



# GRB science: multiwavelength emission and host galaxies

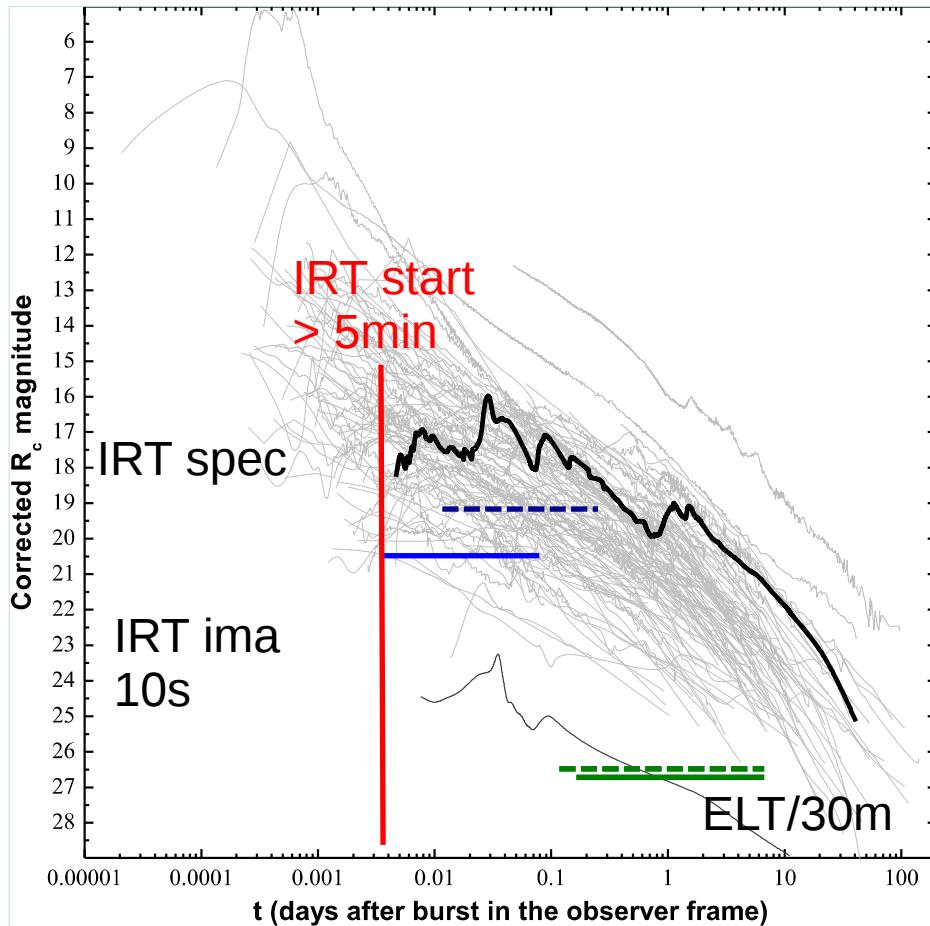
Andrea Rossi a.rossi@iasfbo.inaf.it

Theseus Workshop, October 2017

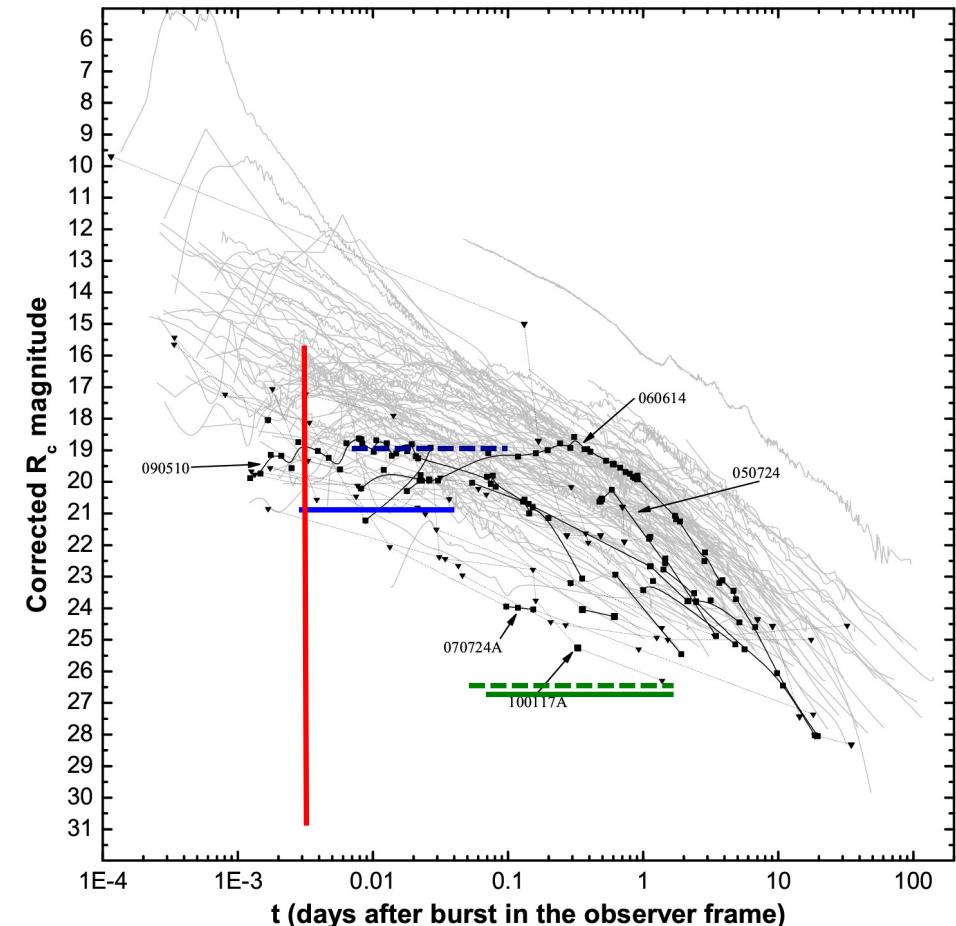
# Outline

- Gamma-X-rays-optical/NIR prompt emission
- Optical/NIR and X-rays afterglows
- GRB Hosts in the 2030s

