

GRB 201015A: from seconds to months optical monitoring and supernova discovery

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Introduction

2

$$E \sim 10^{52-54} \text{ erg}$$
$$0,01 \text{ c.} \leq t \leq 1000 \text{ s.}$$



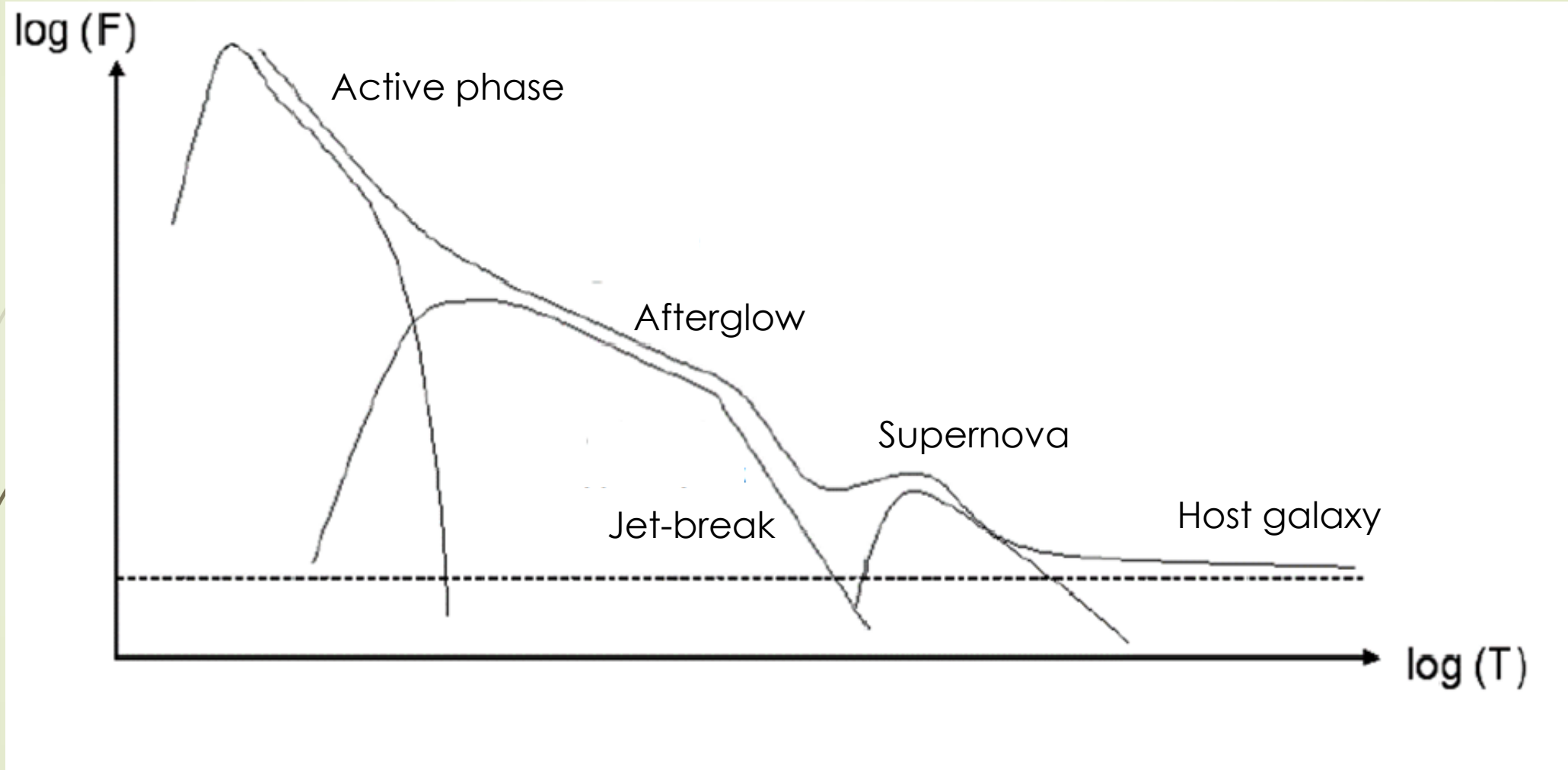
Gamma-ray bursts classification

3

Short GRBs	Long GRBs
Duration less than ~ two seconds	Duration more than ~ two seconds
NS+NS or NS+BH merging	Core-collapse supernova (Ib/c)

