What do we know about the early optical observations of GRBs and what are the challenges for the future

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Motivation of this talk

- Earlier photometry —> inner parts of GRBs
- More bands—> more regions of emissions

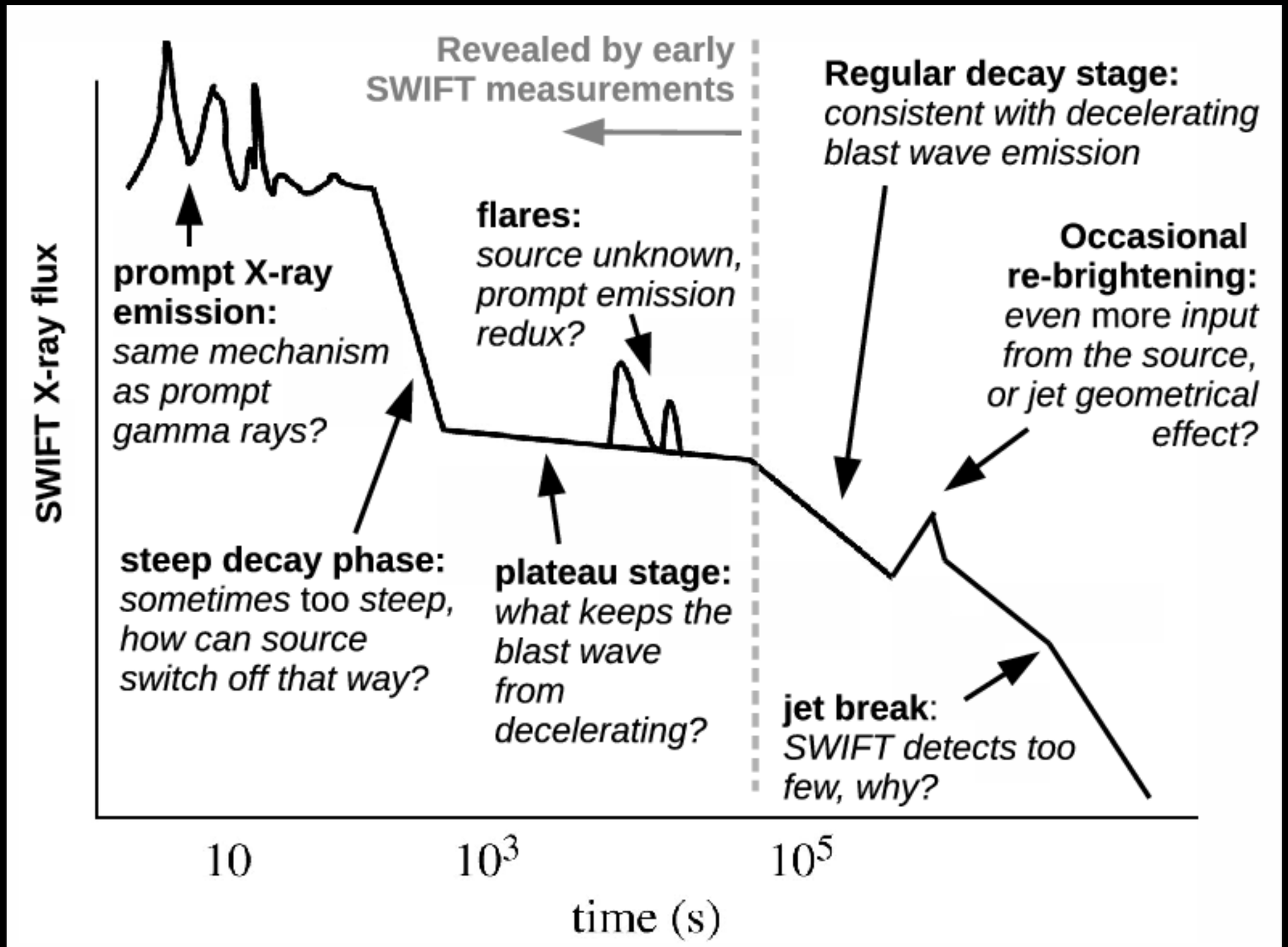
★ Distinctive features (flares, reverse components)

- composition of the jet
- flux dominated by magnetic fields/matter.

Outline

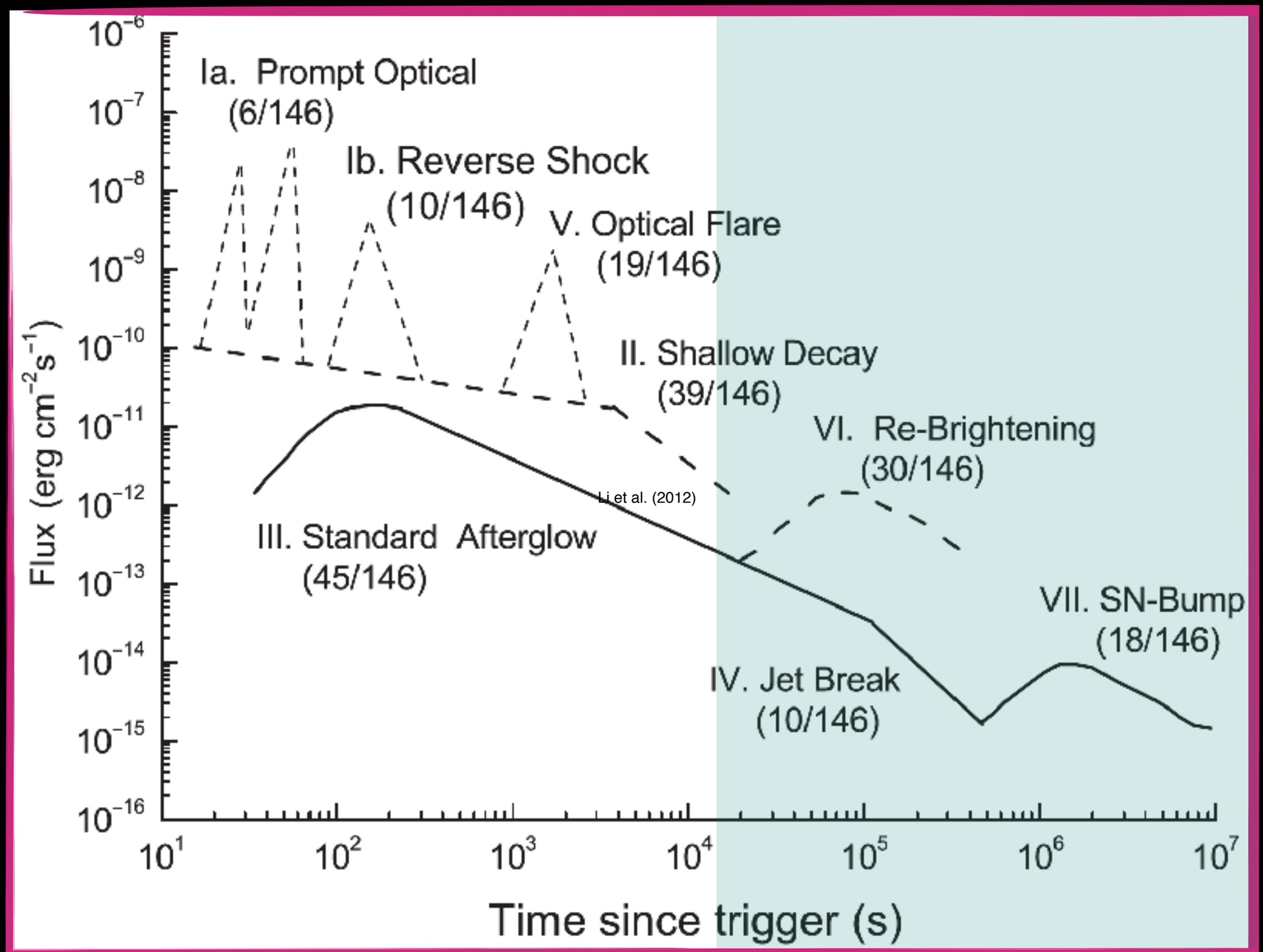
- Historical context of optical photometry (differences with X-rays and difficulties for optical)
- Current work/examples of optical observations for GRBs
    - GRB 180418A (TAROT+RATIR)
    - GRB 180205A (COATLI)
    - GRB 180620A (COATLI+RATIR)
    - GRB 180325A (TAROT+RATIR)
- What do we can expect for the future?