# GRBs in the optical/NIR

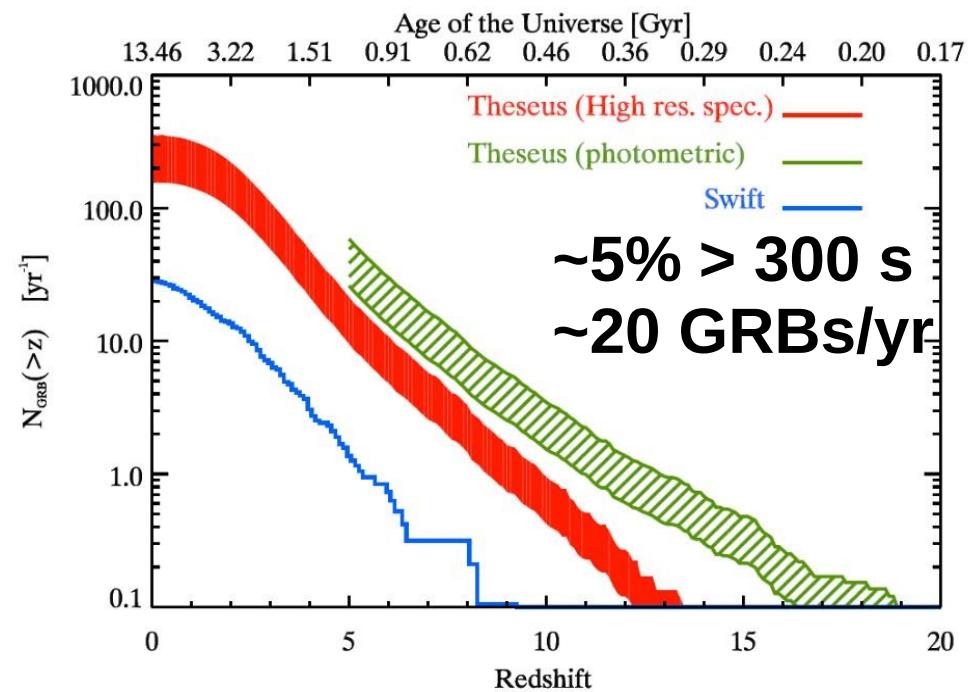
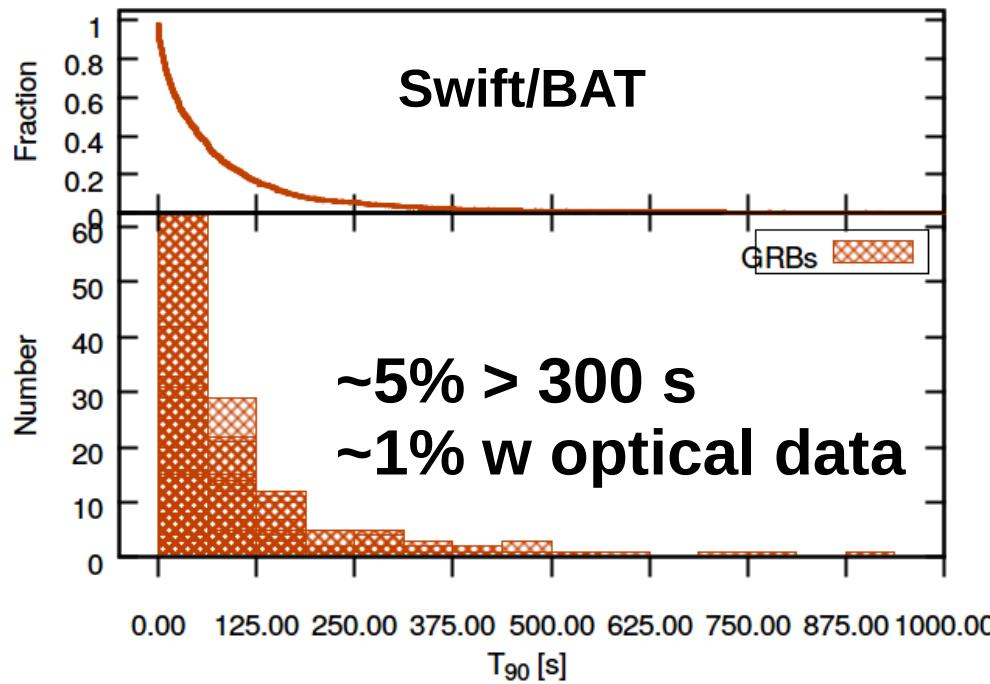


Long GRBs



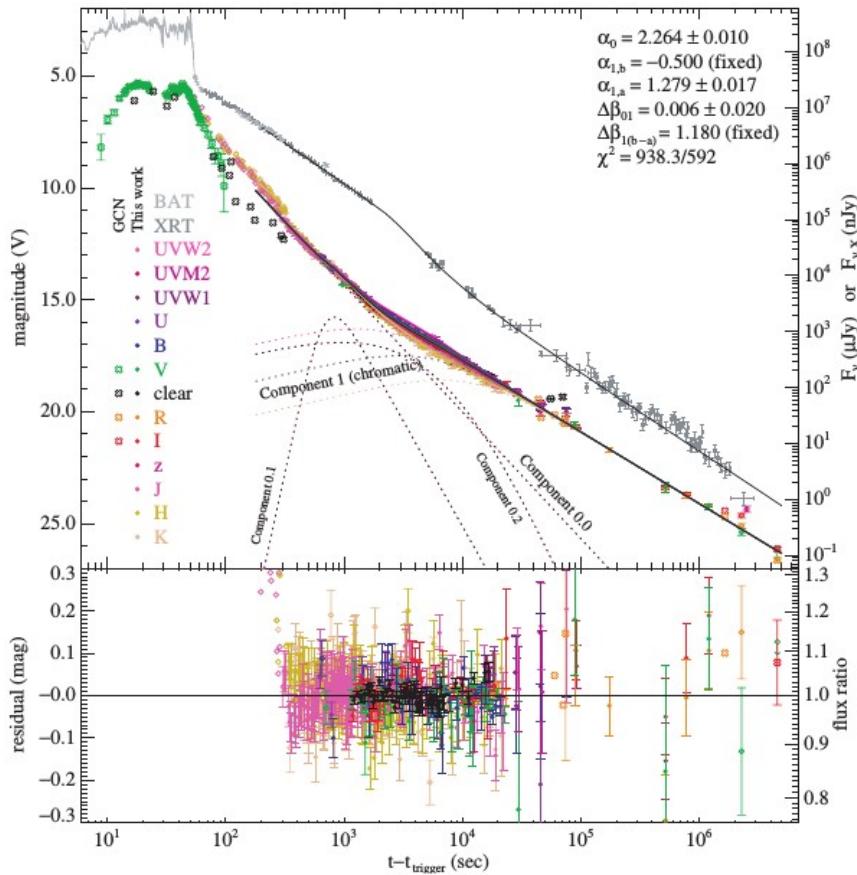
Short GRBs

# GRBs duration > 300 s (no short ones)

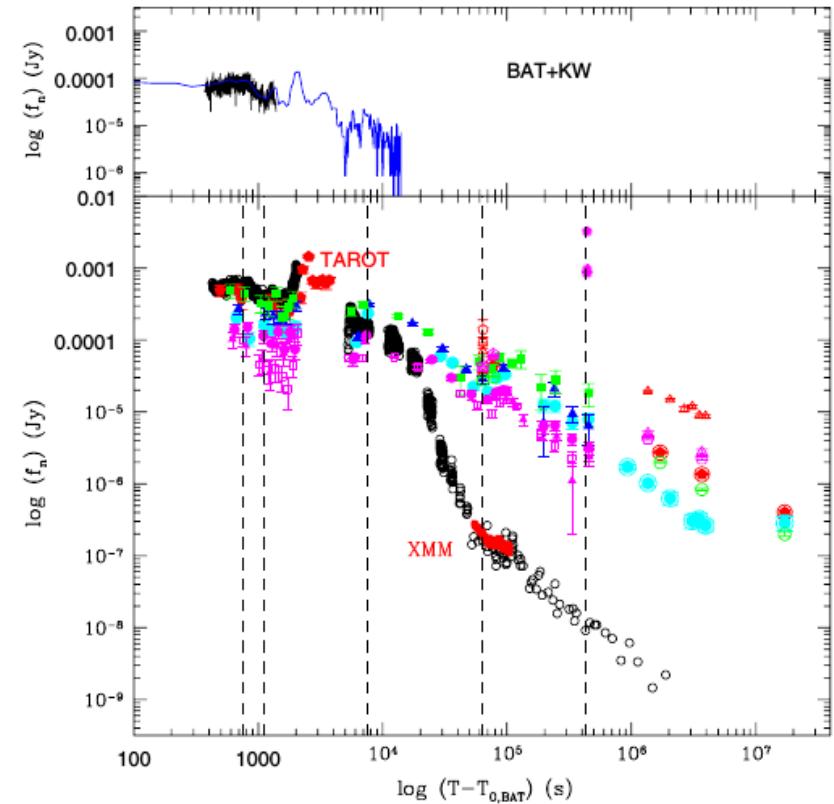


| <b>THESEUS<br/>GRB#/yr</b> | All       | $z > 5$ | $z > 8$ | $z > 10$ |
|----------------------------|-----------|---------|---------|----------|
| Detections                 | 387 - 870 | 25 – 60 | 4 – 10  | 2 - 4    |
| Photometric z              |           | 25 – 60 | 4 – 10  | 2 - 4    |
| Spectroscopic z            | 156 - 350 | 10 - 20 | 1 - 3   | 0.5 - 1  |

