The SVOM mission after 2 years in orbit: first results

Diego Götz (CEA-Irfu) on behalf of the SVOM Collaboration
with inputs from the SWGs

TevPA - Tendo
September 2nd , 2026

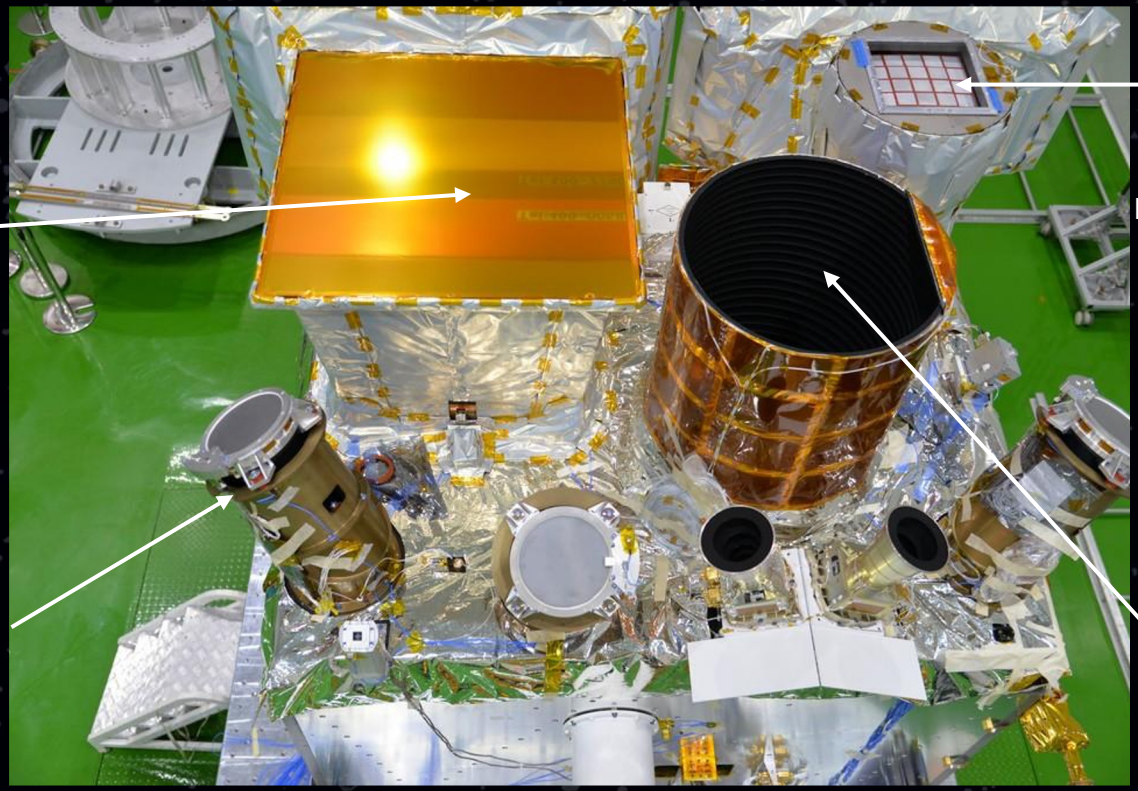
The SVOM Consortium

- **China (PI J. Wei)**
  - SECM Shanghai
  - Beijing Normal University
  - Central China University Wuhan
  - Guangxi University Nanning
  - IHEP Beijing
  - KIAA Peking University
  - Nanjing University
  - NAOC Beijing
  - National Astronomical Observatories
  - Purple Mountain Observatory Nanjing
  - Shanghai Astronomical Observatory
  - Tsinghua University Beijing
- **Mexico** UNAM Mexico

https://fsc.svom.org/home/collaboration/collaborators

- **France (PI B. Cordier)**
  - CNES Toulouse
  - APC Paris
  - CEA Saclay
  - CPPM Marseille
  - LUX Meudon
  - IAP Paris
  - IRAP Toulouse
  - IJCLab Orsay
  - LAM Marseille
  - LUPM Montpellier
  - OAS Strasbourg
- **UK** University of Leicester
- **Germany**
  - MPE Garching
  - IAAT Tübingen

The Space borne Instruments



ECLAIRs

Wide field hard X-ray telescope

GRM

Wide field gamma-ray spectrometer

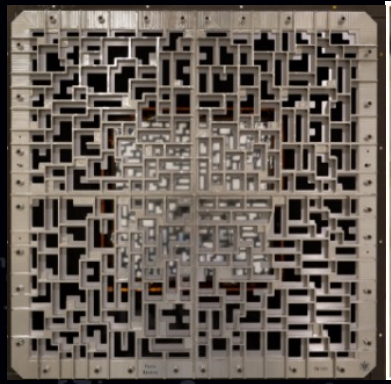
MXT

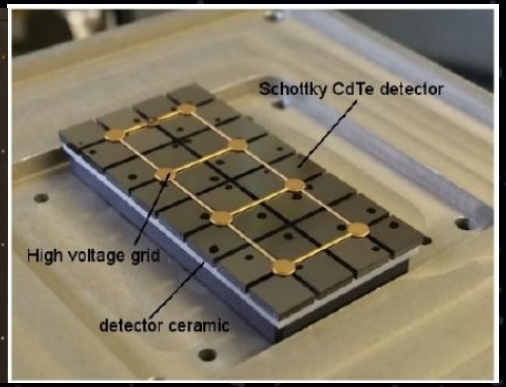
Narrow Field X-ray telescope

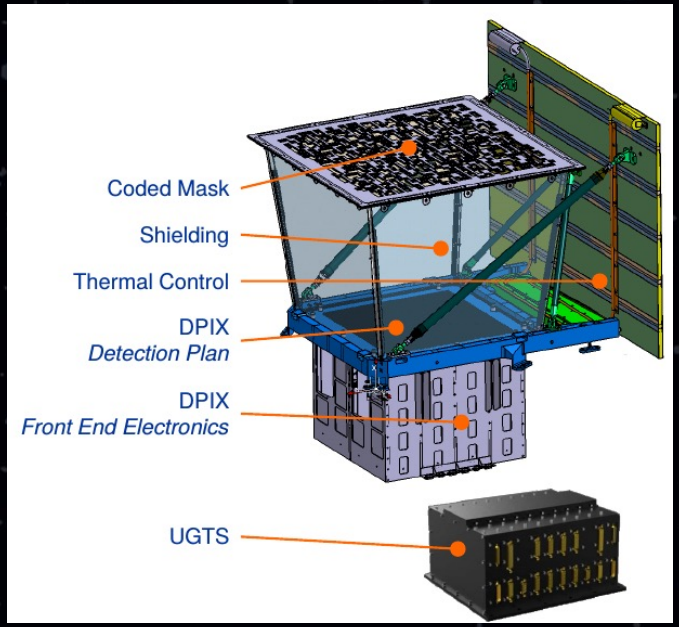
VT

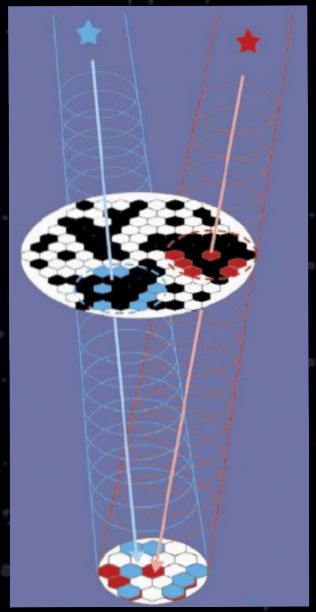
Narrow Field Visible telesco

The ECLAIRs gamma-ray camera



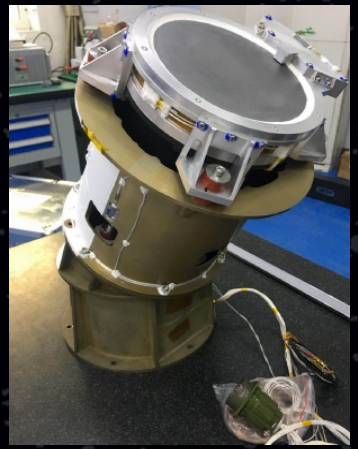


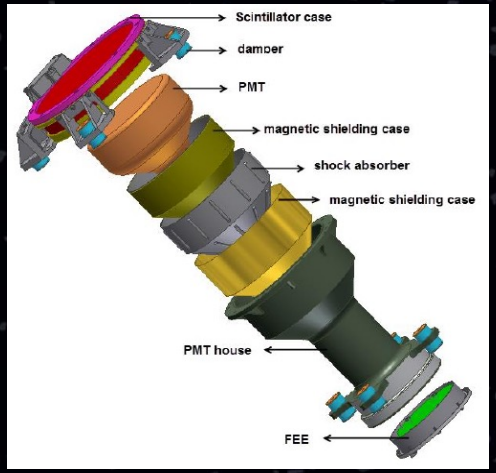


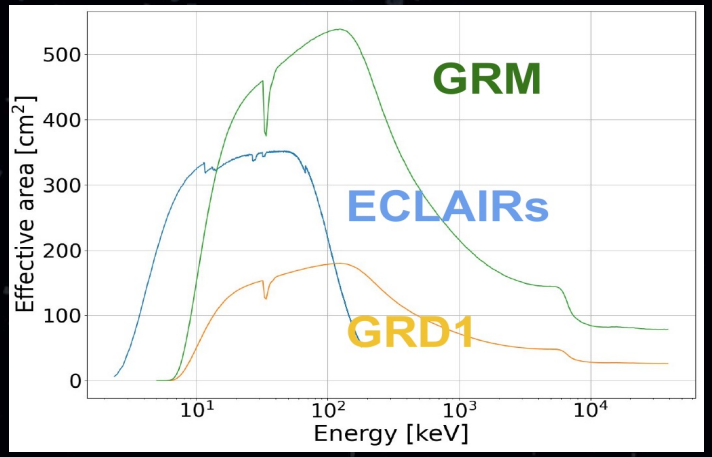


- **Coded mask 54x54 cm², 40% open fraction**
- **Detection plane area 1024 cm² (4-150 keV)**
  - 6400 CdTe pixels (4x4x1 mm3)
- **Onboard real-time trigger and localization (if SNRi>6.5)**
  - Strongly varying background (Earth transit through FoV every orbit)
  - Time scales from 10 ms to 20 min, 4 energy bands, 9 detector zones
  - Count Rate Trigger (CRT, ≤20 s) and Image Trigger (IMT, ≥20 s)
- **Slew request within ~25 s (if SNRi>7)**

