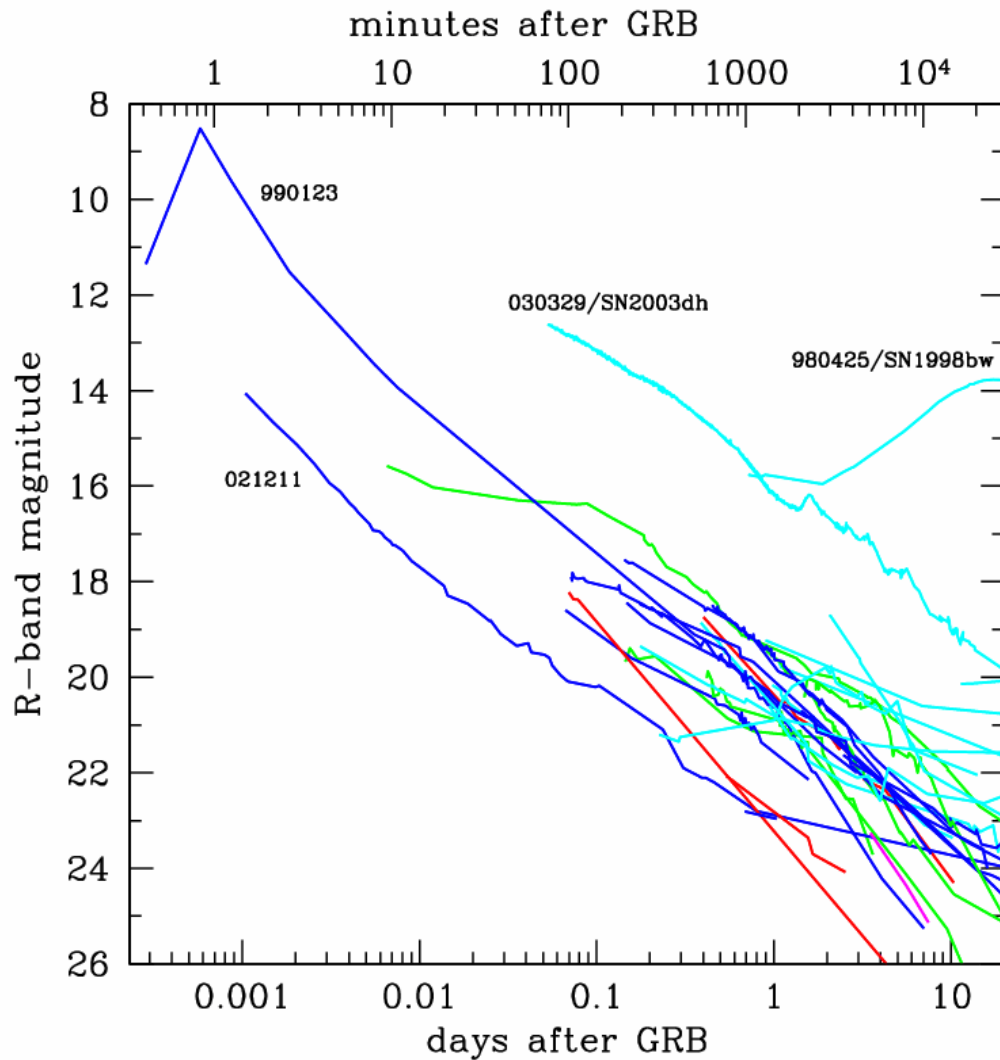


# DLA systems in GRB afterglows

Paul Vreeswijk – ESO, Chile



# GRB afterglows: bright and distant



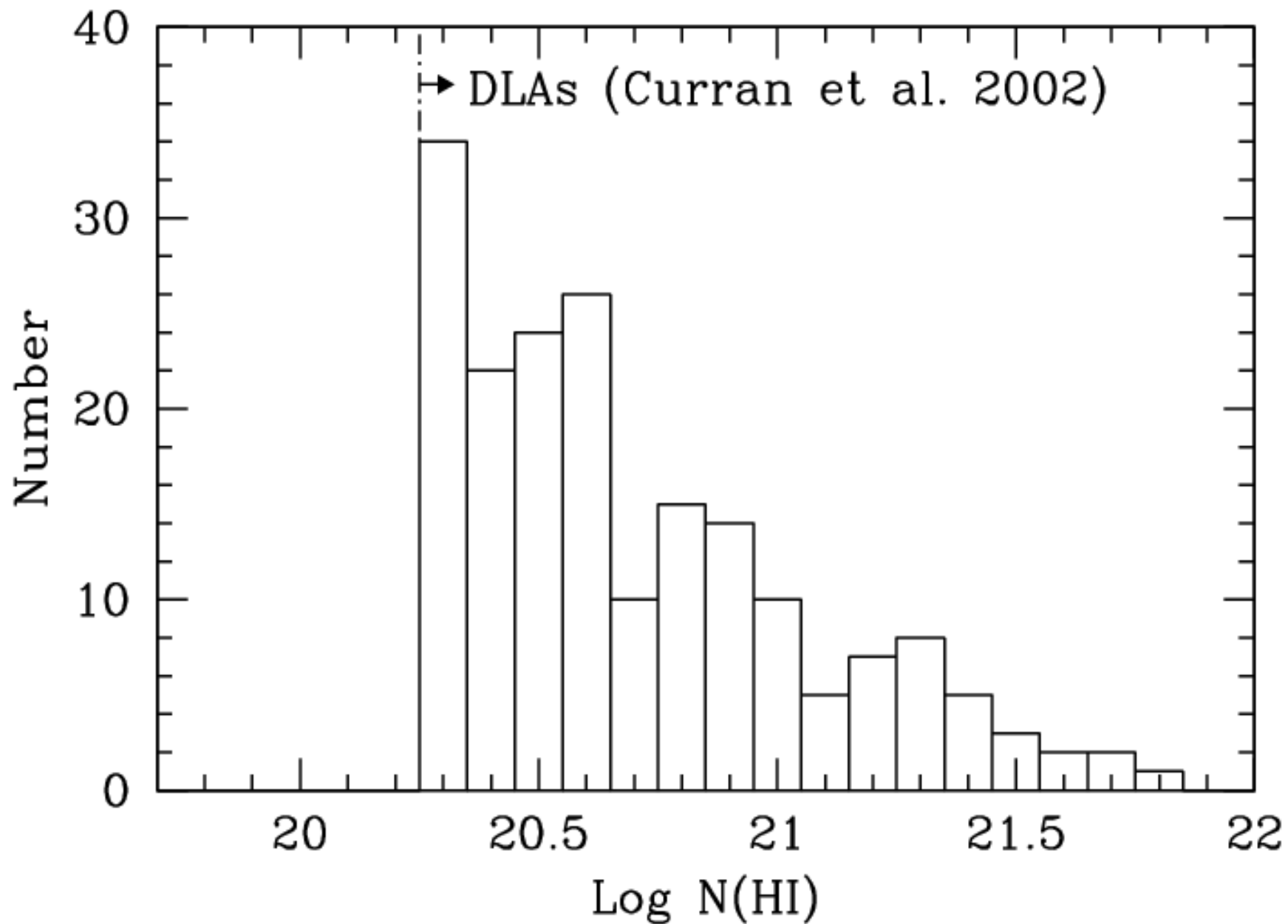
# Differences with QSO absorbers

- ✓ no proximity effect → probe host galaxy
