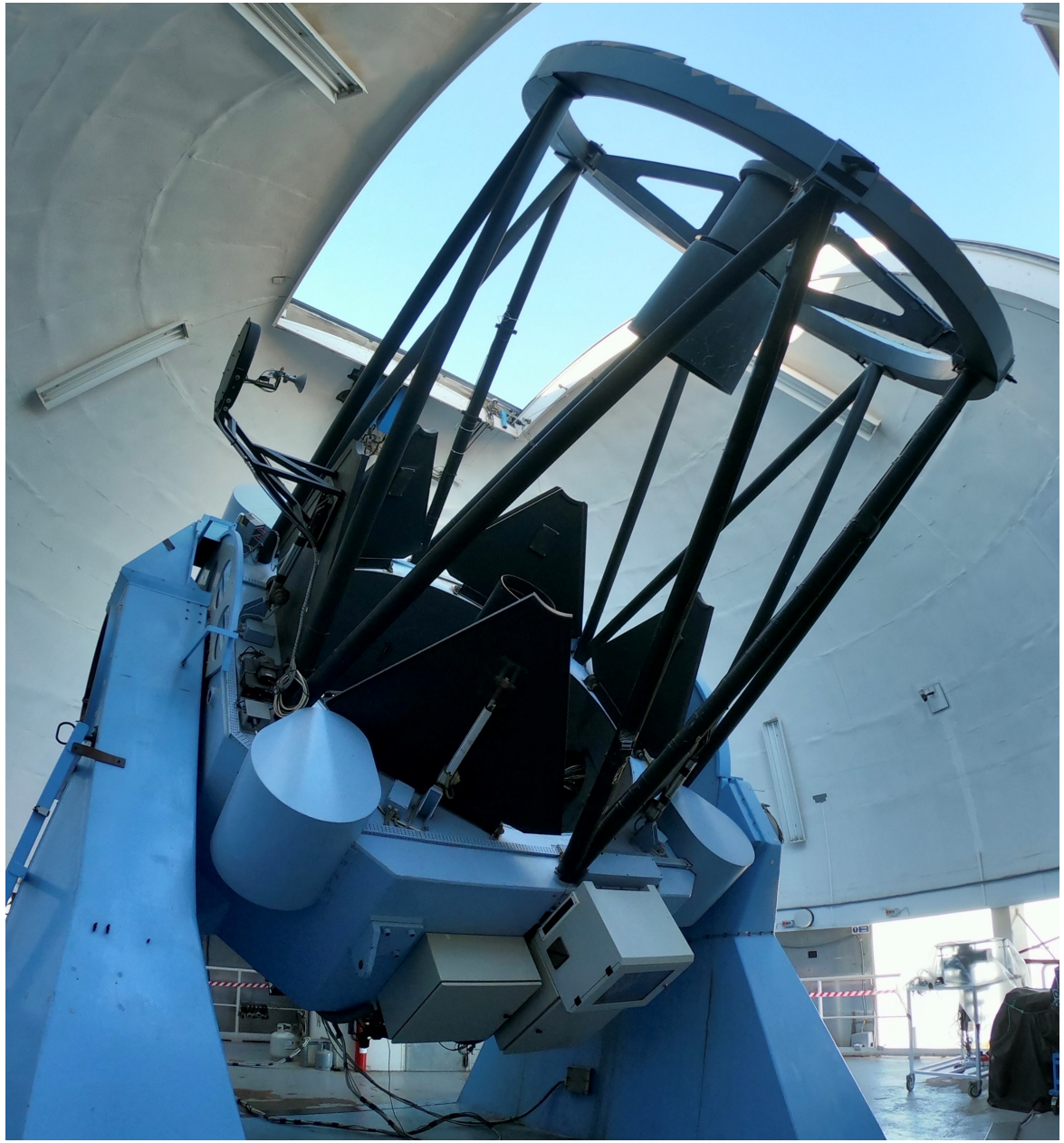


NOT Transient Explorer (NTE)

An Odyssey

https://nte.nbi.ku.dk/

Partners

Optical Imager Mechanics
Department of Physics and Astronomy
University of Aarhus
Denmark

Optical and Infrared Imagers
Finnish Centre for Astronomy with ESO
University of Turku
Finland

Polarimetric mode
Planetary-system research, Department of Physics
University of Helsinki
Finland

Rapid response mode
The Centre for Astrophysics and Cosmology
The Science Institute
University of Iceland, Iceland

Optical and Infrared Imagers
The Oscar Klein centre.
Stockholm University
Sweden

Spectrograph cameras and Infrared Imager Mechanics
Osservatorio Astronomico di Brera
Istituto Nazionale di Astrofisica
Milan, Italy

Infrared detectors
Max Planck Institute for Astronomy
Heidelberg, Germany

Optical and Infrared Imagers
The Key Laboratory of Space Astronomy and Technology
National Astronomical Observatories, Chinese Academy of Sciences
Beijing, China

Atmospheric Dispersion Corrector
Department of Particle Physics and Astrophysics
Weizmann Institute for Science
Tel Aviv, Israel

Core funding

CARLSBERG FOUNDATION

The Carlsberg Foundation is a industrial foundation that supports basic scientific research within the natural sciences, social sciences and humanities conducted by Danish researchers and international researchers connected to Danish research environments. The funds for awards mainly come from the profits of Carlsberg A/S, in which the Carlsberg Foundation has a controlling interest. The Carlsberg Foundation was founded by Brewer J.C. Jacobsen in 1876.

The Carlsberg Foundation awards more than DKK 400 million. DKK per year for basic research.

NTE Team

Niels Bohr Institute

Michael I. Andersen – Systems engineer

Lise Christensen – Pipeline responsible

(**Niels Michaelsen** – Mechanics)

Bo Milvang-Jensen – Pipeline development

Anton N. Sørensen – Calibration and AIT

Joonas K. M. Viuho – Motors and control

Dennis Wistisen - Mechanics

Nordic Optical Telescope

Sergio Armas – Software systems

Peter Brandt – Mechanics

Jacob W. Clasen – Project Manager

Graham C. Cox – Detector systems

Anlaug Djupvik – Astronomer, IR applications

Carlos Perez – Mechanics

Tapio Pursimo – Astronomer, imaging

John Telting – Astronomer, spectroscopy

Partner institutes

John E. V. Andersen – VIS Imager mechanics
University of Aarhus, Denmark

Stefano Covino – Head of science team
INAF Brera, Italy

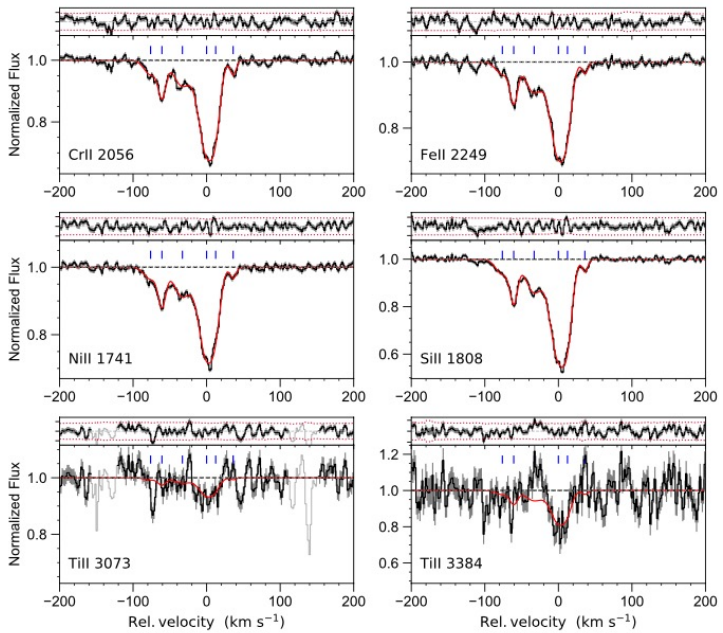
Anders S. Damgaard - VIS Imager mechanics
University of Aarhus, Denmark