Canonical X-ray light curve



Credits: Starling et al. (2008)

Canonical optical light curve?



Credits: Li et al. (2012)

Previous results

	2012	2013	2014	2015	2016	2017
Total alerts (BAT)	98	95	98	83	89	87
$UVOT$	40	48	29	27	29	20
$RAPTOR$	3	2	3	3	2	0
$BOOTES$	1	0	1	0	1	2
$MASTER$	3	2	7	5	5	18
$TAROT$	3	2	0	0	3	0

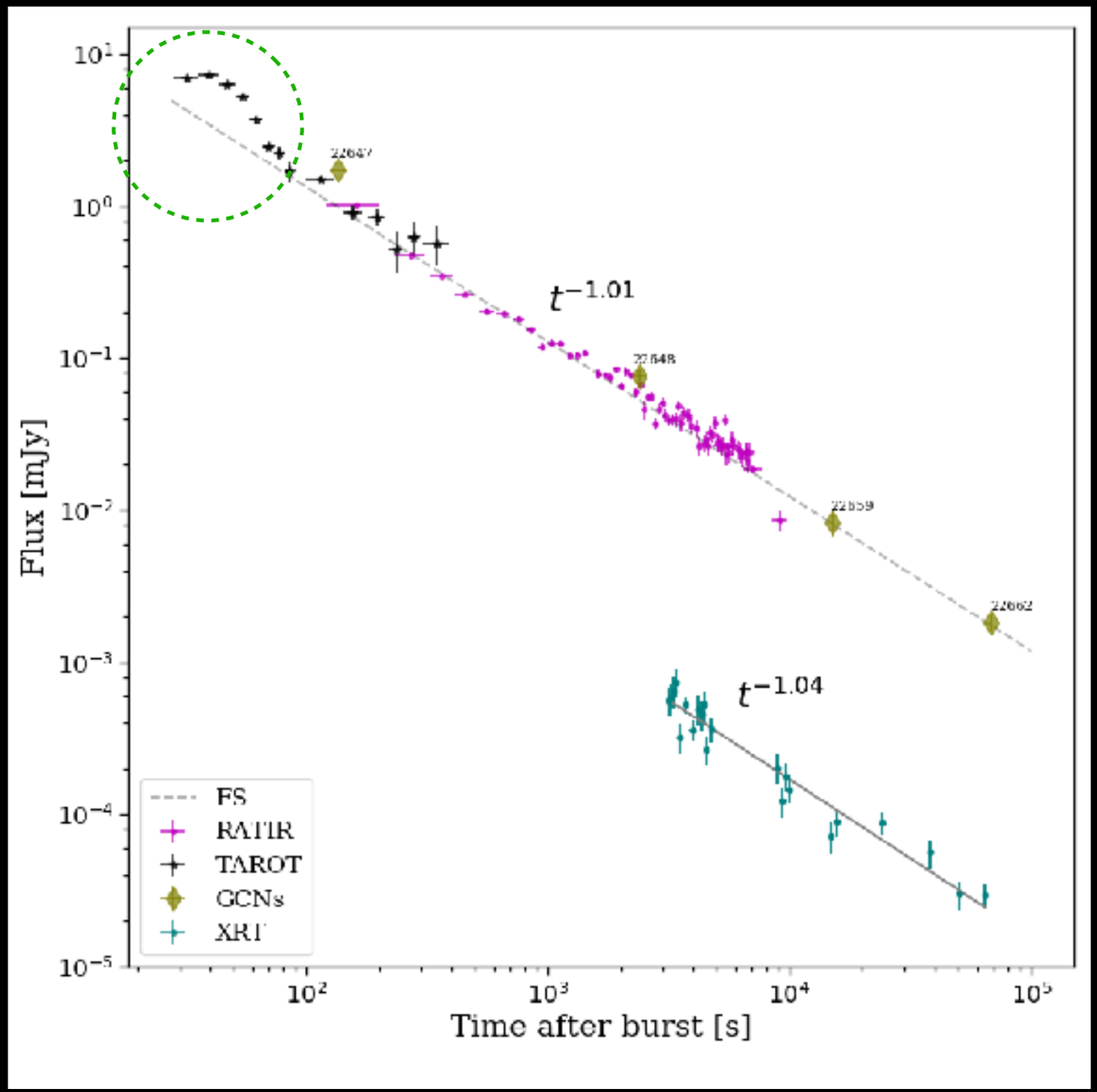
Table 2.2: Number of GRBs with early detections or observations with each one of the main GRB ground optical telescope networks by year in prompt emissions and early afterglows (up to a couple of minutes from the trigger).

Table 2.2 from Thesis

Reverse Shock Emission Revealed in Early Photometry in the Candidate Short GRB 180418A

