

Boris Sbarufatti on behalf of the Swift team



Swift and its legacy

The many tones of accretion – to the memory of Tomaso Belloni

7-11 Sept 2026 Cefalù

Neil Gehrels Swift Observatory

(Previously known as Swift Gamma-ray Burst Explorer)

A (very) condensed history

- Launched November 20th, 2004.
- Nominal mission duration 2 years.
- Main mission objectives:
 - Determine the origin of Gamma-Ray Bursts (GRBs);
 - Classify GRBs and search for new types;
 - Determine how the blastwave evolves and interacts with the surroundings;
 - Use GRBs to study the early universe;
 - Perform a sensitive survey of the sky in the hard X-ray band.
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MORE ON THIS LATER!



XRT



X-Ray Telescope

A sensitive X-ray imaging spectrometer that measures brightness across a wide energy range. Enables Swift to determine GRB positions to a few arcseconds within about a minute of a BAT trigger.

Energy range: **300** to **10,000** electron volts (eV)

BAT



Burst Alert Telescope

Views half the sky each orbit and is triggered by high-energy outbursts. When they occur, the BAT localizes them to within a few arcminutes. Swift sends this position to the astronomical community, then swings its XRT and UVOT toward the target.

Energy range: **15,000** to **150,000** eV

UVOT



Ultraviolet/Optical Telescope

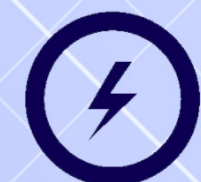
A **30**-cm telescope aligned with the XRT that captures early visible and UV light (600 to 170 nm) from GRBs. It has also studied asteroids, comets, supernovae, and galaxies.

Energy range: **2.1** to **7.3** eV



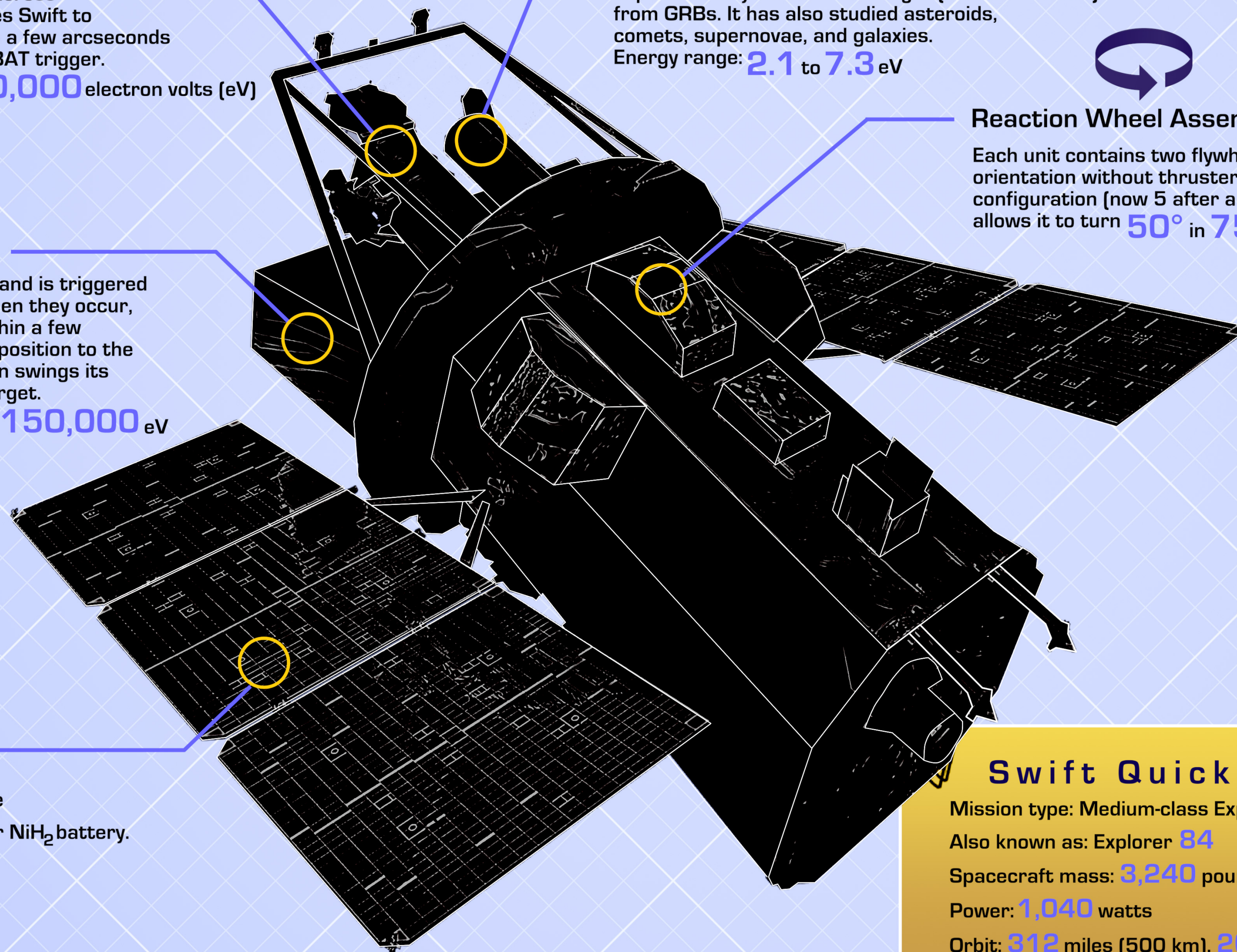
Reaction Wheel Assembly (3)