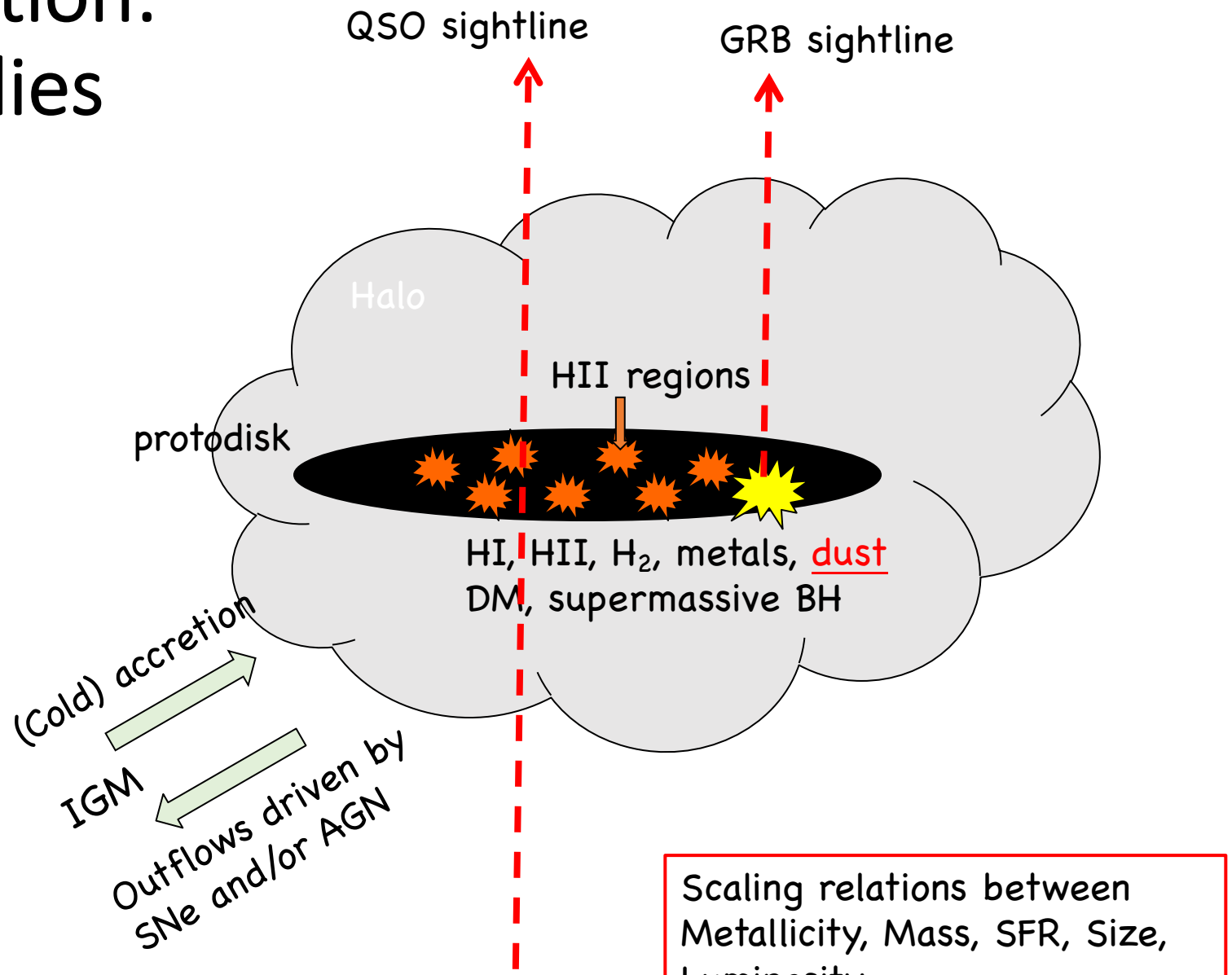
Kasper E. Heinz – Instrument scientist, pipeline
University of Iceland, Iceland

Vitaly Neustreov – Imaging pipeline
FINCA/University of Oulu, Finland

Marco Riva – Spectrograph camera optics
INAF Brera, Italy

My personal motivation: Absorption line studies





Scaling relations between Metallicity, Mass, SFR, Size, Luminosity,...

Motivation for NTE

- The NOT quickly stood out as great for transient follow-up work (hear more in later talks, e.g., Malesani).

- Flexible, informal and friendly community, good instruments

- But there are important limitations:

Motivation for NTE

- The only always available instrument is StanCam (FIES not sensitive enough for extragalactic work).

- We cannot always secure spectroscopy.

- The spectral resolution of Alfosc is good for redshifts and extinction, but not much else.

- Near-IR imaging and spectroscopy very rarely possible.

Motivation for NTE

- X-shooter at the ESO-VLT saw first light in 2009. This instrument is a major inspiration for NTE.

- How could we make an instrument like (or preferably improved) X-shooter for the NOT?

- The NTE is the answer to that question.

Additional constraints for NTE:

- We want NTE to be (quasi)-permanently mounted so it should fulfil the needs of the community (imaging and spectroscopy, FOV, #filters, some polarimetry, etc.)

- It should preferably be innovative and give our user community a strong edge, or several edges. We should be able to do great things few others can do.

Science with NTE: GRB follow-up (example)

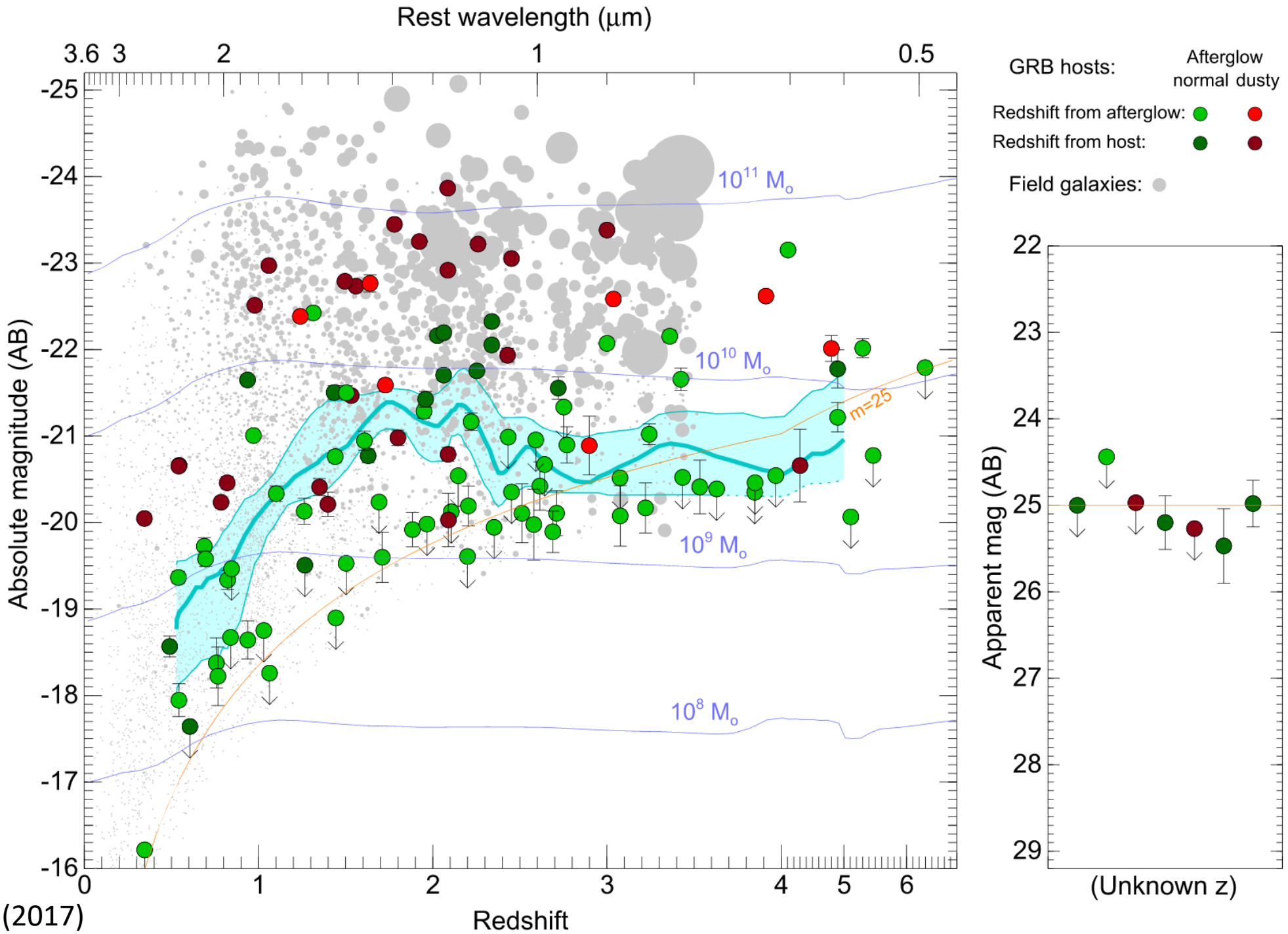
- Close to 1000 GRB afterglows have been studied and redshifts have been measured for hundreds ($0.0085 < z < 8.2$).