- ✓ GRBs explode in star-forming regions
- ✓ afterglow brightness fades rapidly:
  - difficult to obtain a good spectrum
  - but afterwards clear view of the sight line

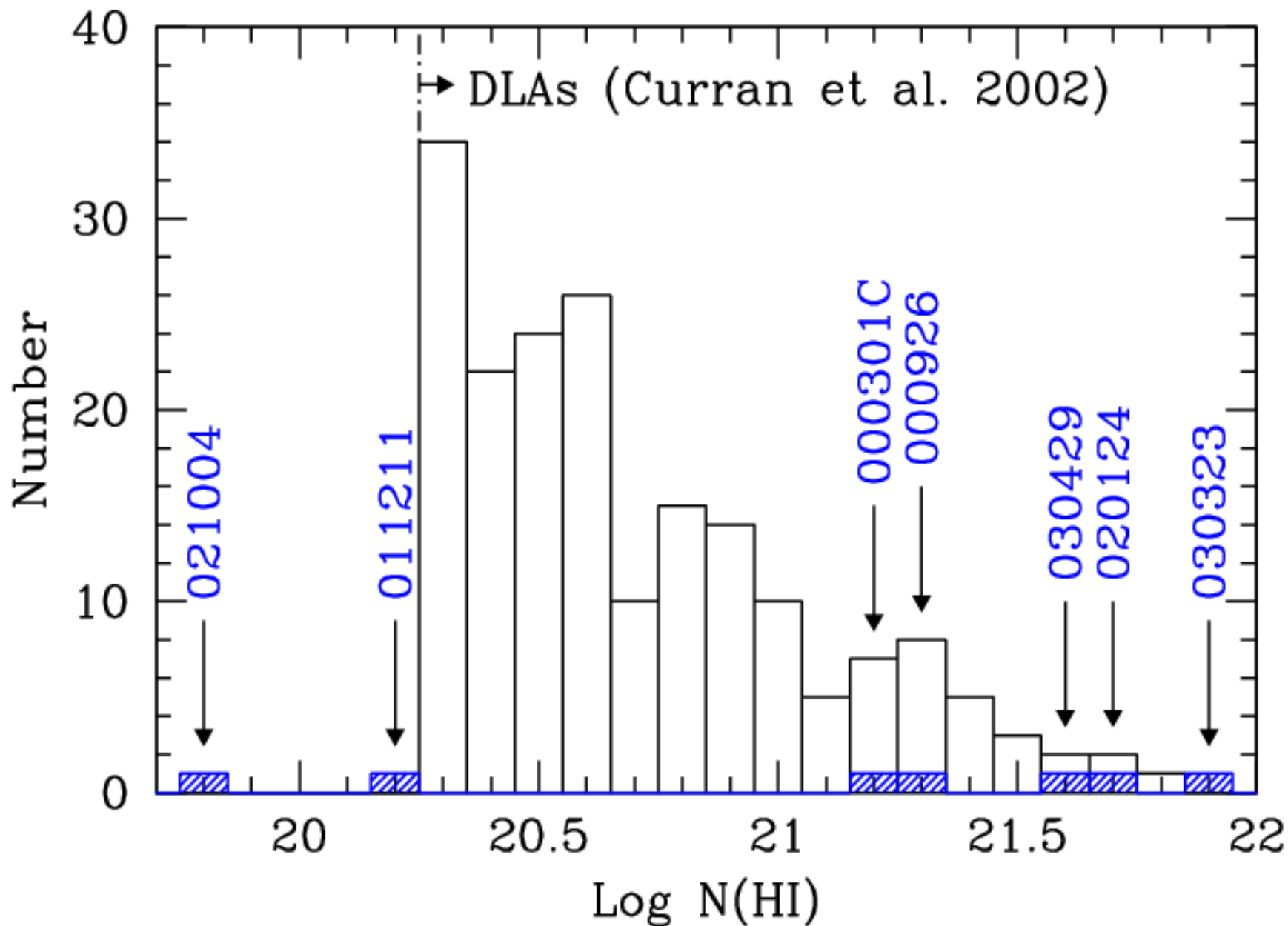
**GRB 030323: low-resolution example  
of probe of host-galaxy ISM**