# Multi-wavelength prompt emission



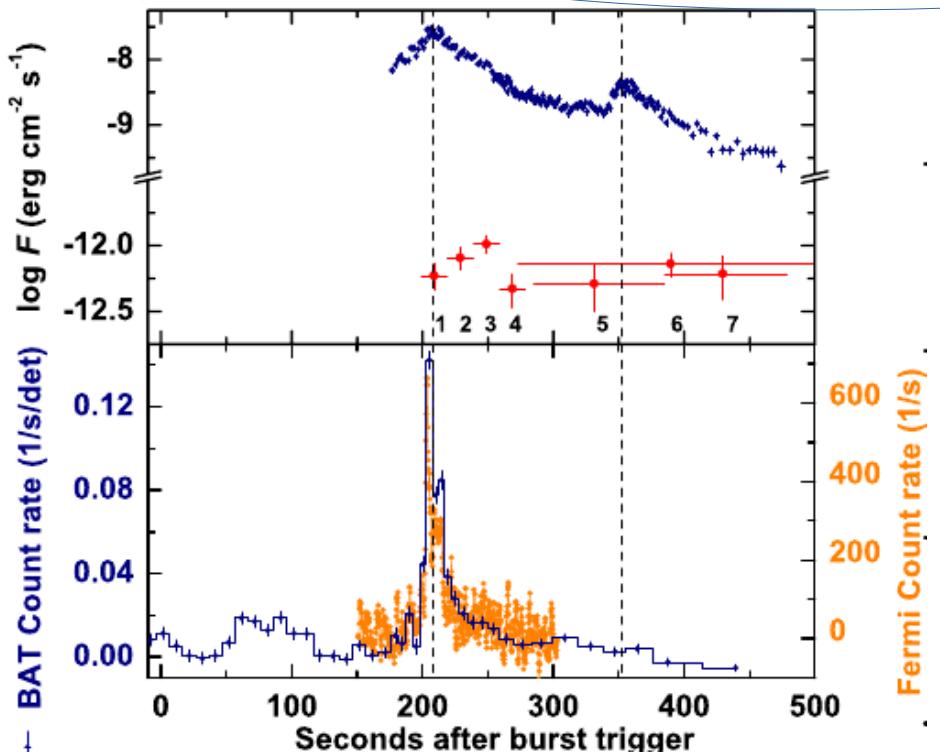
GRB 080319B T90=45s  
(Bloom et al., 2009)



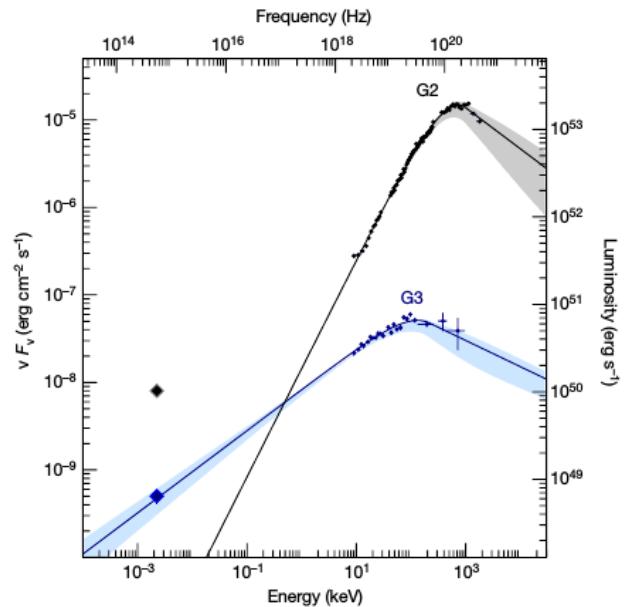
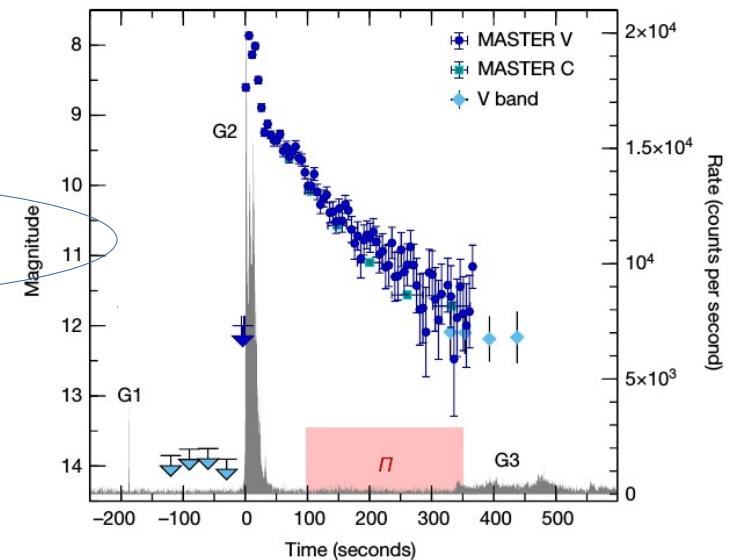
GRB 111209A (~25000s)  
(Stratta et al., 2013)