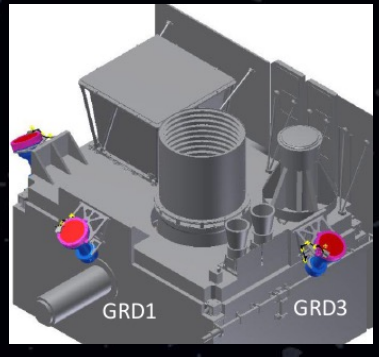
The GRM spectrometer



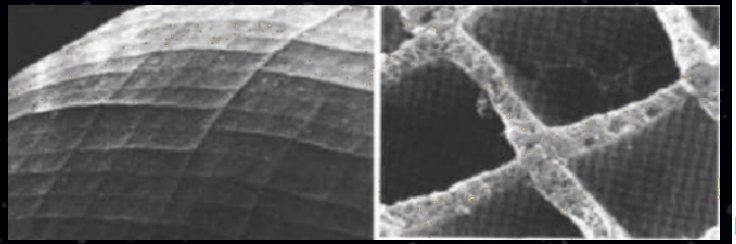


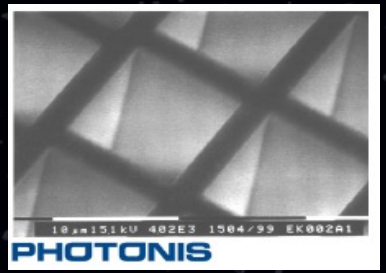


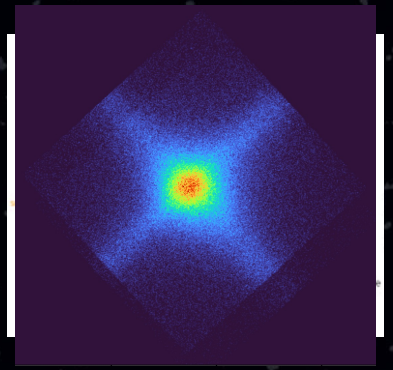
- **3 Gamma-Ray Detectors (GRDs, 15-5000 keV)**
  - NaI(Tl) (16 cm Ø, 1.5 cm thick)
  - 30° inclination w.r.t. ECLAIRs optical axis
- **Count Rate Trigger (2 GRDs above threshold)**
  - Time scales 0.1 to 4 s, 4 energy bands

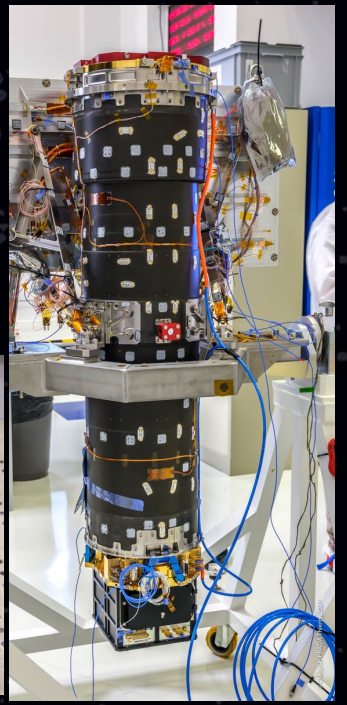


The Microchannel X-ray Telescope

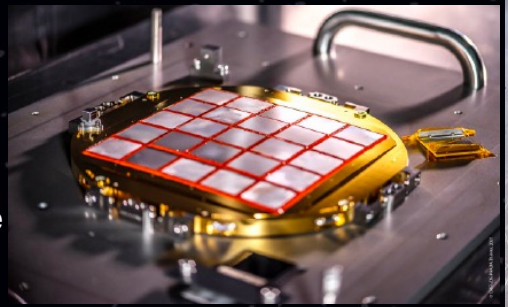


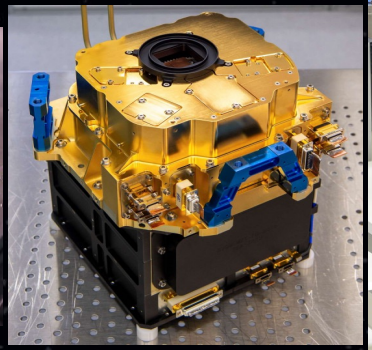






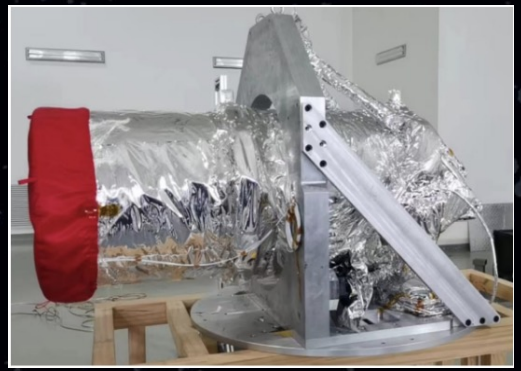
- **Micro-channel plate optics (0.2-10 keV)**
  - 40 micron size pores in a “lobster eye” configuration
  - Focal length: 1.15 m
  - pnCCD camera (256x256 pixels of 75 microns), cooled at -65°C. State of the art spectral resolution

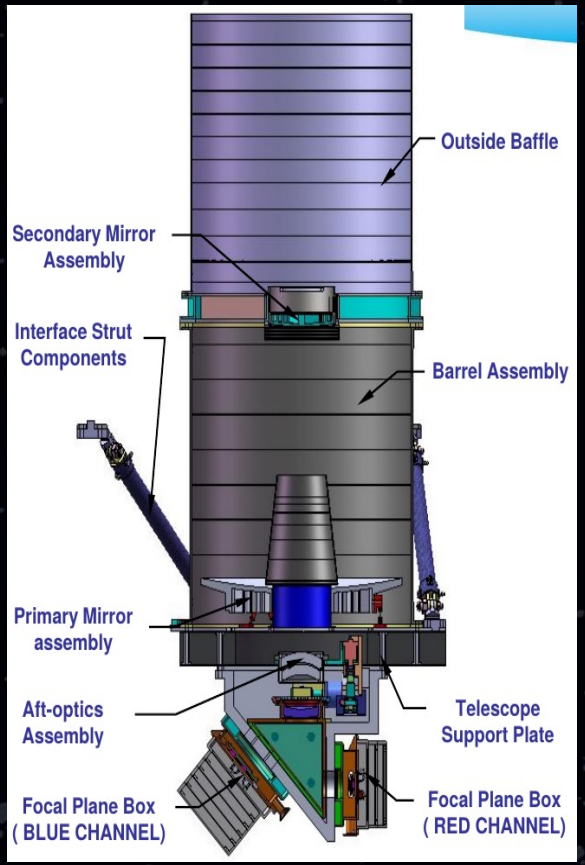




The Visible Telescope

- **Ritchey-Chretien telescope**
  - 40 cm Ø, f=9
  - Focal length: 3.6 m
  - 2 channels: blue (400-650 nm) and red (650-1000 nm)
  - 2k * 2k CCD detector each
- **FoV covering ECLAIRs error box in most cases**
- Sensitivity M_V = 22.5 in 300 s





Ground based dedicated Telescopes

- **Ground-based Wide Angle Camera (GWAC)**
  - 36 camera units covering 5400 deg² (~1/2 ECLAIRs FoV)
  - Installed in Ali (China) and CTIO (Chile)
  - 500-800 nm; M_{lim}=16-17 (10 s exposure)
  - Explore the prompt optical emission

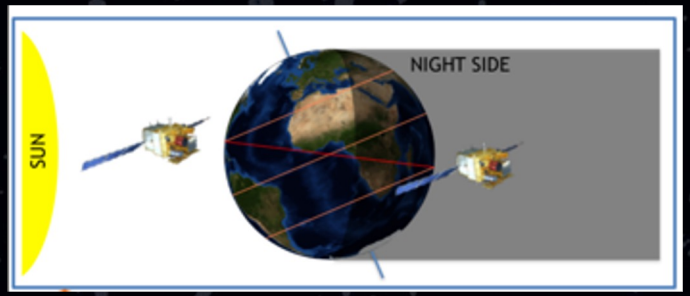
- **Ground Follow-up Telescopes (GFTs)**
  - Robotic 1-m class telescopes (fast repointing, <30 s)
  - San Pedro Martir (Mexico) and Xinglong observatory (China)
  - **C-GFT**: 1.2 m, FoV = 21x21 arcmin², 400-950 nm
  - **FM-GFT (a.k.a. Colibri)**: 1.3 m, FoV = 26x26 arcmin², multi-band photometry (400-1700 nm, 3 simultaneous bands)
    - A new camera (CAGIRE) to be installed in coming months, allowing observations in J,H bands

- **Accurate GRB localization → observations with large telescopes**

SVOM is placed in a Low Earth Orbit (LEO)

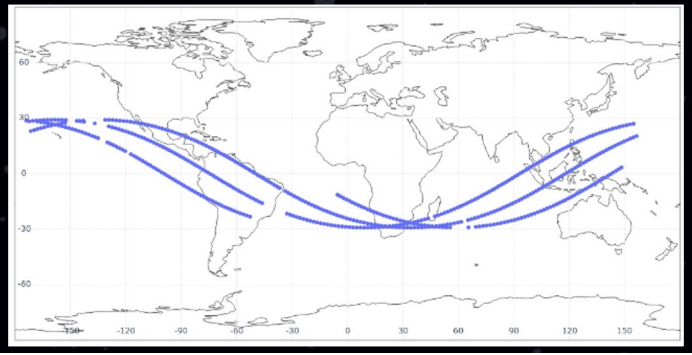
Anti-Solar pointing strategy

~625 km, ~29° inclination angle, 1 orbit ~ 96min



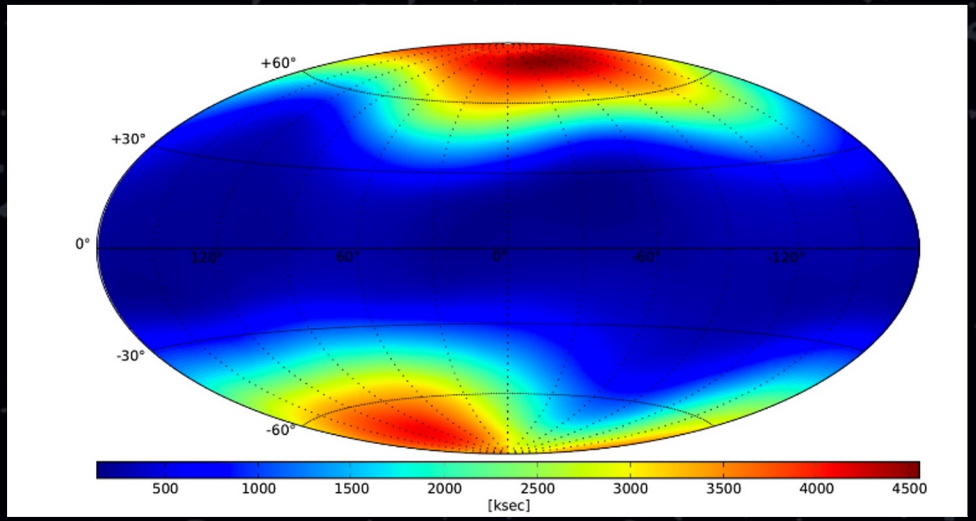
The satellite track on Earth

+/- 30° latitude



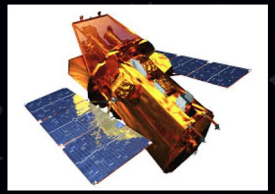
ECLAIRs exposure map simulation (over one year)

Initial Hypothesis : 65 GRBs/year, 1 ToO per day
- 4 Ms in the direction of the galactic poles
- 500 ks on the galactic plane



SVOM: Boosting the space and ground-based telescope synergies

Great synergies with Einstein Probe and Swift teams



Automatic follow-up request
EP-FXT
(since April 2025)
and
Swift-XRT
(Feb. 2025 – Feb. 2026)

A dedicated ground-based follow-up segment
from 25 cm to the 8m class telescopes

- Official Partners
- Associate Partners
- Bought time (LCO)
- Close collaboration

SVOM: the scientific programs

The SVOM Core program
reserved to SVOM Co-Is

Gamma-ray bursts

Two SVOM science groups :
GRB science : F. Daigne
Observatory Science : A. Coleiro

ToO scientist : Cyril Lachaud

The General & ToO programs

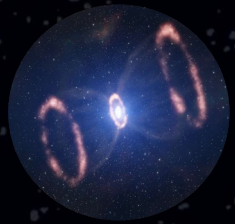
GP obs (known sources): Observation proposals awarded by a TAC (your proposal has to include a SVOM co-I).
ToO obs (not anticipated flaring sources): If you want a ToO, please contact the SVOM PIs

Magnetar Giant flares

CVs, x-ray binaries

Flaring stars

AGNs/Blazars



Supernovae

TDE, FRB, etc.

