LAM, Marseille

GRB Afterglow observations

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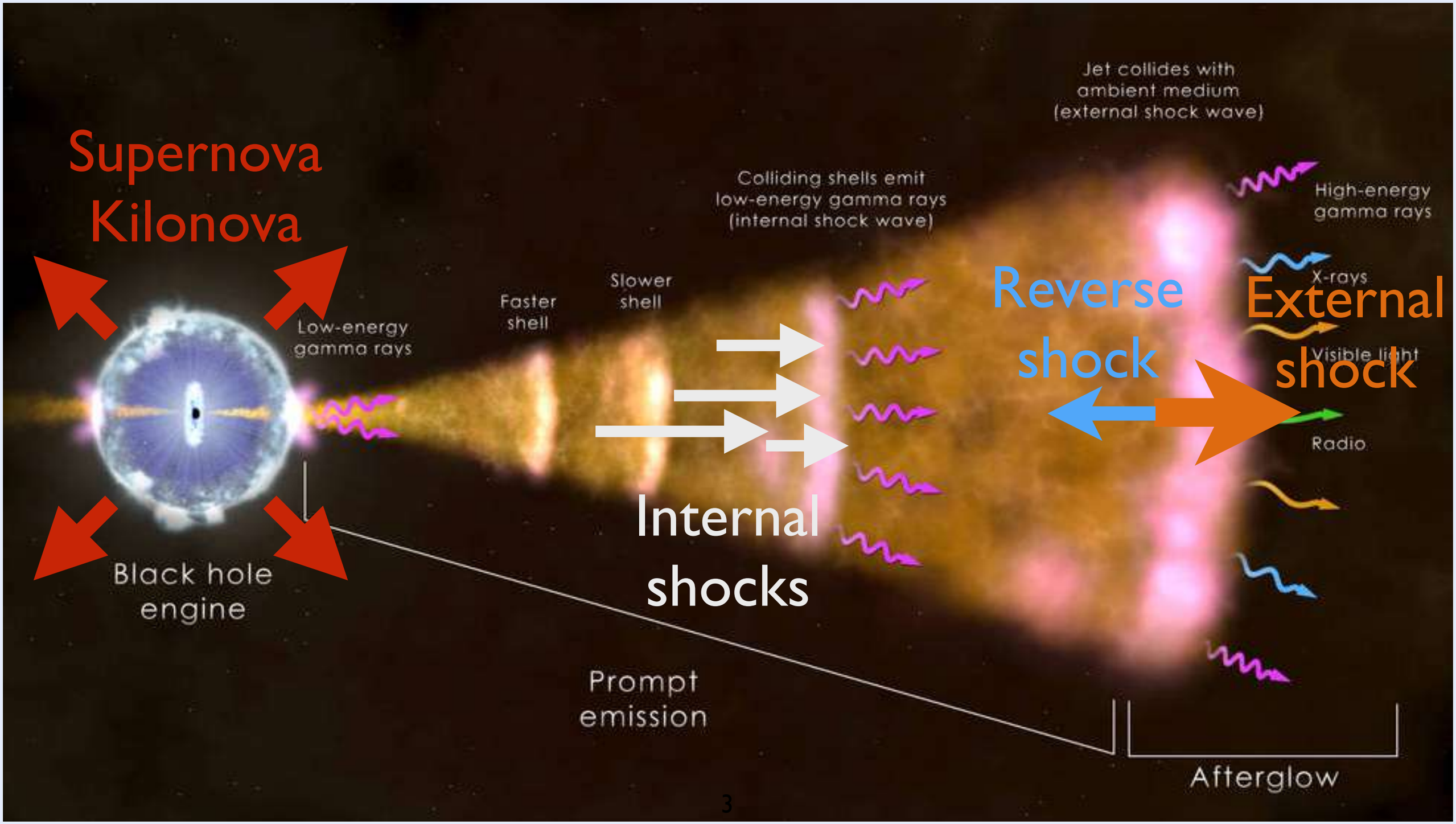
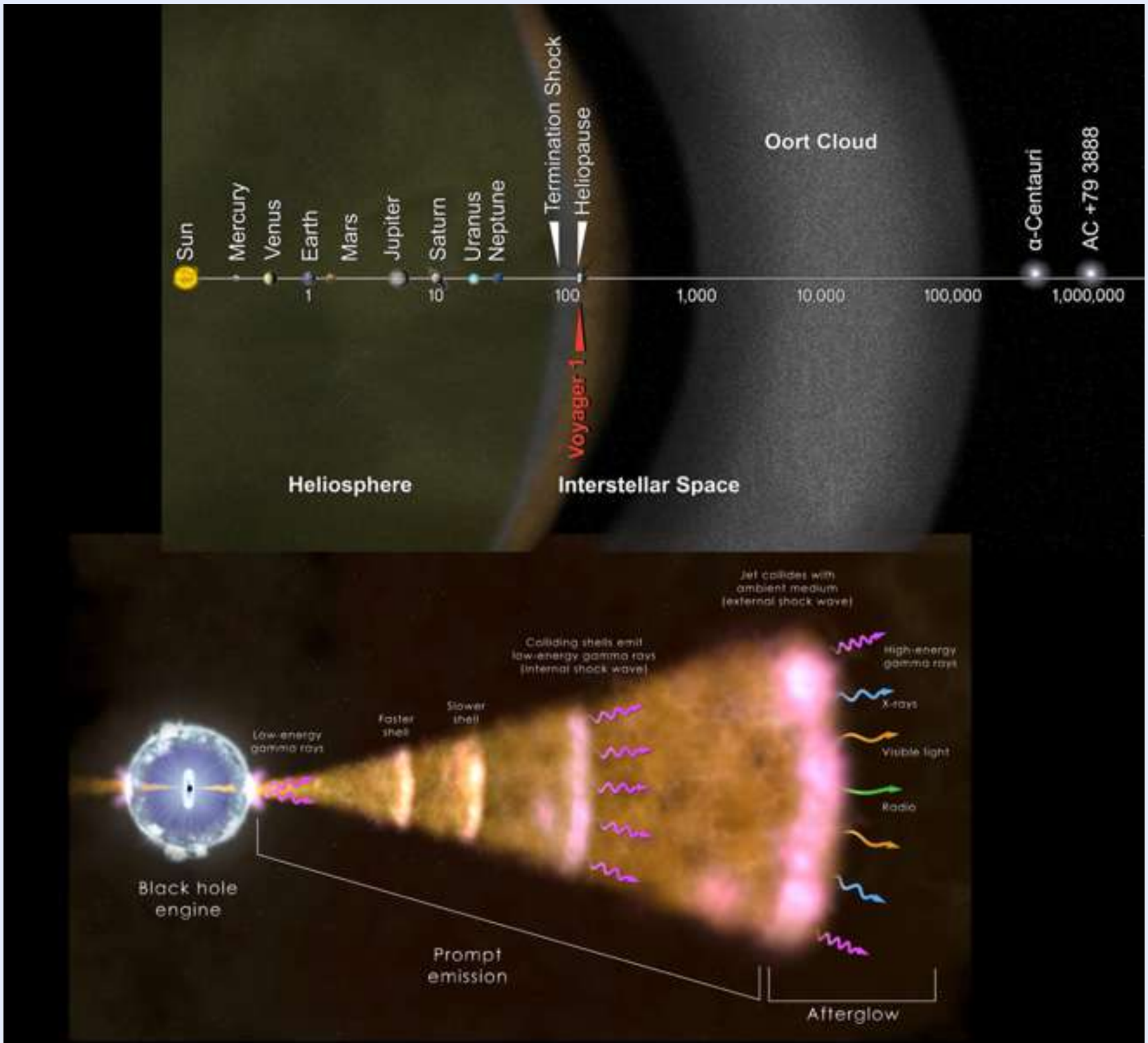
Anatomy of a GRB