# HI columns QSO-DLAs

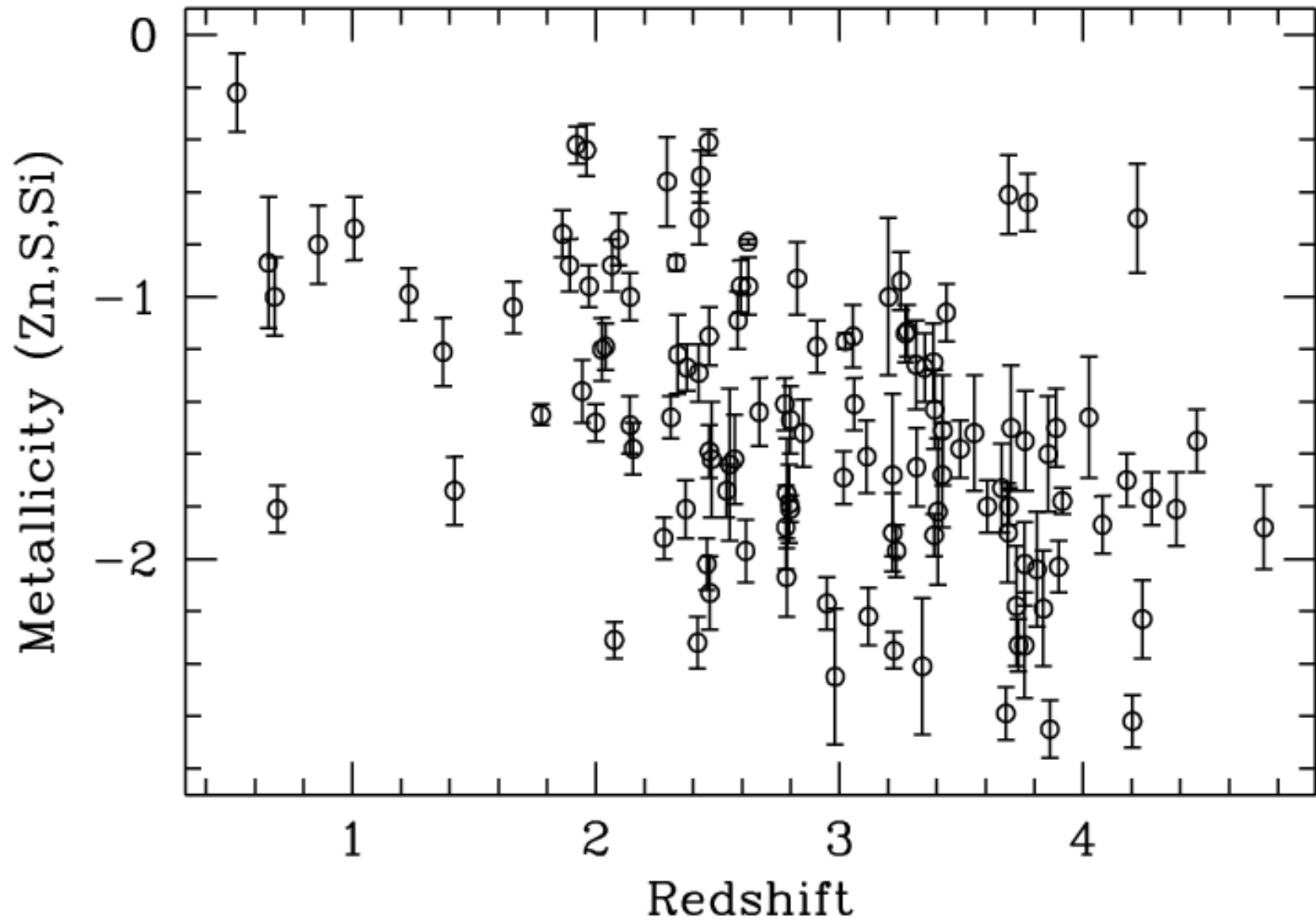


# HI columns QSO-DLAs and GRB-DLAs