SVOM General Programme and ToOs

Serendipitous detections

High-energy source monitoring when present in the ECLAIRs field-of-view by chance

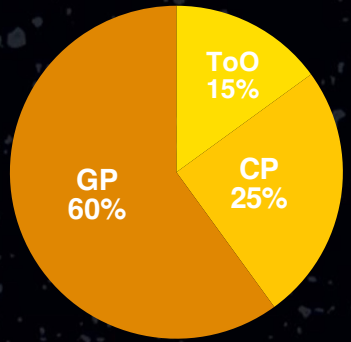
General Program (GP)

Observation proposals awarded by a TAC (proposals have to include a SVOM Co-I) - Yearly call for proposals (spring/summer 2026)

Targets of Opportunity (ToO)

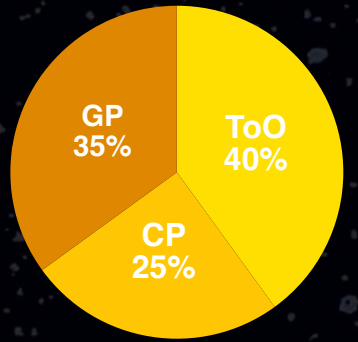
ToO-NOM — Normal ToO
ToO-Ex — Fast ToO
ToO-MM — For large error boxes, with a tiling strategy

Nominal Mission



1 ToO per day, 15 % GP outside B1 law

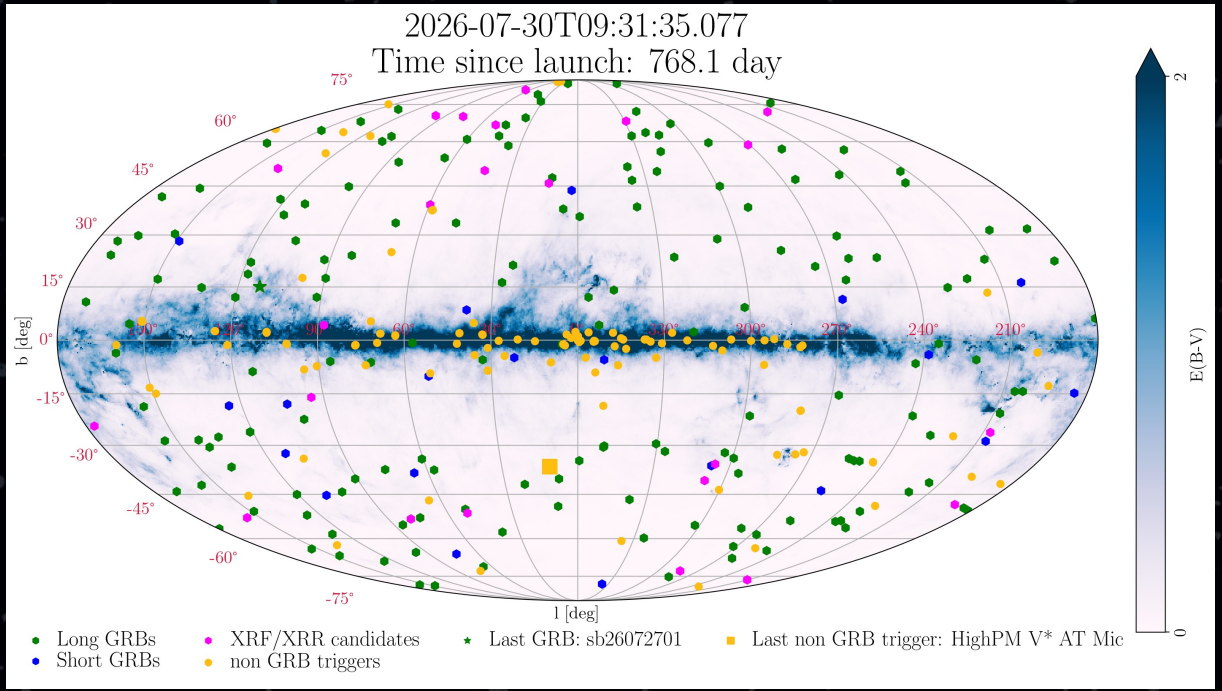
Extended Mission



5 ToOs per day, 50 % GP outside B1 law

	ToO-NOM	ToO-EX	ToO-MM
Frequency	Nominal mission : 1/day Extended mission : 5/day	1/month => 1/day	1/week
Priority	Low	Highest	Very High
Upload Delays	< 48h (regular X-band)	< 12h (requested X-band)	< 12h (requested X-band)
Duration	Base: 1 orbit => 2.7 ks Max: 14 orbits => 38 ks SAA optimized	Max : 14 orbits => 38ks	Max : 14 orbits => 38ks SAA optimized

SVOM 2 years discovery map



GRB Triggers (June 2026)

318 GRBs of all types detected onboard + on-ground

1 GRB at z ~ 7.3

> 2000 GCN circulars

Non-GRB Triggers (June 2026)

343 triggers onboard (known or unknown sources) + **178 triggers from Offline Trigger** searches

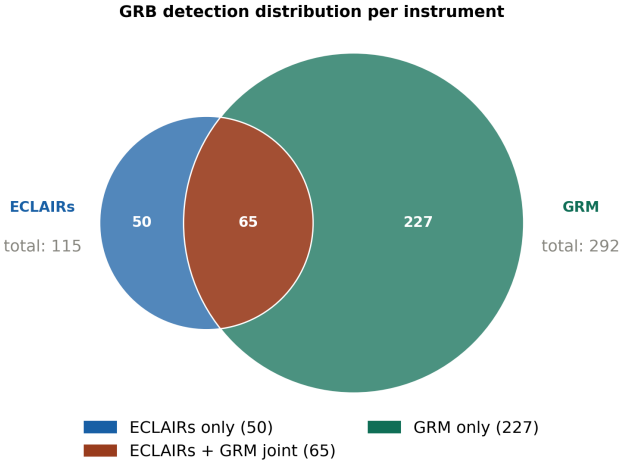
30 Atel on X-ray binaries & AGN

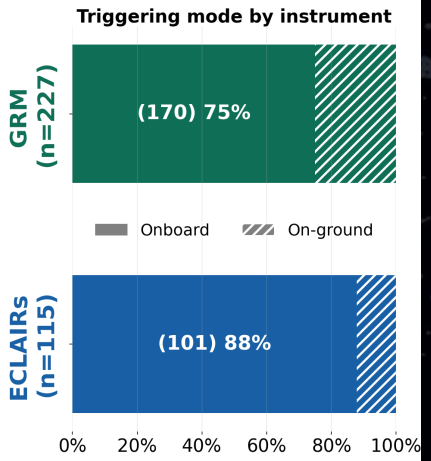
A few unidentified sources

Summary of GRB detections

GAMMA-RAY PROMPT EMISSION DETECTION

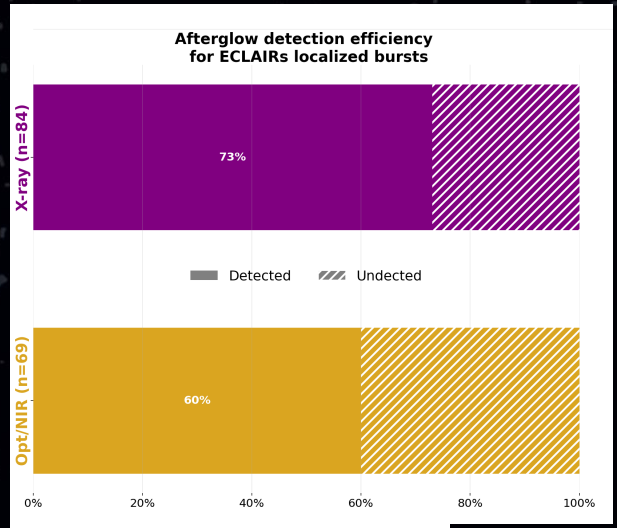
Total GRBs	ECLAIRs detection	GRM detection	ECL+GRM joint detection
340	115	292	65
162 GRBs/year	55 GRBs/year	139 GRBs/year	31 GRBs/year

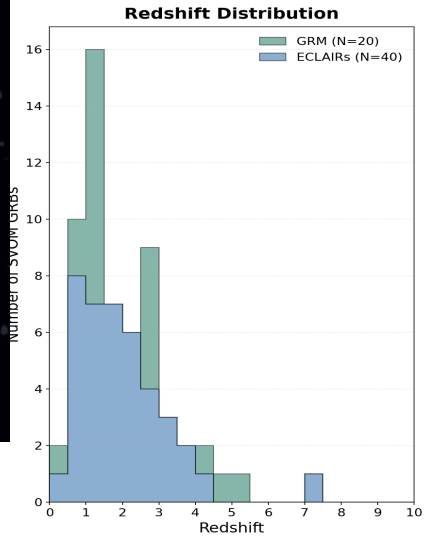


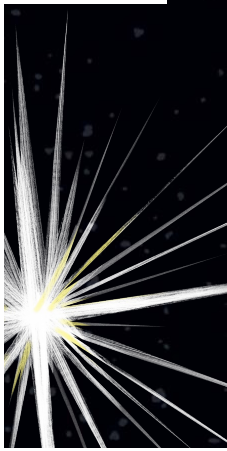


AFTERGLOW EMISSION DETECTION AND REDSHIFT DISTRIBUTION

X-ray afterglow detection	Optical/NIR afterglow detection	# redshift measured
117	101	60



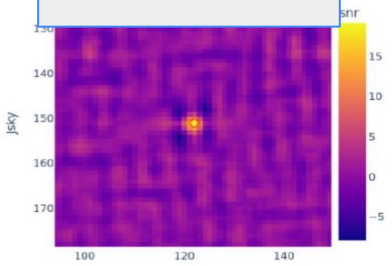




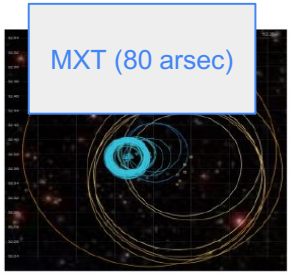
TevPA - Tendo
September 2nd , 2026

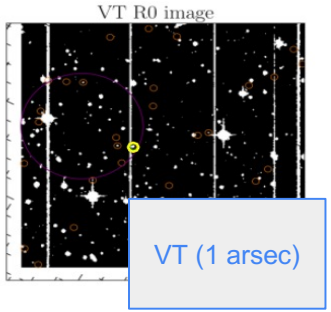
GRB 250205A: a textbook case

ECLAIRs (4.5 arcmin)

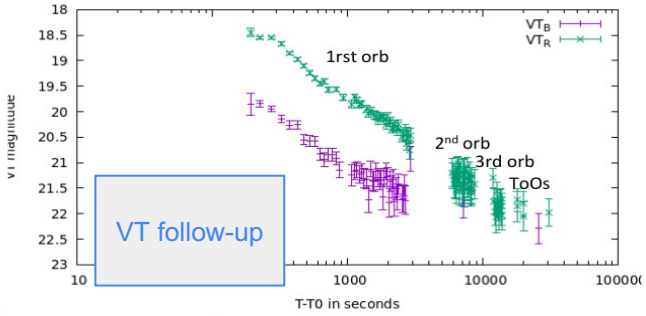


MXT (80 arsec)