# Multi-wavelength prompt emission

Shallow/delayed optical evolution

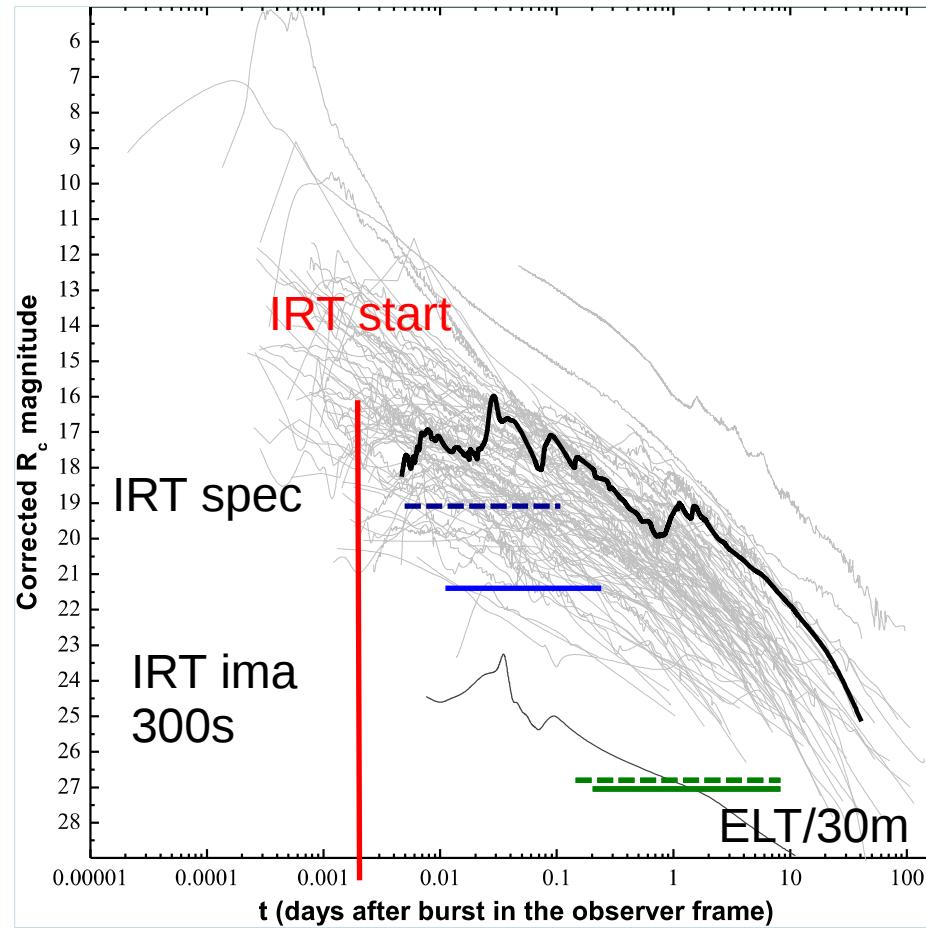


optical and X/y-rays emissions originate from different physical locations in the flow!

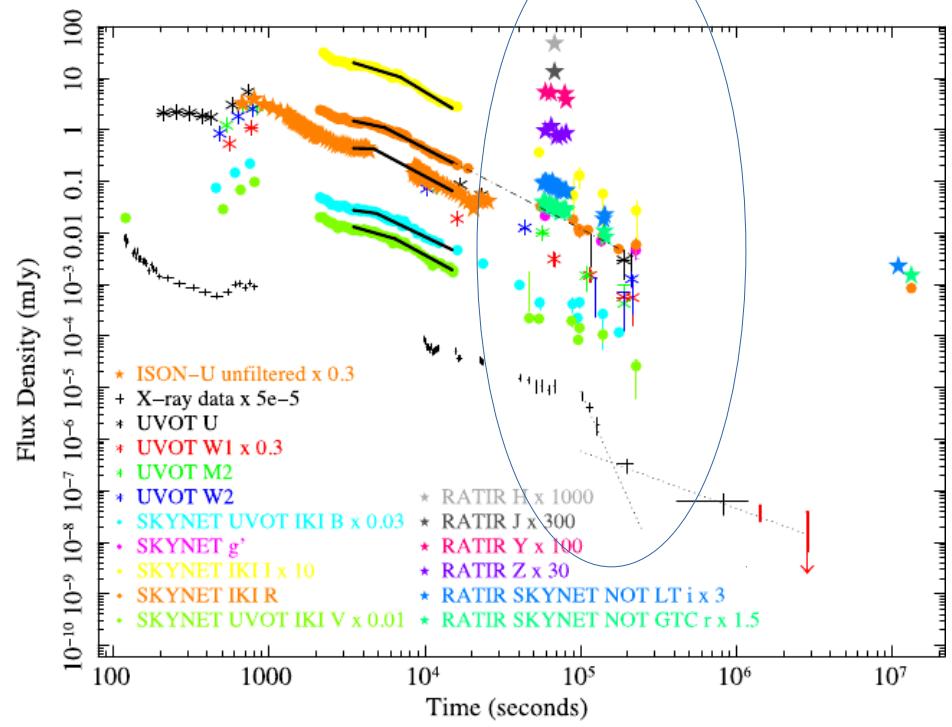
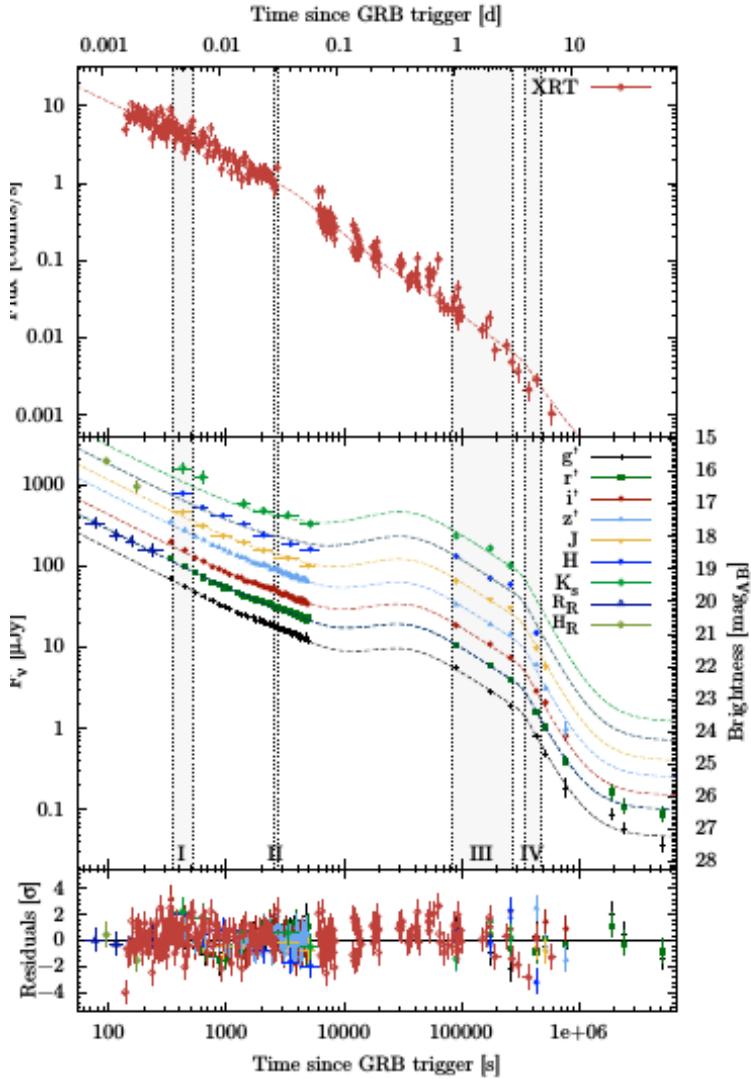


GRB 160625 (Troja+17, Nature)