Each unit contains two flywheels that control Swift's orientation without thrusters. Swift's six-wheel configuration (now 5 after a 2022 failure) allows it to turn **50°** in **75** seconds.



Solar Array (2)

Converts sunlight into electricity to charge the onboard **80** amp-hour NiH₂ battery.



Swift Quick Facts

Mission type: Medium-class Explorer (MIDEX)

Also known as: Explorer **84**

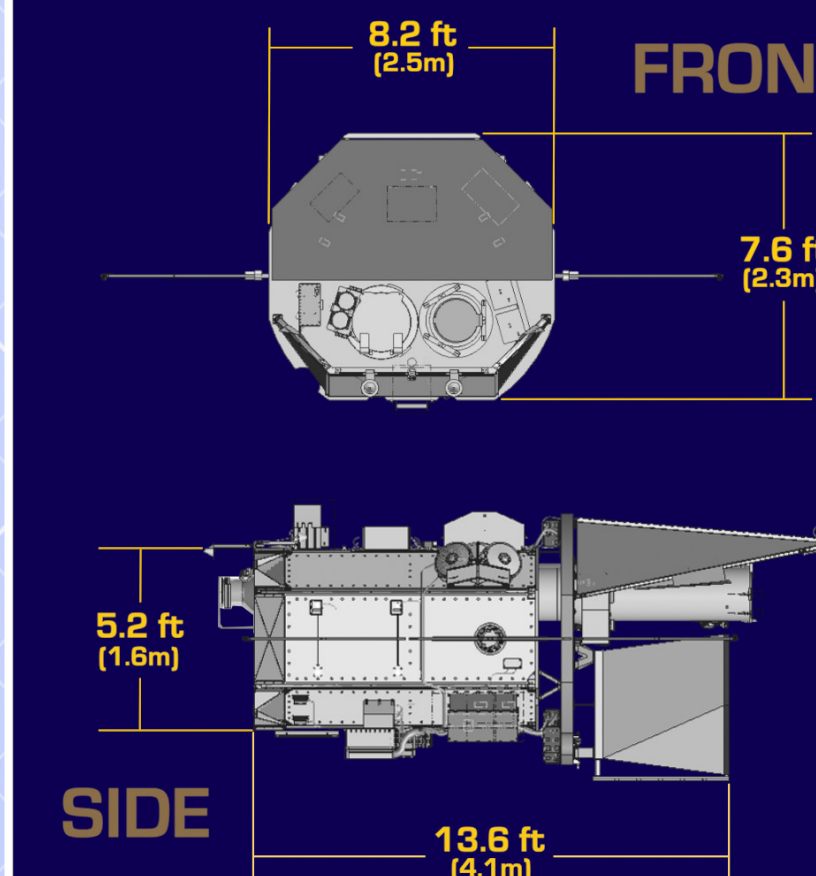
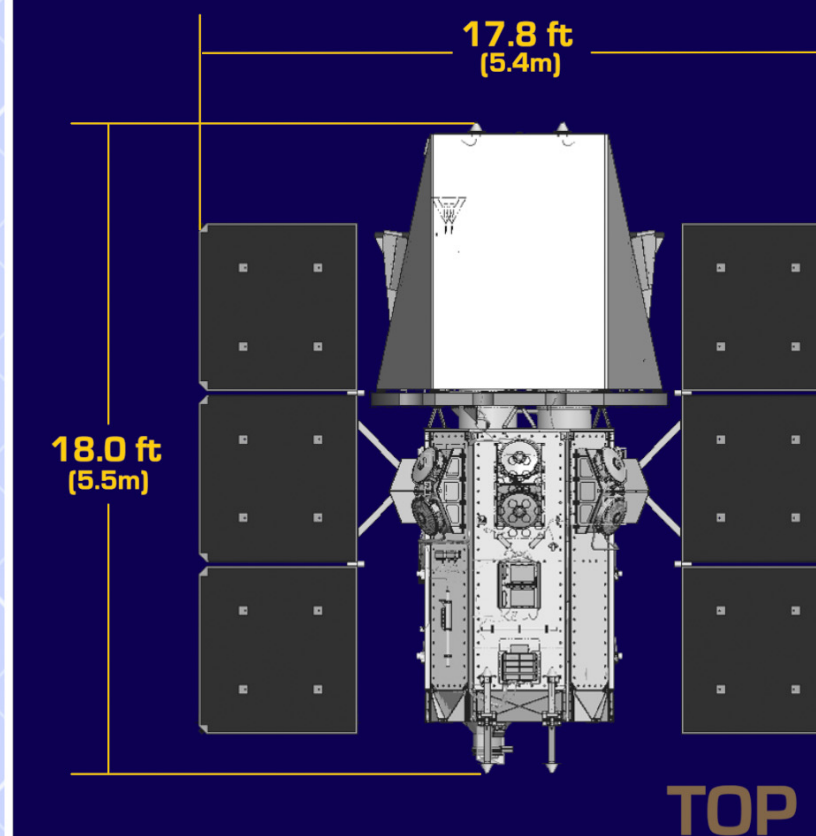
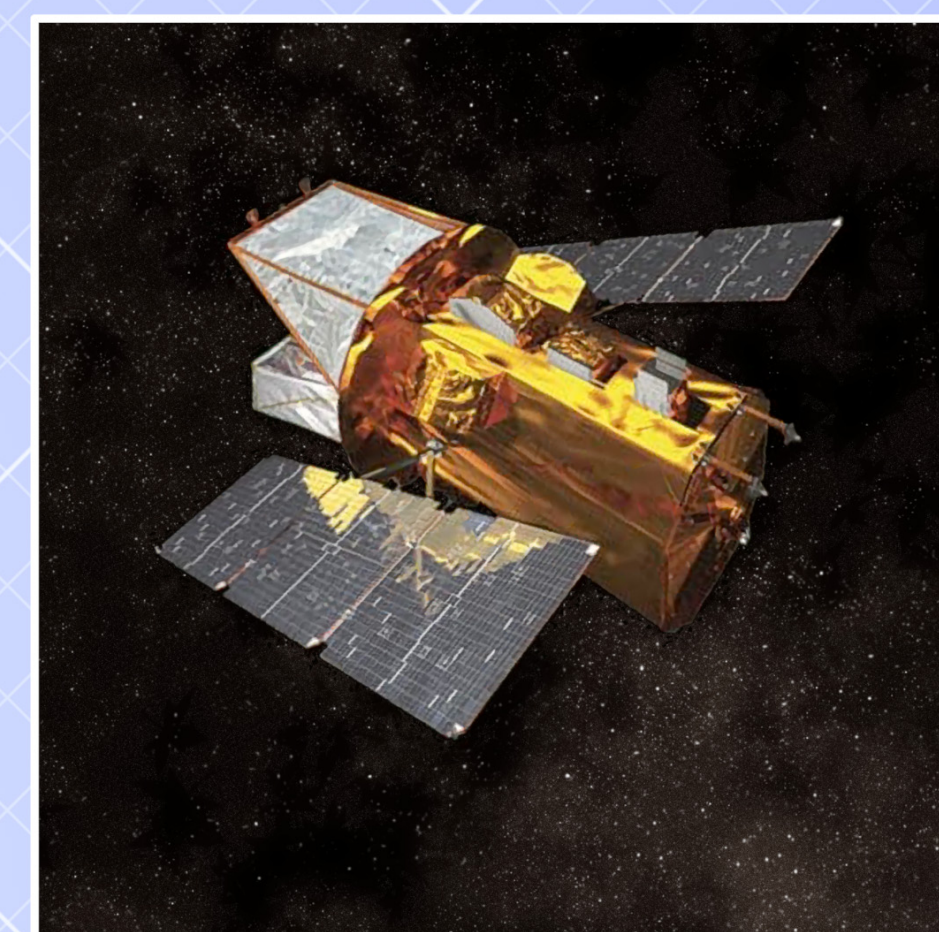
Spacecraft mass: **3,240** pounds (1,470 kg)