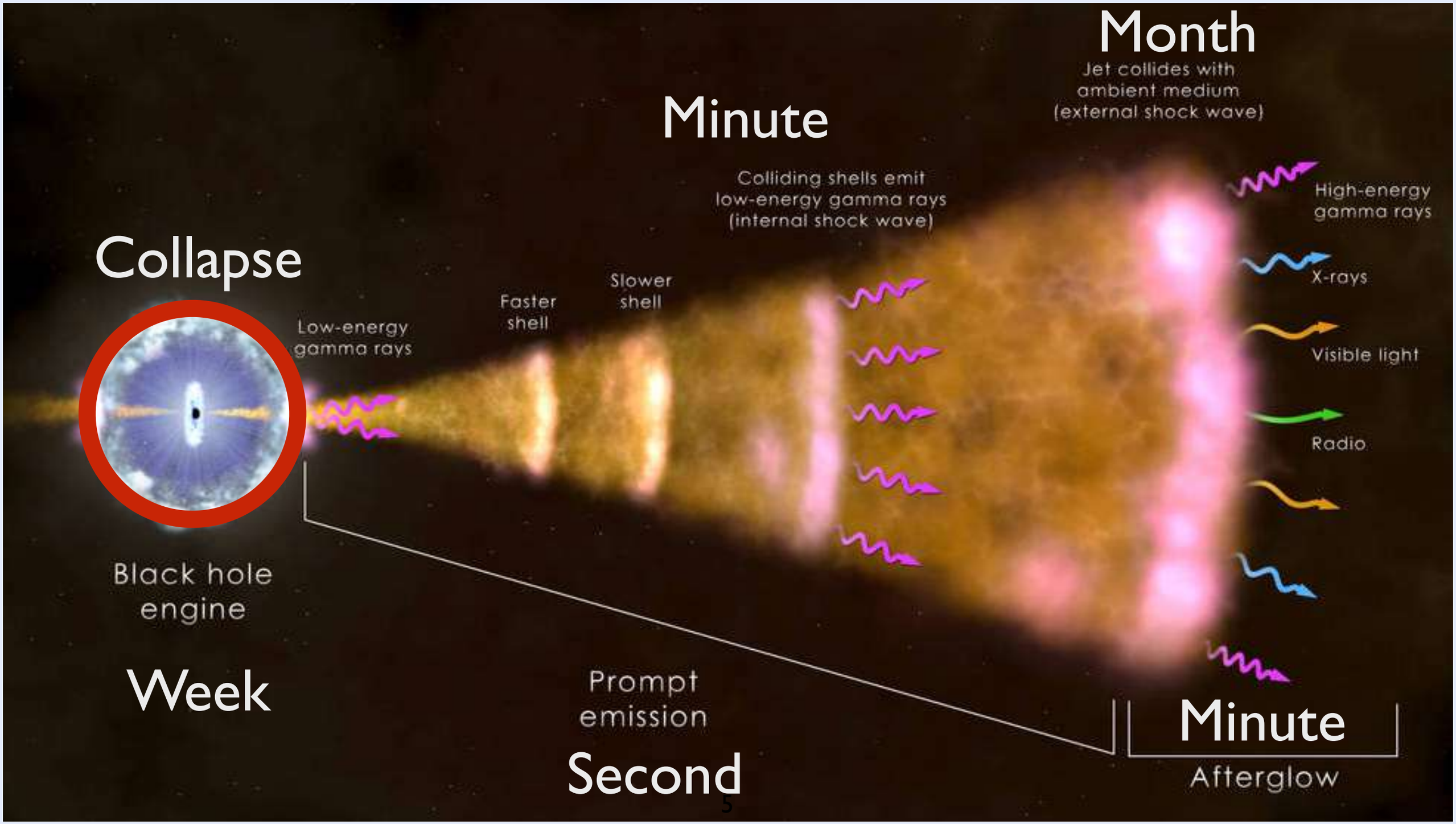
Ultrarelativistic jets



Physical scale of a GRB



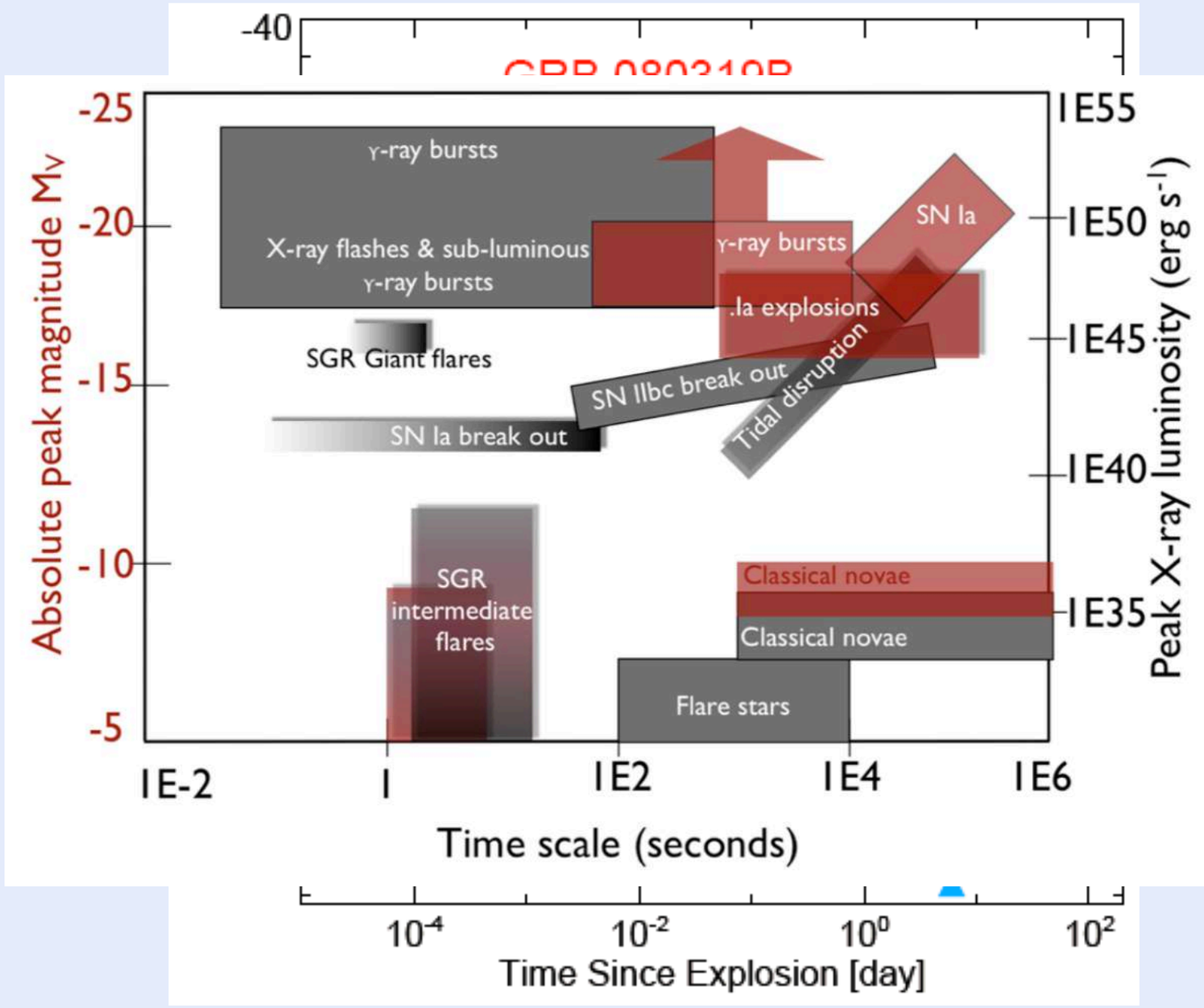
Temporal scale of GRBs



Afterglow observations

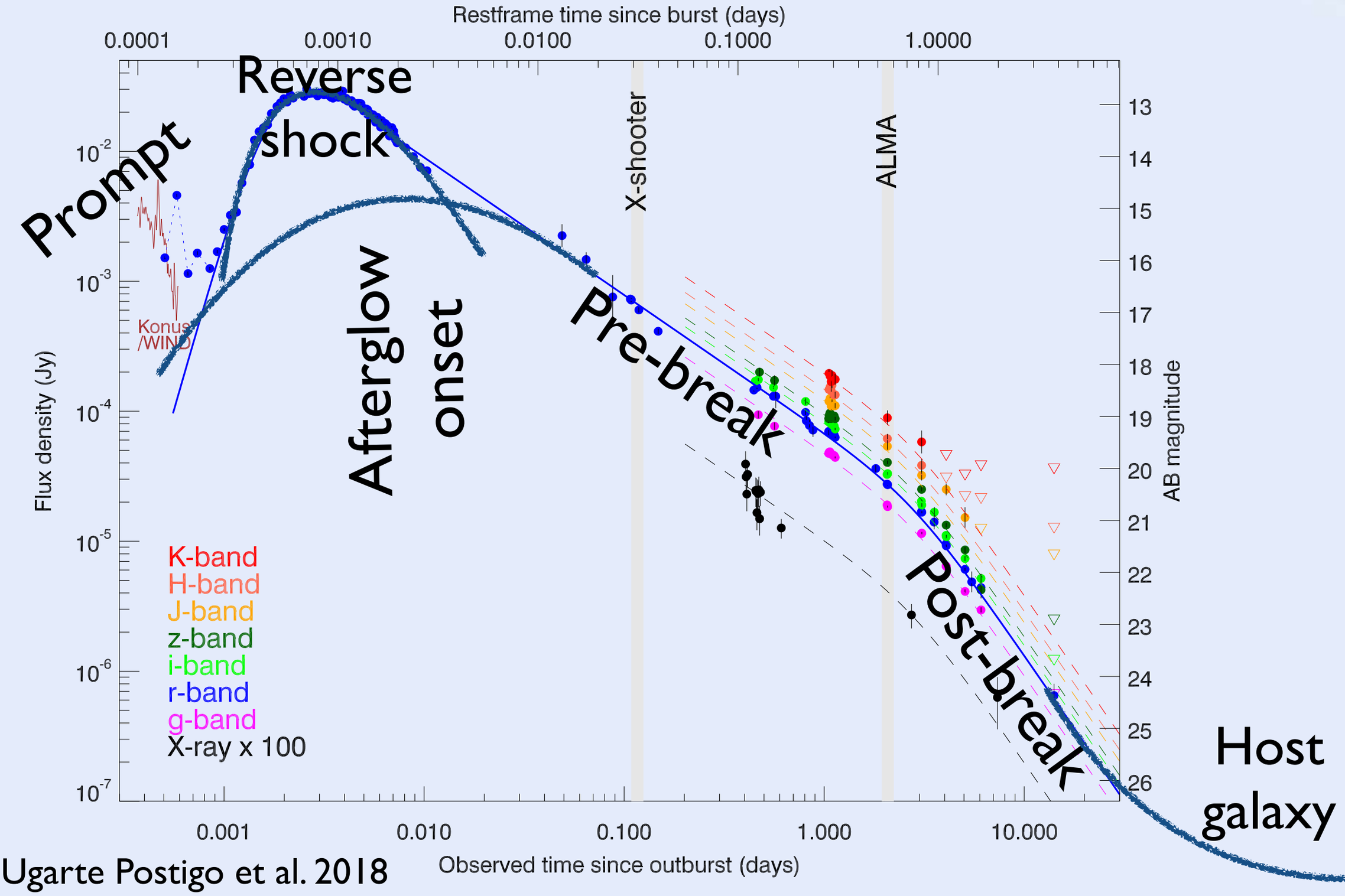
Luminosity of a GRB

- Gamma-ray emission brighter than the rest of the sky
- Afterglow not as much but also extremely luminous
- GRB 080319B, at M_U=-38 mag at 20 000 light years would shine as bright as the Sun