R. L. Becerra, S. Dichiara, A. M. Watson et al., The Astrophysical Journal (submitted)

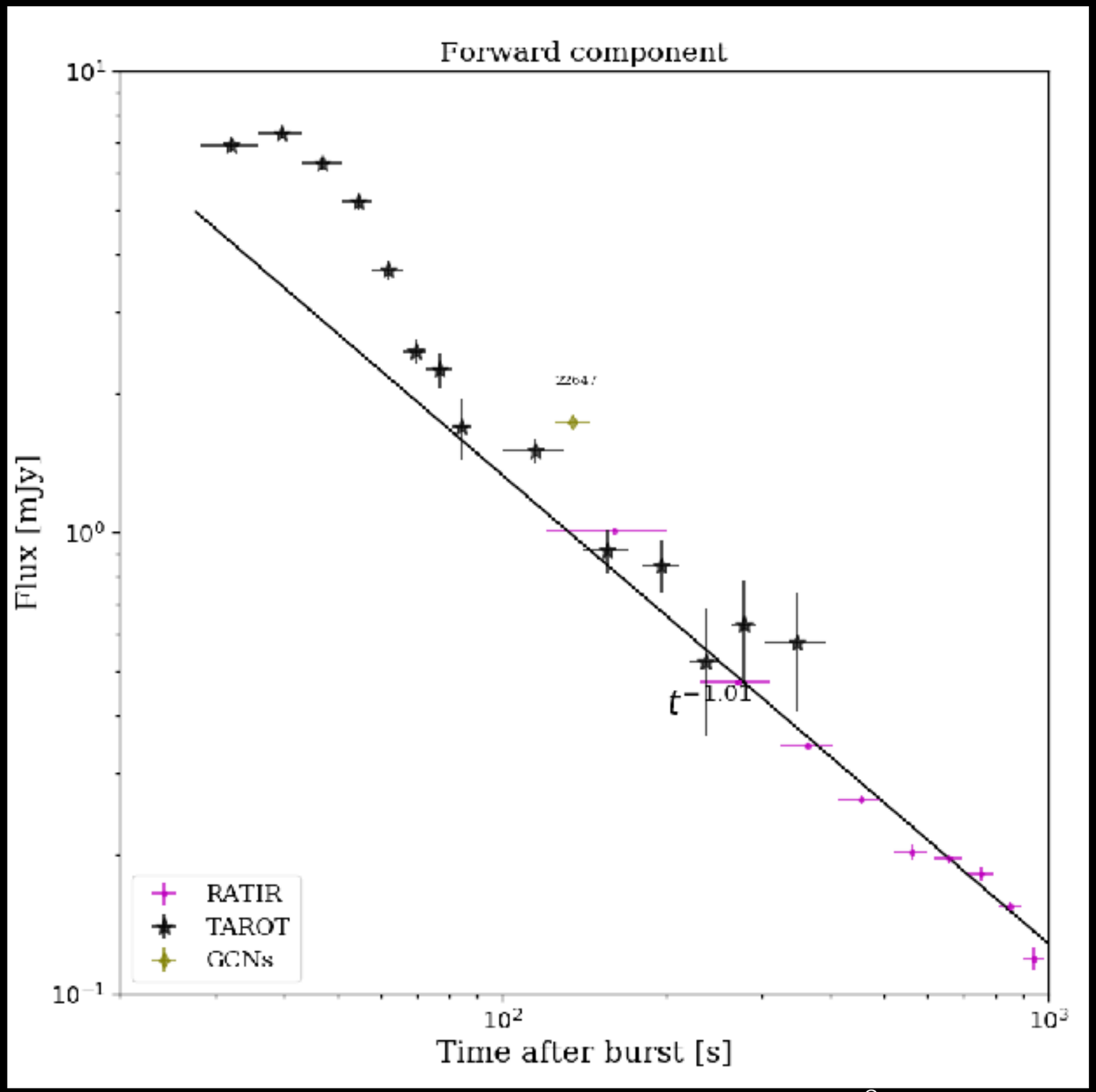
GRB 180418A



TAROT+RATIR data

Becerra et al. 2019b

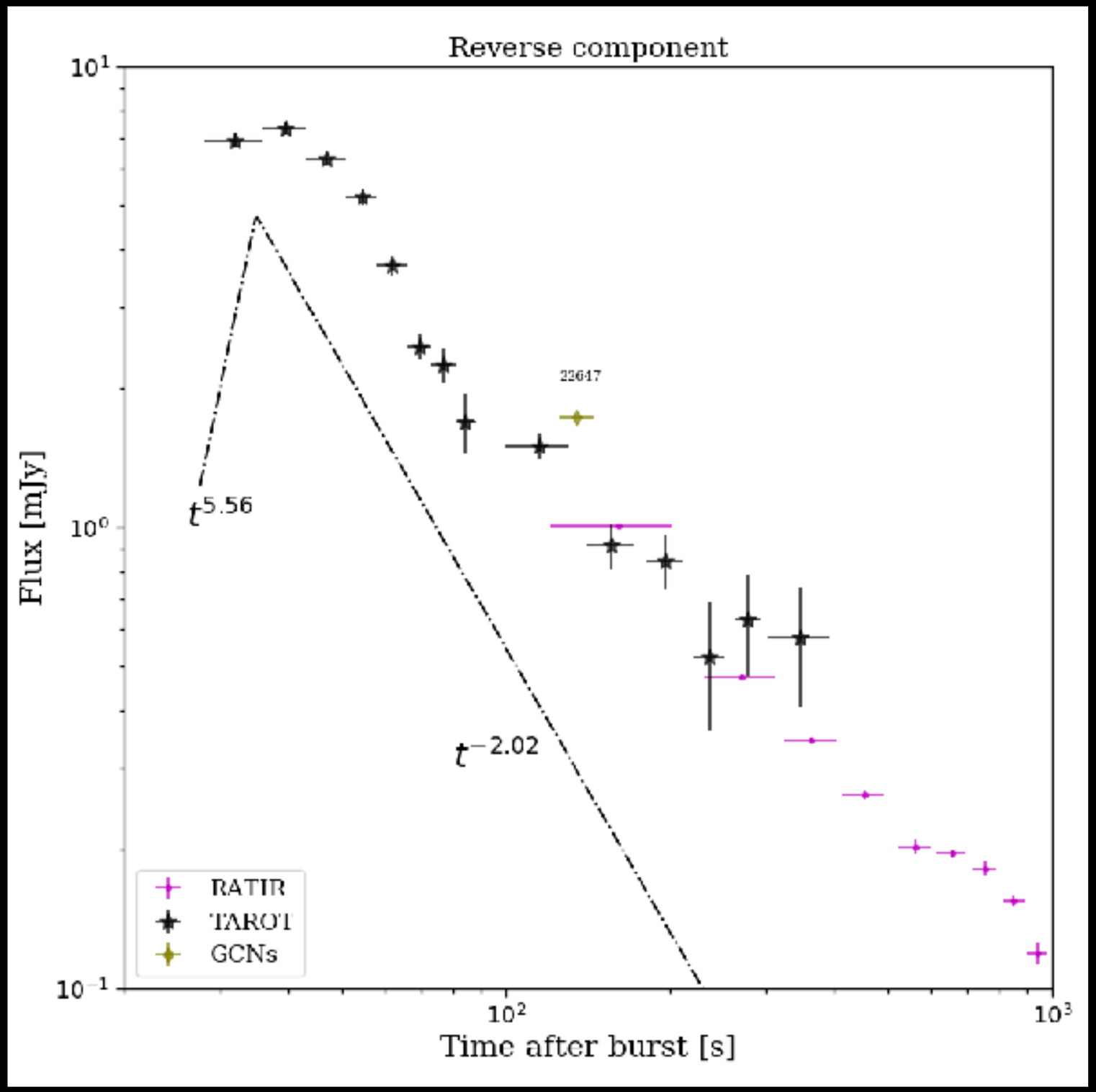
GRB 180418A



TAROT+RATIR data

Becerra et al. 2019b

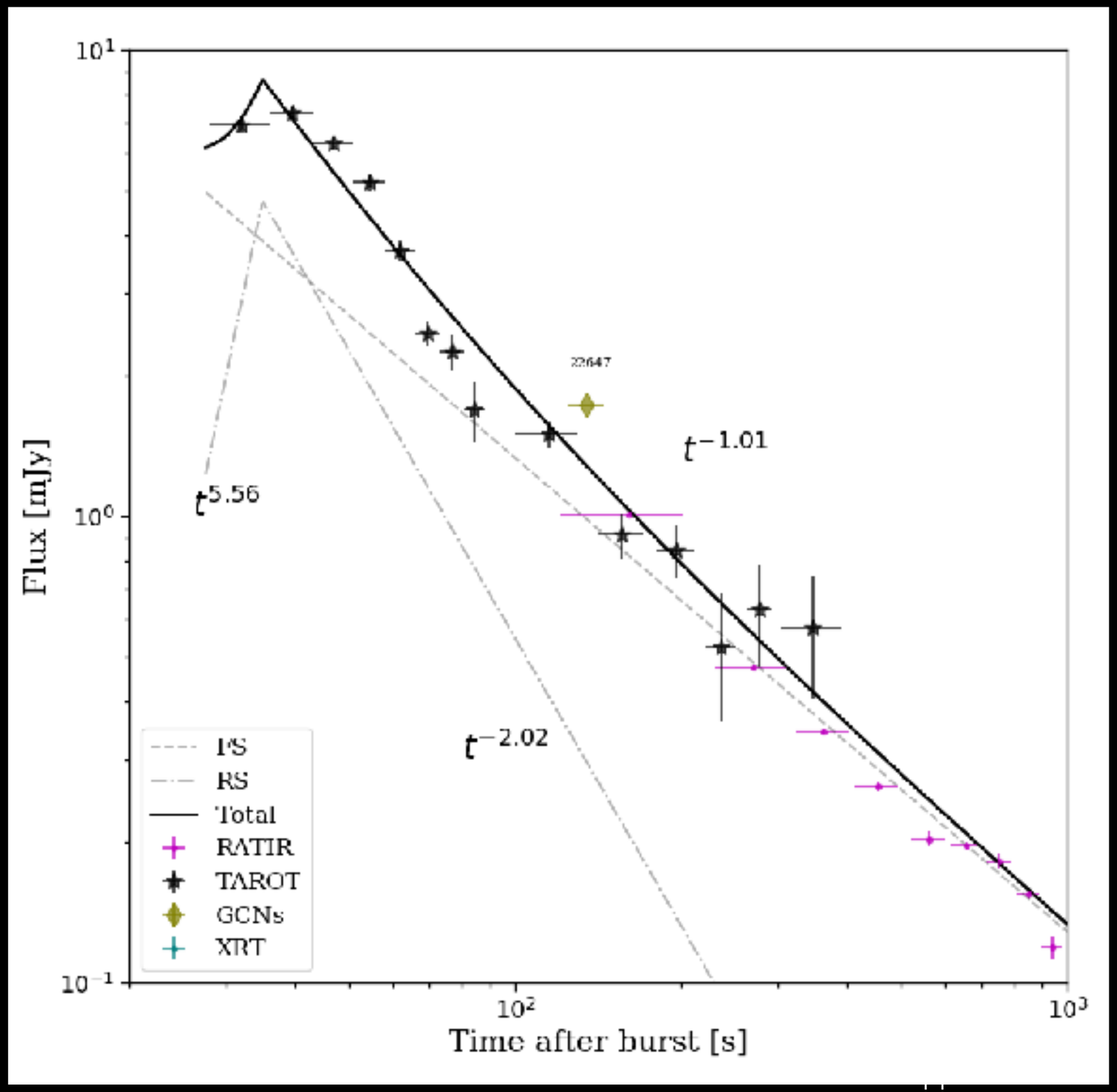