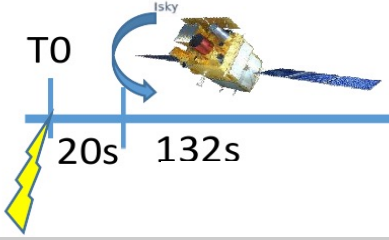




VT (1 arsec)



VT follow-up



T0

20s

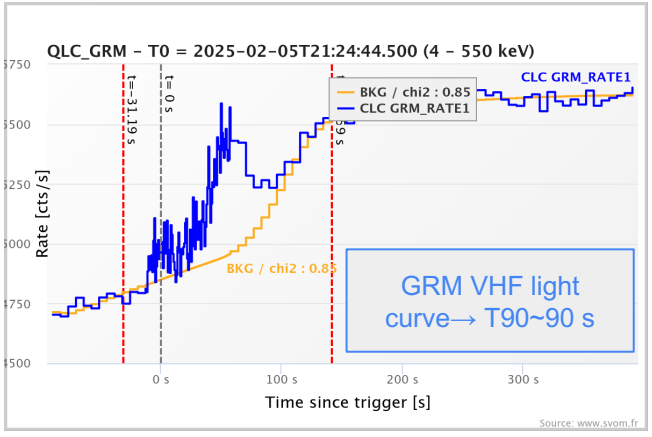
132s

450s (VT)

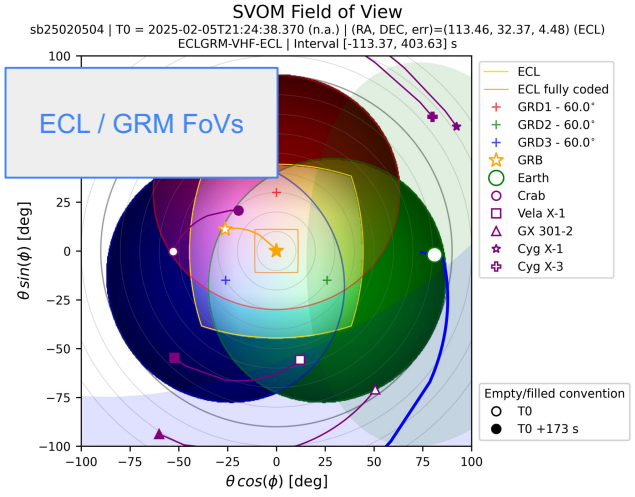
593 (MXT)

23000s (F-GFT)

Time

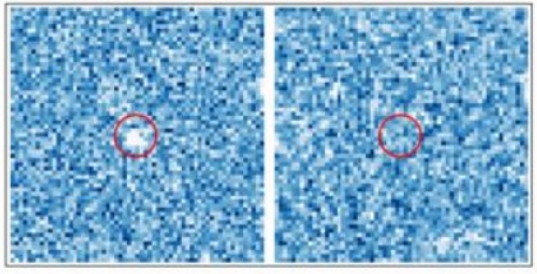


GRM VHF light curve→ T90~90 s



ECL / GRM FoVs

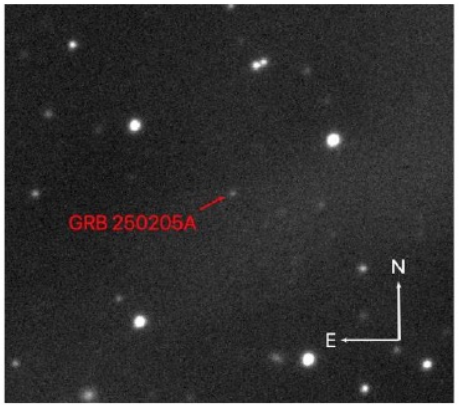
COLIBRÍ (FM-GFT) at T0+6.4h
r = 22.89 + /- 0.11



GRB 250205A: a textbook case

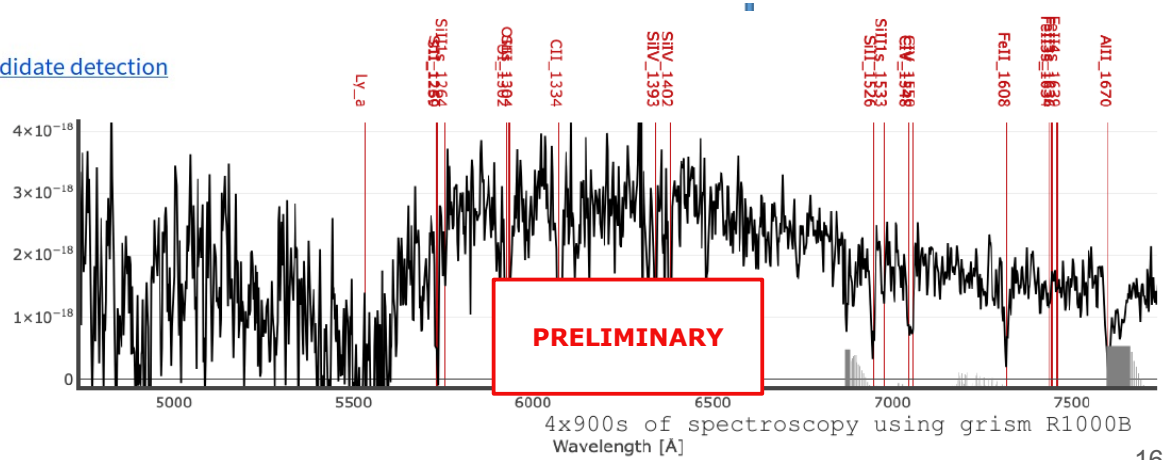
39520. GRB 250205A / EP250205A: further radio observations with the VLA
39315. GRB 250205A: VIRT Optical Upper Limit
39314. GRB 250205A: Leavitt Observatory optical upper limit
39302. GRB 250205A: Calapai Observatory, Massa S. Giorgio (Messina), upper limit
39289. GRB 250205A / EP250205A: radio detection with the VLA
39240. GRB 250205A: 1.3m DFOT optical upper limit
39171. GRB 250205A: Fermi GBM Observation
39170. GRB 250205A: REM NIR upper limit
39169. EP250205a/GRB 250205A: FTW optical and NIR observations of the counterpart
39168. GRB 250205A: Swift/UVOT Upper Limits
39166. EP250205a/GRB 250205A: correction to the source localization
39165. EP250205a/GRB 250205A: Einstein Probe observation
39162. GRB 250205A: COLIBRÍ/DDRAGO Optical Afterglow Detection
39161. GRB 250205A: Swift/XRT detection
39160. GRB 250205A: Redshift from OSIRIS+/GTC z = 3.55
39159. GRB250205A: SVOM/VT optical afterglow detection
39158. GRB 250205A: GOTO optical upper limits
39157. GRB 250205A: OHP/T193 optical counterpart candidate
39156. GRB 250205A: Liverpool Telescope optical counterpart candidate detection
39154. GRB 250205A: SVOM detection of a burst

GCN circulars



30-s acquisition in r-band

- **Mobilization of the GRB community**
- **At T0+1h45: OSIRIS+ on the 10.4 m GTC (La Palma) → z = 3.55**



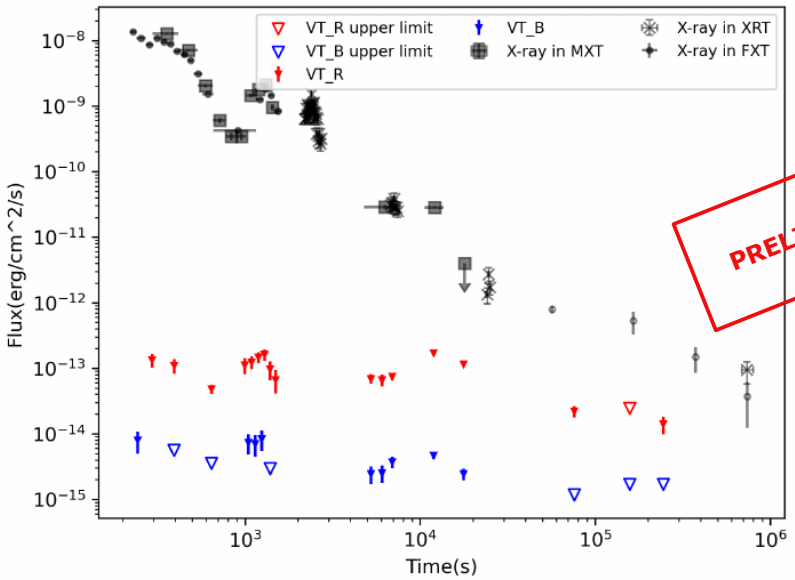
Long Gamma-Ray Bursts

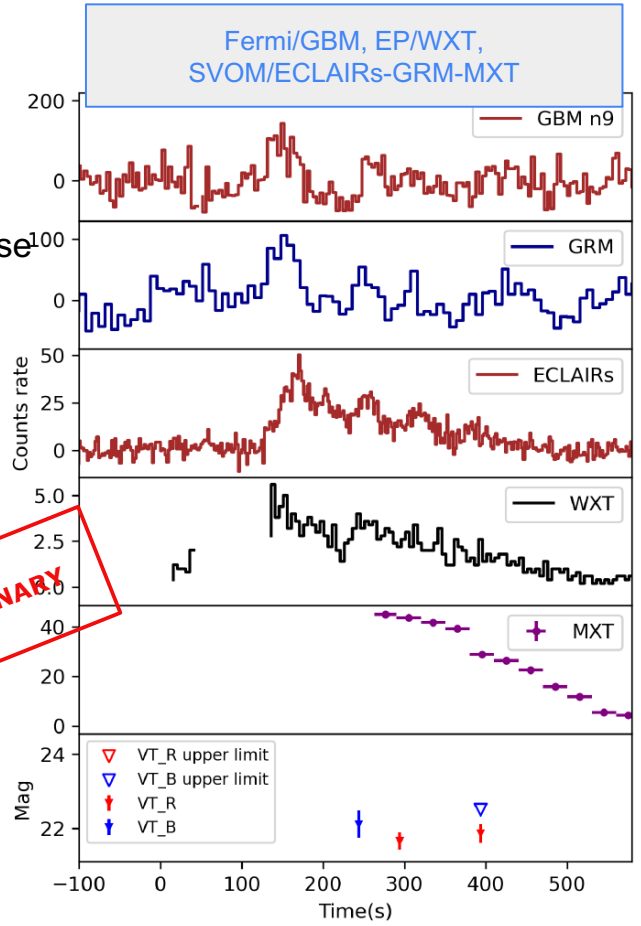
<u>Our goal:</u> contribute to build a well sampled multi-wavelength coverage of the prompt and afterglow phases with a high fraction of redshift determination

GRB 241217A (z = 1.879, VLT/X-shooter)

- Very long (~500 s) GRB detected by Fermi, SVOM and EP
- MXT & VT: end of the prompt emission, and transition to the afterglow phase
- Peculiar visible afterglow: shallow phase until ~10ks, with possible flares
- Not a standard scenario: late activity in a low-density environment?