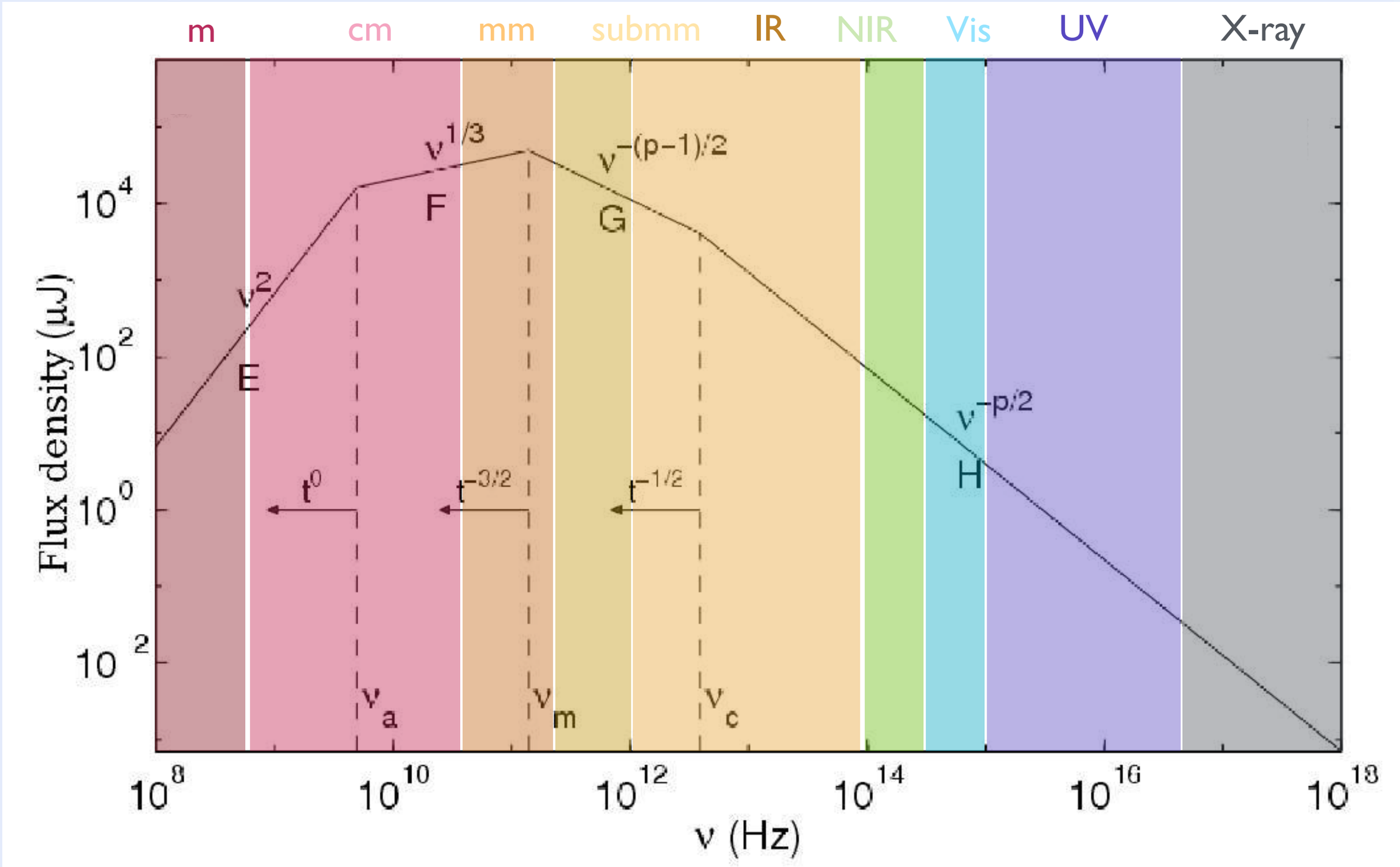
Bloom et al. 2009

Optical light curve



de Ugarte Postigo et al. 2018

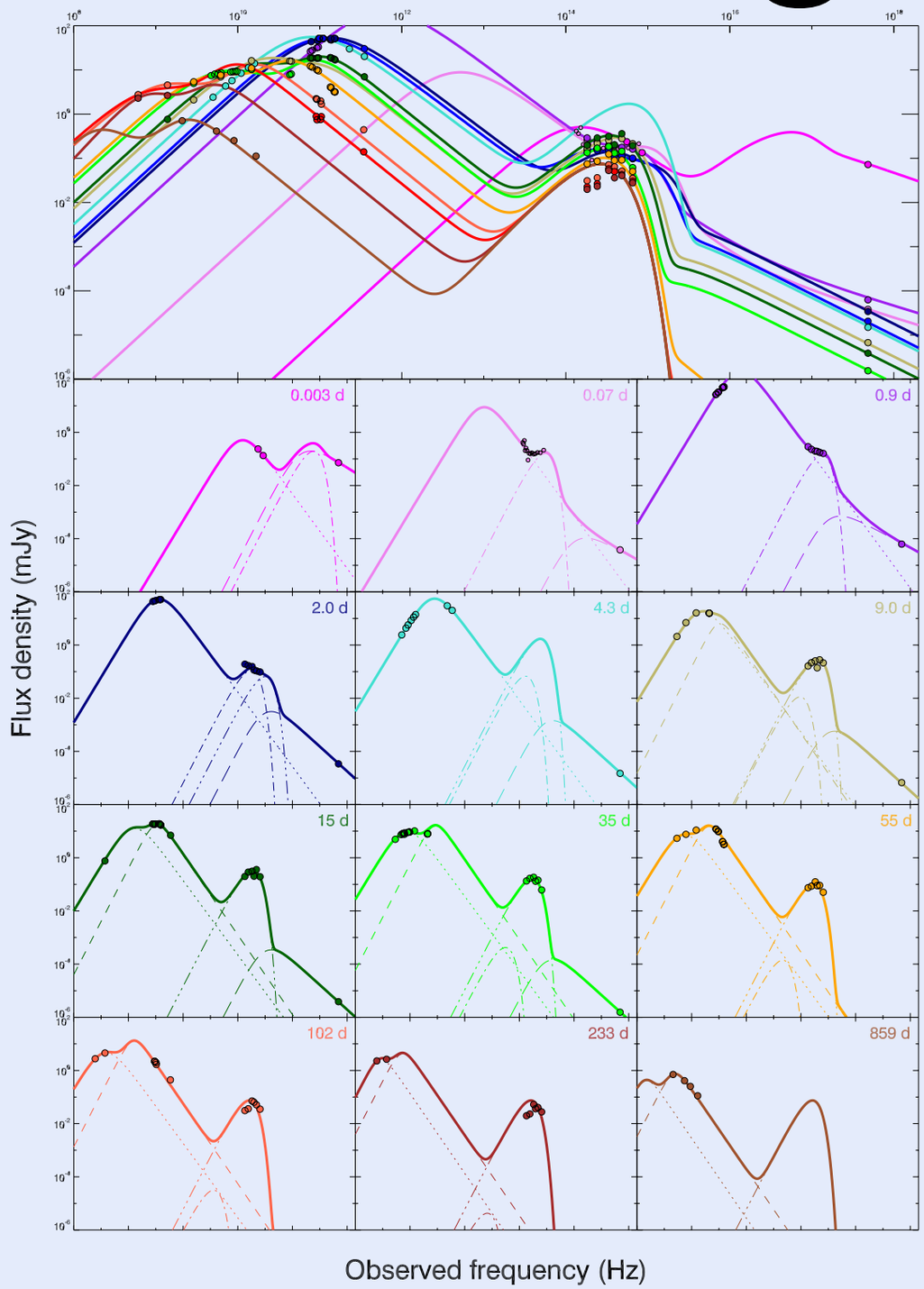
Synchrotron spectrum



Sari et al. 1998

Broadband modelling

- To understand micro- and macro-physical parameters
- Many parameters (often degenerated)
- Require many observations
- Many observations often imply discovering non-standard behaviour