GRB 180418A



TAROT+RATIR data

Becerra et al. 2019b

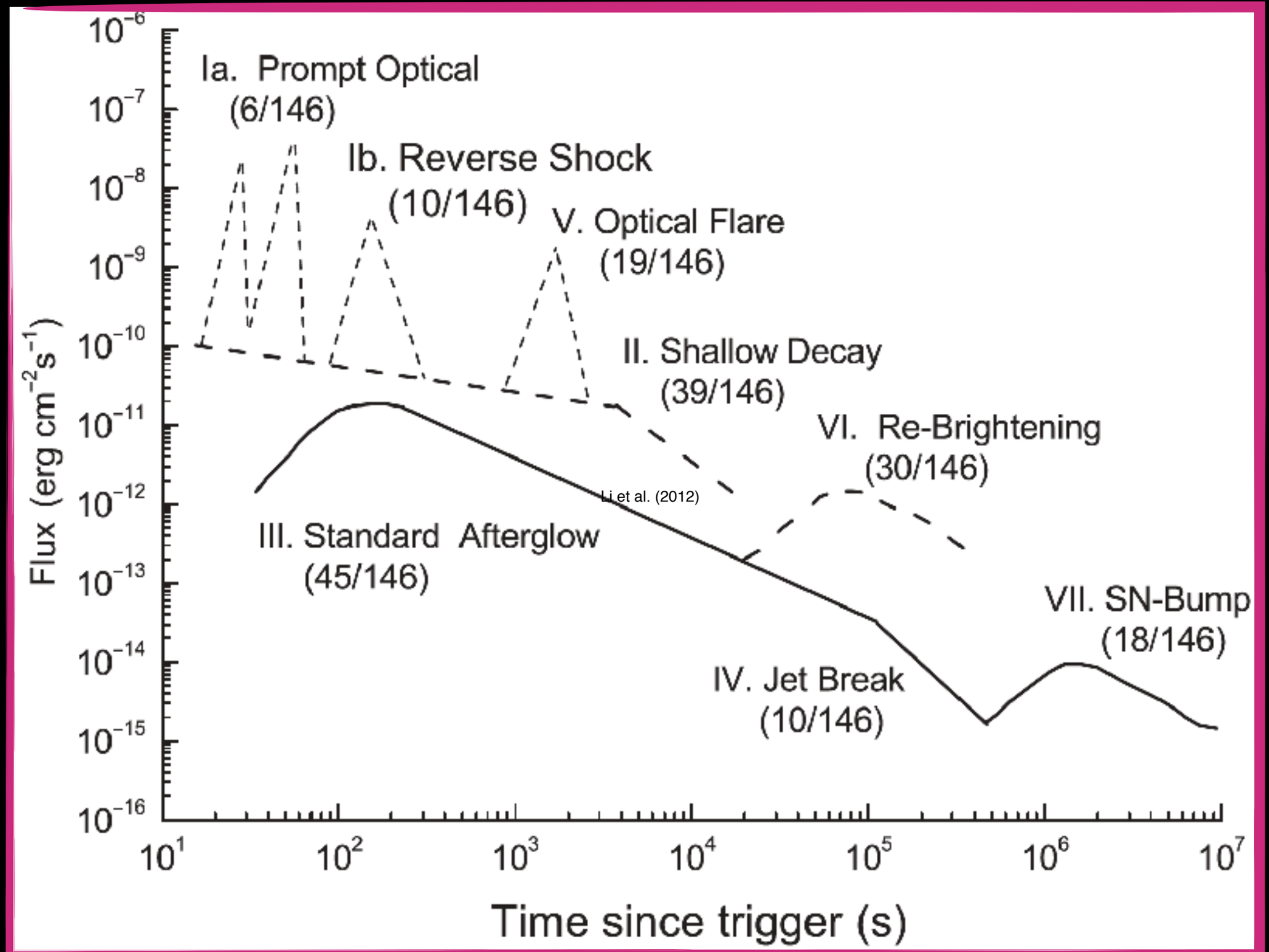
GRB 180418A



TAROT+RATIR data

Becerra et al. 2019b

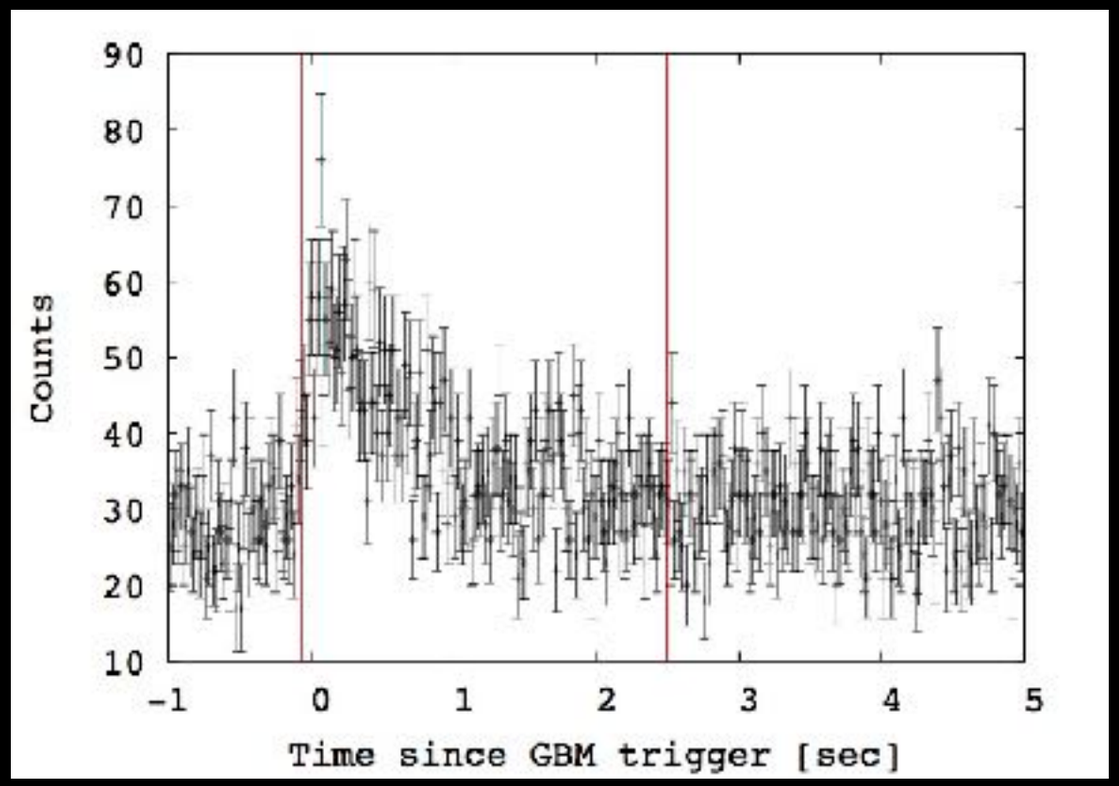
Canonical optical light curve?

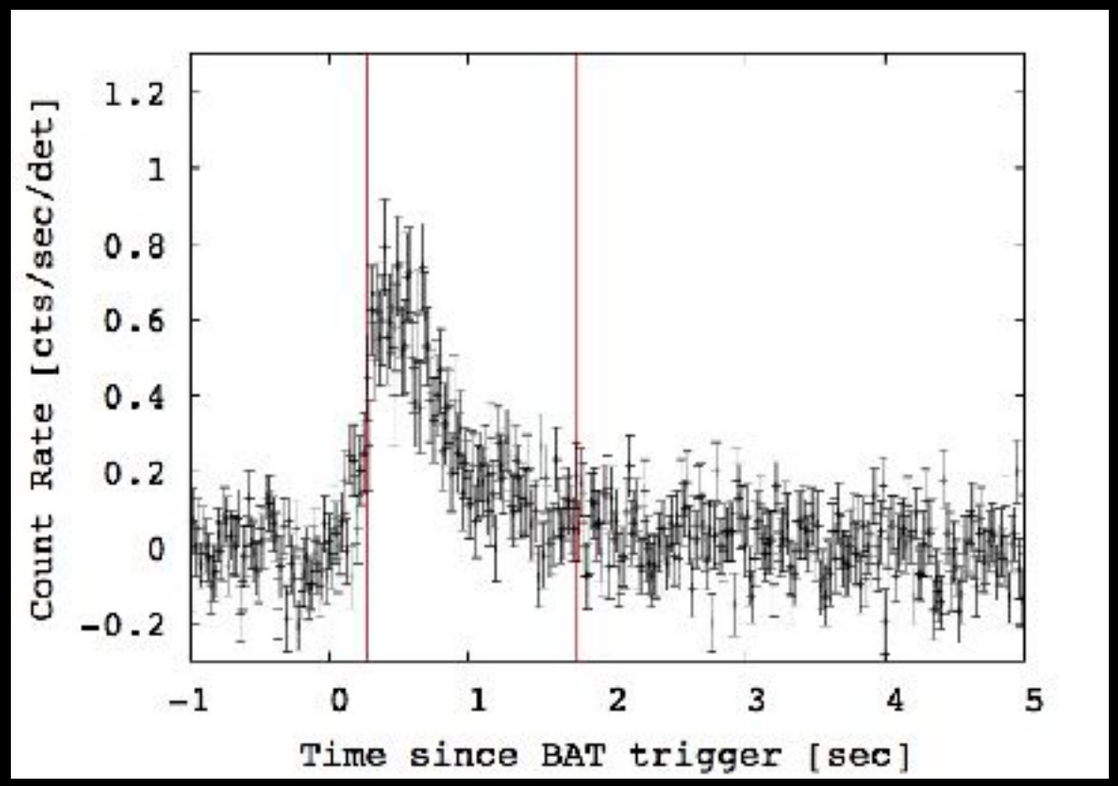


Credits: Li et al. (2012)