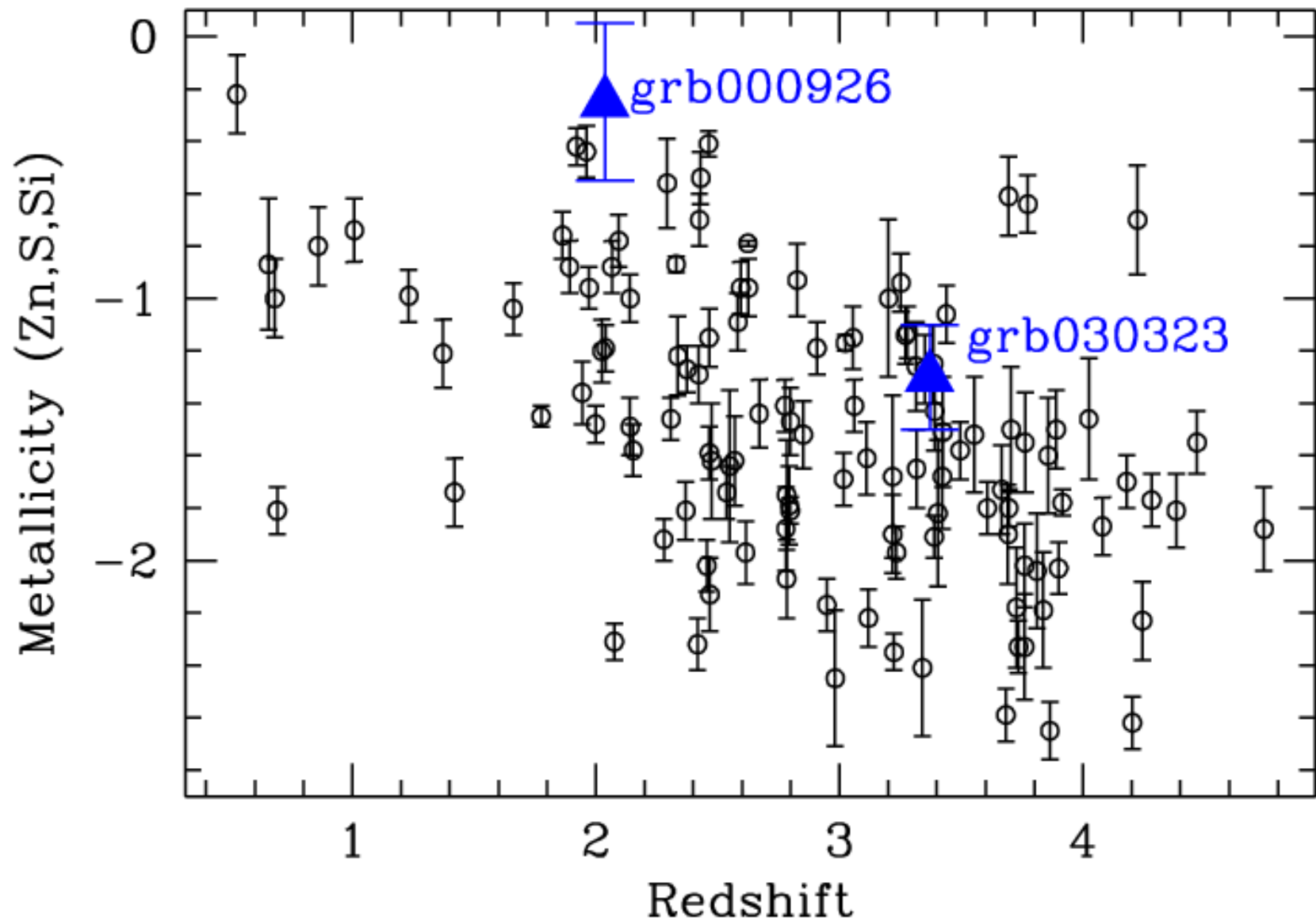
# metallicity QSO-DLAs

Prochaska, Gawiser, Wolfe et al. (2003)