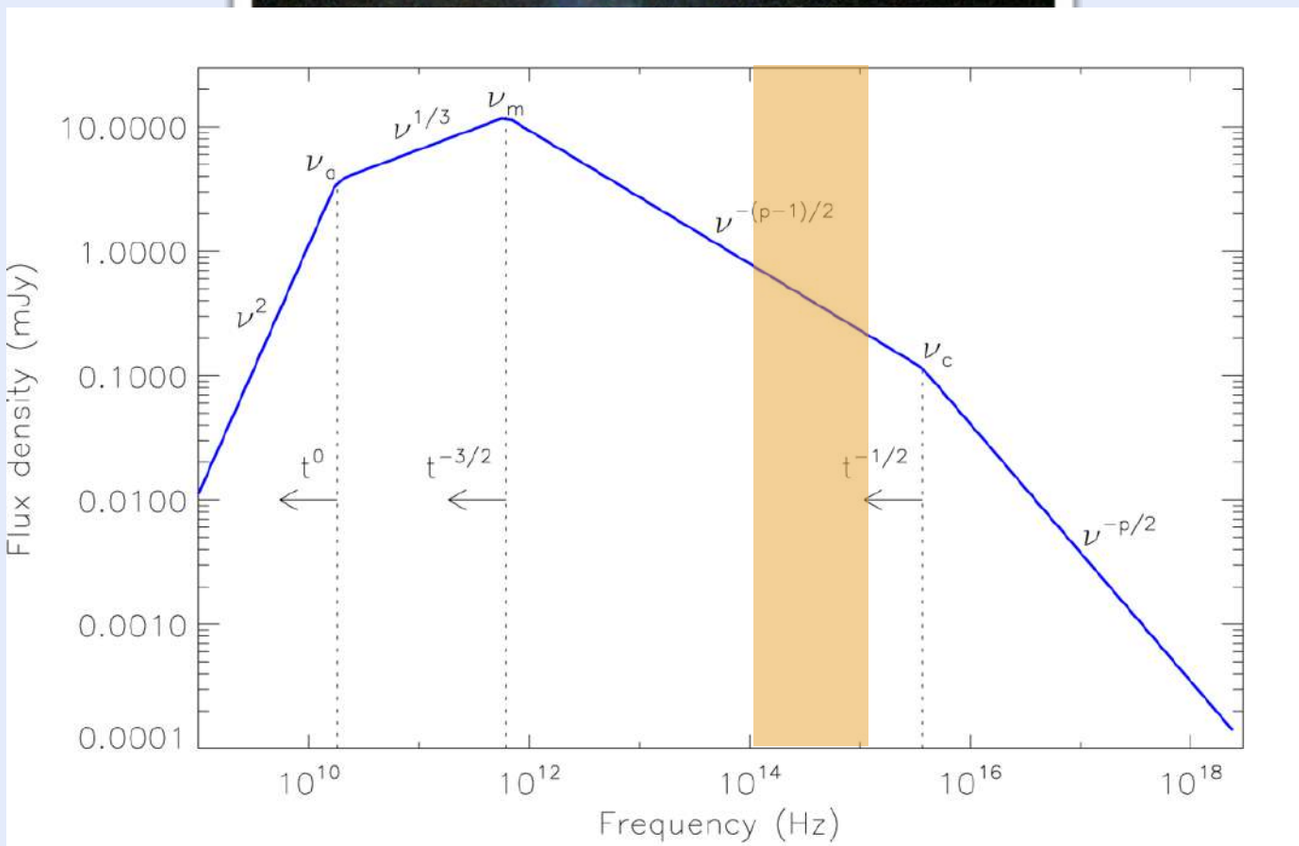


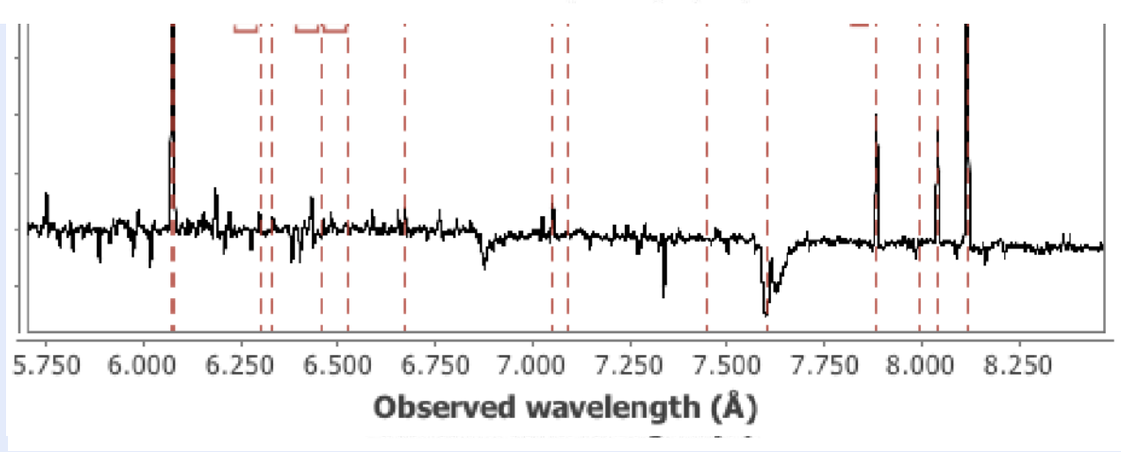
de Ugarte Postigo et al. in prep

GRBs as beacons

Afterglow spectroscopy

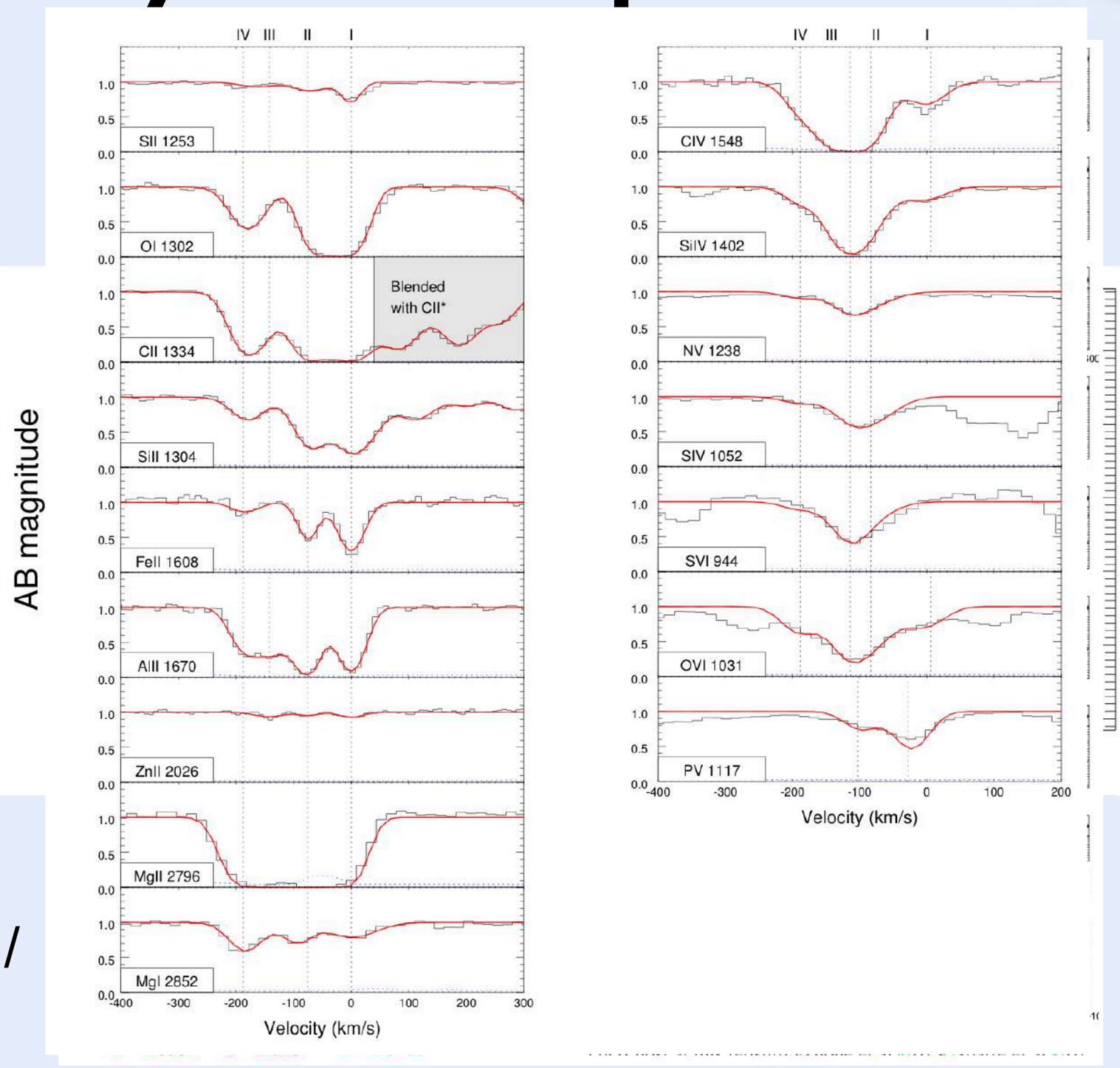
- Clean synchrotron spectrum
- Redshift
- Chemistry and dynamics of the GRB environment and host galaxy
- Host galaxies inside and out
- Tracers of star formation
- Dust extinction
- Intervening systems