Nature of GRB 180418A

Classification by T90





Fermi/GBM

Swift/BAT

Becerra et al. 2019b (working in the corrections)

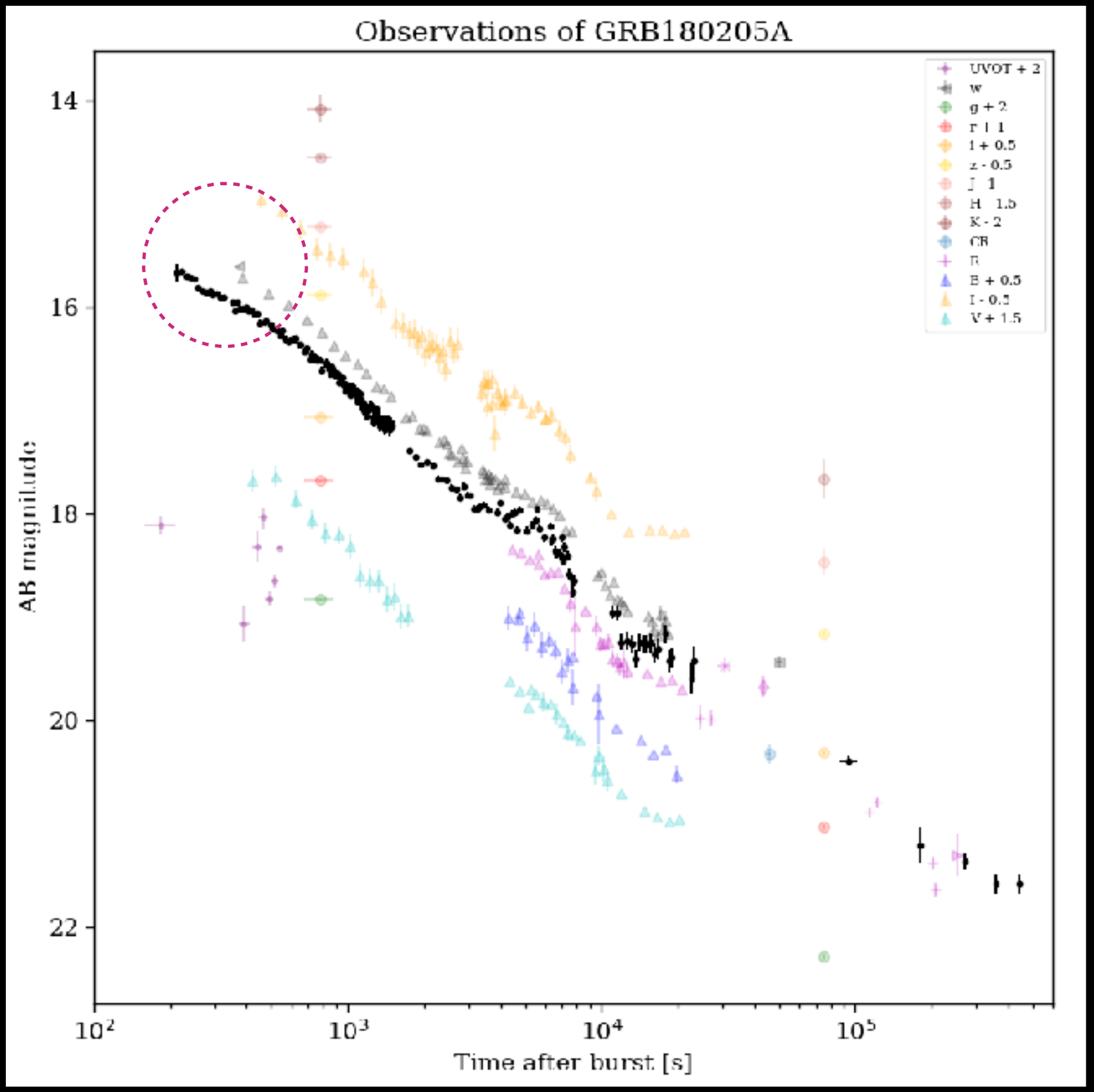
GRB 180418A
Why is important this work?

- TAROT and RATIR data set.
- Candidate of SGRB 180418A.
- Reverse shock component revealed.
- Host galaxy limit and therefore, the constrain of its properties.