There is still a lot of potential – especially with NTE and its NIR capabilities:

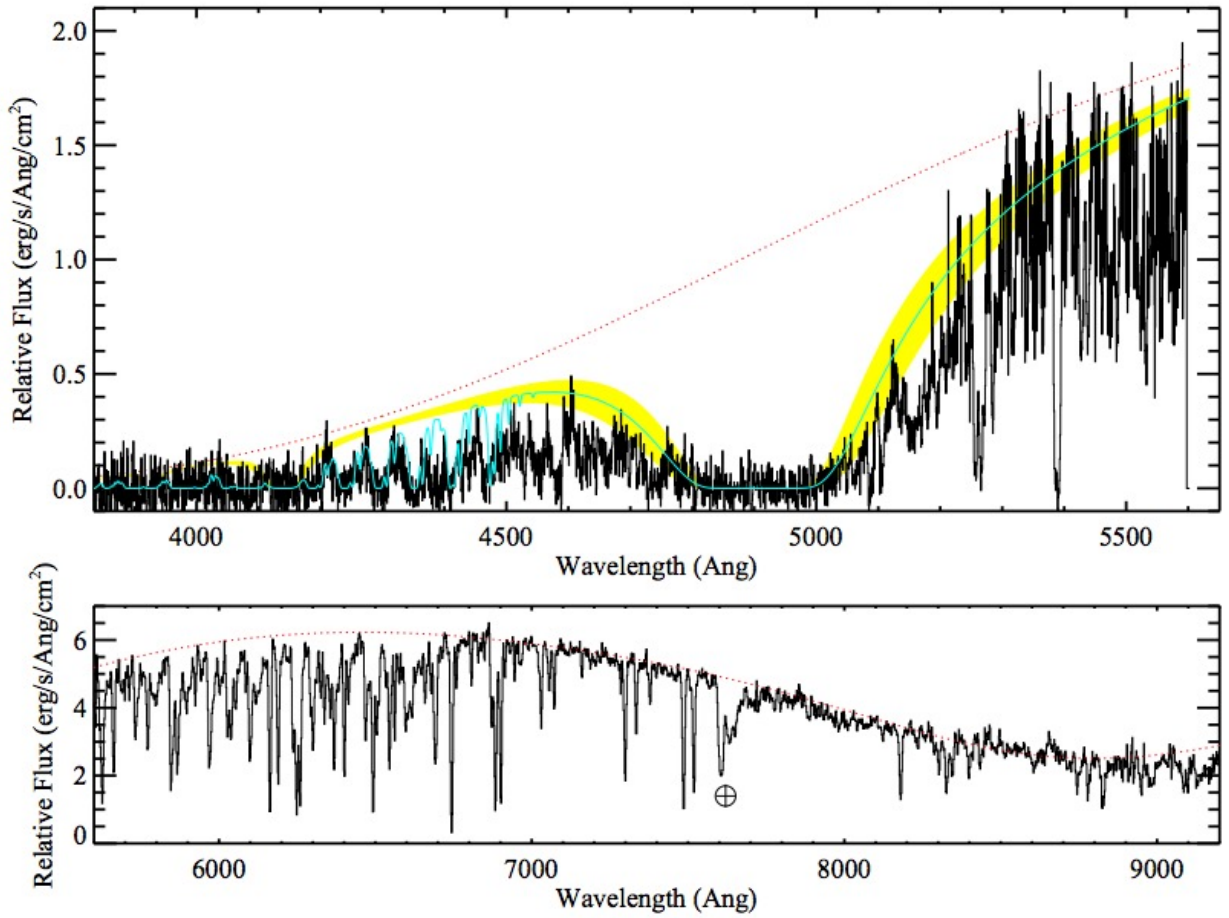
- $z>6$ events occur at a rate of a few per year. They offer a very clean measurement of the ionization degree if spectra with decent S/N~10 can be secured.

- We don't detect optical afterglows for 40% of the GRBs (Fynbo+2001,2009).

- Short GRBs related to gravitational wave events – one kilonova spectrum so far.



Perley et al. (2017)



Prochaska et al. (2009)

GRB080607

Very bright afterglow observed 12 minutes after the burst

$z = 3.04$

$\log N_{HI} = 22.7$

H_2 and CO

Forest of metal lines!