# Afterglows

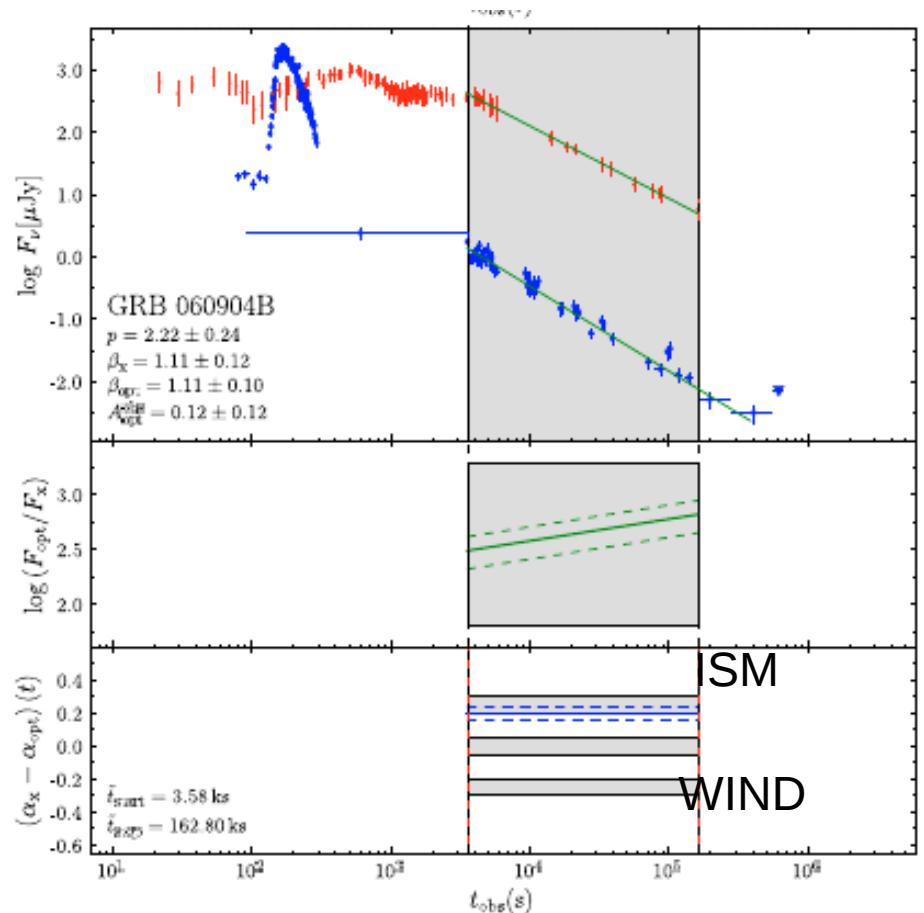
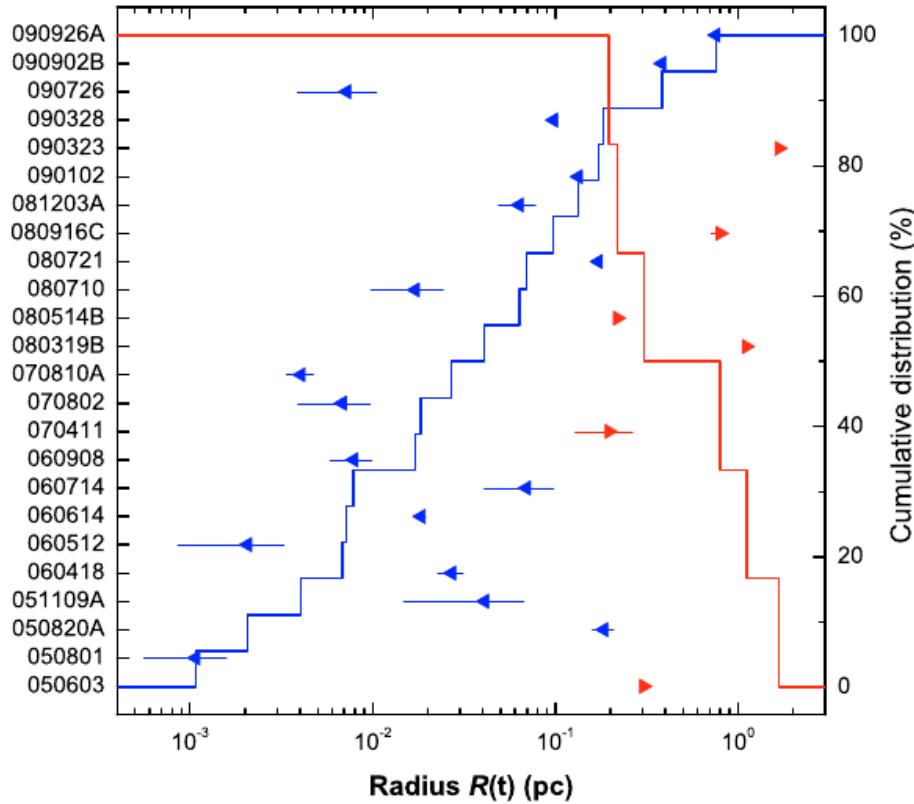


# Afterglows



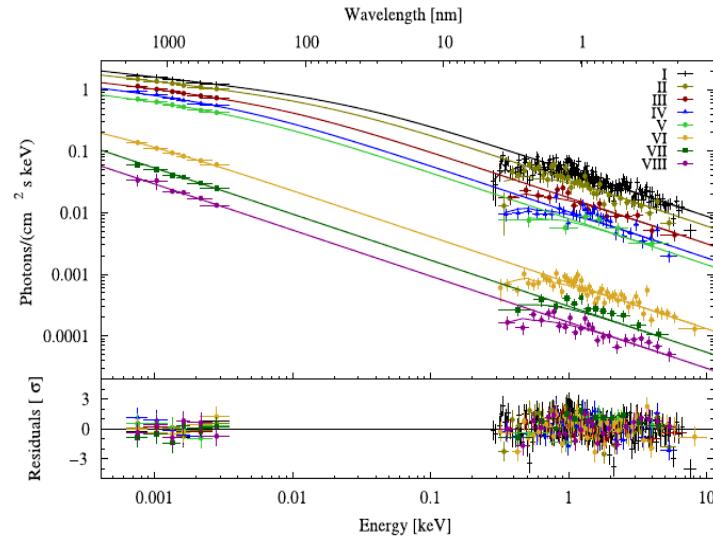
Long GRB 130831A De Pasquale et al., 2016  
Newly born spin down magnetar

# WIND / ISM?

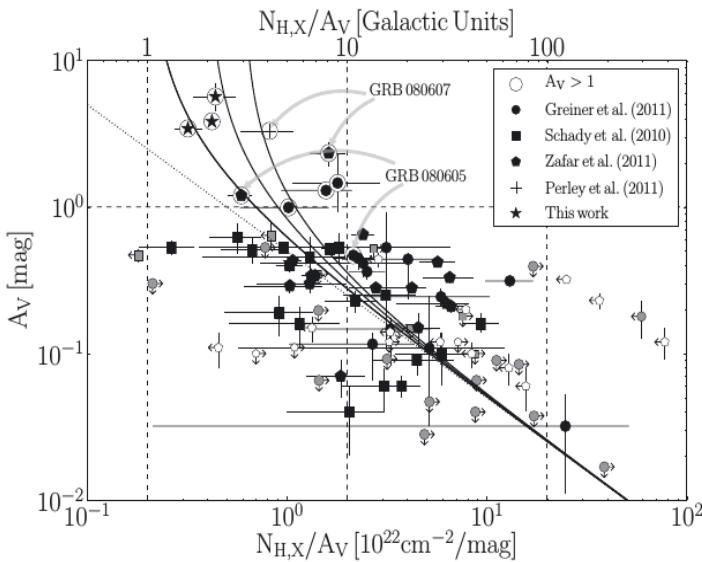
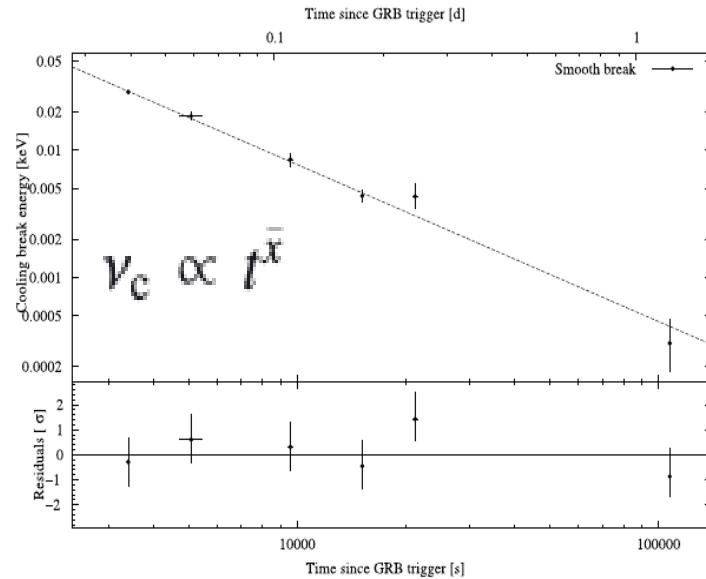