Brunet et al. 2026 (submitted)



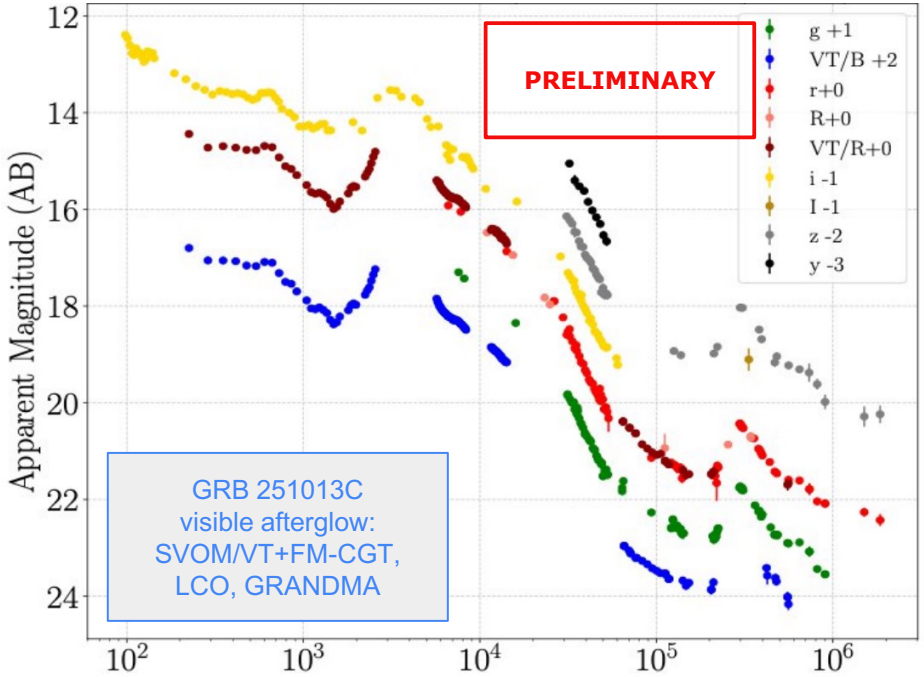


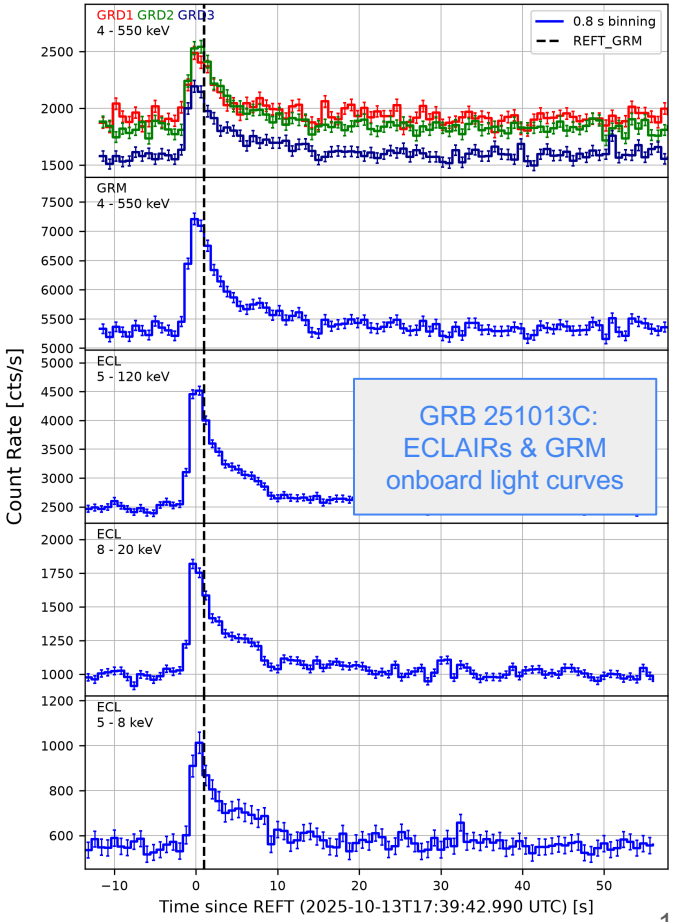
Long Gamma-Ray Bursts: visible afterglow rebrightenings

Mandarakas et al. (in prep)

GRB 251013C (z = 0.572, NOT)

- Detected by ECLAIRs and GRM (T90~17 s)
- Monitoring with SVOM/COLIBRÍ until ~T0+26d
- Non standard afterglow light curve: origin of the rebrightening events?



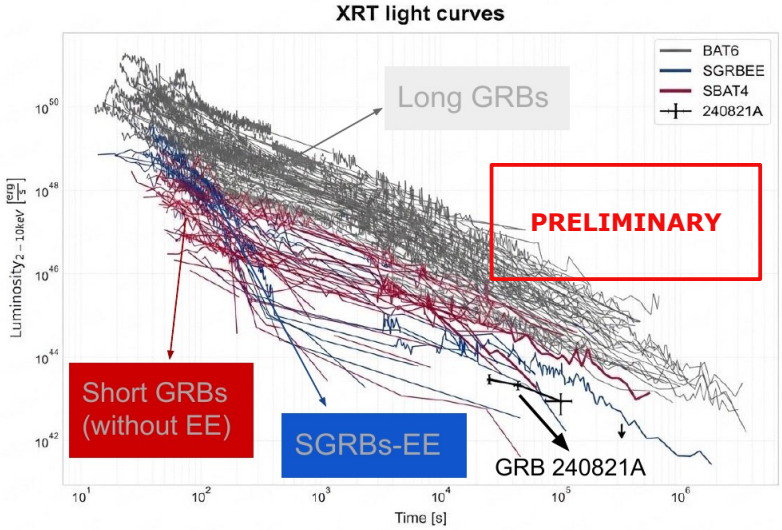


Short Gamma-Ray Bursts

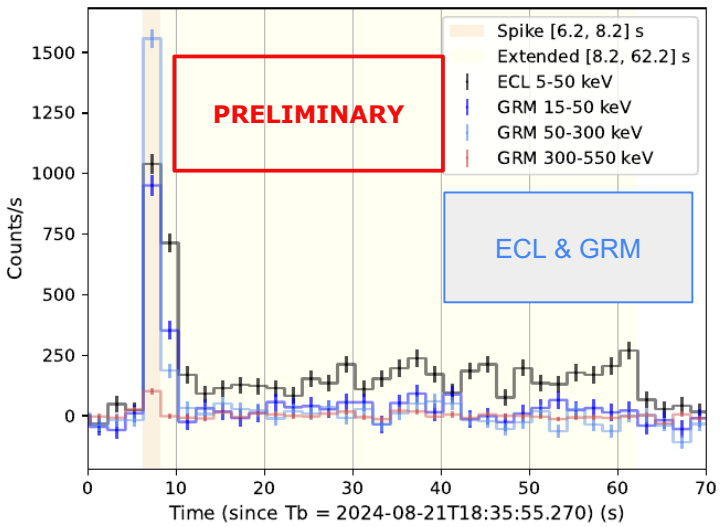
Our goal: contribute to build a sample of well characterized short GRBs, including the properties of the host galaxy

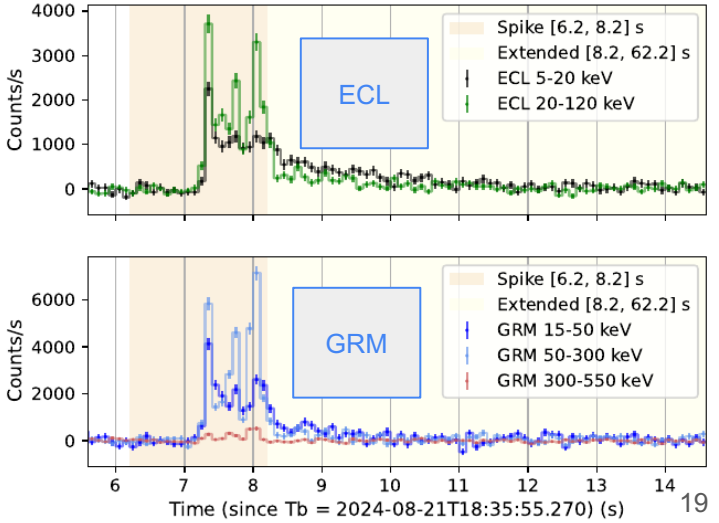
GRB 240821A (z = 0.238, VLT/X-shooter)

- First ECLAIRs + GRM joint detection (T90~50 s)
- Initial spike (<2s): variable, SED peak energy Ep>1 MeV
- Extended emission (EE): softer (Ep~25 keV), still non thermal
- Faint X-ray afterglow, consistent with other SGRBs with EE
- Host galaxy (GTC, VLT, Keck) clearly favors a merger origin



Daigne, Maiolino et al. (in prep)





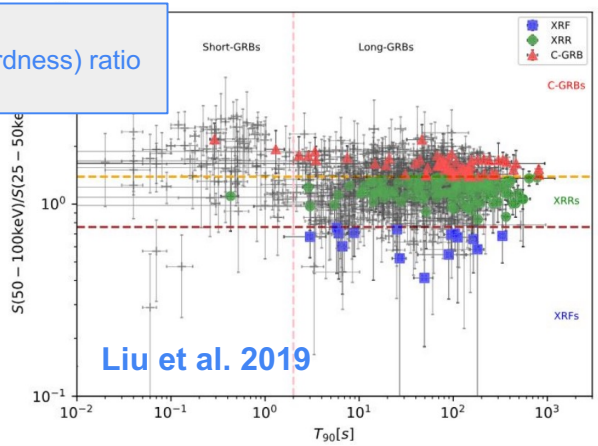
Soft Gamma-Ray Bursts

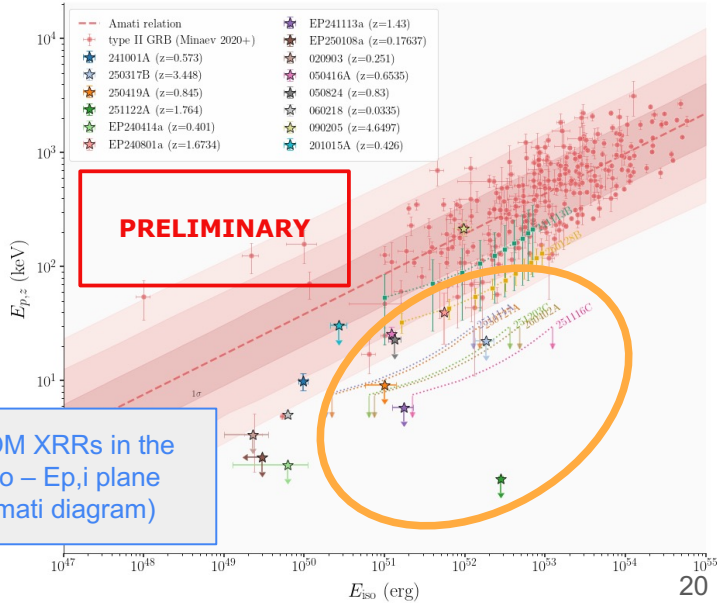
<u>Our goal:</u> probe the diversity of long GRBs and bring a physical interpretation of the poorly known population of very soft X-ray bursts

- **Population discovered by Beppo-SAX and HETE-2, also well explored by EP**
  - Classification: X-Ray Rich GRBs (XRRs) or X-Ray Flashes (XRFs)
  - Soft and under-luminous, faint X-ray afterglows with single decay
  - Sample of well-characterized events is limited
- **Connection between classical collapsar GRBs and "failed" or low-luminosity GRBs?**
  - External effects? (high z, off-axis view)
  - Intrinsic effects (shock breakout, low Γ jet)