Solar metallicity

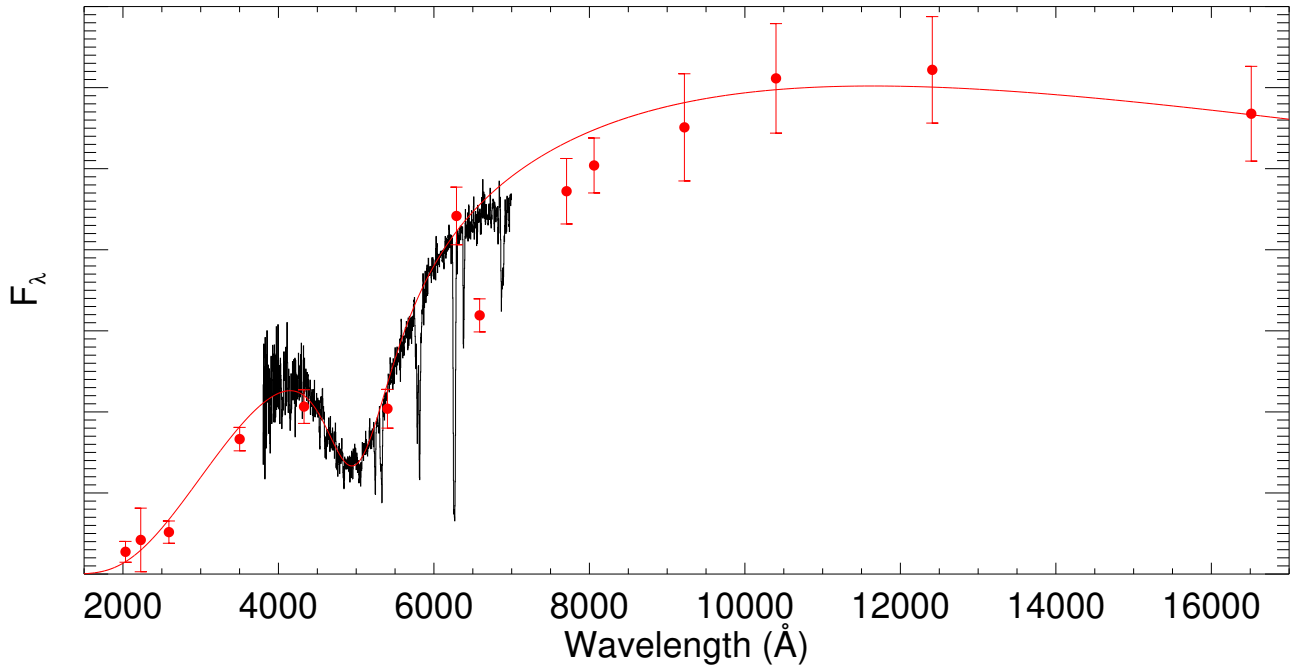
$A_V = 3.3$ mag

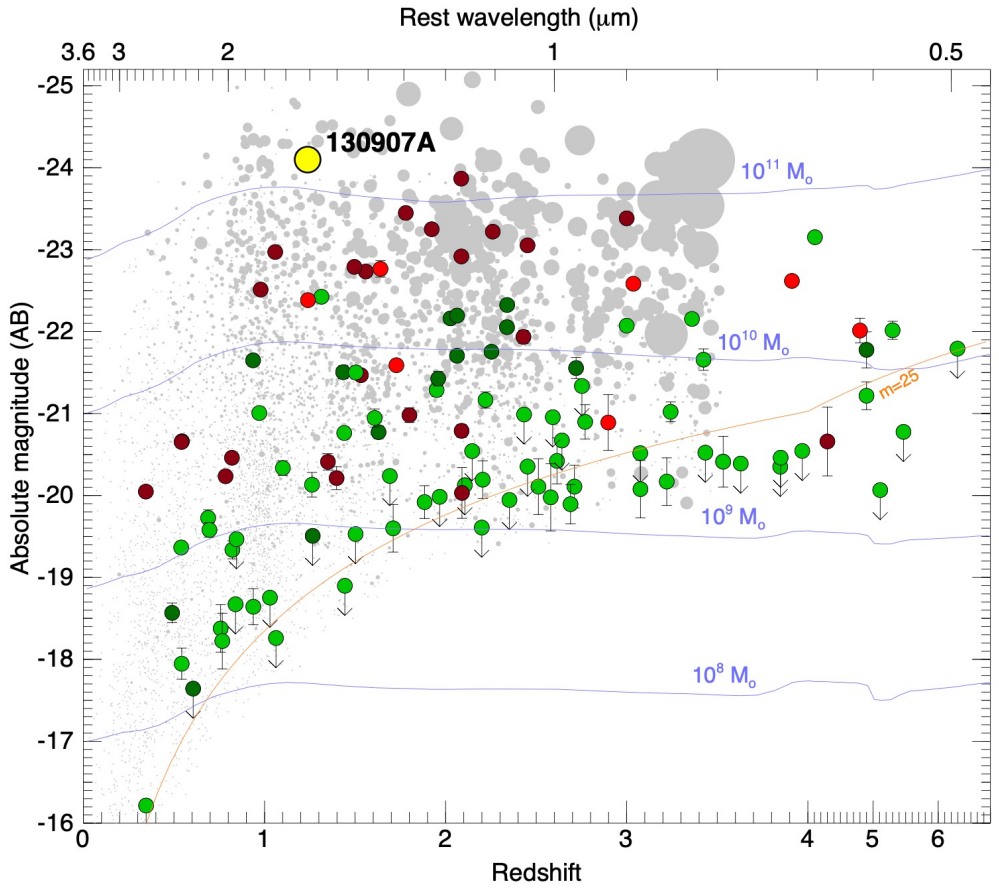
2175Å extinction bump.