# metallicity QSO-DLAs and GRB-DLAs

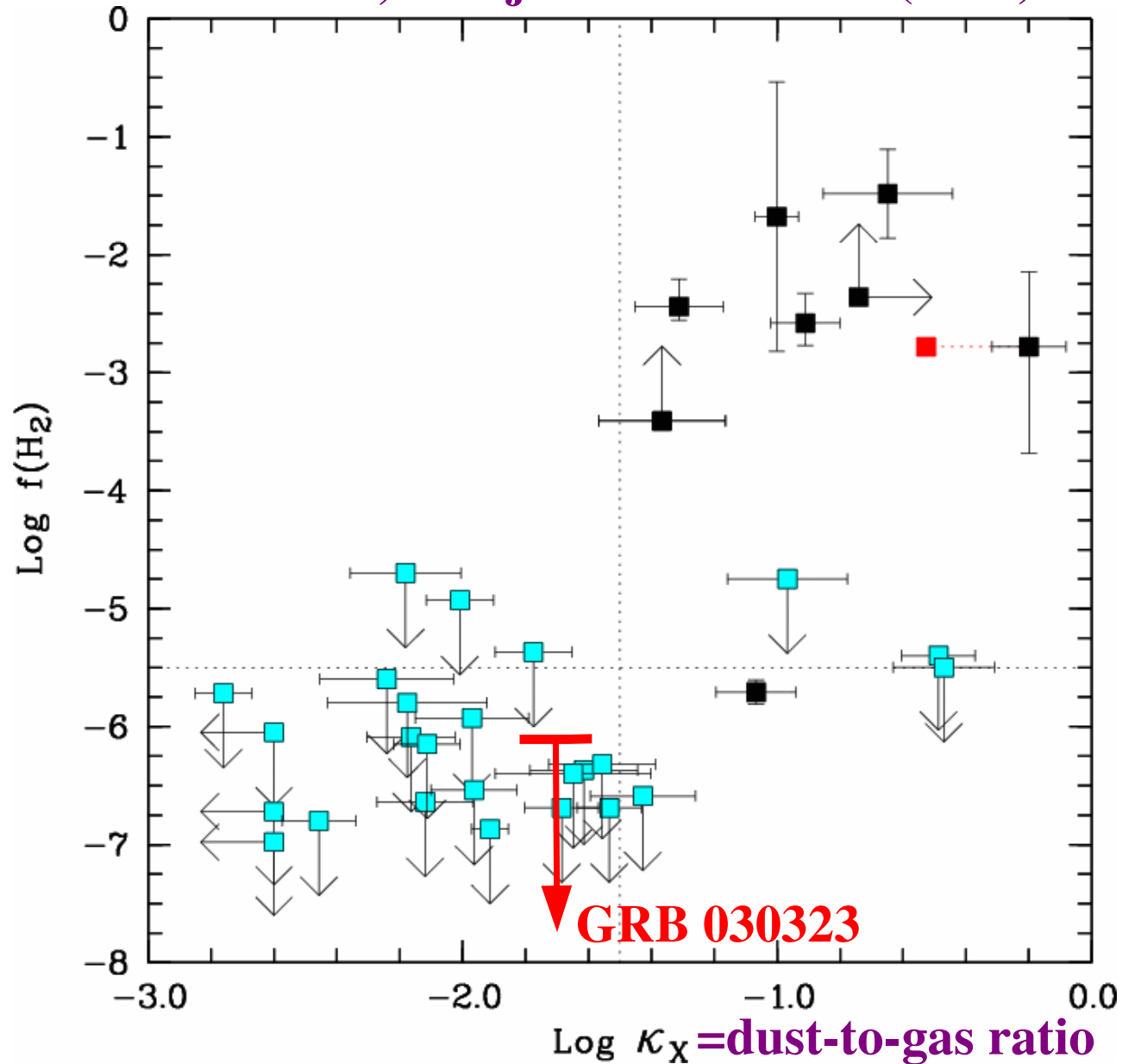
Prochaska, Gawiser, Wolfe et al. (2003)