Schematic light curve of gamma-ray bursts in the optical range

4



GRB 201015A: review

5

- Registration date : October 15, 2020, 22:50:13 UT;
- Registration: BAT/Swift (GCN Circ. 28632), XRT/Swift (GCN Circ. 28635), UVOT/Swift (GCN Circ. 28662), GBM/Fermi (GCN Circ. 28663);
- Coordinates: RA(J2000): 23h 37m 16,414s Dec(J2000): +53d 24' 56,410"
- Redshift: $z=0,426(2,36 \text{ Gpc})$;
- $T_{90,i} = 6,86 \pm 2,43 \text{ s}$;
- $E_{\text{iso}} = (1,1 \pm 0,2) 10^{50} \text{ erg}$;
- $E_{p,i} = 19,96 \pm 8,56 \text{ keV}$.

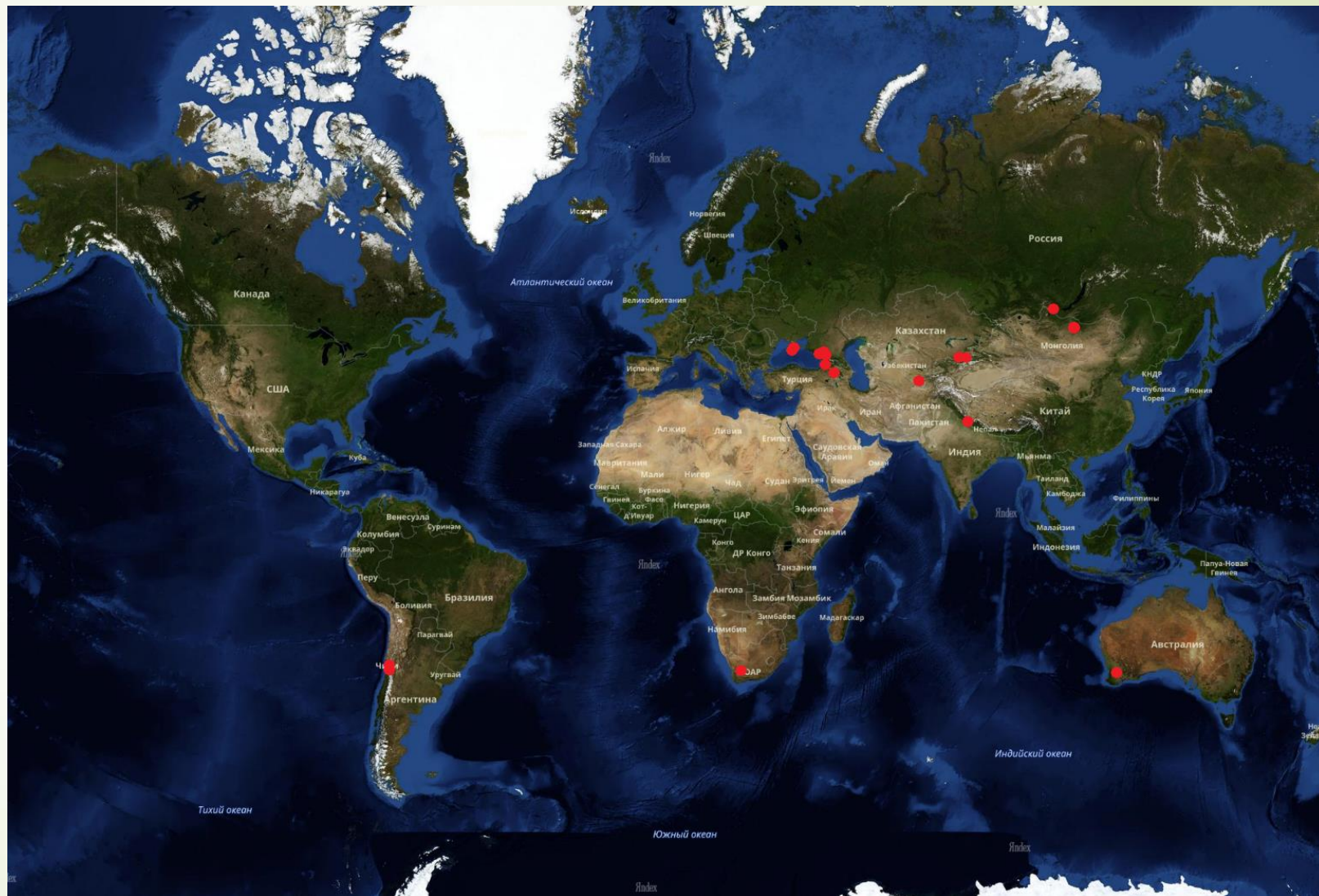
Observations

6

GRB-IKI FuN:

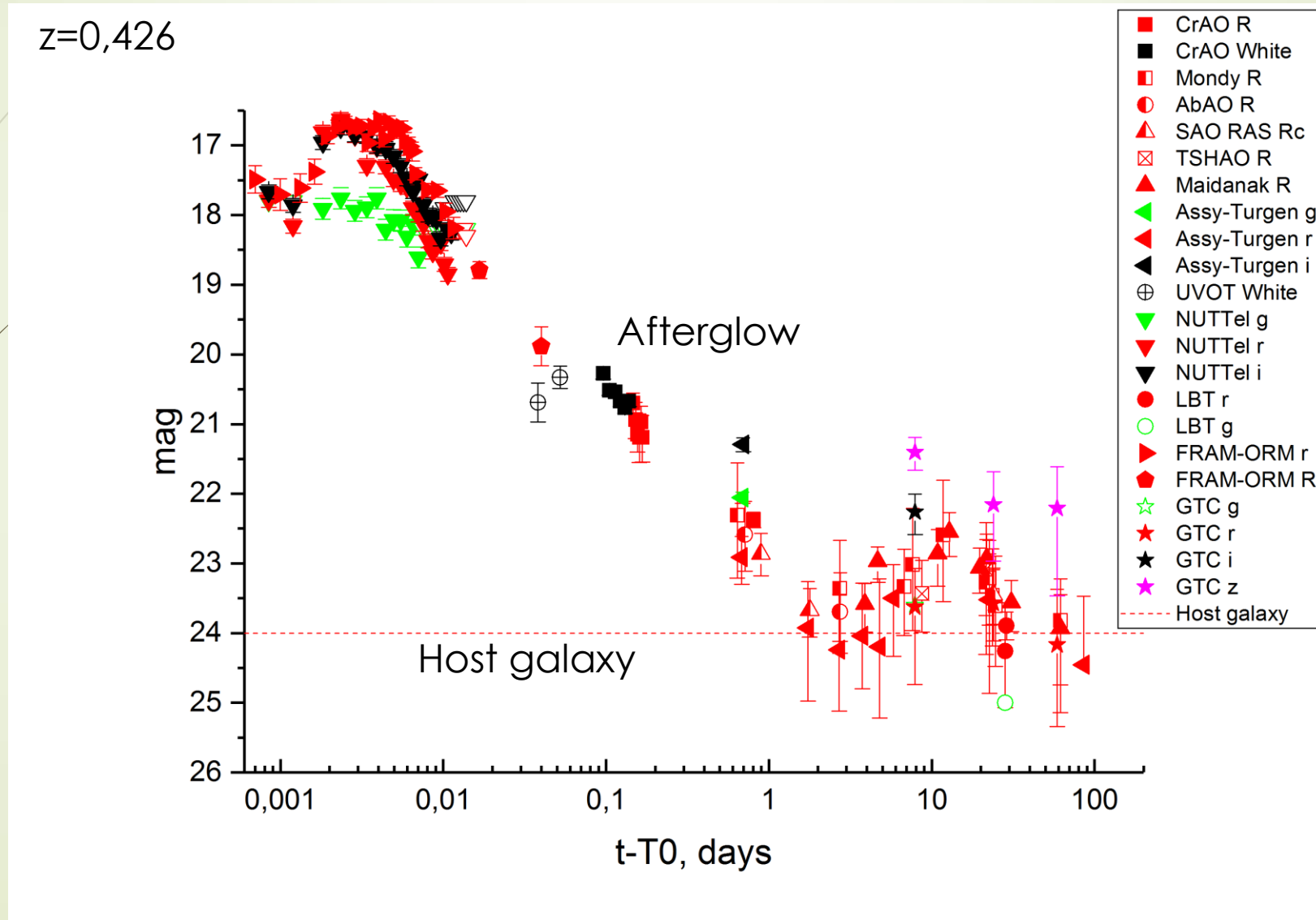
- Assy-Turgen (1,5 m);
- AbAO (0,8 m);
- TSHAO (1 m);
- CrAO (2,6 m);
- Mondy (1,5 m);
- SAO RAS (1 m);
- Maidanak (1,5 m);

-
- NUTTel(0,25 m);
 - GTC (10,4 m);
 - LBT (8,4 m);
 - FRAM-ORM (0,25 m).