set upper/lower limits on the wind termination-shock  
 radius for GRBs in ISM/wind profile

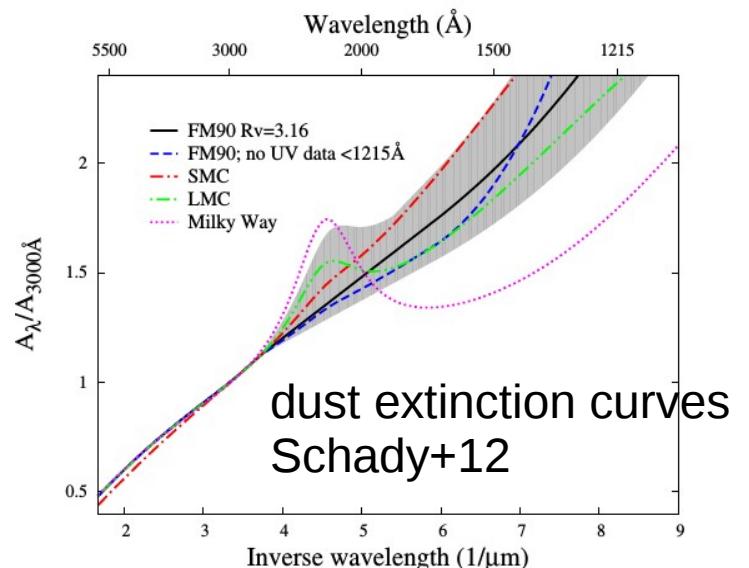
# Optical/NIR to X-rays SED fitting



GRB 091127  
Filgas+11

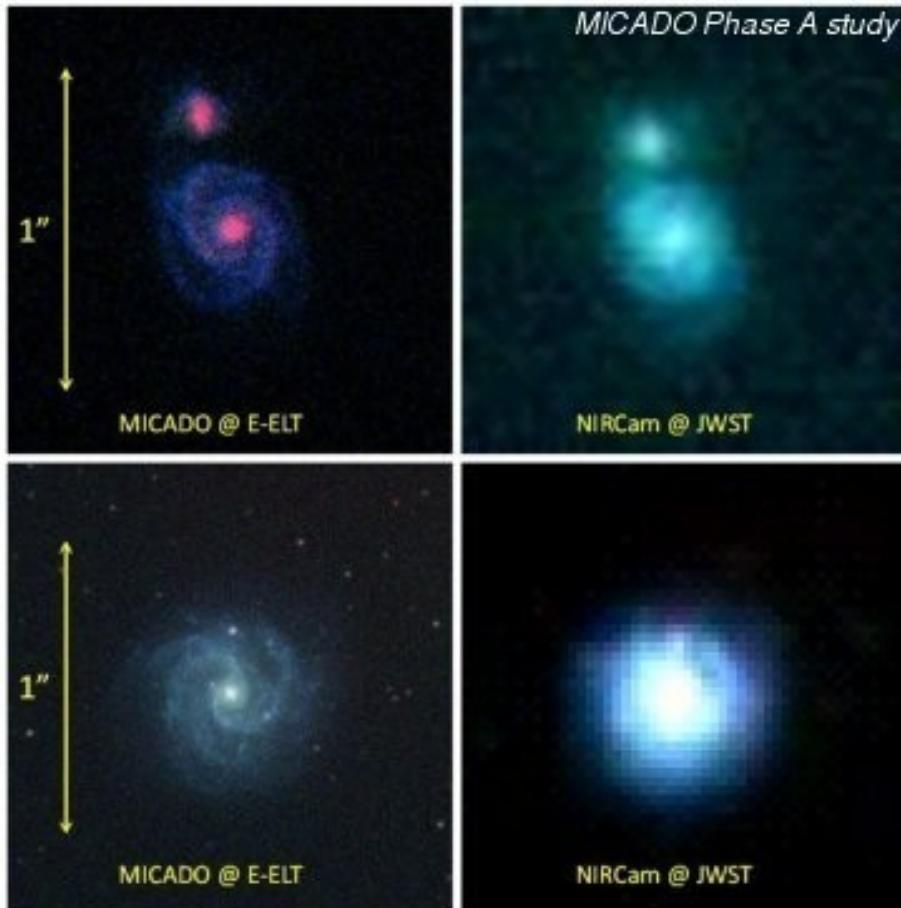


Kruehler et al., 2011



dust extinction curves  
Schady+12

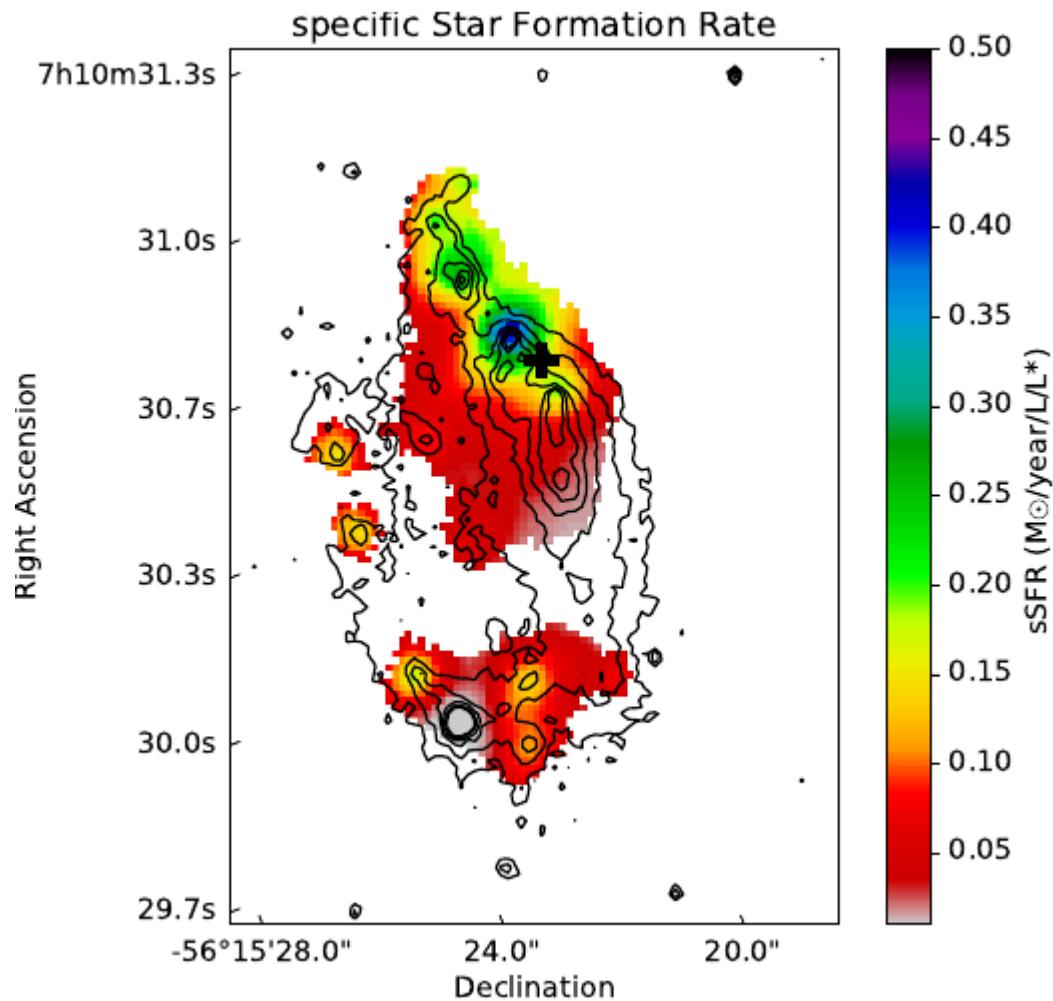
# Synergy with future largest NIR telescopes