Bright/massive and dusty host

SFR = 10 $M_\odot$/yr

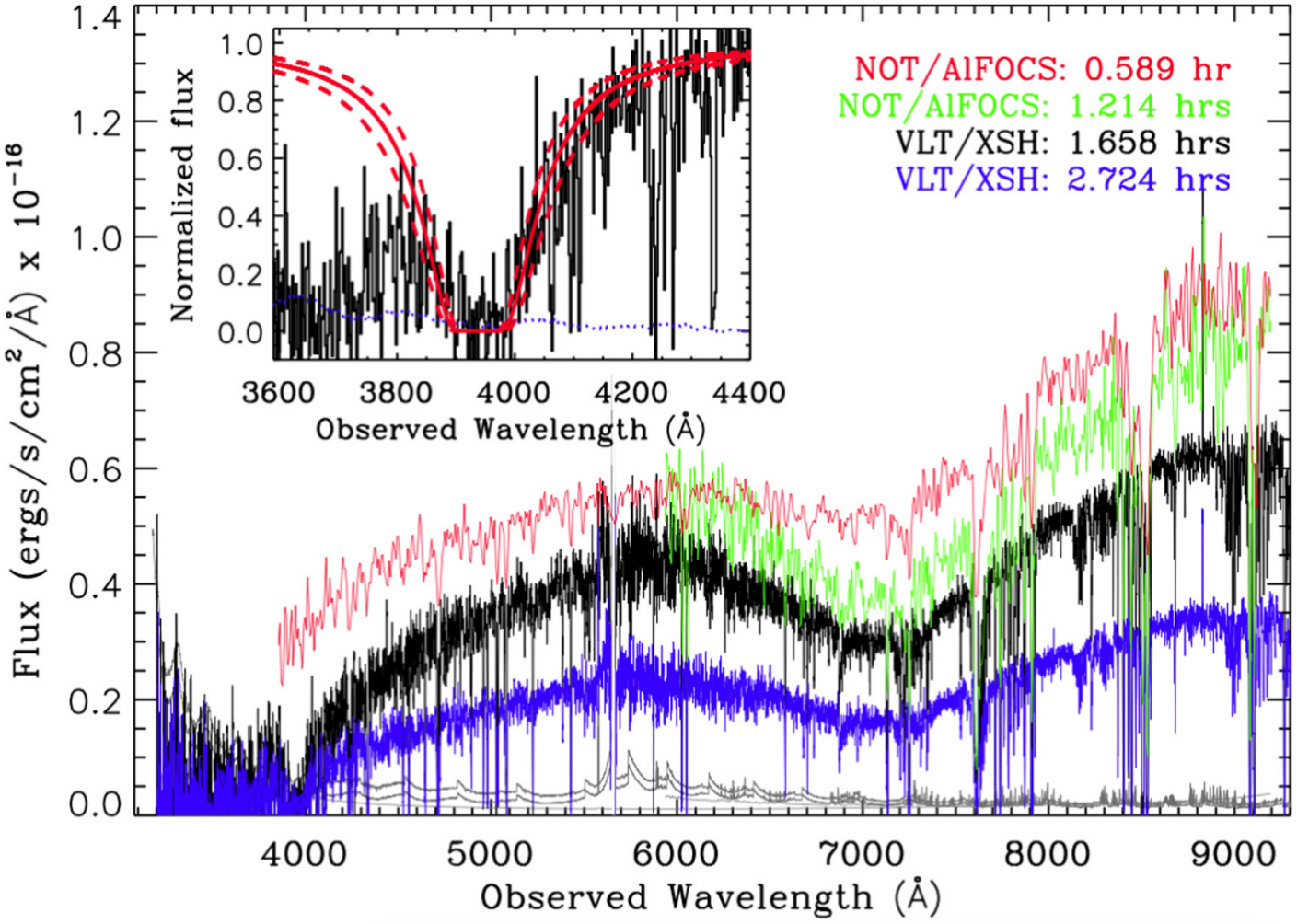
GRB130907A, z=1.24





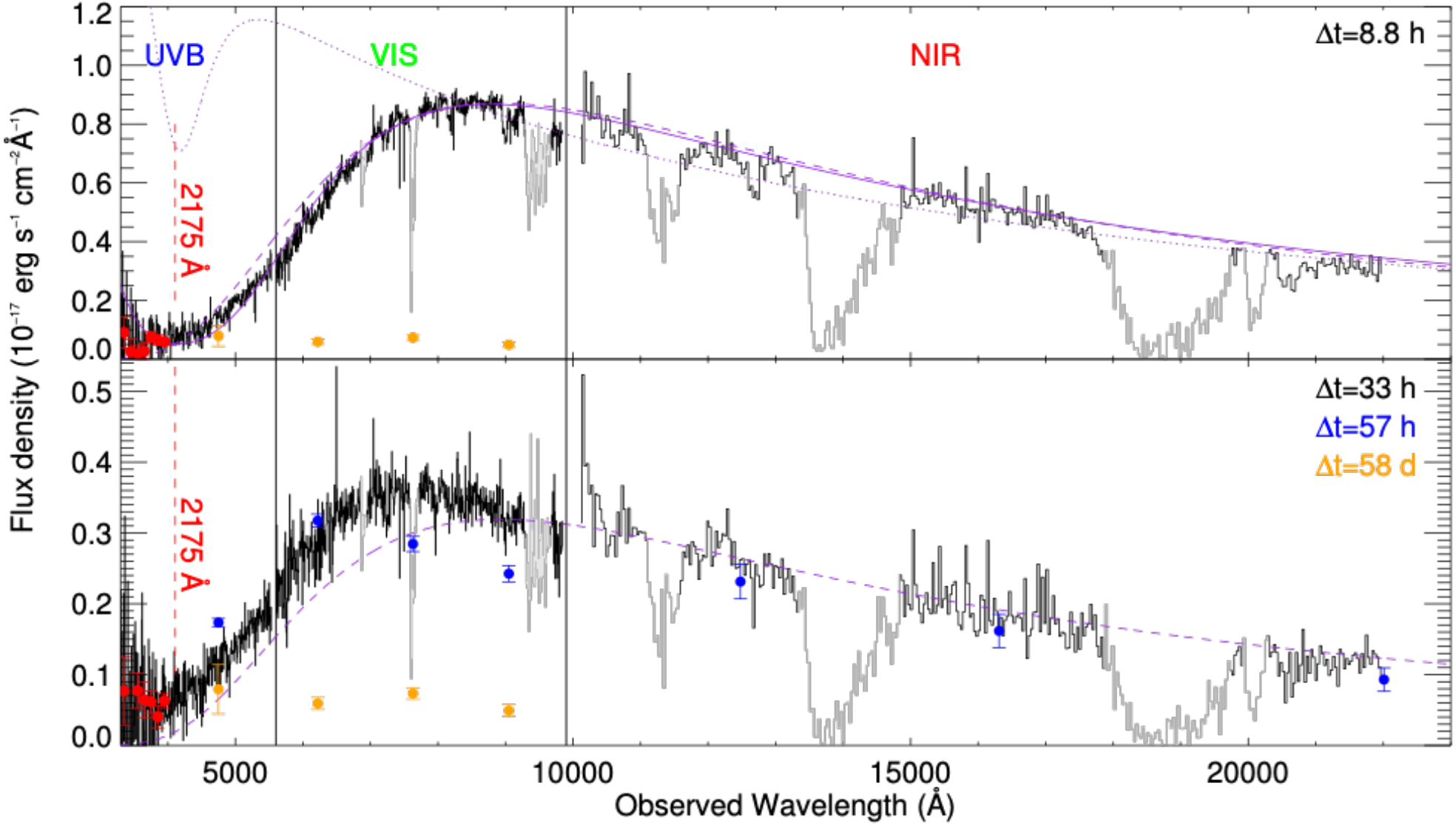
DePasquale et al. in prep

GRB180325A, z=2.25



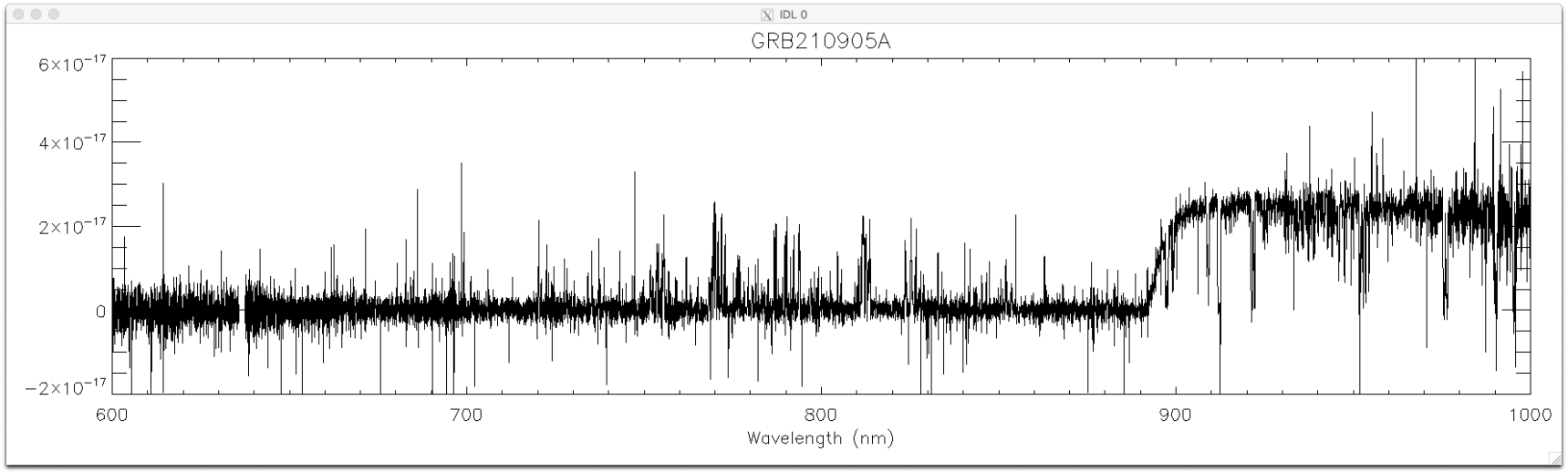
Zafar et al. (2018)