Power: **1,040** watts

Orbit: **312** miles (500 km), **20°** inclination

Launch date: November **20, 2004**

Launch vehicle: Delta **7320-10C**

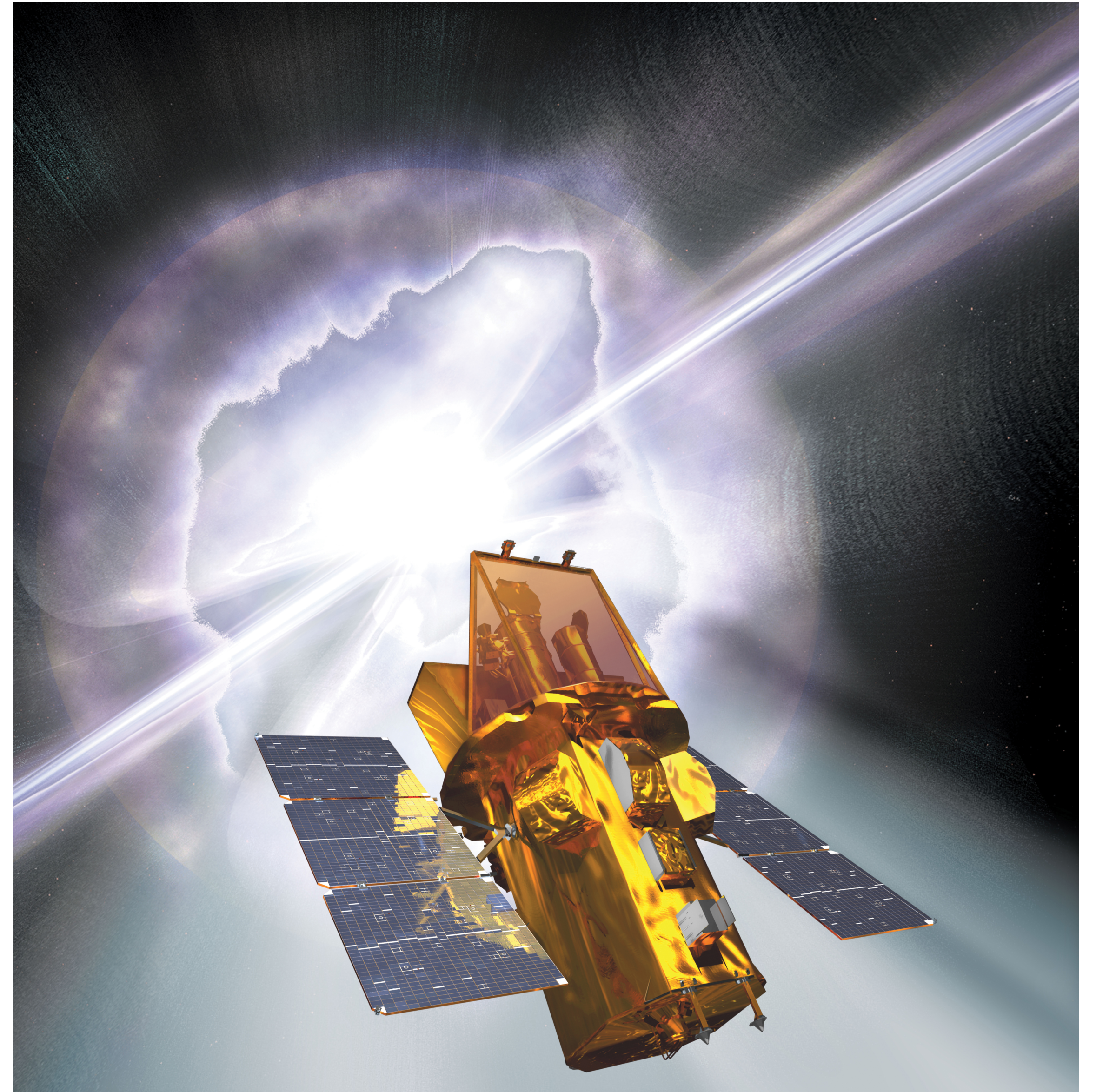