FWHM: 5-10mas  
(MICADO consortium)

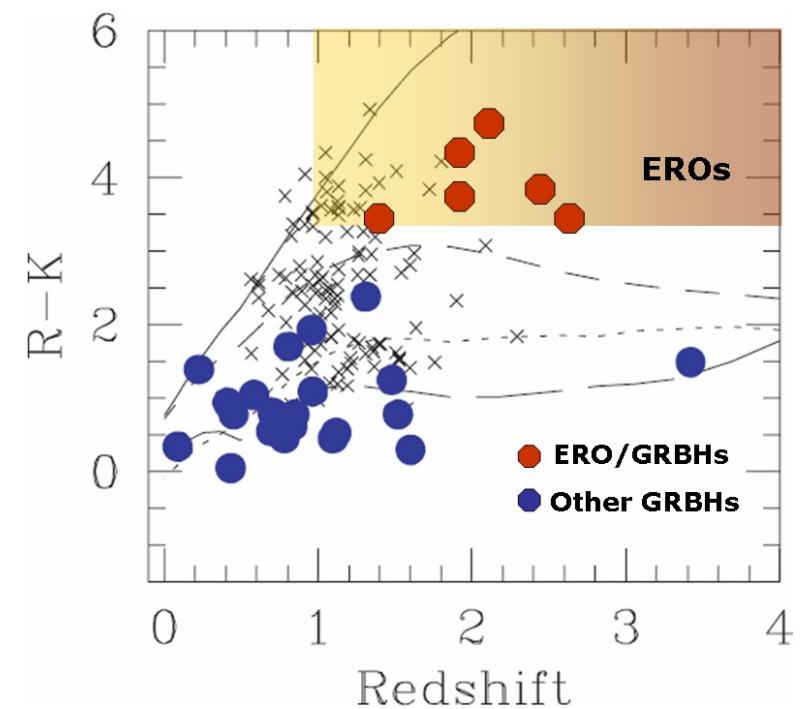
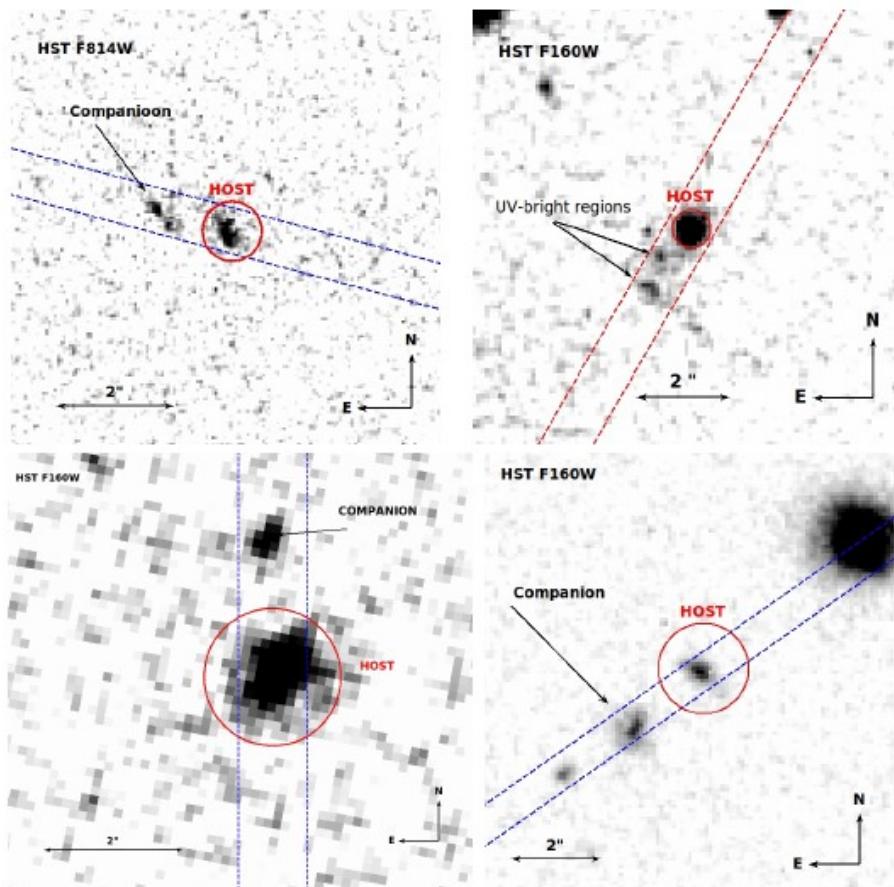
FWHM: 30-70mas (JWST)