Late Central-engine Activity in GRB 180205A

R. L. Becerra, A. M. Watson, N. Fraija et al., The Astrophysical Journal Volume 872, Number 2

GRB 180205A

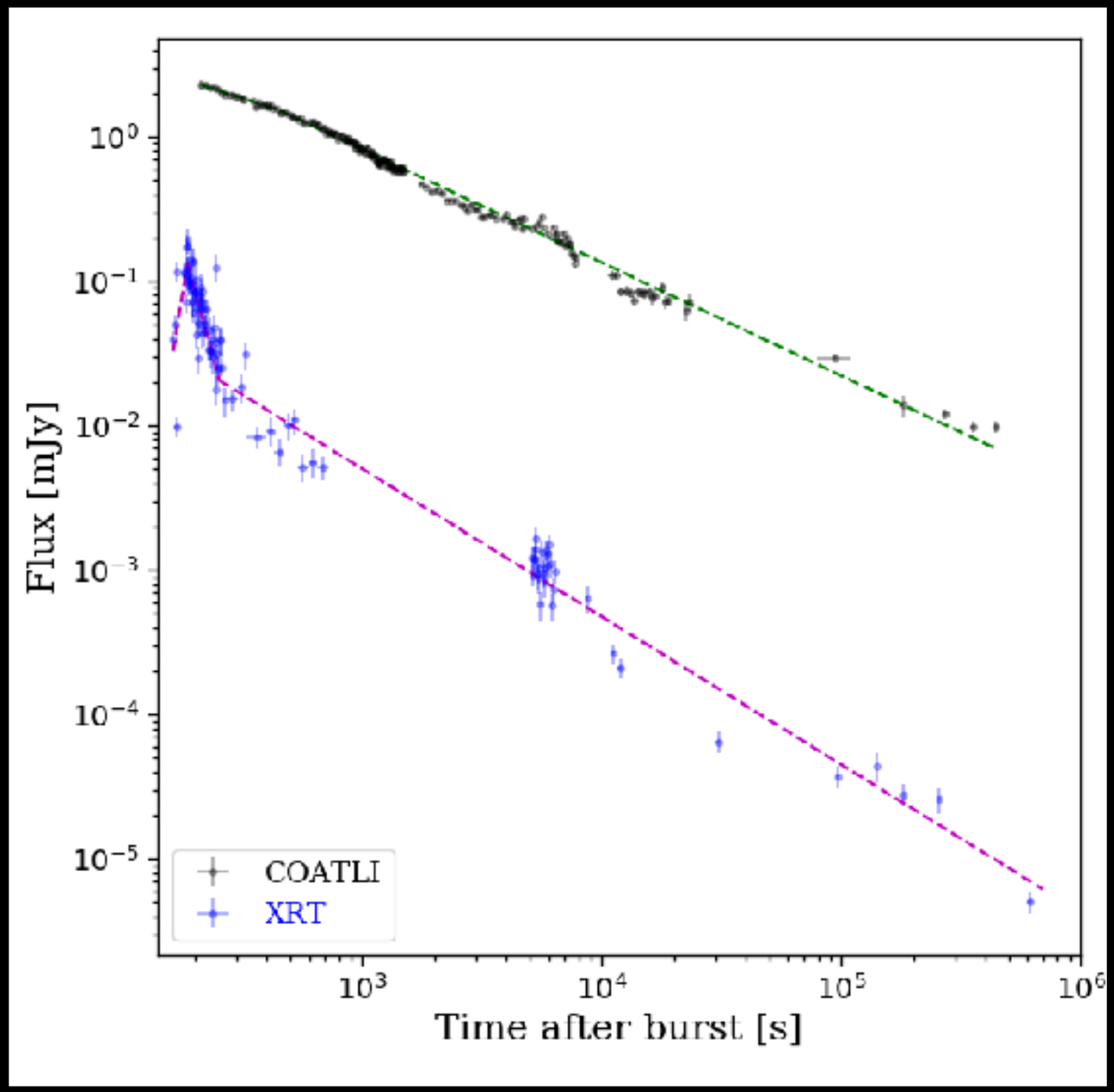


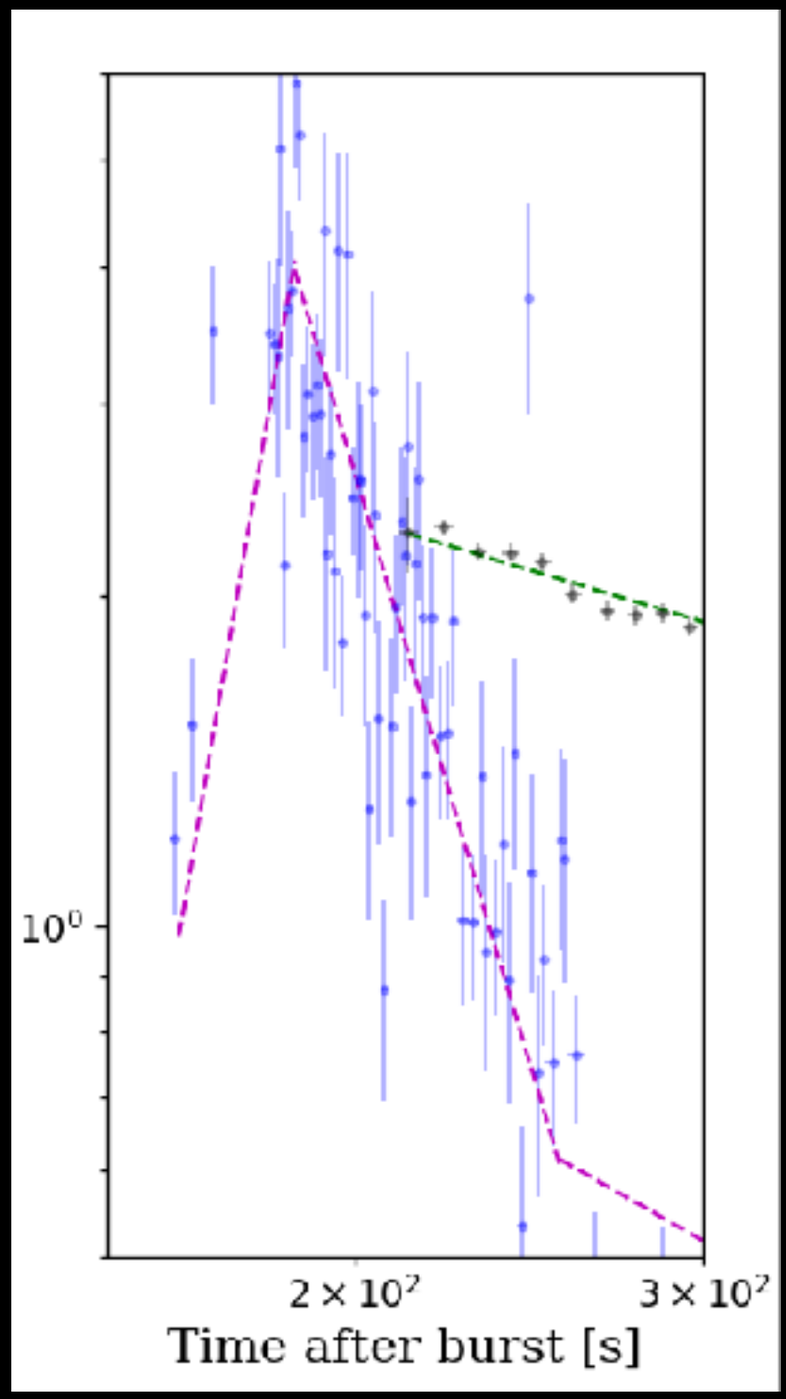
First early optical data from a ground telescope

SWIFT/UVOT does not have a light curve

Becerra et al. 2019a

GRB 180205A





Becerra et al. 2019a

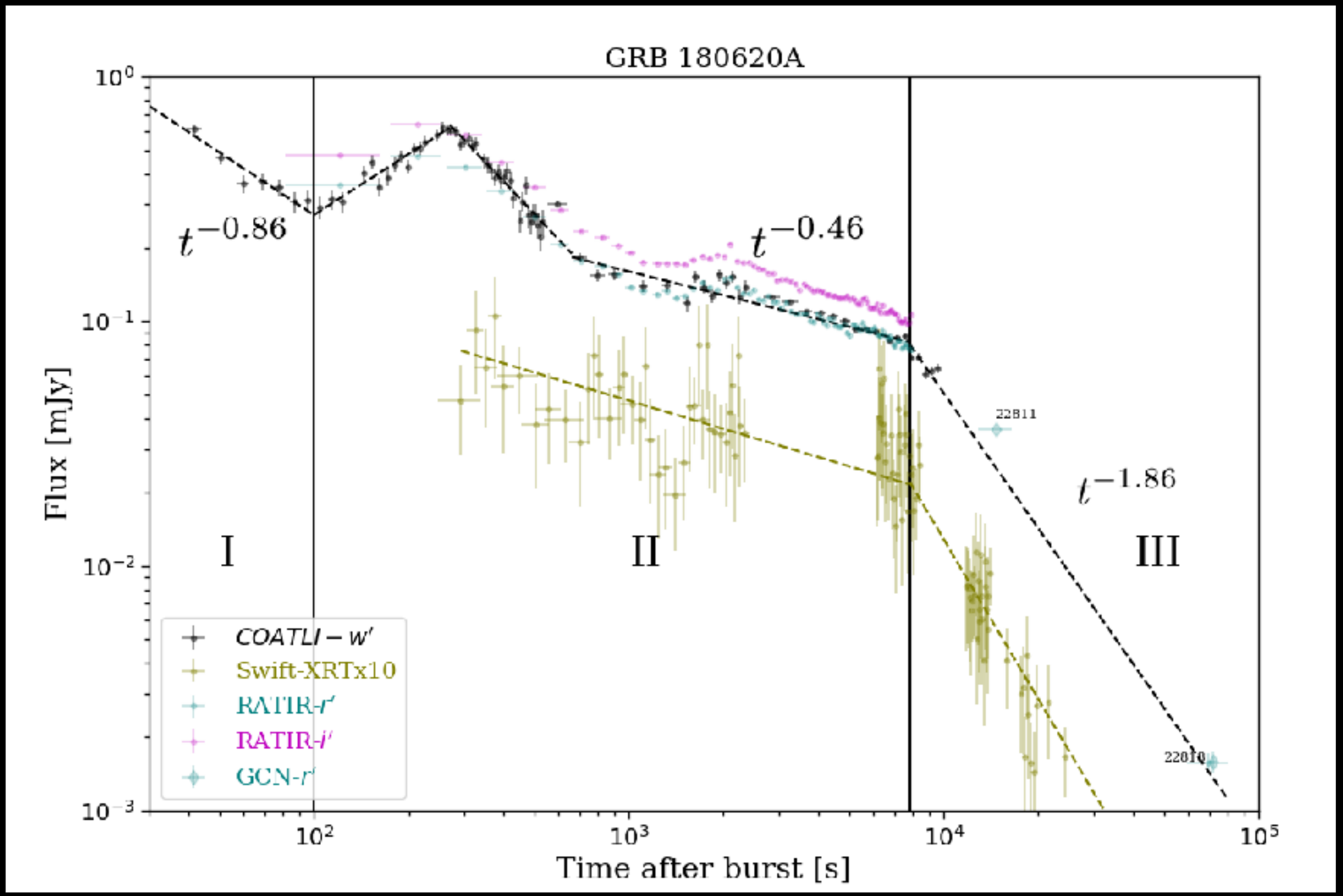
GRB 180205A
Why is important this work?