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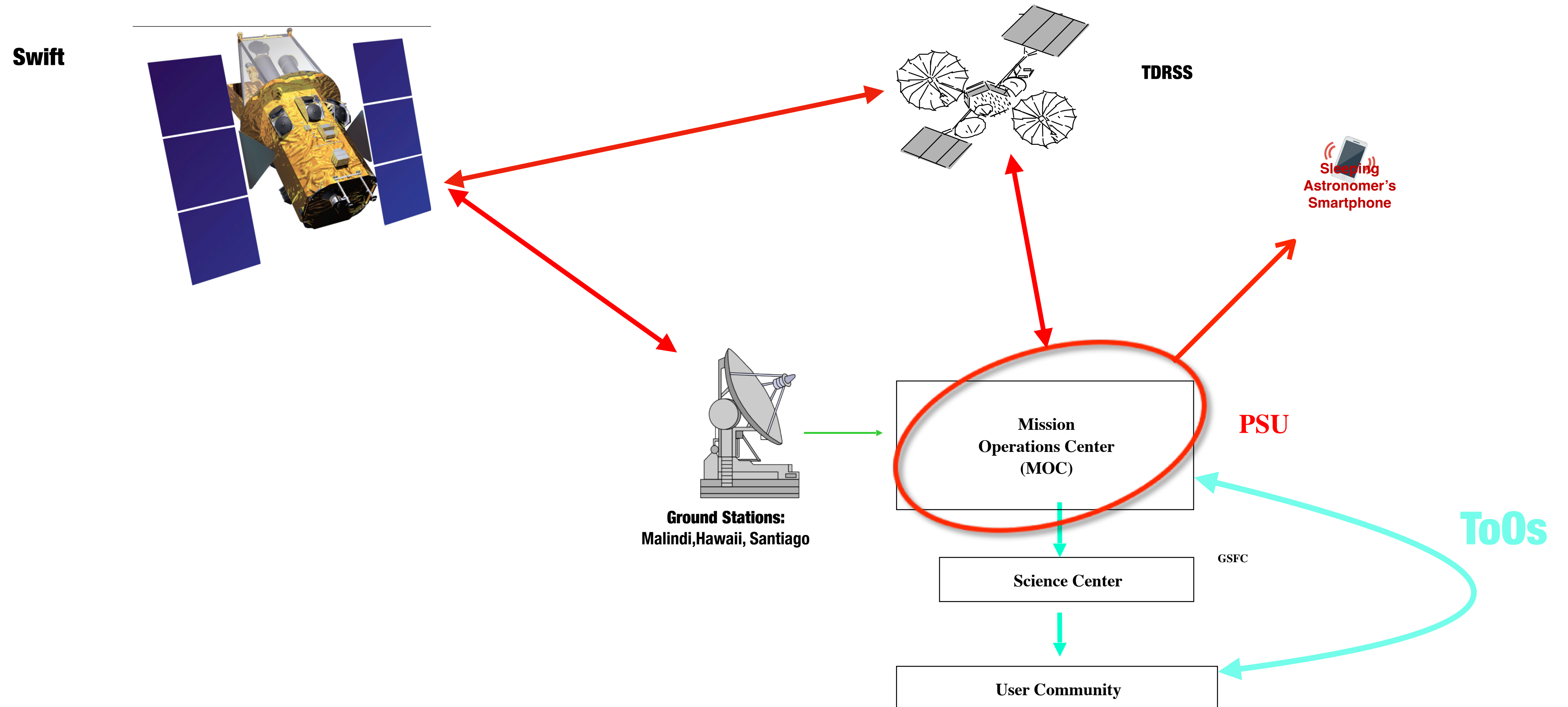
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Ground segment and triggering