redshift ~ 2

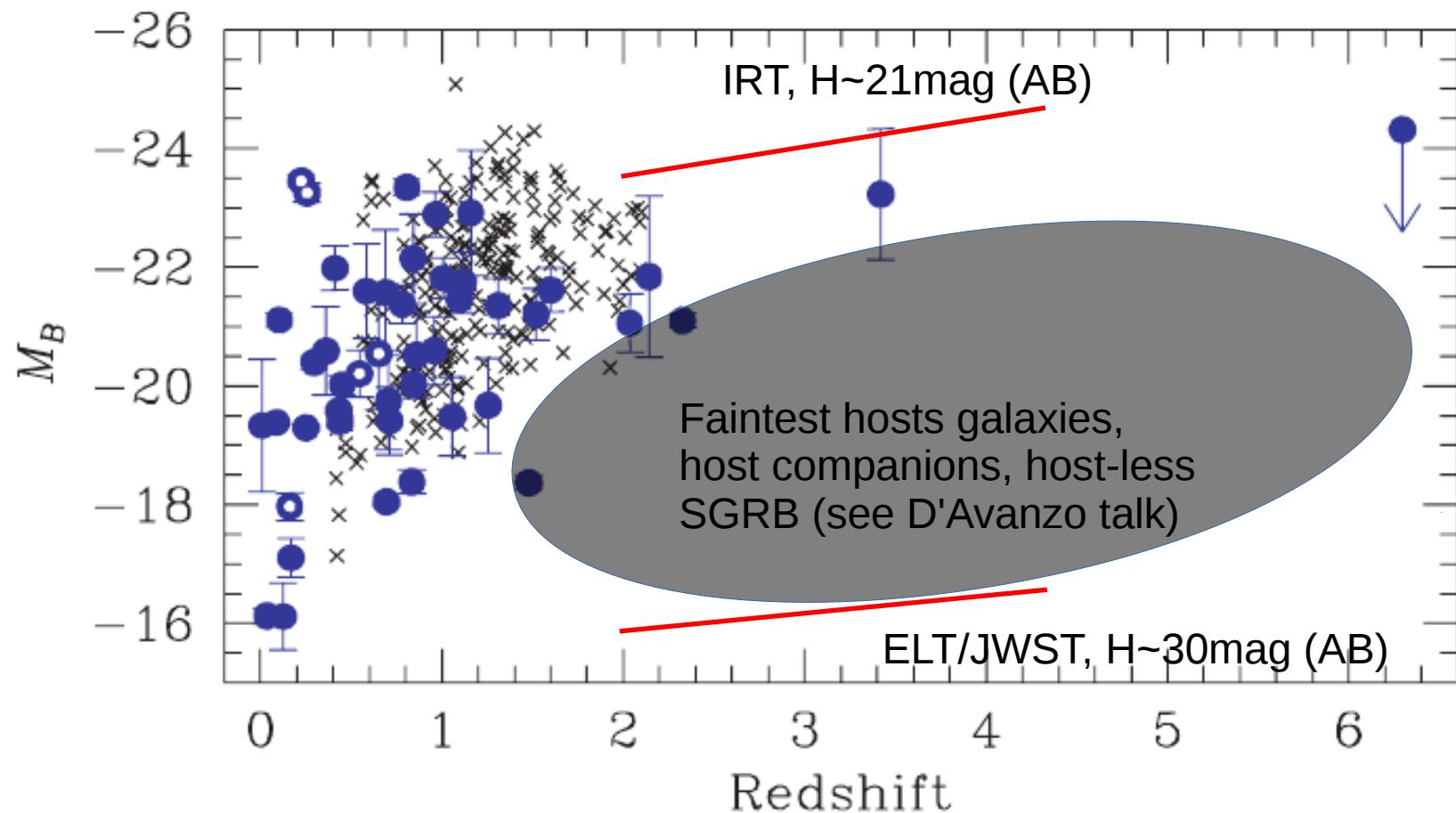


Host GRB 100316D Izzo  
et al., 2017  $z \sim 0.06$

# Galaxy-galaxy interactions



# Deep searches for hosts



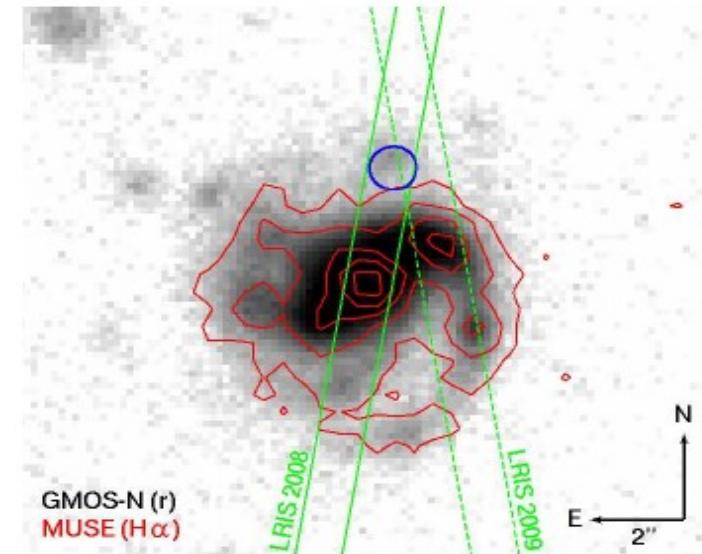
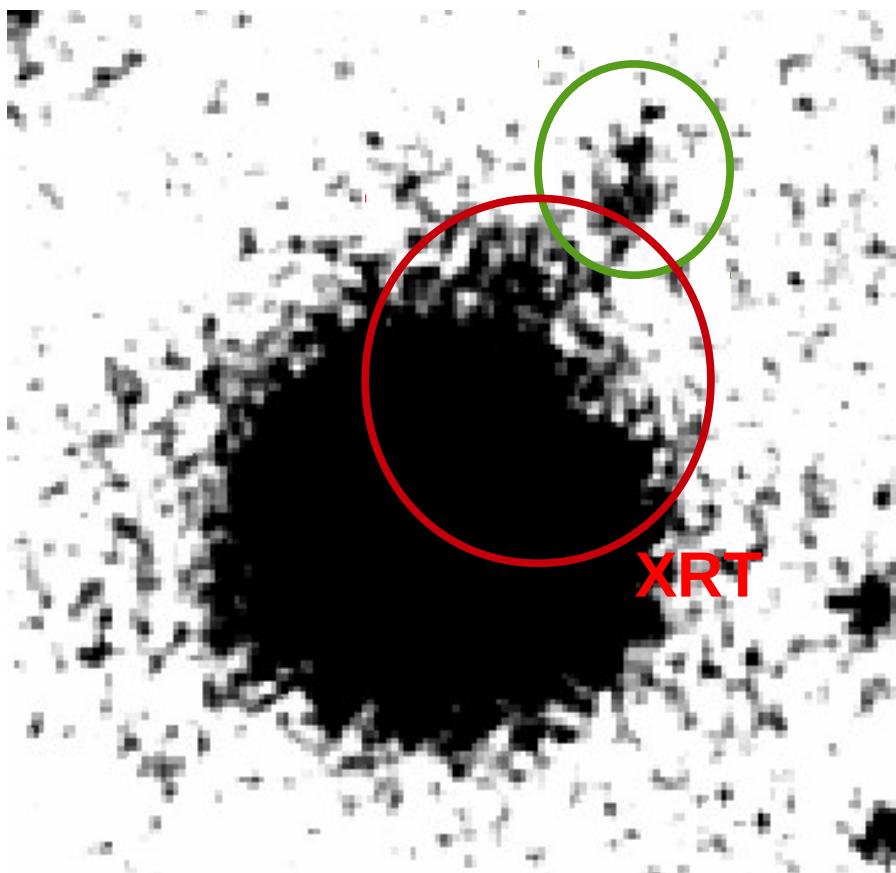
Savaglio et al., 2009

# Chance alignment?

GRB 020819A (Perley et al. 2017)

Purported high metallicity, host galaxy ( $z=0.41$ )

Actual LIRG host ( $z=1.962$ ) in background coincide with the afterglow position, thanks to MUSE and X-Shooter



GRB 050219A (Rossi et al., 2014)

- Bright ETG host?
- Or background host?
- Or galaxy-galaxy interaction?

# Summary

THESEUS will allow to:

- observe the prompt emission simultaneously in optical/NIR to gamma-rays (structured jets, LAE)
- understand the physics of the afterglows (fireball, spin-down magnetar)
- understand the environment of GRBs (ISM/WIND,  $N_H$  vs  $A_V$ , dust/gas properties)
- study the hosts of GRBs in the 30s (high spatial resolution, deep limits)