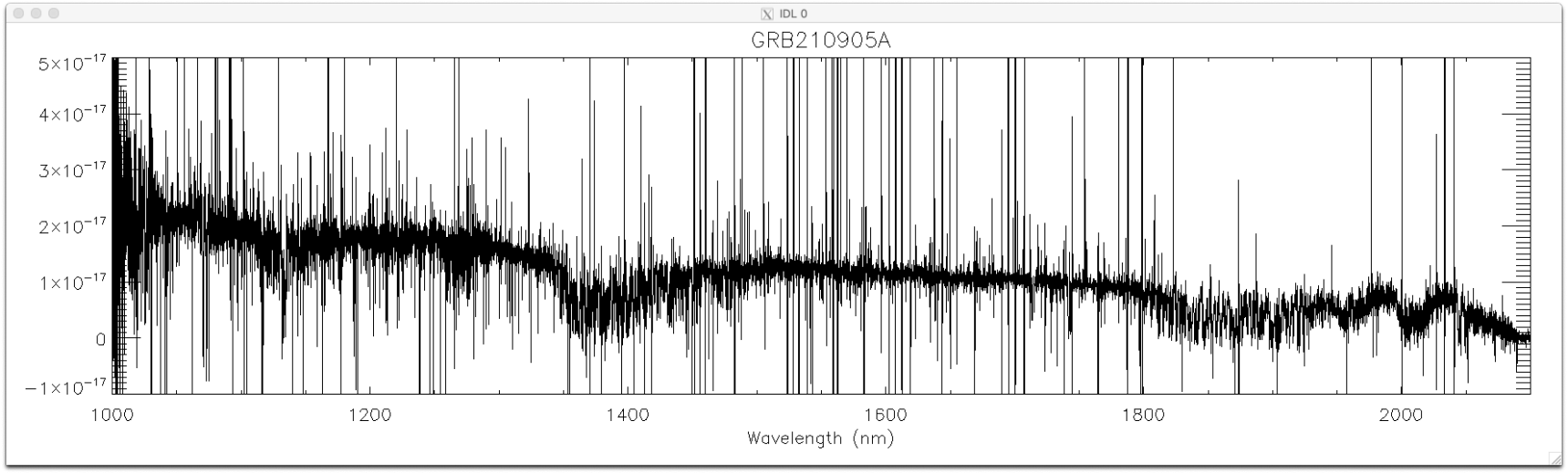
GRB140506A



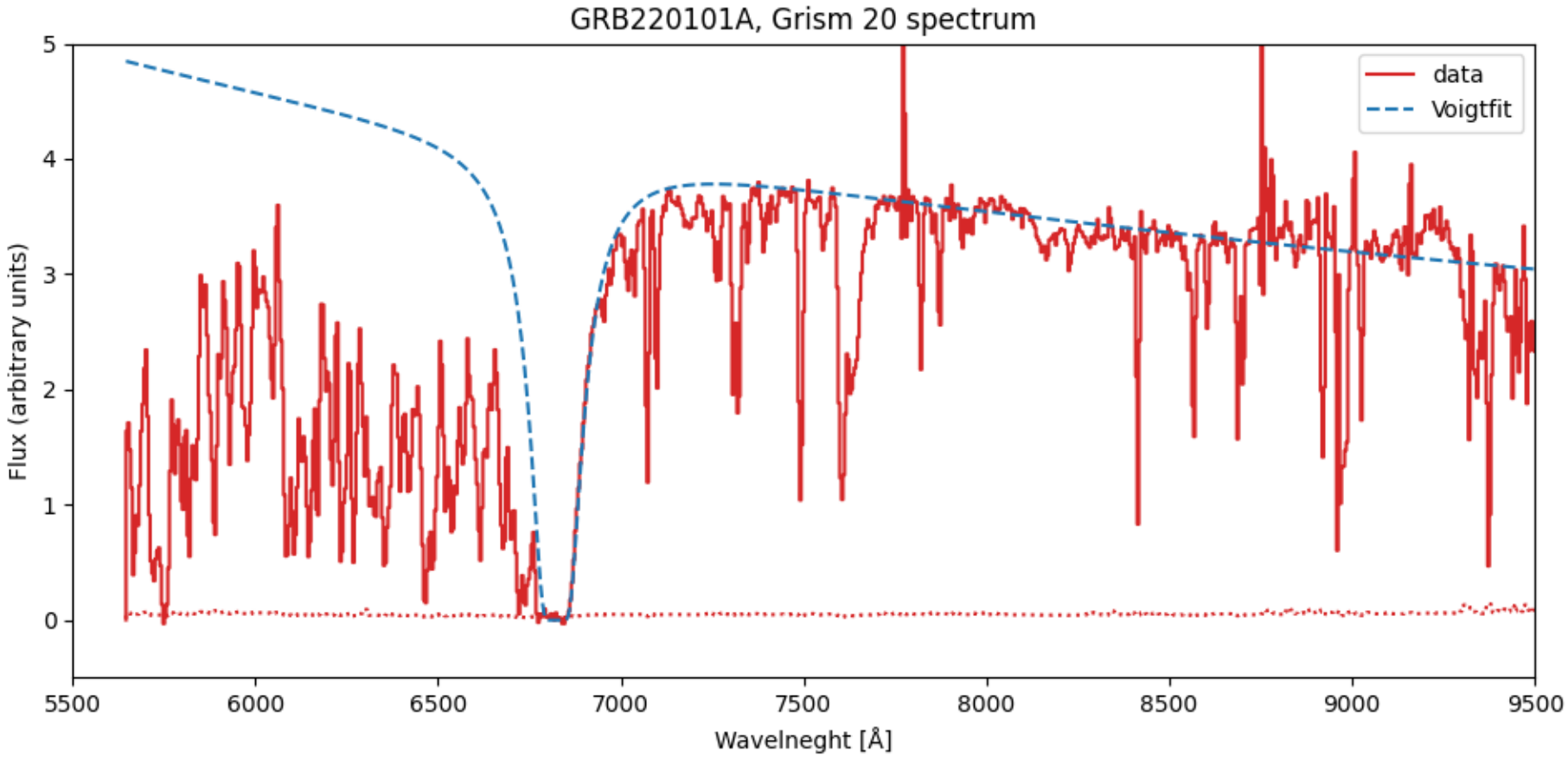
Fynbo et al. (2014)

Very distant GRBs. Probing the epoch of re-ionization.

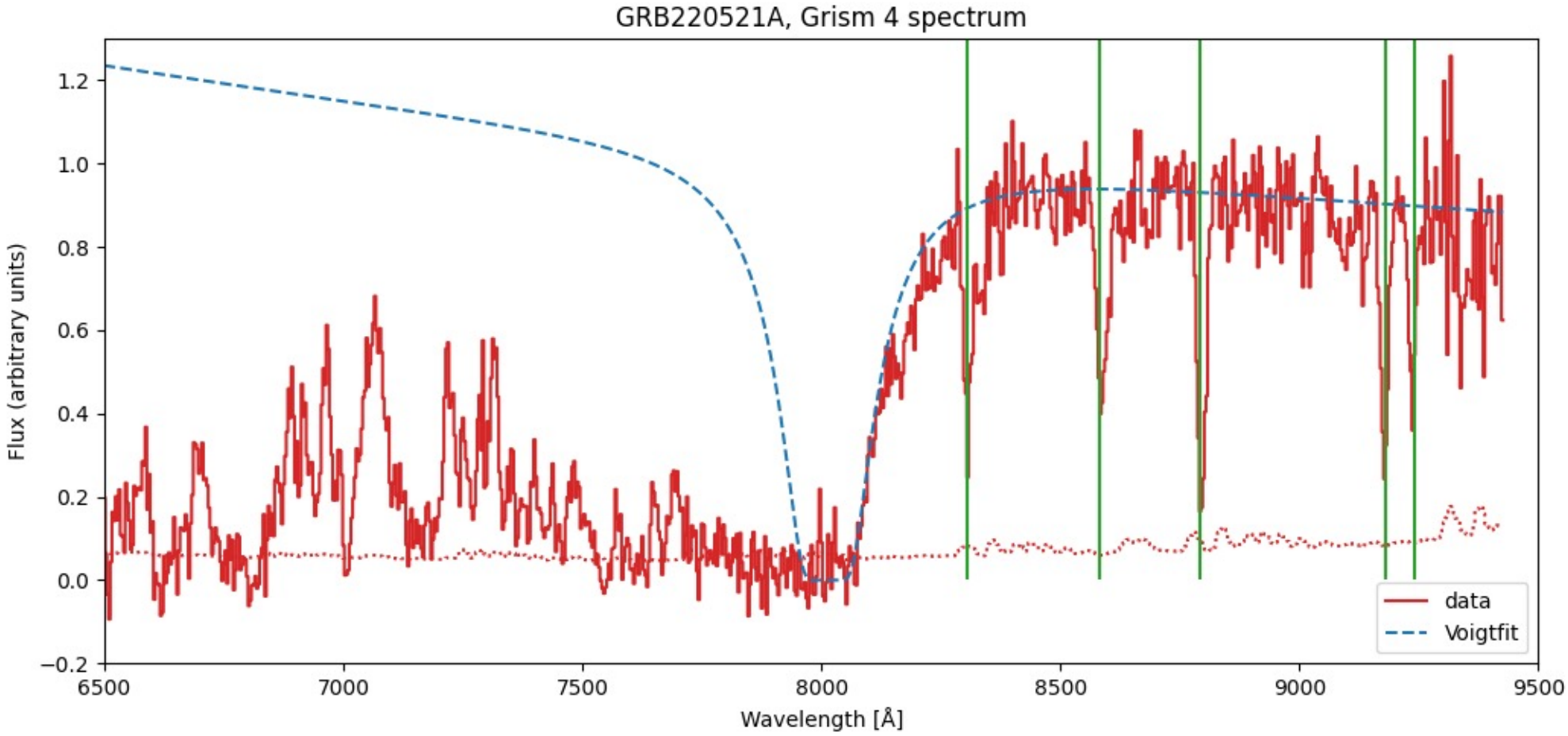




The NOT is large enough to secure good spectra – also of very distant events



The NOT is large enough to secure good spectra:



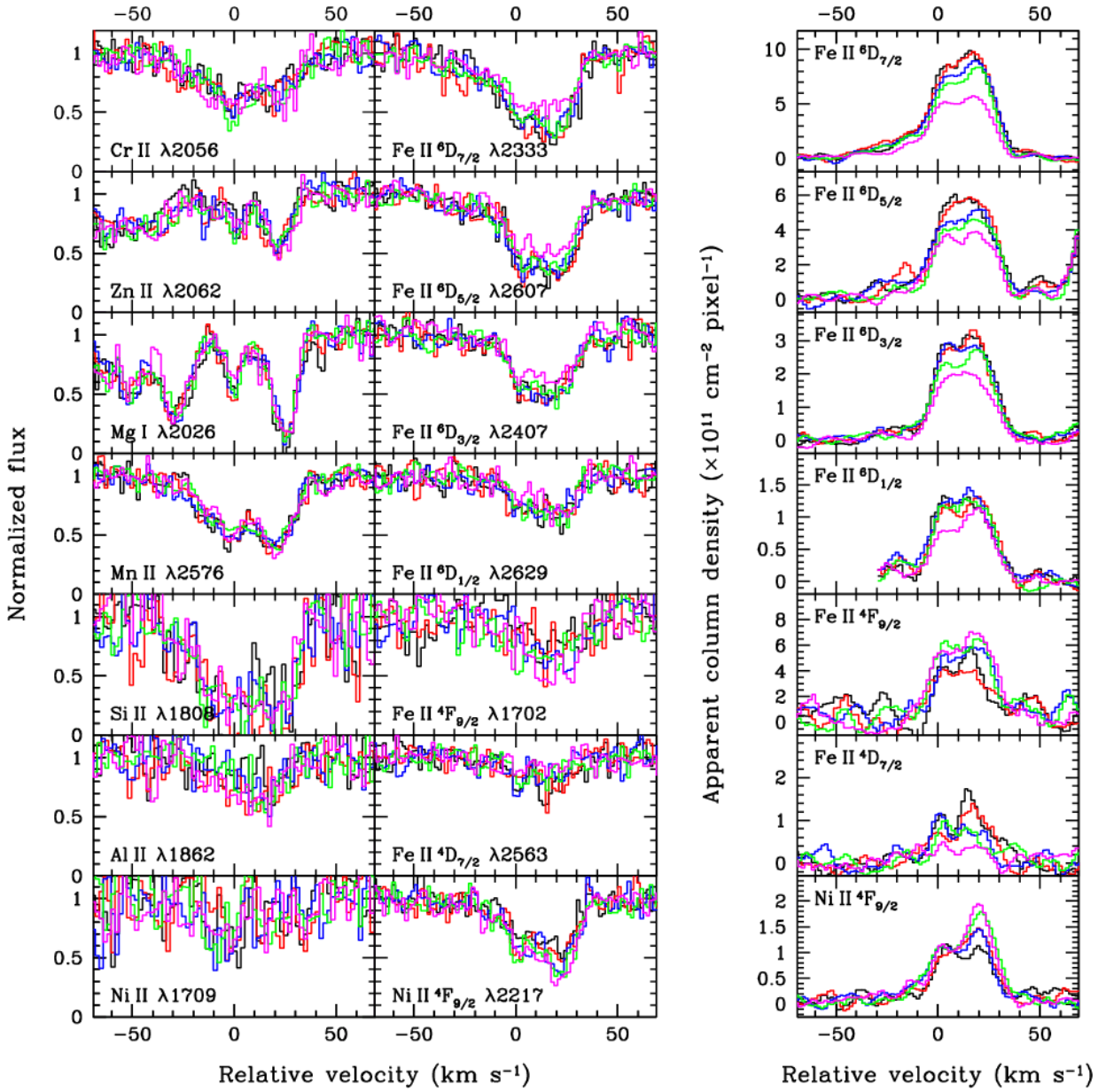
VERY FAST RESPONSE

Very rapid response (here Vreeswijk et al. 2007)

Variable absorption lines

Getting an optical spectrum during the prompt phase is something we really want to do.

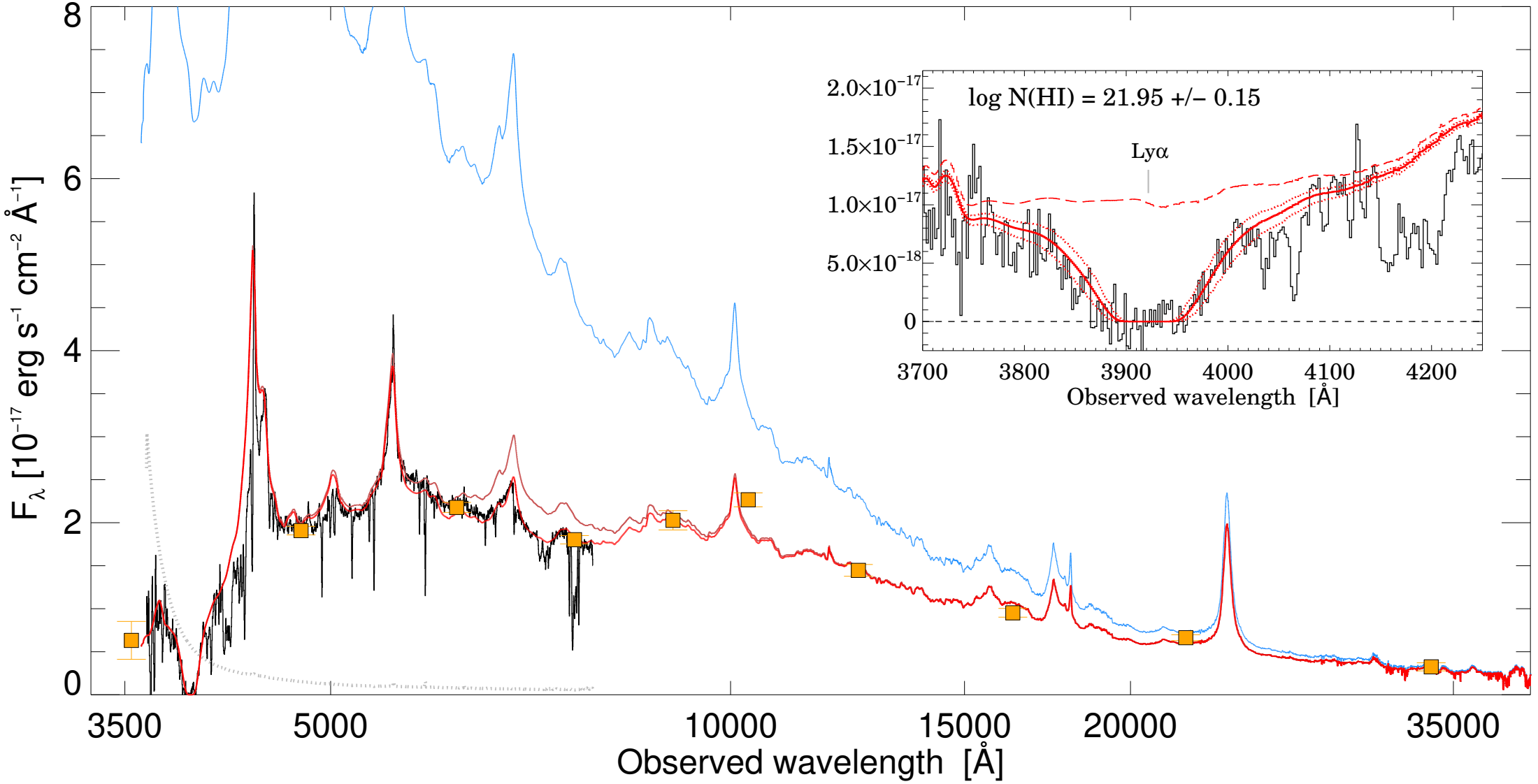
NOT is optimal for this as it points very quickly. With a RRM system we can be on target within 1 min.