# H<sub>2</sub> content in QSO-DLAs

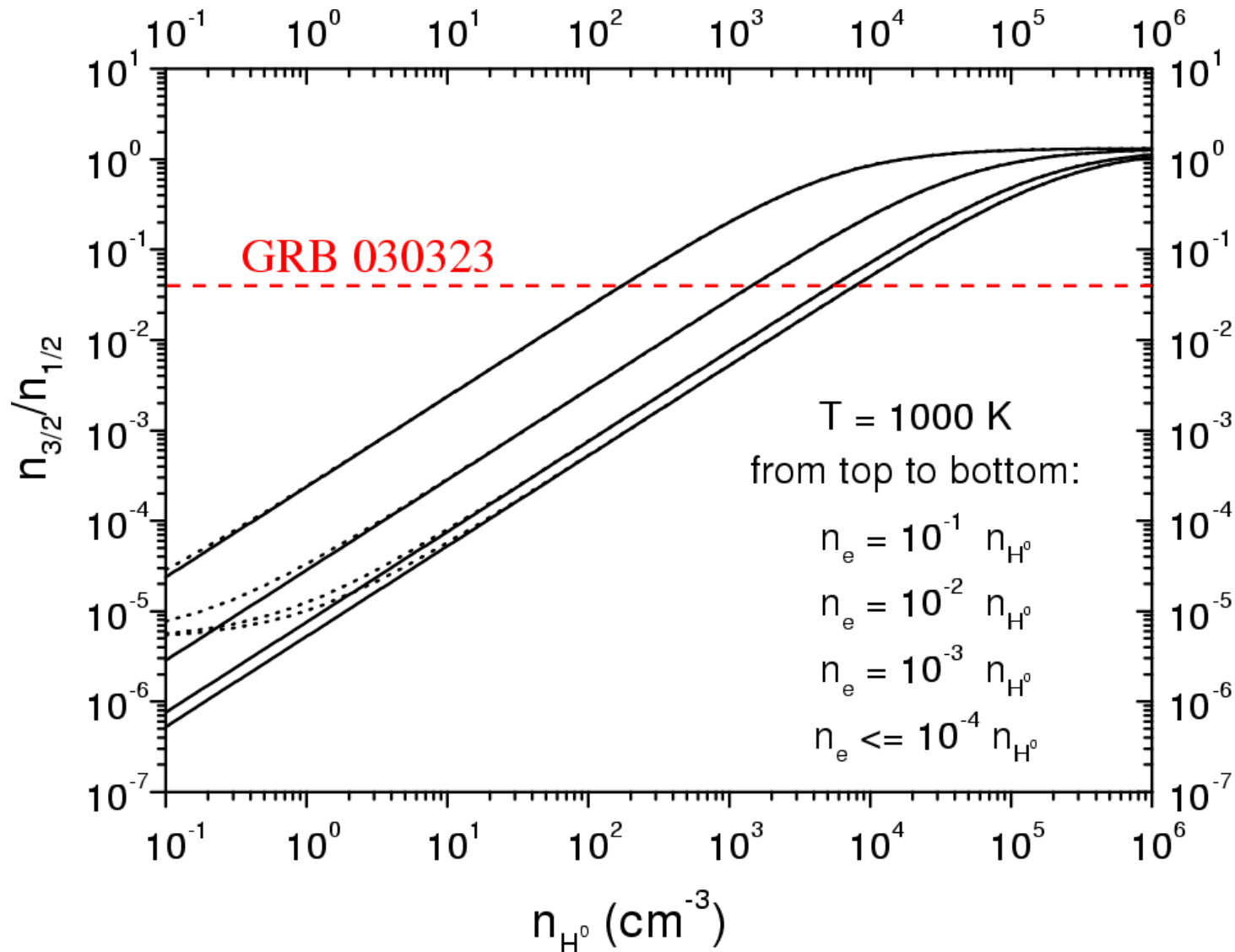
Ledoux, Petitjean & Srianand (2003)





# SiII\* in GRB 030323: $n_{\text{HI}} = 10^2 - 10^4 \text{ cm}^{-3}$ ?

Silva & Viegas (2002)