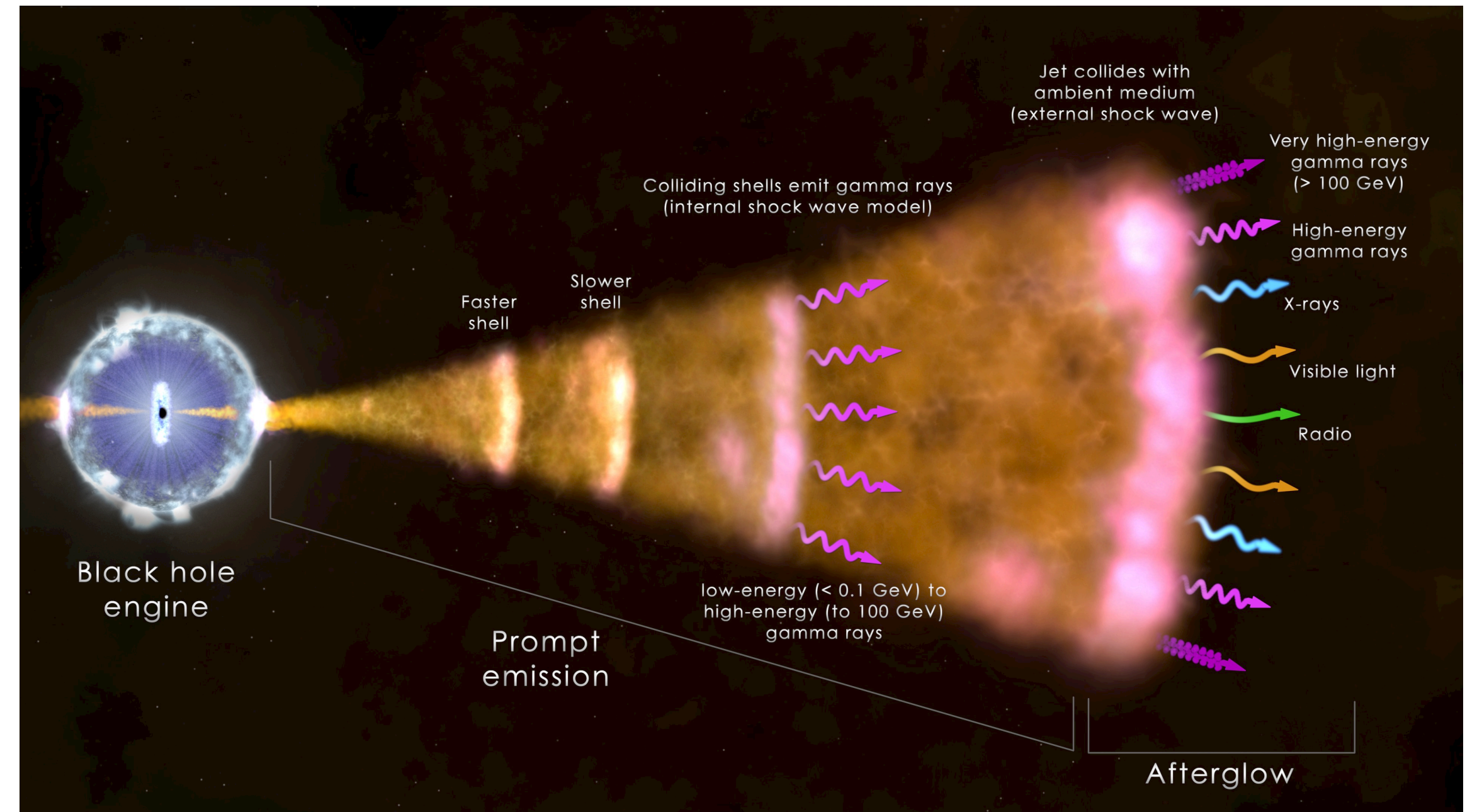
aka a burst goes BOOM! in (your) night



Swift GRB highlights

Primary mission accomplished

- Swift has:
 - detected 1760 GRB that triggered BAT
 - provided precise localisations for short GRBs
 - discovered the complex nature of X-ray afterglows
 - confirmed the association between long GRBs and SNe
 - fundamentally contributed to the identifications of GRB progenitors (massive star collapse for LGRBs, NS mergers for SGRBs) and their environment
- ...