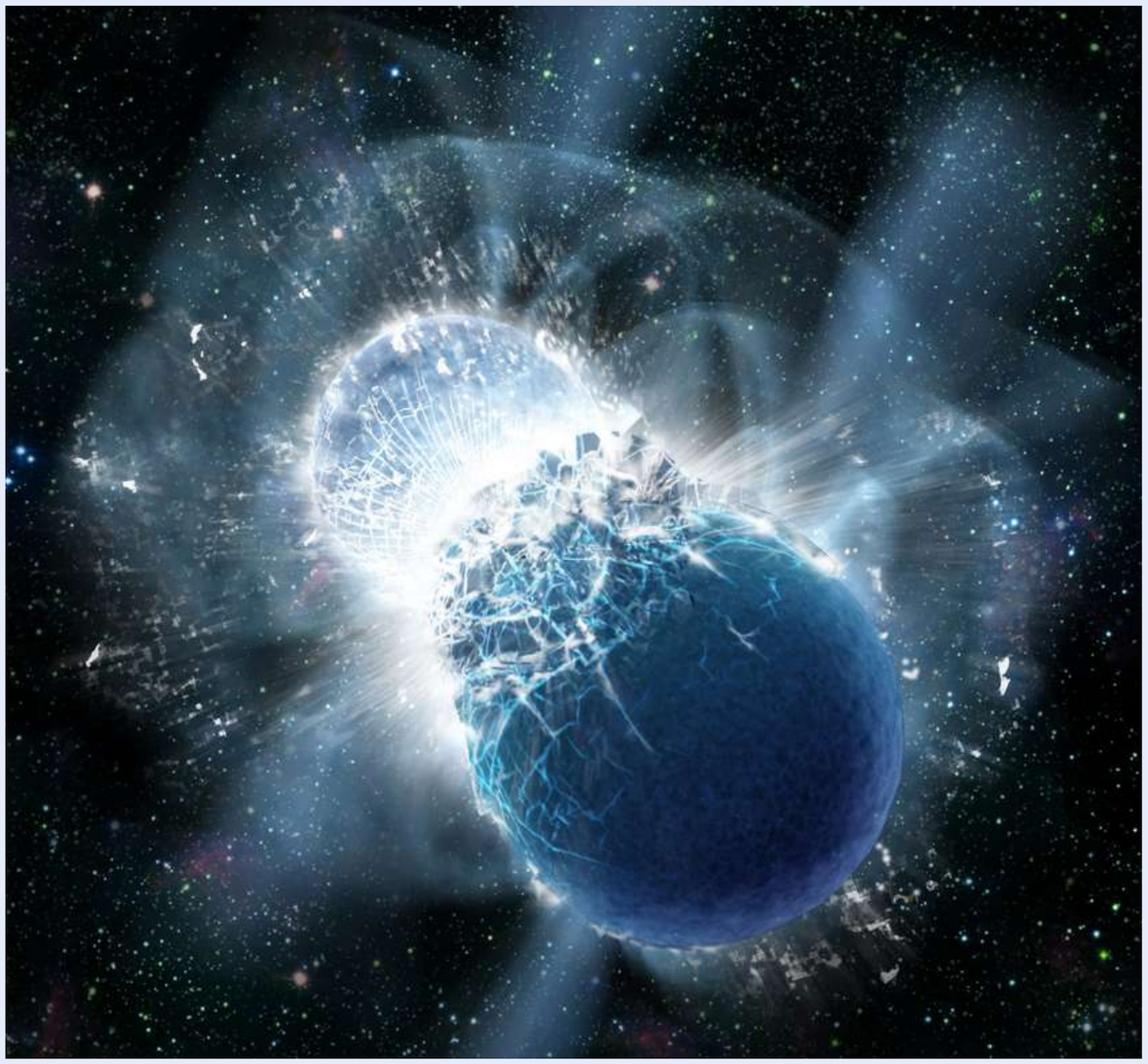
Host galaxy absorption

- Redshift
- Extinction
- Composition
- Dynamics
- Abundances
- Line variability => excitation mechanisms / distance