# GRB 030323 ISM properties

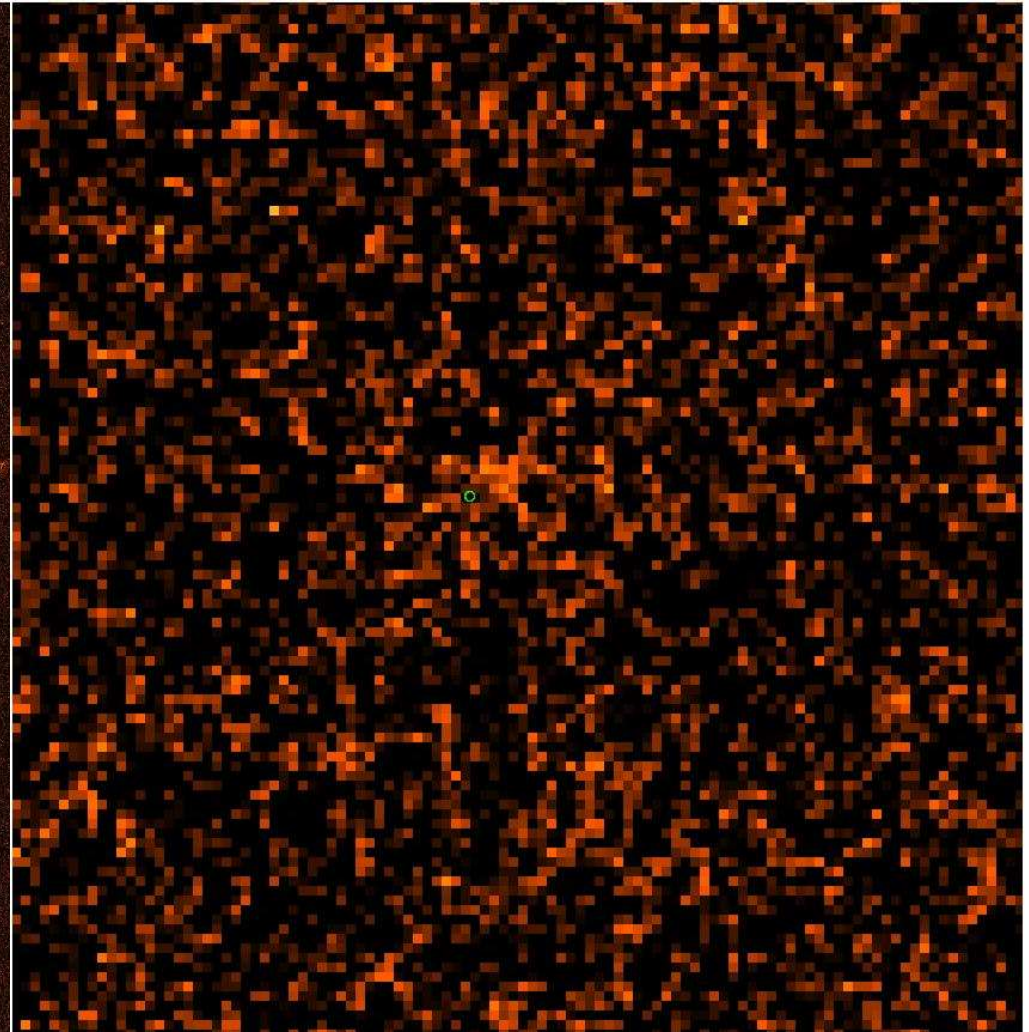
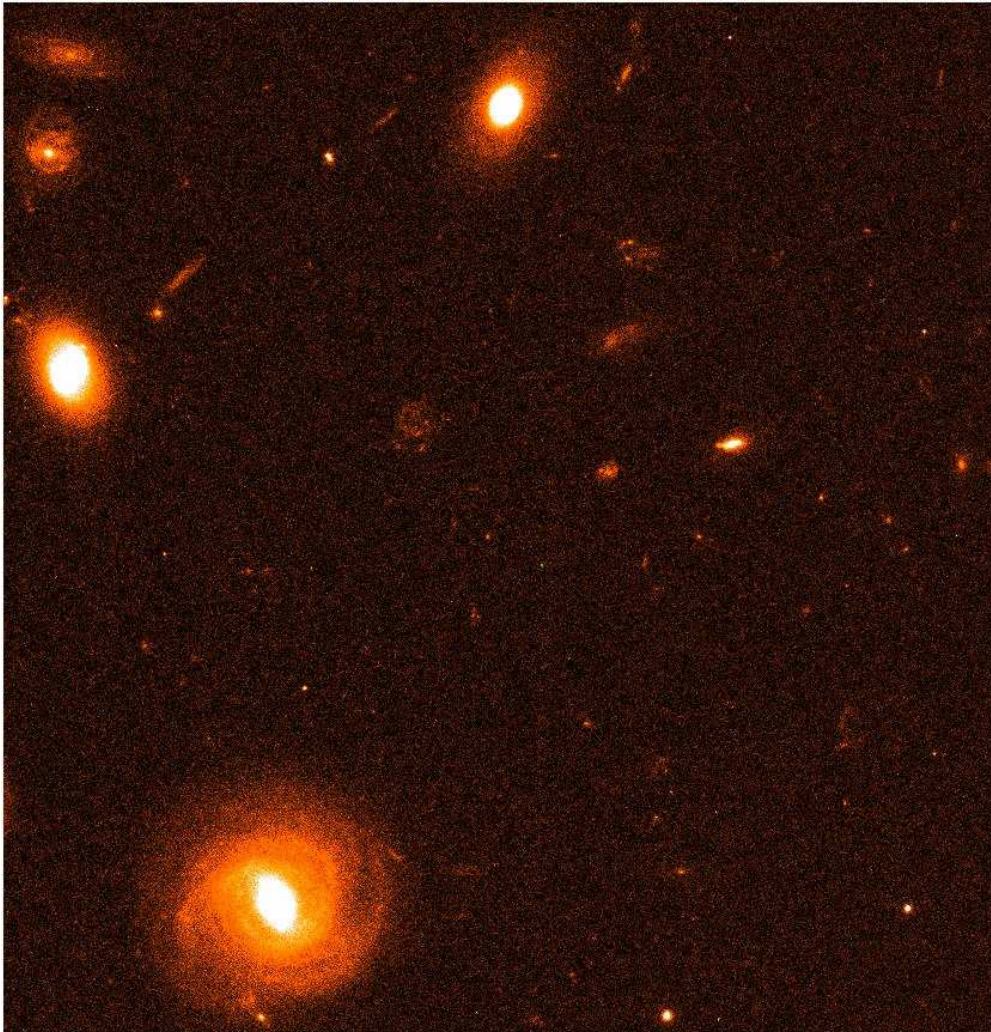
- ✓  $\log N(\text{HI}) = 21.9 \pm 0.07$
- ✓ Ly $\alpha$  emission: SFR  $\sim 1 \text{ Msun/yr}$
- ✓ from lightcurve:  $A(V) < 0.5 \text{ mag}$
- ✓  $[\text{Fe}/\text{H}] = -1.5 \pm 0.1$ ;  $[\text{S}/\text{H}] = -1.3 \pm 0.2$
- ✓  $\text{H}_2$  fraction:  $2N(\text{H}_2) / \{2N(\text{H}_2) + N(\text{HI})\} \leq 10^{-6}$
- ✓ SiII\* detected  $\rightarrow n_{\text{HI}} \sim 1000 \text{ cm}^{-3}$  ?