- **Joint SVOM/EP project: 15 events (Aug. 2024 – Oct. 2025)**
  - 6 bursts with EP/WXT & SVOM/ECLAIRs **Adrien et al. (in prep)**
  - 12 bursts with EP/WXT & SVOM/GRM
  - 14 bursts with detected afterglow (X and/or visble)
  - 7 bursts with redshift
- **SVOM project on classification** **Godet et al. (in prep)**

Fluence (hardness) ratio





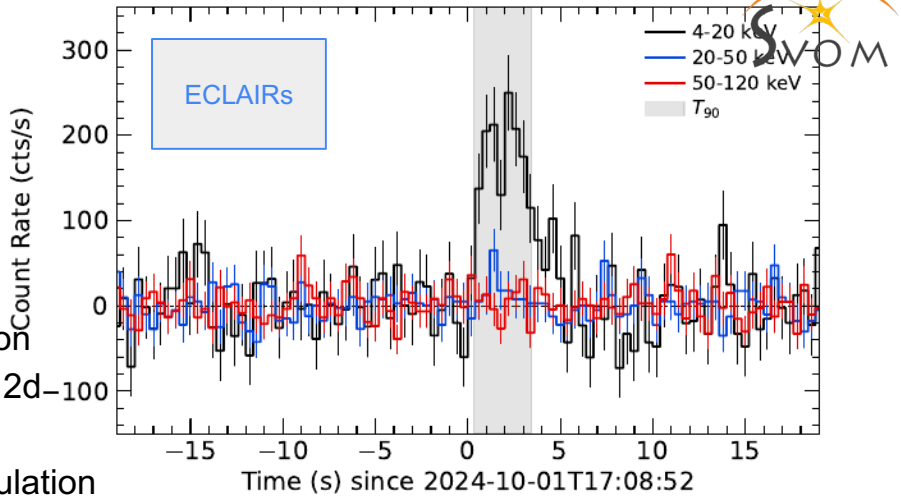
SVOM XRRs in the Eiso – Ep,i plane (Amati diagram)

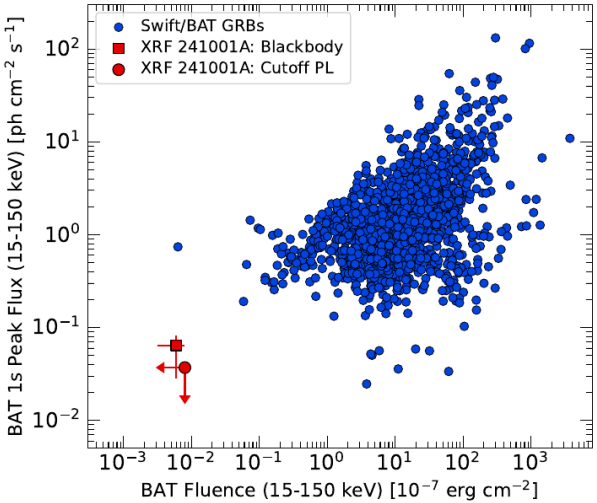
Soft Gamma-Ray Bursts

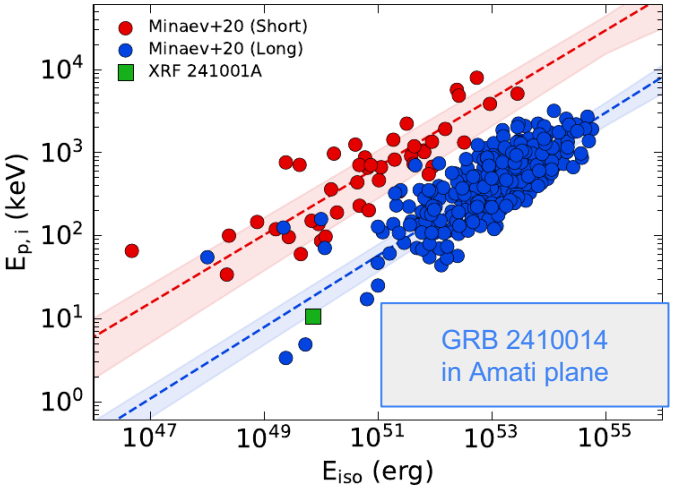
Schneider et al. 2026

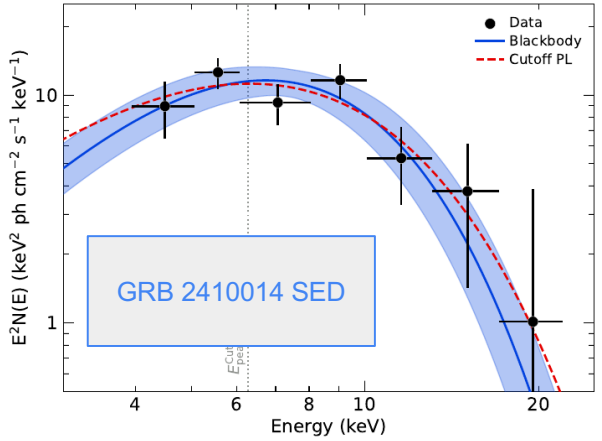
GRB 241001A: XRF at z = 0.573 (VLT/X-shooter)

- Weak prompt emission (ECLAIRs <20 keV, T90=3.1 s)
  - BB (kT=1.7 keV) but B/CPL OK too (PL rejected)
  - Underluminous: Eiso=7x10^{49} erg
- Faint X-ray afterglow, typical GRB visible afterglow evolution
- Associated with a type-Ic broadline SN (SVOM/VT at T0+12d and JWST at T0+24d) → collapsar origin
- Weak relativistic on-axis jet, very soft tail of the LGRB population







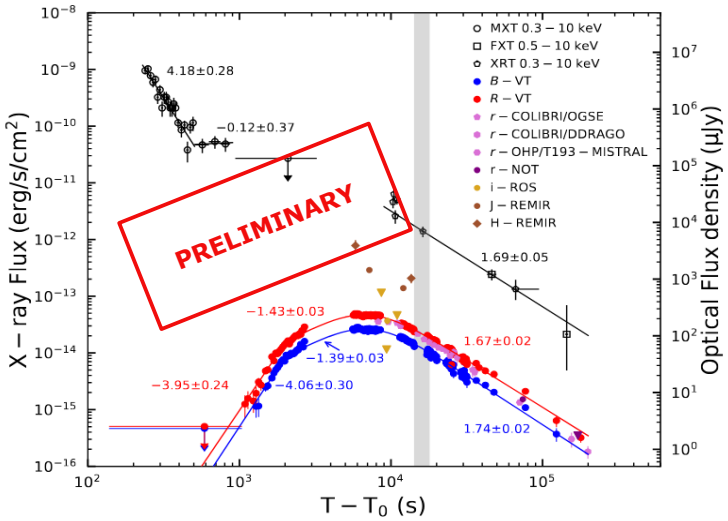


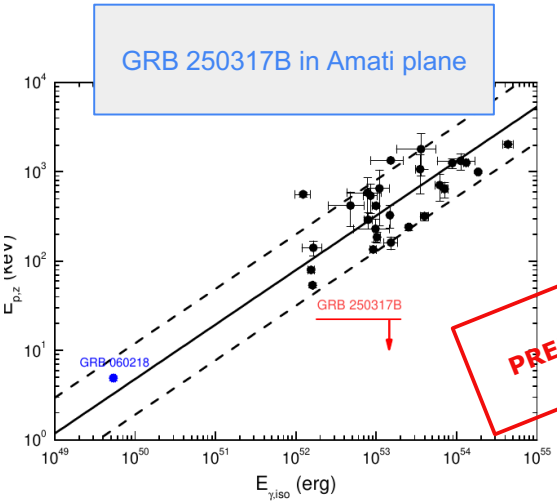
Soft Gamma-Ray Bursts

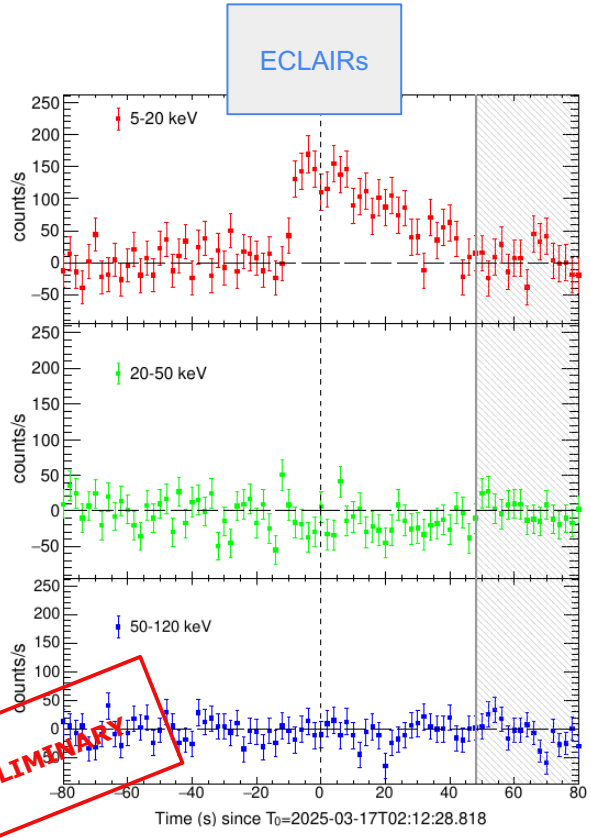
Zhao et al. 2026 (submitted)

GRB 250317B: 2nd most distant XRF, at z=3.448 (GTC/OSIRIS)

- Weak prompt emission (ECLAIRs <20 keV, T90~30 s)
  - Steep photon index (-2.9±0.2) → Ep<5 keV
- Excellent multi-wavelength follow-up observations
  - X-ray afterglow (SVOM, EP, Swift): shallow phase → late activity
  - Visible afterglow (VT, COLIBRÍ, etc.): late & steep, peaking at ~T0+6 ks
  - On-axis jet with low Γ~30 but normal energetics
    → dirty fireball? structured CSM (probes progenitor mass-loss history)?