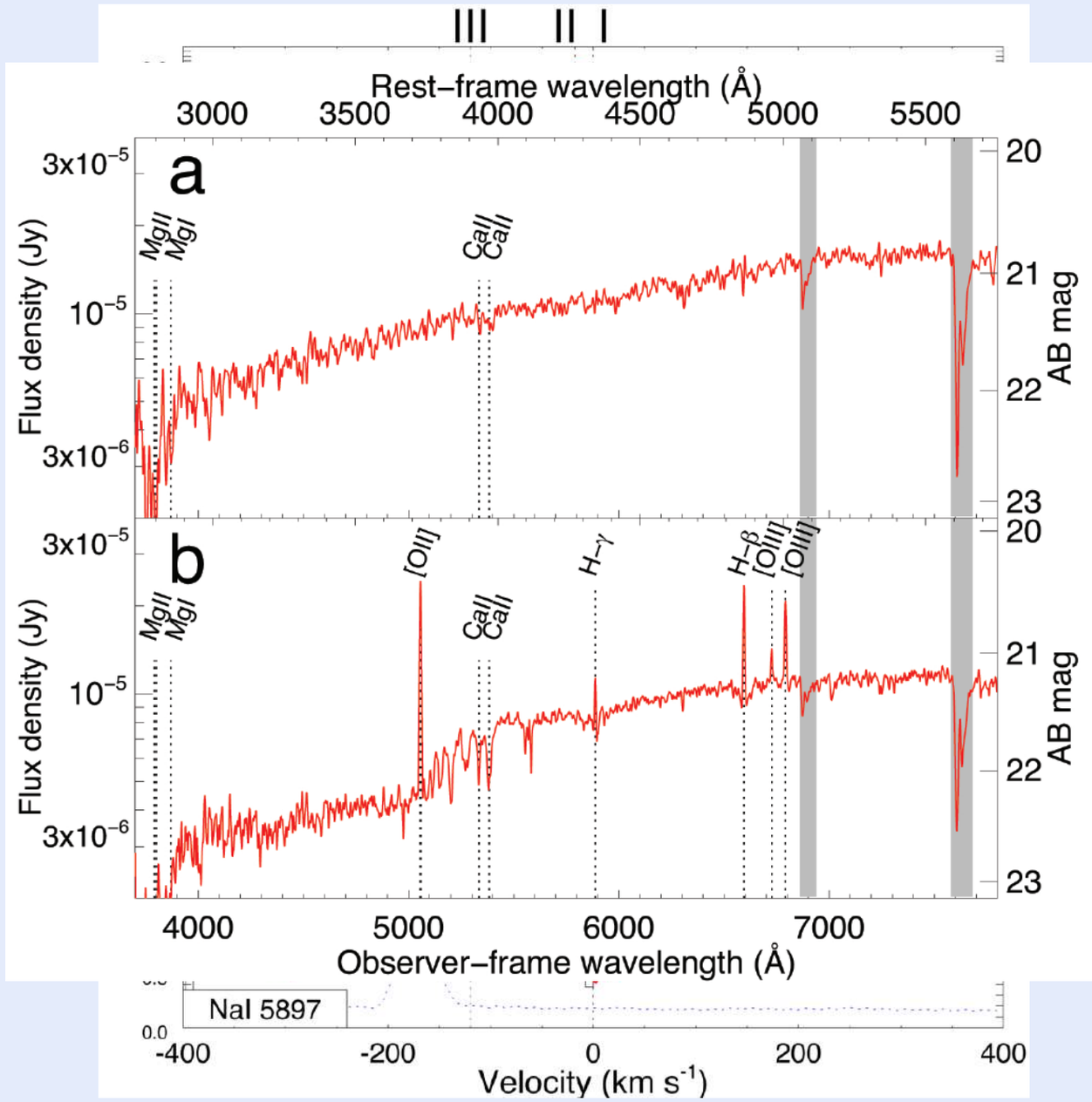


de Ugarte Postigo et al. 2018

GRB 130603B: First spectroscopy of a SGRB

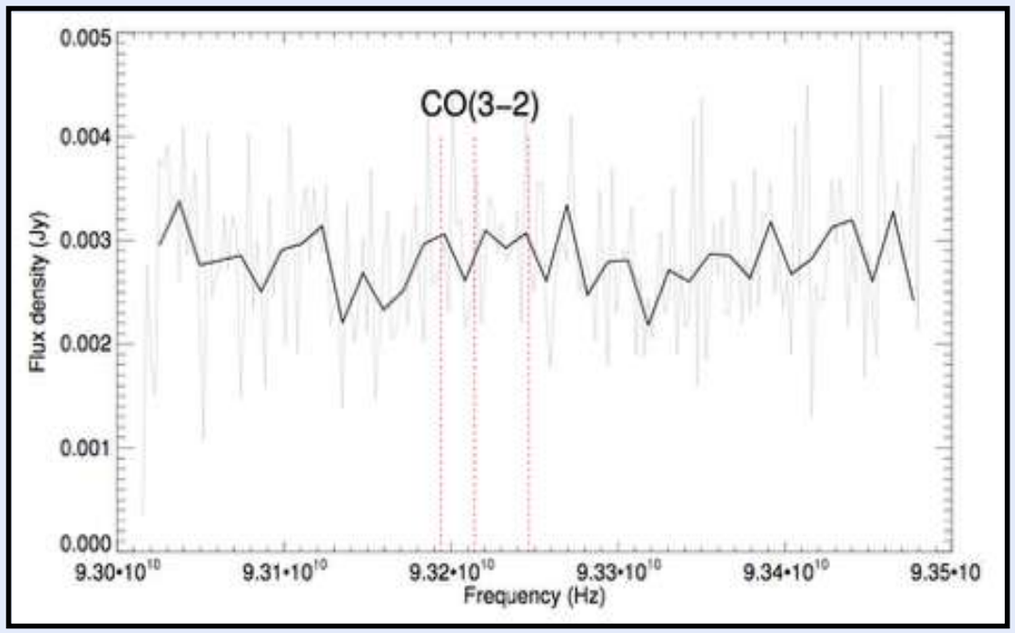


de Ugarte Postigo et al. 2014



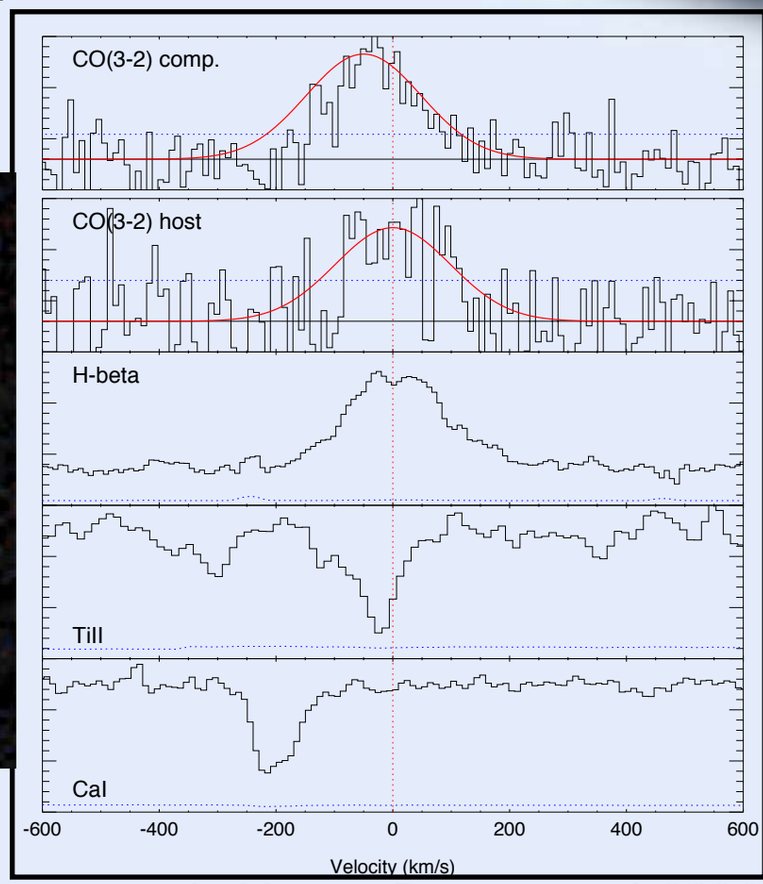
mm spectroscopy

GRB 161023A



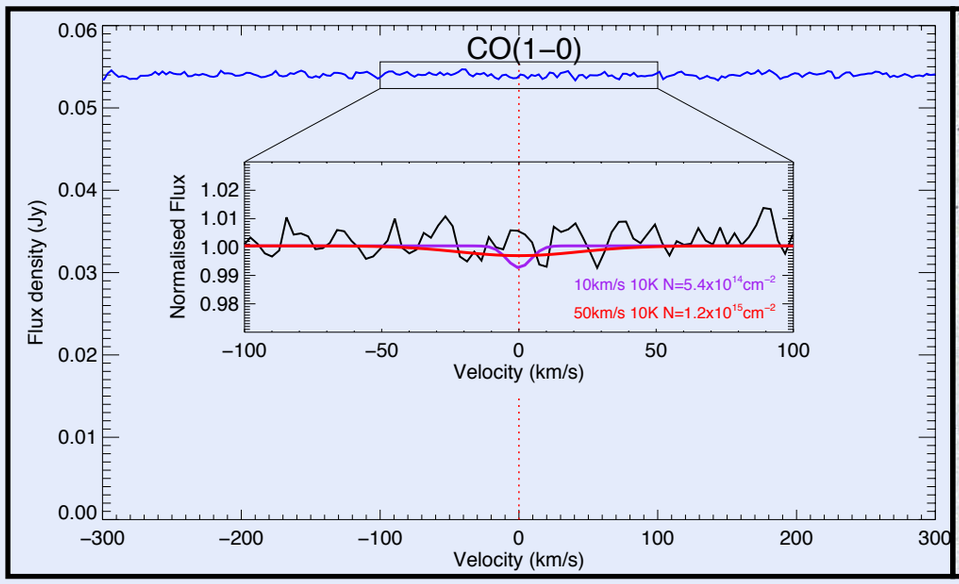
de Ugarte Postigo et al. 2018

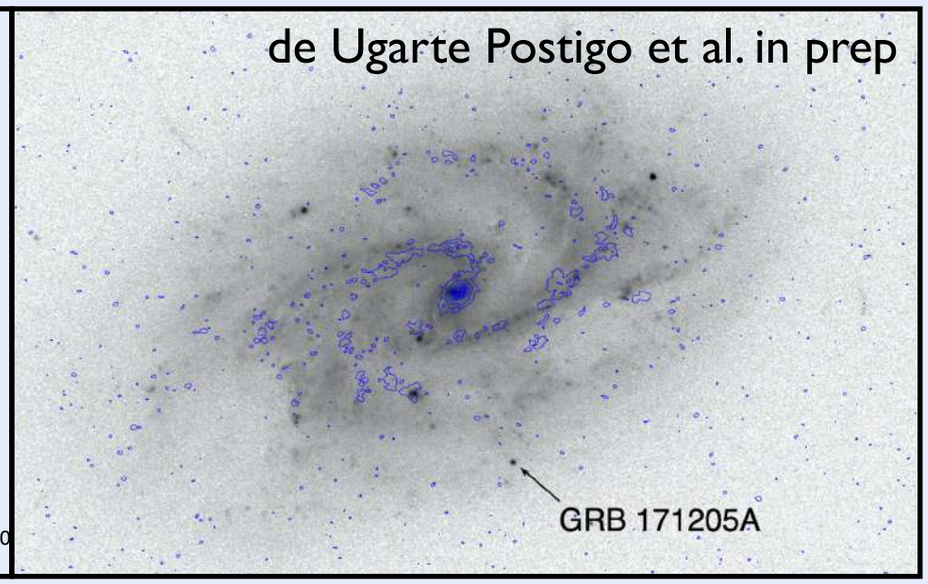
GRB 190114C



de Ugarte Postigo et al. 2020

GRB 171205A

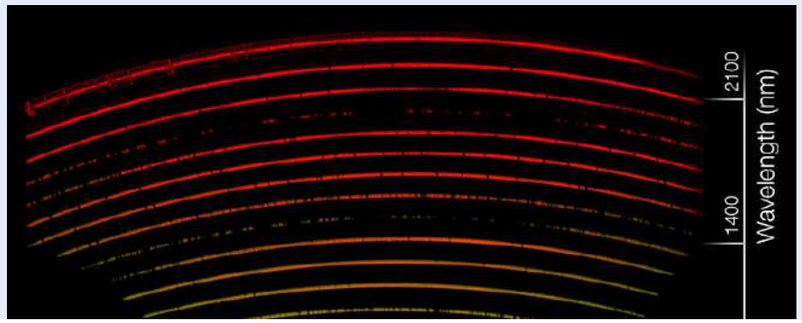


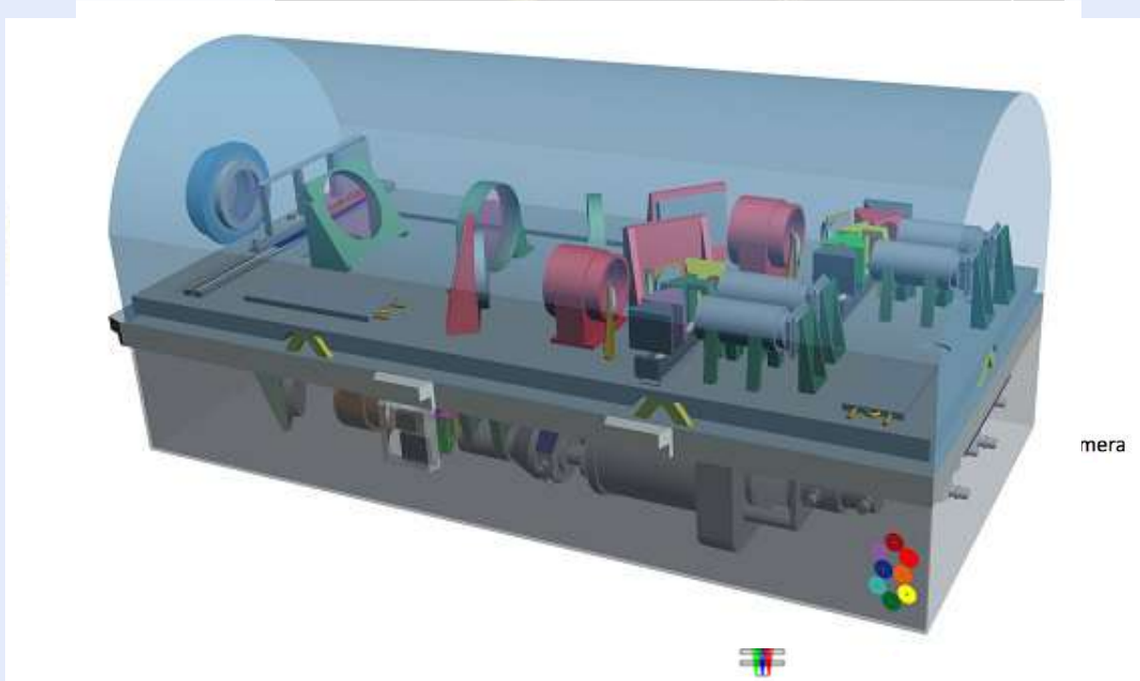


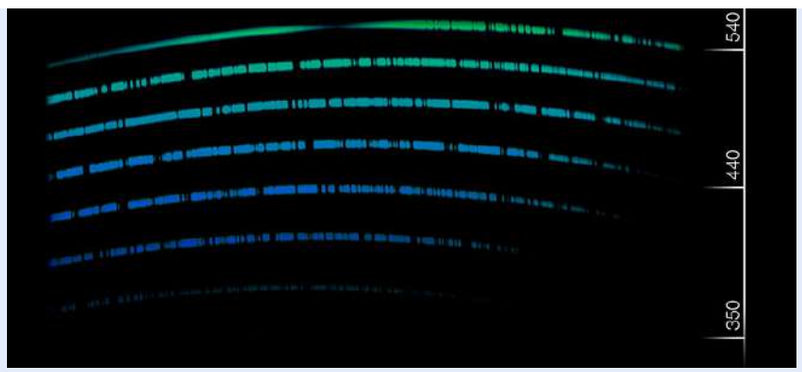
Tools for afterglow study

Instrumentation for transients

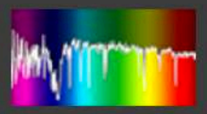
- **Simultaneous broad wavelength**
- GROND (Greiner et al.)
- X-shooter (Vernet et al.)
- HiPERCAM (Dhillon et al.)
- OCTOCAM (de Ugarte Postigo et al.)
  - SCORPIO (Gemini)
  - GATOS (GTC)







GRBSpec.eu



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Welcome to the GRBSpec database!