- First data set obtained with COATLI.
- Description and characterization of COATLI.
- Early photometrical data of a GRB 180205A.
- Scenario of late activity proposed to explain the plateau phase in optical and X-ray flare at early times which matches with the photometry and the SED.

Challenging the canonical fireball model: GRB 180620A

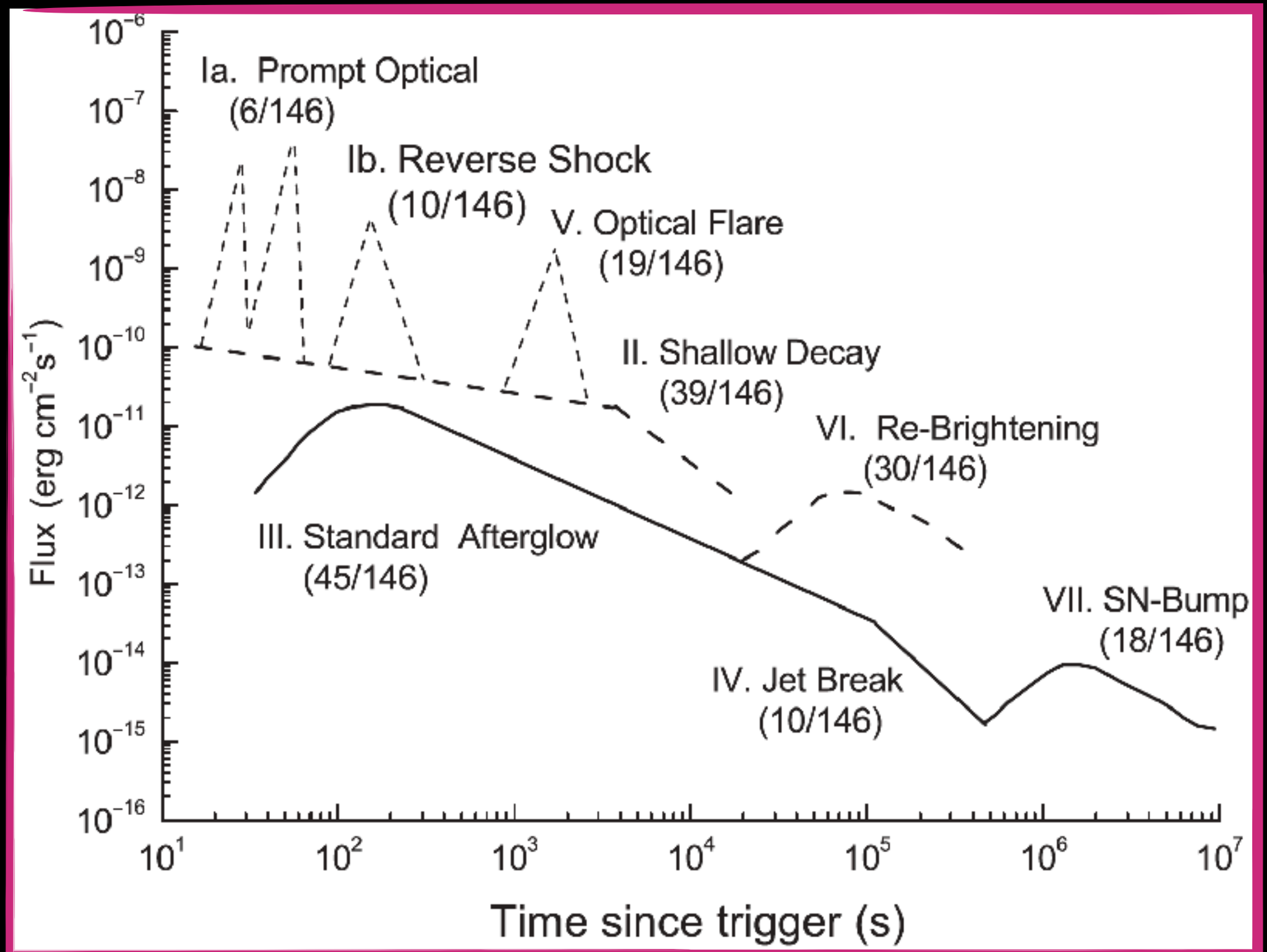
R. L. Becerra, A. M. Watson, F. De Colle et al. 2019c (in prep)

GRB 180620A
RATIR and COATLI data



Becerra et al. 2019c (in prep)

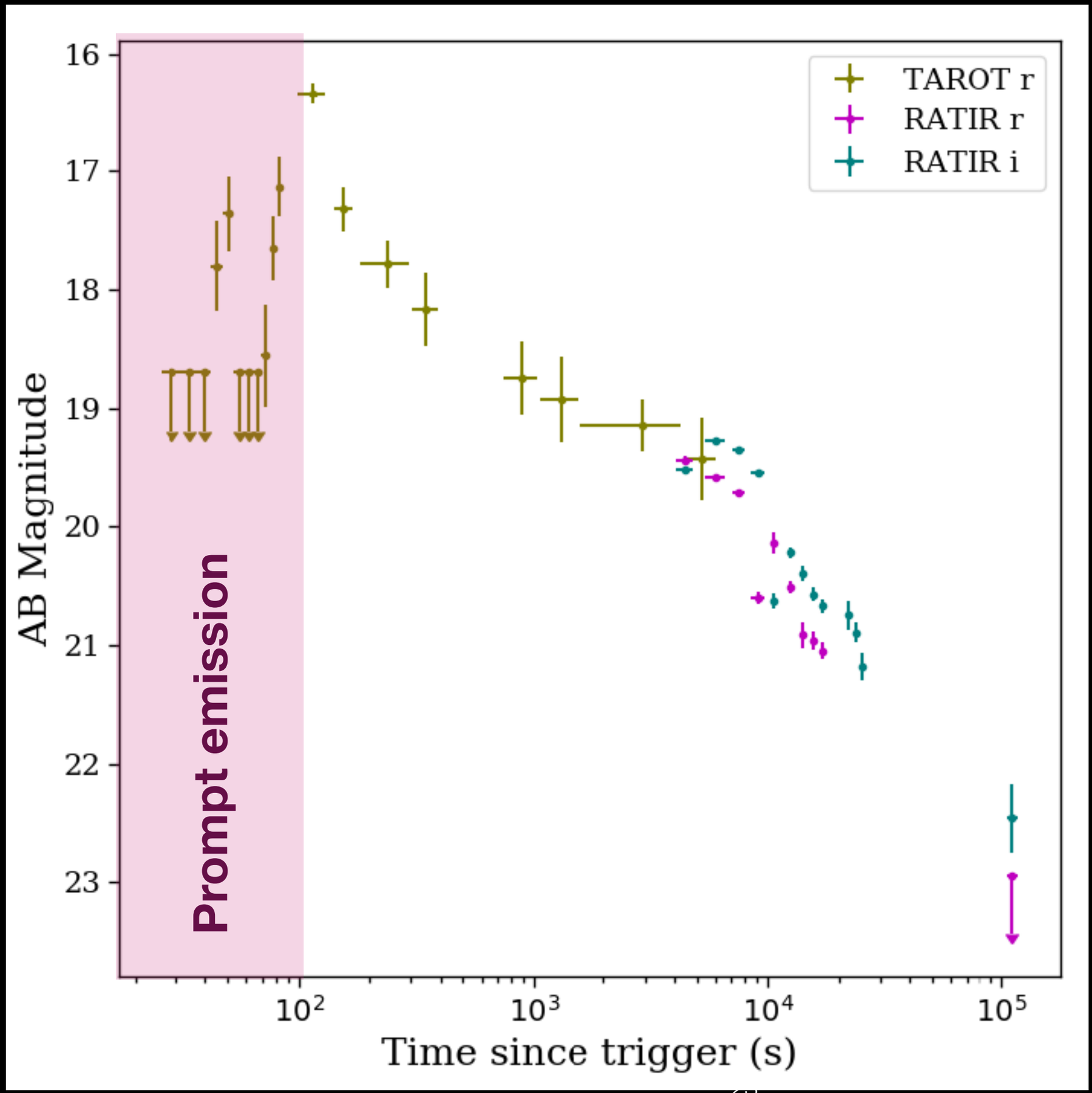
Canonical optical light curve?