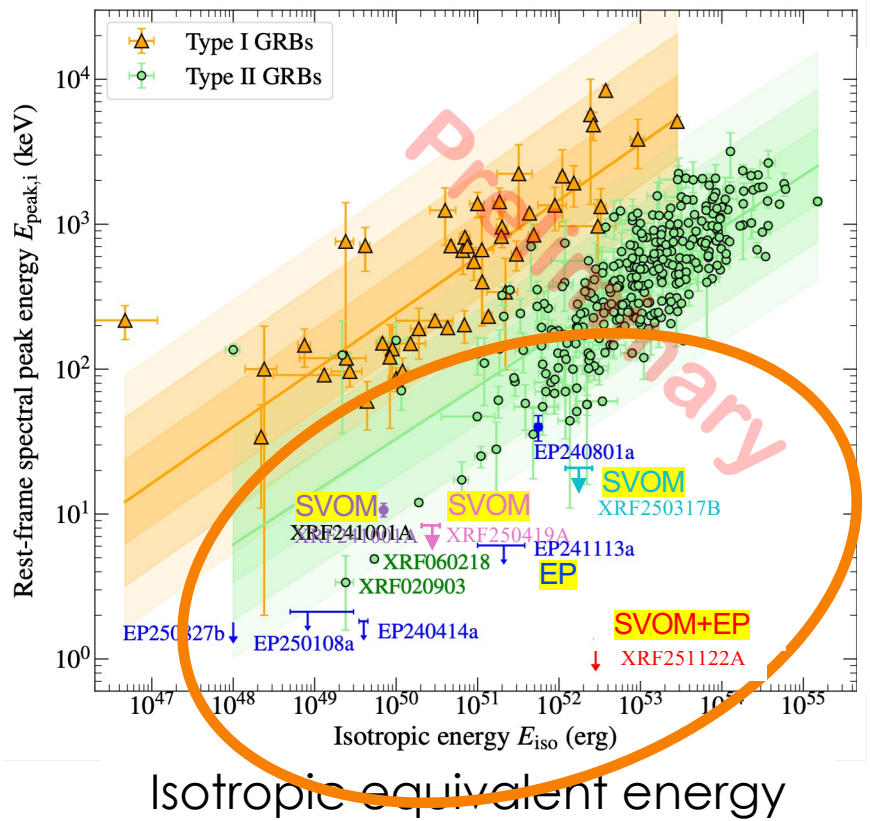






Bright & Soft Gamma-Ray Bursts: Amati diagram

Peak Energy in Source Frame
= Spectral Properties
of the Prompt Emission



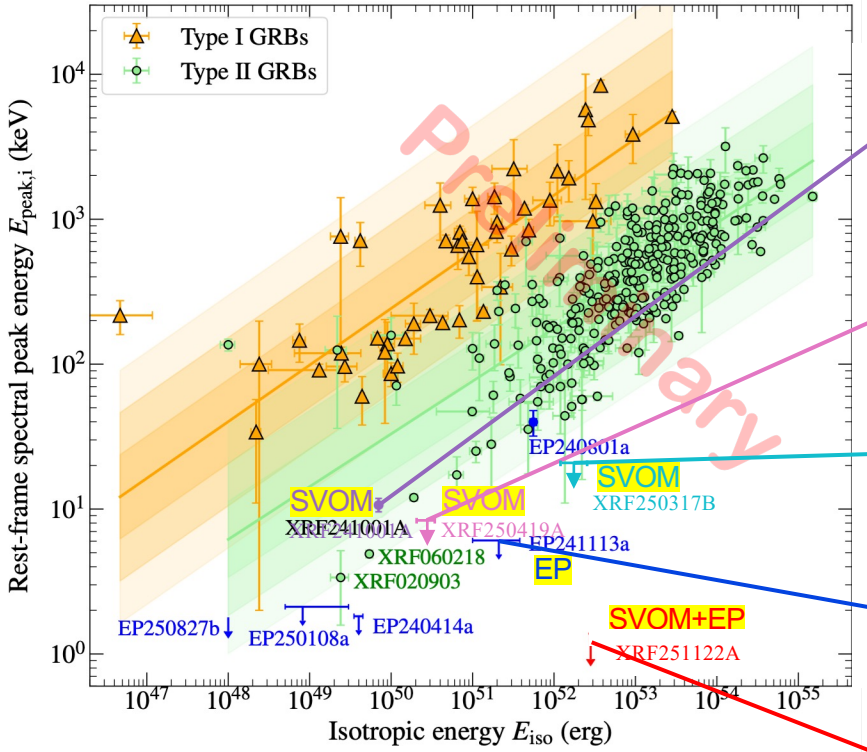
Isotropic equivalent energy
released in gamma-rays

Zhe-Yu Lin+ in preparation

- **Einstein Probe and SVOM start to detect new GRB-like events, which are soft (XRR/XRF), <u>but</u> energetic!**
- **SVOM is the perfect mission to characterize them!**
- **New constraints on the many theoretical scenarios for the physical origin of XRFs:**
  - offaxis classical LGRBs?
  - low-E_p tail of on-axis classial LGRBs?
  - dirty fireballs
  - shock breakouts
  - etc.

Bright & Soft Gamma-Ray Bursts: Amati diagram

Peak Energy in Source Frame
= Spectral Properties
of the Prompt Emission



Isotropic equivalent energy
released in gamma-rays

Zhe-Yu Lin+ in preparation

241001A:
Schneider+26 (accepted)

250419A:
Boting Wang+ in
preparation

250317B:
Dong-Hua Zhao+
(submitted)

EP241113a:
Dai et al. (submitted)
(SVOM contribution: VT data)

251122A:
Zhe-Yu Lin+ in preparation

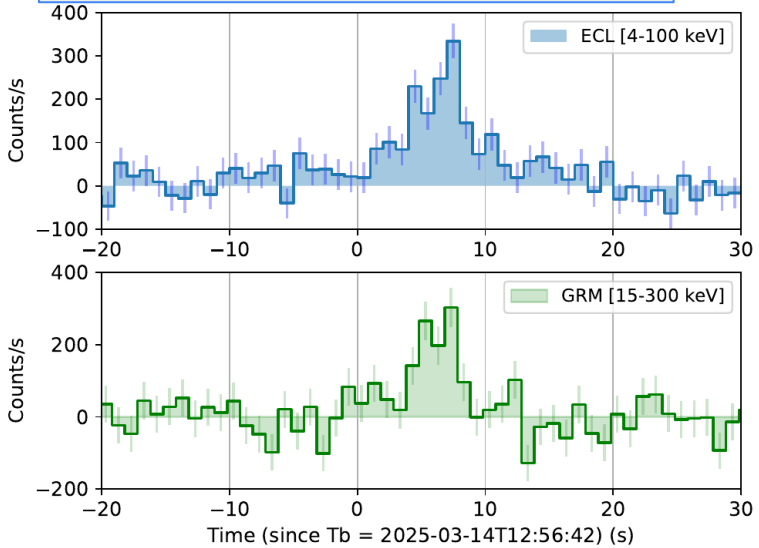
High-z Gamma-Ray Bursts

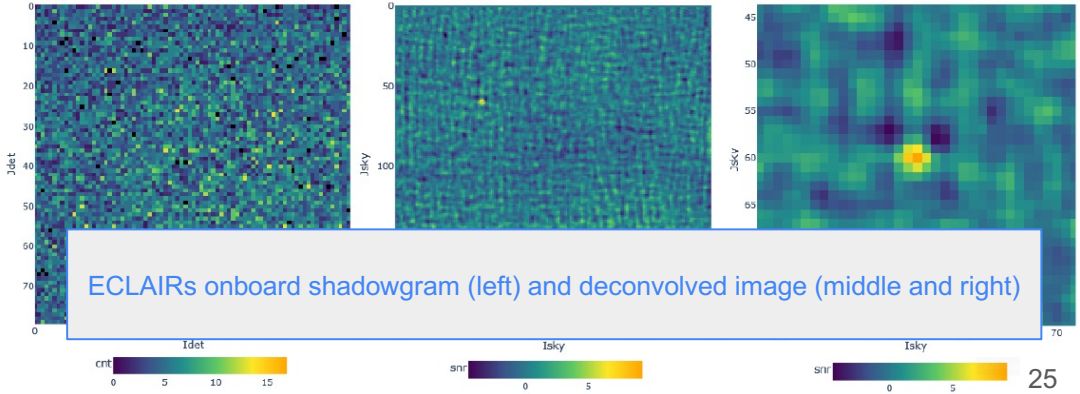
Our goal: probe the distant Universe, thanks to the ECLAIRs low-energy threshold (4 keV) and to the VT sensitivity in two channels (VT_R up to 1000 nm)

GRB 250314A at z ~ 7.3 (VLT/X-shooter) Cordier, Wei et al. 2025

- Detected by ECLAIRs and GRM (T90~10 s)
- Type-II GRB (collapsar) in the Ep,i-Eiso plane
  - Confirmed by JWST at T0+110d: type-Ic broadline SN
- MXT/VT quick follow-up (from T0+180s): no detection
- X-ray afterglow: Swift/XRT detection, fading confirmed by EP/FXT
- NIR afterglow discovered by NOT (T0+12.3h)
- VLT/X-shooter at T0+16.5h → spectroscopic z → 5th most distant burst and most distant SN!

GRB 250314A: ECLAIRs & GRM light curves



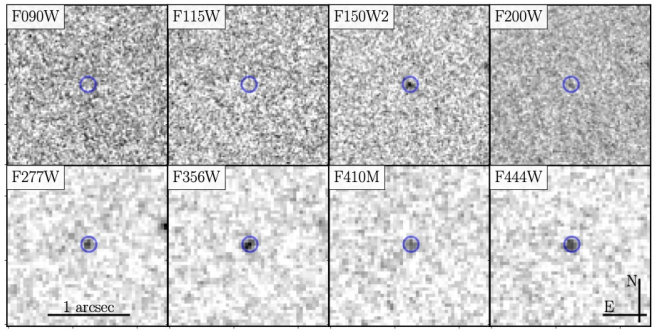


ECLAIRs onboard shadowgram (left) and deconvolved image (middle and right)

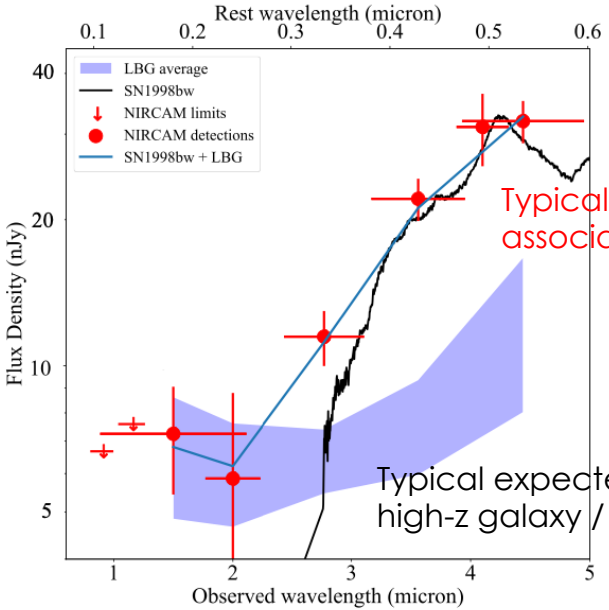
- **JWST detection of an associated supernova:**
  thanks to SVOM, JWST has detected the most distant supernova ever.