GRBspec is a database of GRB spectra that compiles spectra of gamma-ray burst (GRB) afterglows and their host galaxies. It is a collaborative effort in which users are invited to upload their data. Please register to be able to upload and download data.

Database statistics

673 spectra
1502 GRB's, **251** with associated spectra
1872 uploaded files

When using GRBspec for a publication please cite: **"de Ugarte Postigo et al.: GRBSpec: a multi-observatory database for gamma-ray burst spectroscopy, SPIE, 9152 (2014), adsabs.harvard.edu/abs/ 2014SPIE.9152E..0BD"** and include in the acknowledgements: **"This work made use of the GRBspec database grbspec.iaa.es"**.

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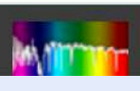
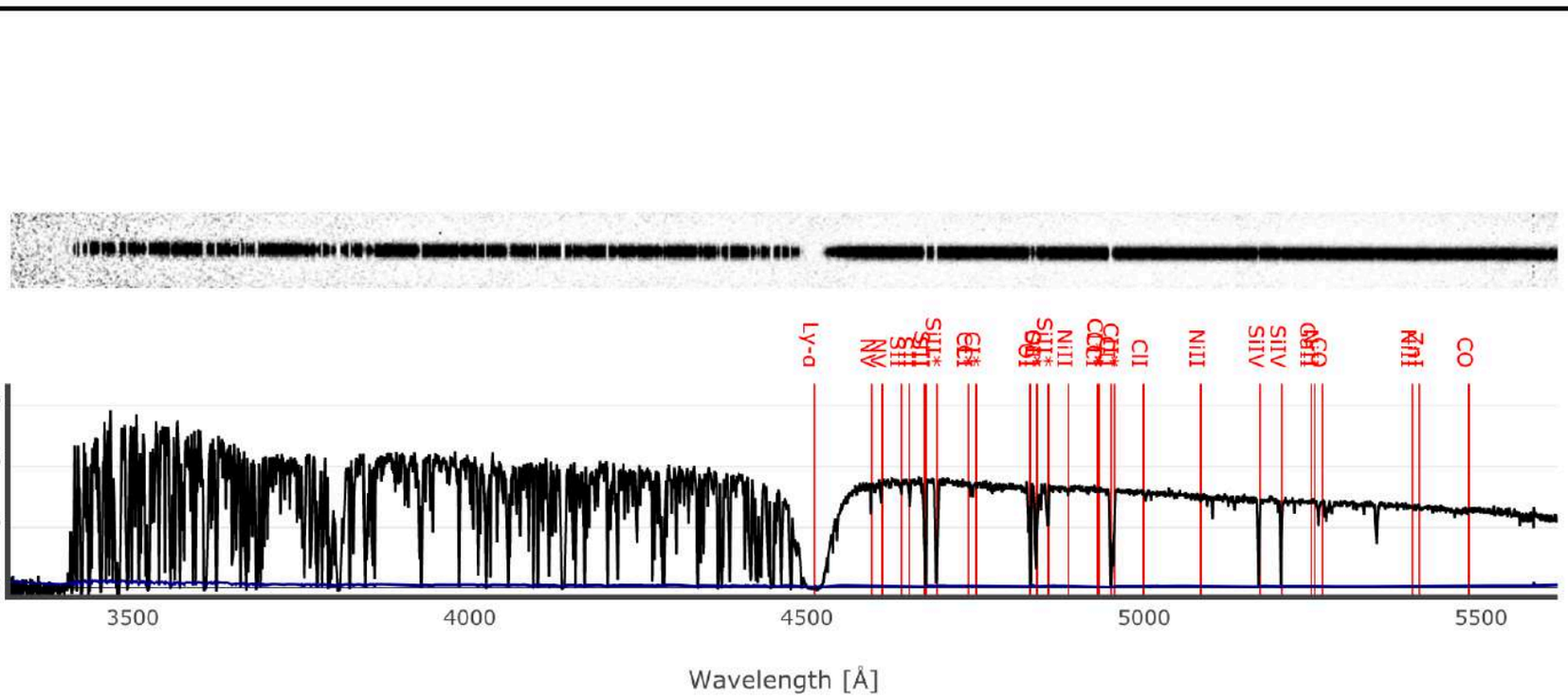
Is being expanded with photometry: GRBPhot (D.A. Kann)



GRBSpec: Plot and measure



Flux-calibrated spectrum (SF1/FITS)

Show 2D Spectra
Vacuum wavelengths already calibrated
Binning
Gaussian Smoothing
Show Error
Show telluric absorption
Show sky emission

Show emission lines
Redshifts: 2.7105

Show absorption lines
Redshifts: 2.7105

X min: 3318.38 X max: 5613.60
Y min: -2.3e-17 Y max: 6.7e-16

Clear plots | Initial zoom

Show measured lines

Measure EWs

Download Picture

--- Plotting telluric features.
--- Plotting laboratory absorption lines with redshifts: 2.7105. You can adjust number of plotted lines by the slider.
--- Applet for graphical visualization and online analysis of GRB spectra, feel free to test it in "New Data -> Sandbox" mode.
--- Compare your data with set of emission/absorption features at any redshift or start measuring the equivalent widths of spectral lines with "Measure EWs" button.

Summary

- GRBs are the most luminous transients and imply ultrarelatvistic physics
- Broad band afterglow observations to derive micro- and macro-physical parameters
- GRBs as probes: Redshift, interstellar and intergalactic medium, extinction, abundances, dynamics
- Instrumentation for transient study: Simultaneous broadband observations with high time-resolution
- GRBSpec database for GRB spectroscopy

Merci!