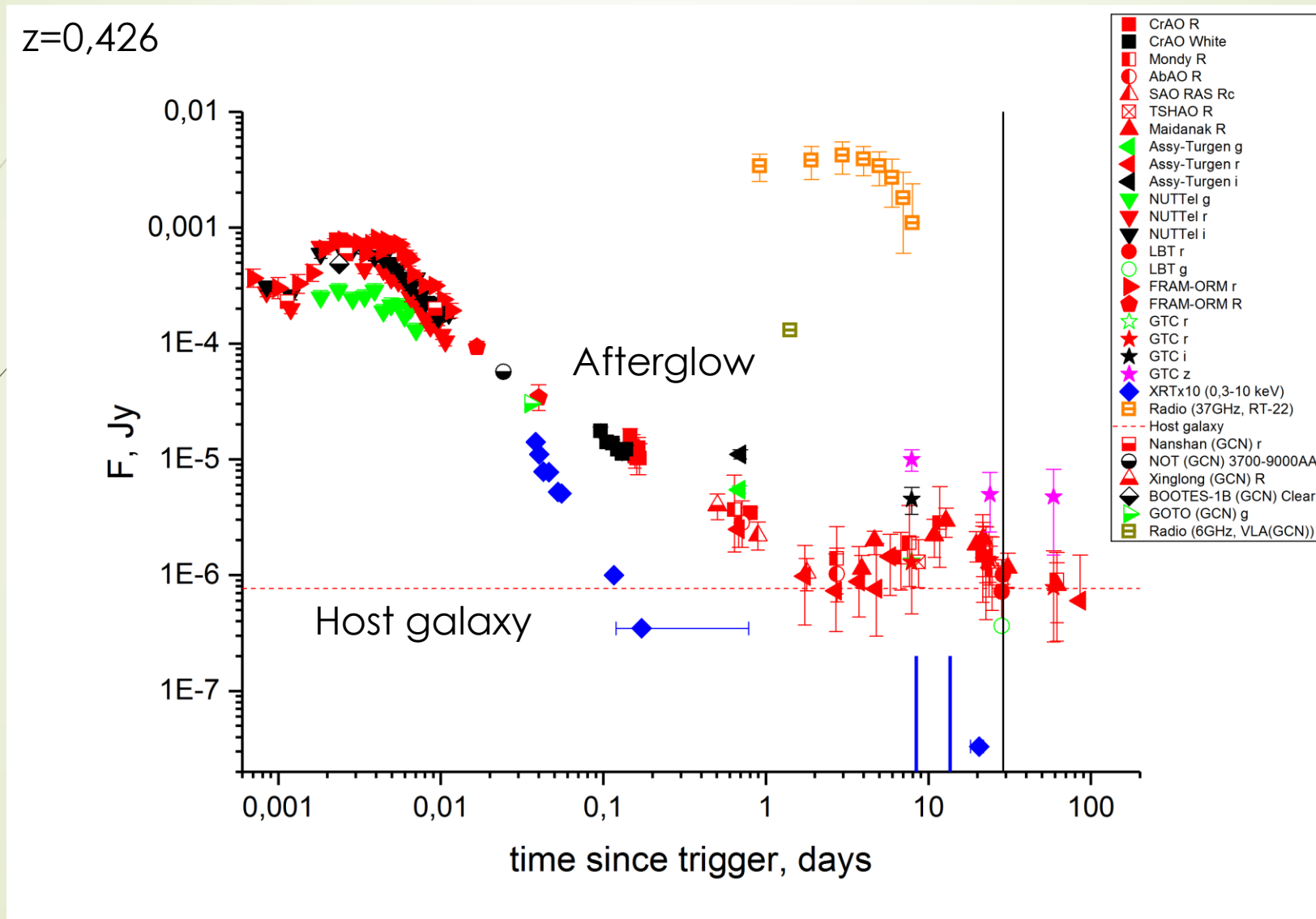
Multicolor light curve of GRB 201015A

7



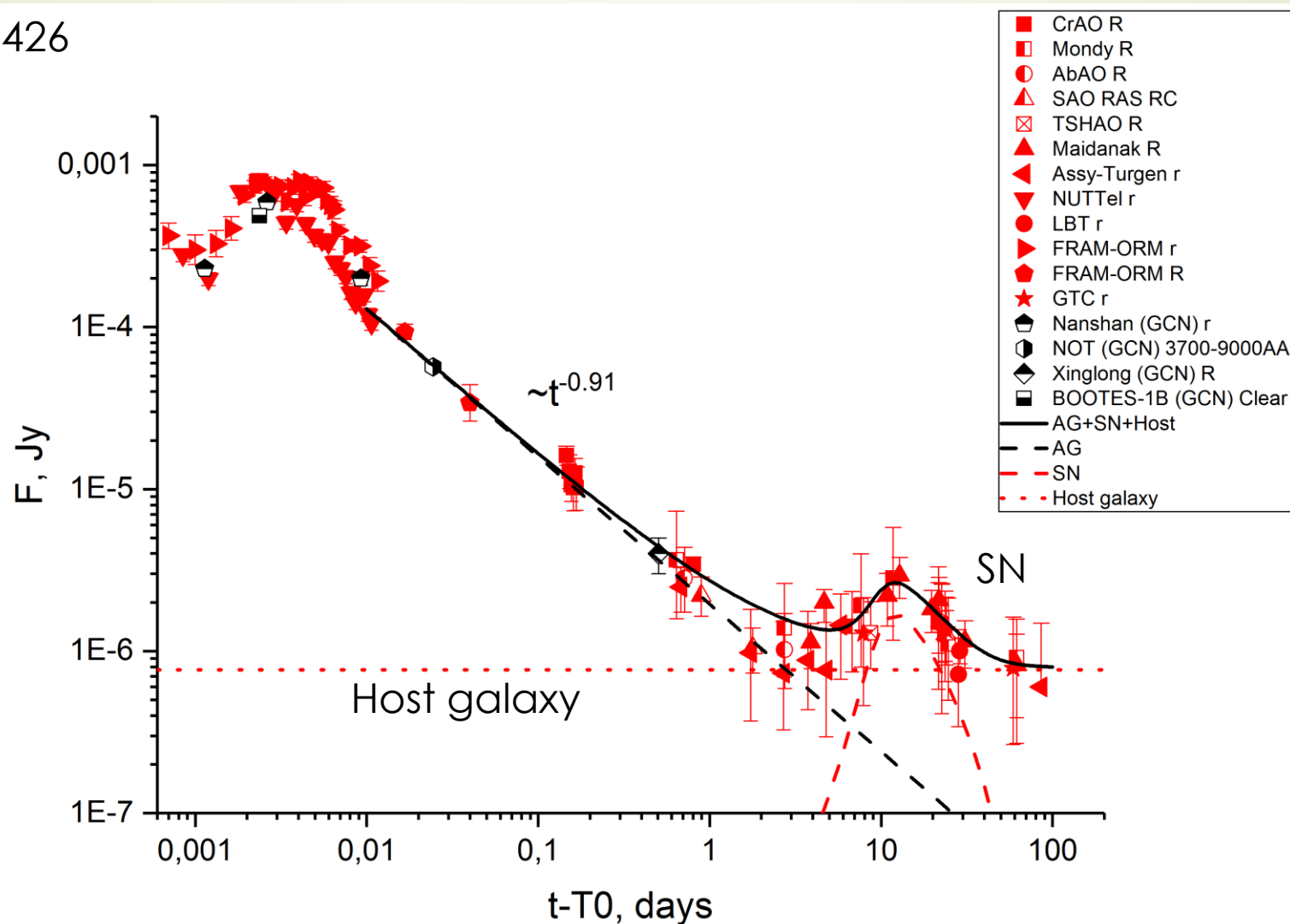
Multicolor light curve of GRB 201015A

8



Afterglow stage approximation

$z=0,426$



Supernova parameters

10

- V-band absolute magnitude :