Credits: Li et al. (2012)

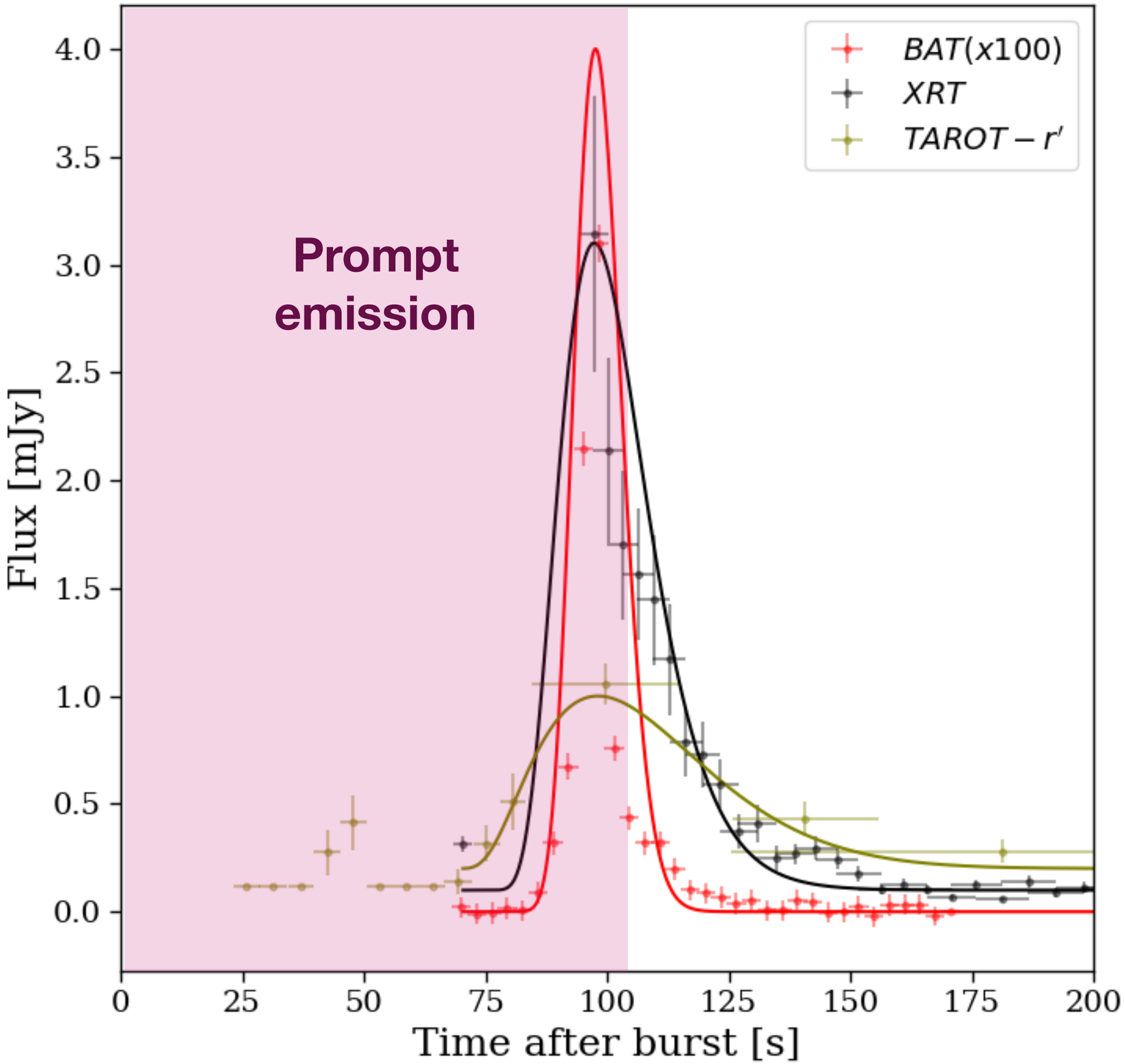
Modelling of Optical prompt photometry of GRB 180325A

R. L. Becerra, A. Klotz, A. M. Watson et al. 2019d (¿?) (in prep)



GRB 180325A
TAROT and RATIR data

Becerra et al. 2020a (in prep)

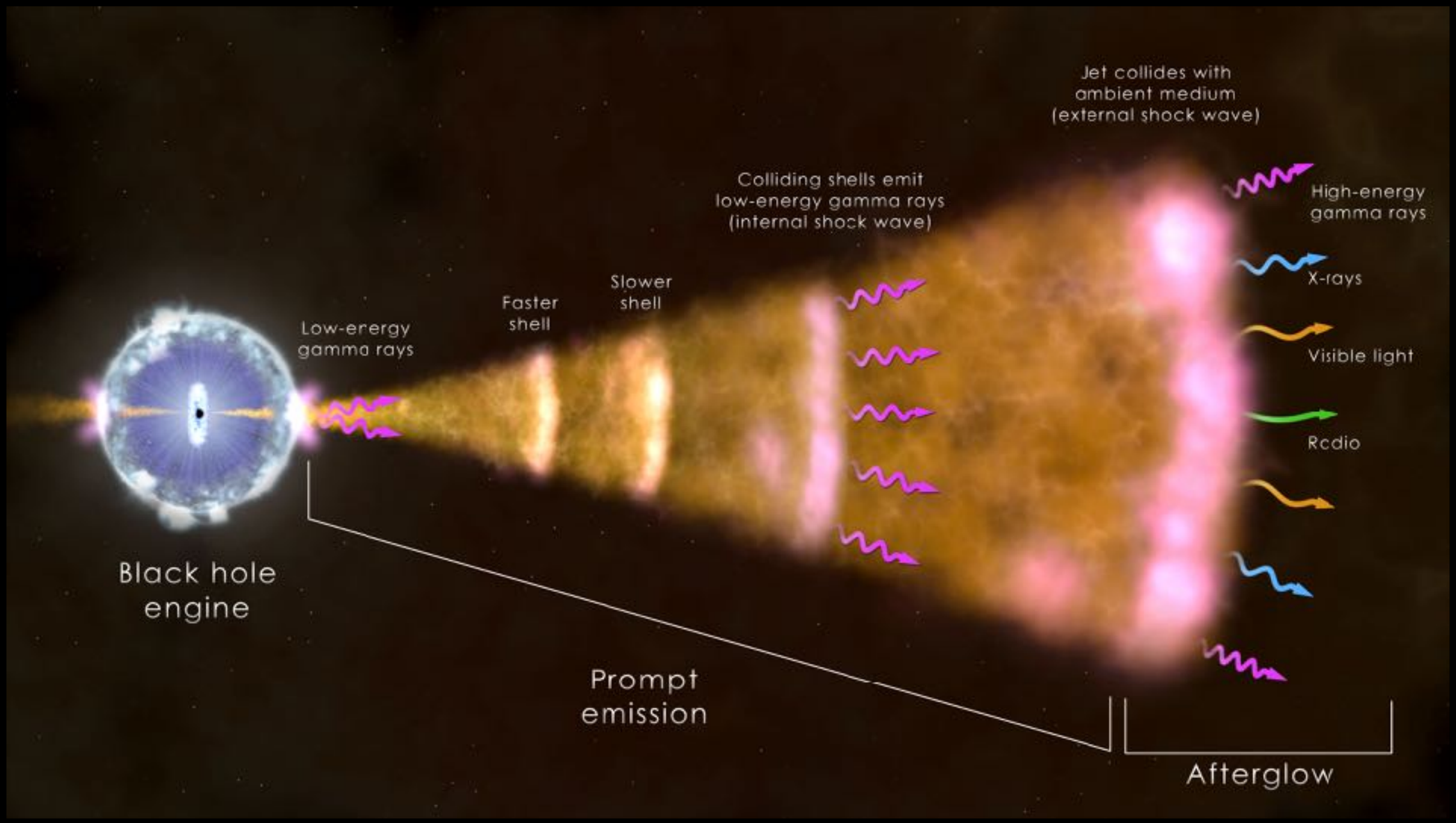


GRB 180325A TAROT and RATIR data

Becerra et al. 2020a (in prep)

Conclusions

See Fabio's talk



The future of our understanding of the very start of a GRB

- COATLI+RATIR+TAROT is a great collaboration!

- COLIBRÍ—> more colors, we will have more multiwavelenght coverage

- COLIBRÍ—>Photometrical redshift

Conclusions

- Amplify the sample of early data allows us to understand the first stages of the jet.

- Environment (stellar wind/constant), features, magnetic fields etc.

- Combine these kind of studies with polarization and numerical simulations.