# GRB 030323 HST imaging

50"×50"

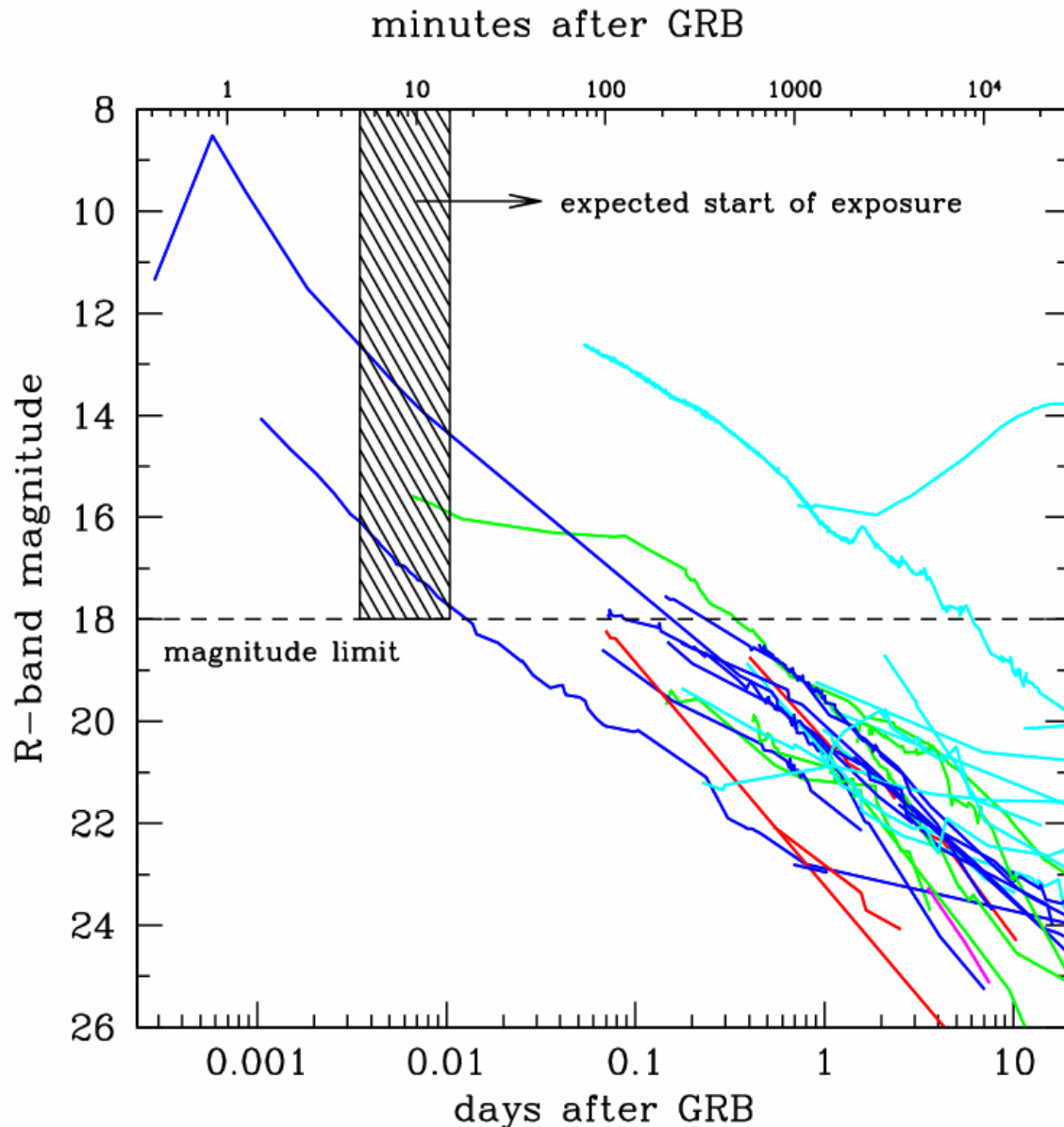
GOSH collaboration (Fruchter et al.)

3"×3"



# GRB afterglow UVES-RRM survey

(Vreeswijk, Ellison, Jaunsen, Ledoux, Smette, Fynbo, Møller, Kaufer, Andersen, Hjorth, Wijers)



- ✓ Swift localizations
- ✓ with Rapid-Response Mode (RRM) at VLT

# Swift satellite

- ✓ NASA mission (+UK/Italy)
- ✓ launch: early Nov 2004
- ✓ 100 GRBs per year
- ✓ Gamma-ray: ~4' after 15sec
- ✓ X-ray: ~5" after 3min
- ✓ UV/optical: ~1" after 4min