Levan+25

Images
JWST/NIRCam:



JWST/NIRCam SED:

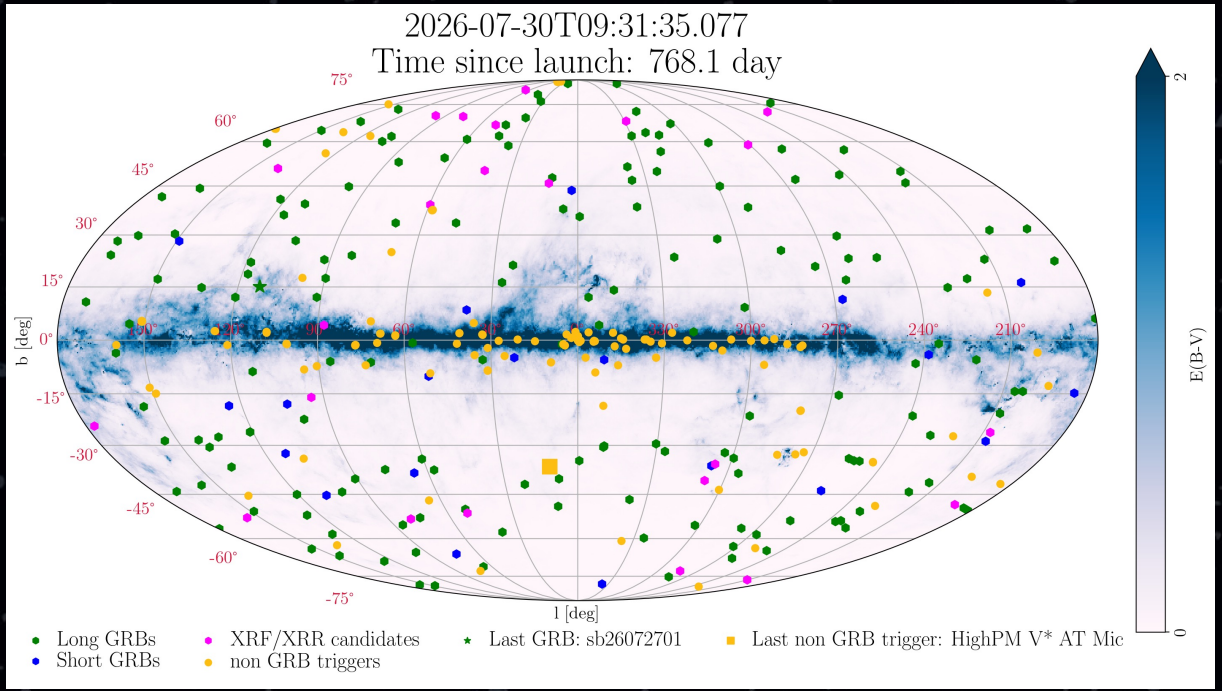


Typical spectrum of a supernova associated to a long GRB

Typical expected contribution for a high-z galaxy / afterglow contribution

- **We can observe an exploding star during the reionization era**

SVOM 2 years discovery map



GRB Triggers (June 2026)

318 GRBs of all types detected onboard + on-ground

1 GRB at z ~ 7.3

> 2000 GCN circulars

Non-GRB Triggers (June 2026)

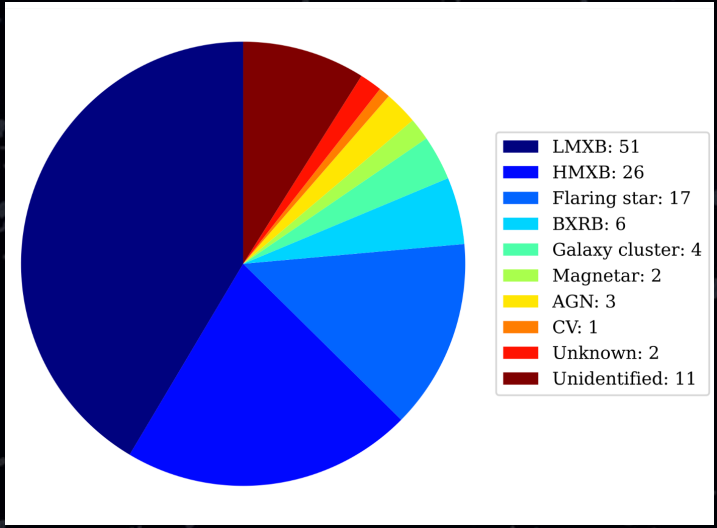
343 triggers onboard (known or unknown sources) + **178 triggers from Offline Trigger** searches

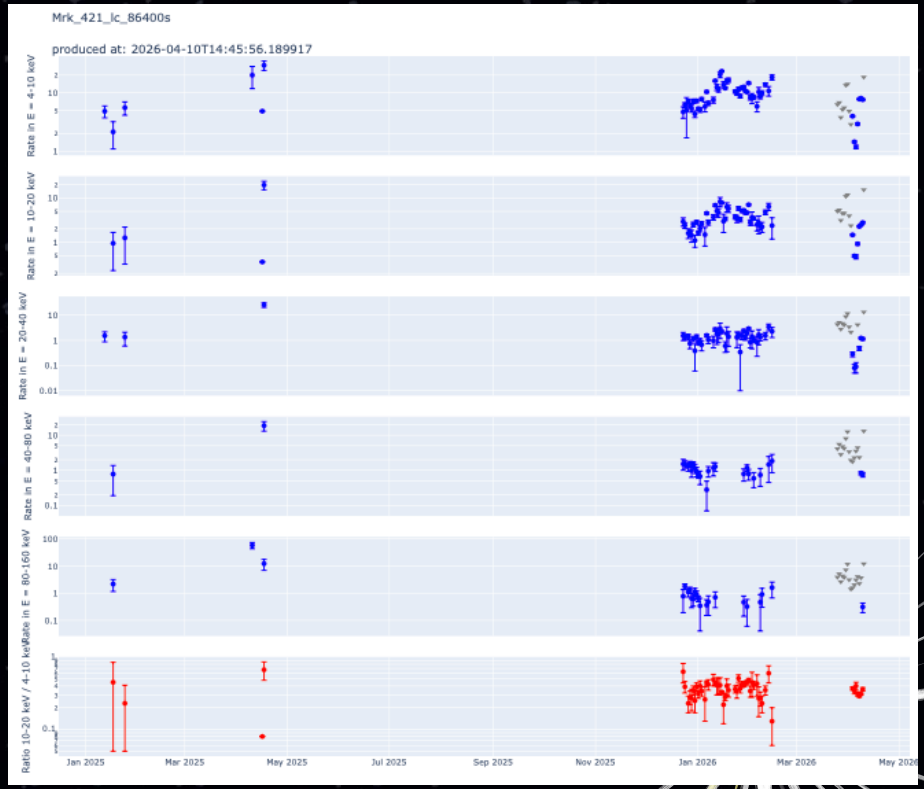
30 Atel on X-ray binaries & AGN

A few unidentified sources

Serendipitous HE sources Working Group

5 sources exhibiting (long-term) spectral state transitions detected with ECPI QLA light curves
27 ATels on Type I X-ray bursts, HMXB/LMXB outbursts, AGN outbursts

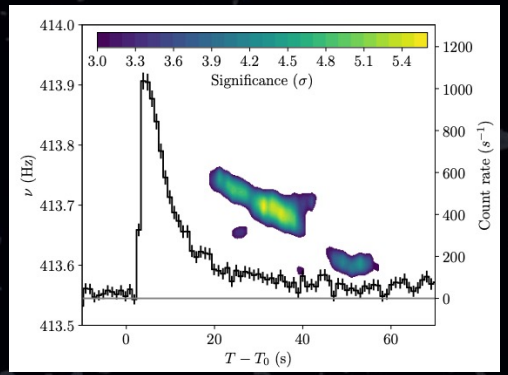




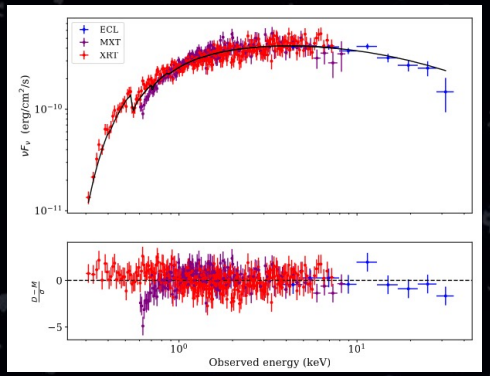
From ECLAIRs X-band Quick-Look Analysis (for longer-timescale variability)

Selected Science Results

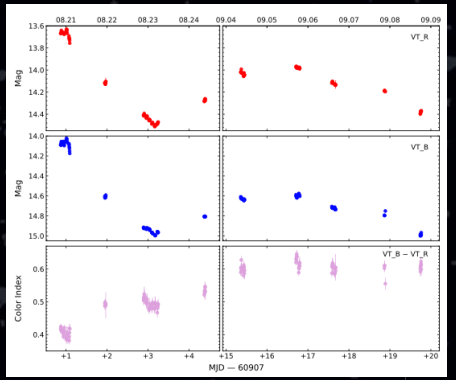
Type I burst of 4U 0614+091 (S. Le Stum et al.)



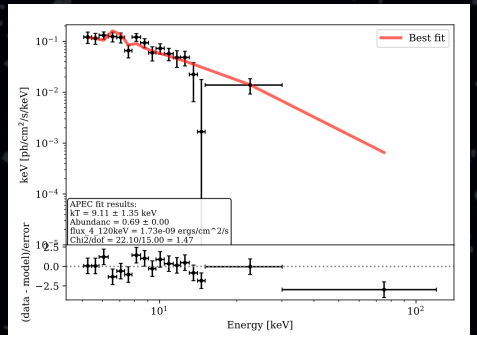
Outburst of 1ES 1959+650 detected by ECLAIRs (A. Foisseau et al.)



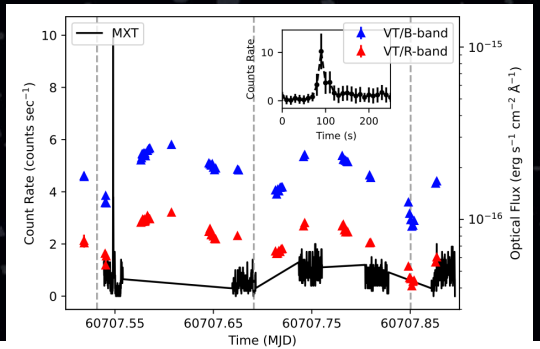
Fast optical variability of the TeV blazar PKS 1725+123 (S. Liu et al.)



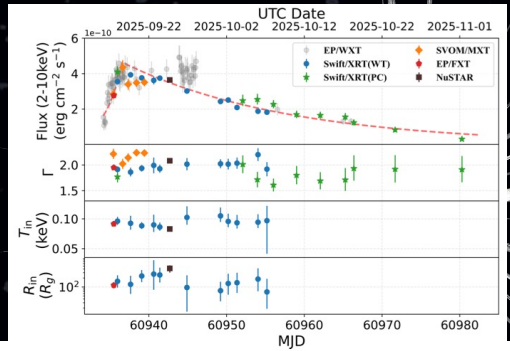
Chromospheric evaporation of a RS CVn (J. Wang et al.)



Double type I burst of EXO 0748 676 detected by ECLAIRs and MXT (D. Rawat et al.)



SVOM follow-up of the X-ray binary candidate EP J175257-351923 (G. Huang et al.)



Conclusions

- **A 4 keV low energy band a clear impact to better explore the**
  - The softest GRBs and the XRR/XRF population
  - High-z LGRBs: GRB250314A is the first burst at z>7 for the past 12 years
- **A full spectral coverage of the burst's emission from 4 keV - 5 MeV**
  - Detection (ECL>50/year, GRM~130/year) of all types: ~75% LGRBs, ~15% SGRBs(+EE), ~10% XRRs/XRFs
- **A large FoV (1°x1°) MXT x-ray telescope & a sensitive 40 cm VT telescope**
  - Several well-characterized events during the prompt & early/late afterglow phases
  - Prompt-to-afterglow transition for some bursts
  - Several cases on non detection in VT: dark or high-z bursts? Prompt systematic NIR Follow-up is still missing, but CAGIRE and SOXS will help

- **A pointing strategy optimized to coordinate fast follow-up observations**
  - Already a high rate of optical afterglow detection and redshift measurement, still increasing
- **Already fruitful Collaboration with other missions and groups**
  - Efficient ToO links between SVOM, Einstein Probe and Swift
  - ESO/VLT (Stargate collaboration), GTC and NOT
- **A collaboration open to exchange of data on specific science projects**
  - SVOM is open to jointly publish its data as lead collaboration or as partner
  - All critical SVOM information is publicly available through GCNs (soon through a public table)
  - SVOM is open for ToOs from the community, provided that one co-I is involved

>40 single GRB papers under review/submitted

A SVOM special issue in press (RAA)