Vreeswijk et al. 2007

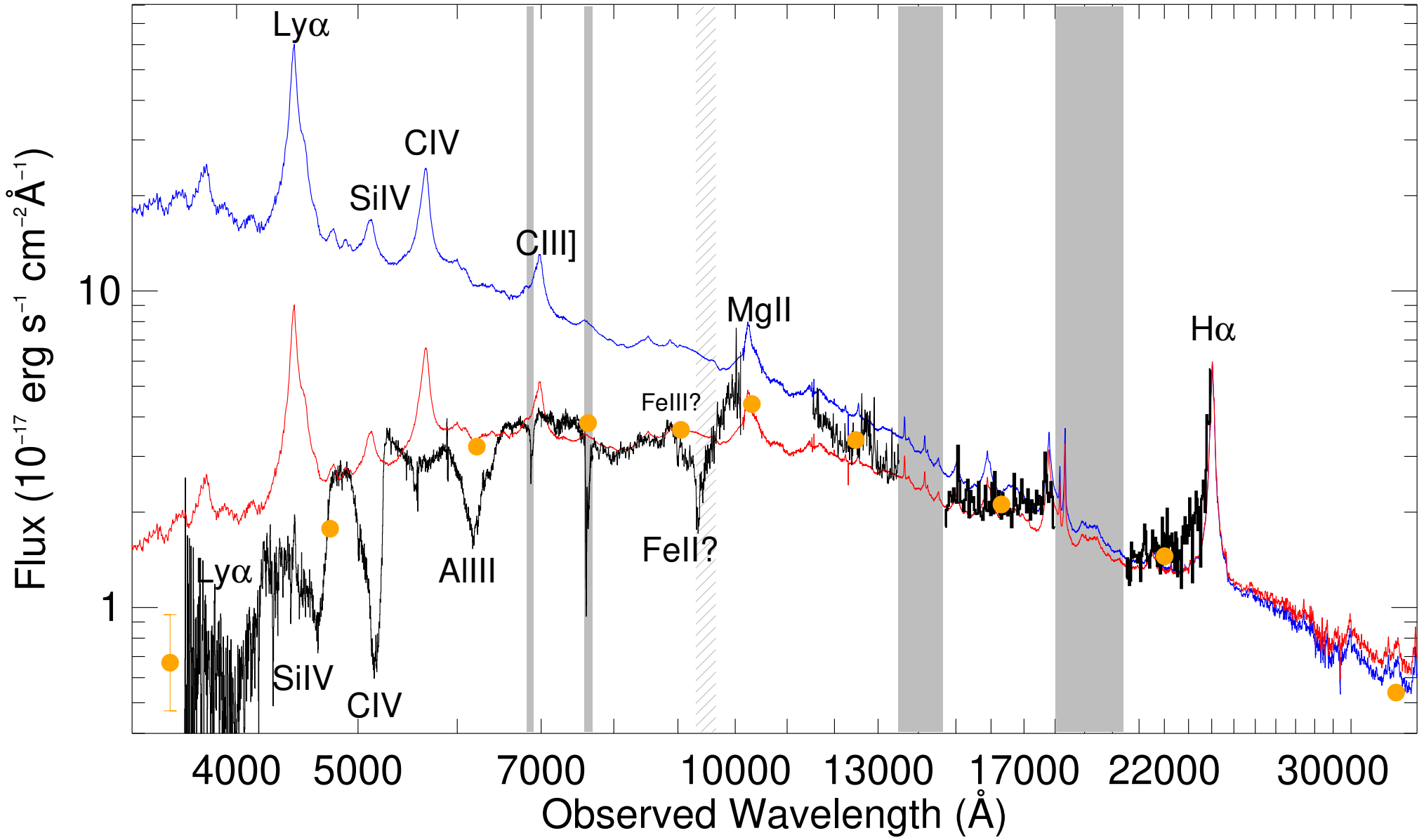
Quasars

(See also posters by Marina Koukouvaou, Ioannis Mageiras, Guozhen Ma)



NOT Transient Explorer (NTE) 2022

Geier et al. (2019). See also Heintz et al. (2018) and Krogager et al. (2019).



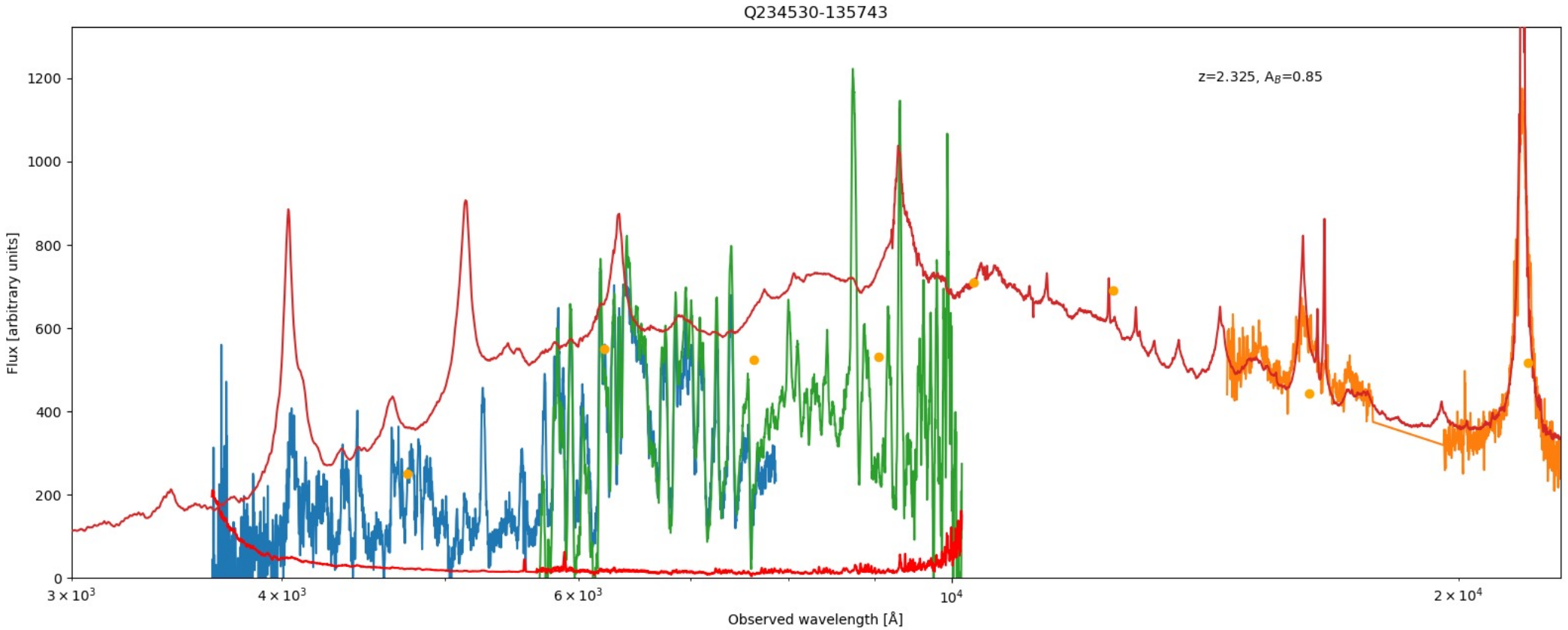
Fynbo et al. (2020)

The NTE Odyssey

- We are trying to build a dream instrument. It will be a dream instrument for transient astrophysics, but also for many other types of studies (including quasar absorption line studies).

- Building the NTE is indeed an Odyssey. Like Odysseus we have lost men to monsters and sometimes it looks like the gods are against us. Other times it seems like other gods are with us and mana fall down from the sky.

- NTE will be completed, it is a difficult travel, but we will come home. The NTE will be a great instrument that will give the user community strong competitive edges: A great spectrograph, powerful detectors, near-IR target acquisition, simultaneous vis/near-IR imaging, KDP enhanced near-IR imaging, spectropolarimetry.


Q234530-135743
z=2.325, A_B=0.85
Flux [arbitrary units]
Observed wavelength [Å]
0
200
400
600
800
1000
1200
3×10^3
4×10^3
6×10^3
10^4
2×10^4