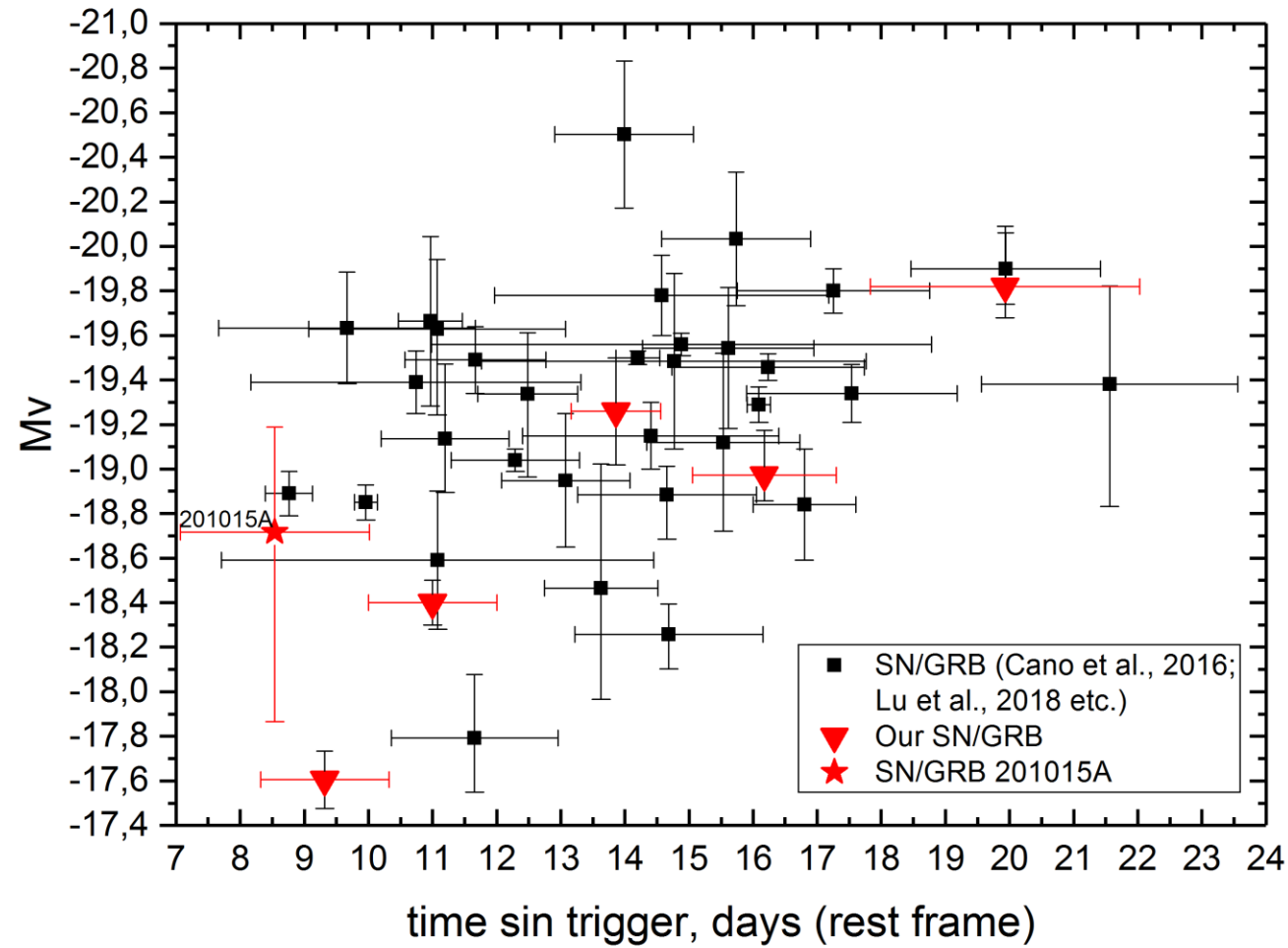
$$M_v = -18,72 \pm 0,85 - 0,47^m$$

- Time from the registration of the burst to the maximum of the supernova in the observer's (source) reference frame:

$$t - T_0 = 12,18 \pm 2,11 \text{ (} 8,54 \pm 1,48 \text{) days.}$$

Comparison with known cases of GRB-SN

11



Spectroscopic confirmation of SN associated with GBR 201015A

12

- Data: Rossi et al., GCN 29306;
- Telescope: 2x8,4-m LBT;
- Instrument: MODS;
- Observation date : 2020-11-13 (UT) 04:00:00 (~28,8 day);
- Exposure: 8*900 s;
- Wavelength range : 3200-10000 Å;
- Identified SN type : Ic-BL.

Conclusions

13

- An almost continuous multicolor light curve of GRB 201015A was constructed, consisting of 185 observations from X-rays to radio, which cover it from about **73 seconds after the registration of the GRB for about 3 months (85 days)**;
- **A supernova has been detected in GRB 201015A, which is another, among 24 others, cases that have received both photometric and spectroscopic confirmation of the presence of supernovae in GRBs.;**
- The parameters obtained are in agreement with most cases of supernovae associated with gamma-ray bursts.;
- Observations of a part of the light curve in the supernova phase, along with regular observations of the afterglow stage and the host galaxy, are necessary to determine the presence or absence of a supernova in a given gamma-ray burst and to estimate its parameters;
- **Observations in the region of the supernova maximum at the Maidanak Astronomical Observatory made it possible to obtain photometric confirmation of its presence in this light curve.**

Thanks for your attention!