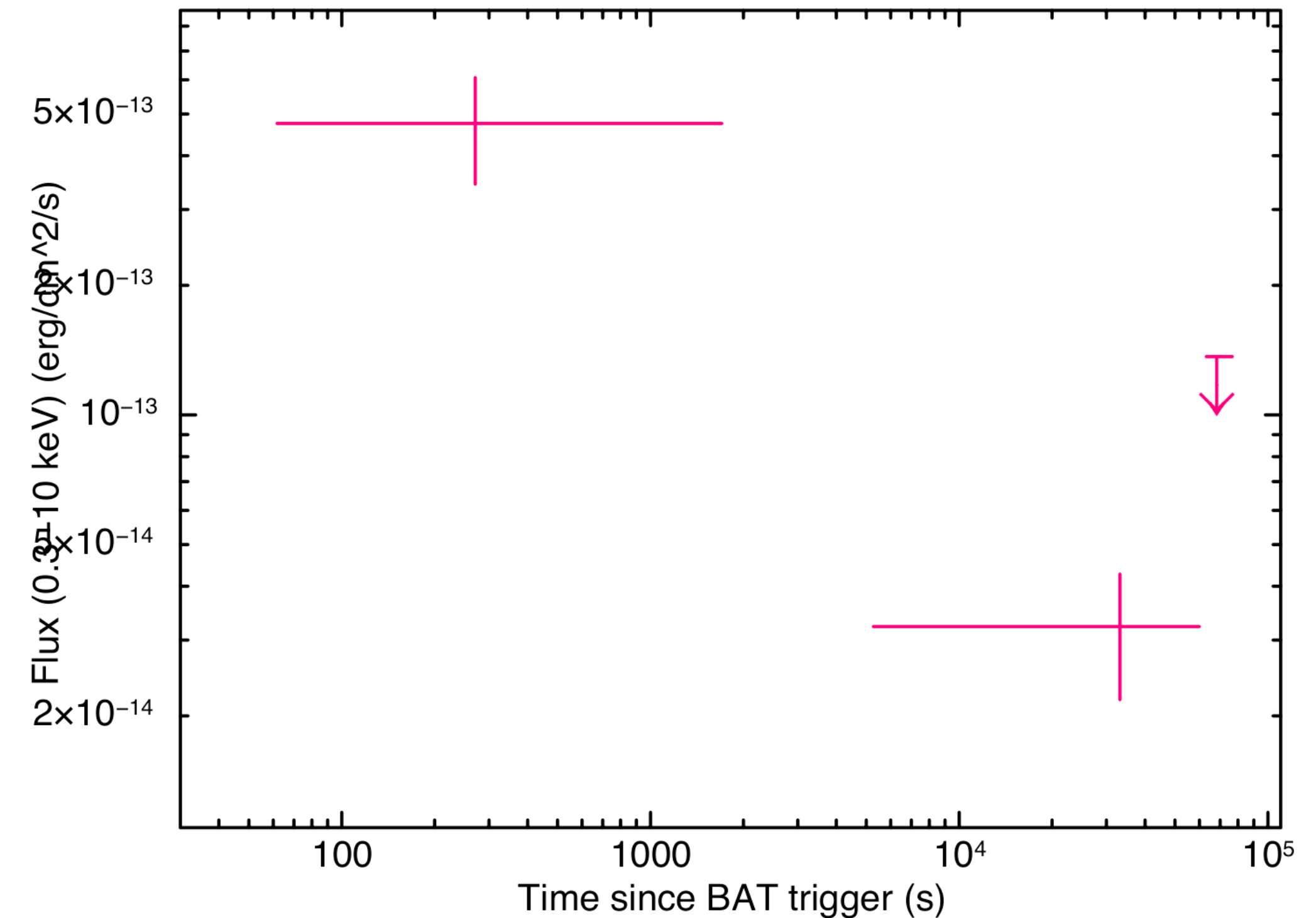


Swift GRB highlights

Primary mission accomplished

- GRB 041217: first GRB detected on board.
- GRB 050117: first slew to a GRB (~3 minutes) and XRT localization.
- GRB 050509B: first detection of the afterglow of a short GRB.
- GRB 060614: the first “intermediate” GRB.
- The “Naked Eye” GRB 080319B ($z=0.937$).
- Record distances: GRB 080913 ($z=6.7$), GRB 090423 ($z=8.2$), GRB 090429B ($z=9.06$).
- The BOAT: GRB 221009A, brightest burst ever observed.

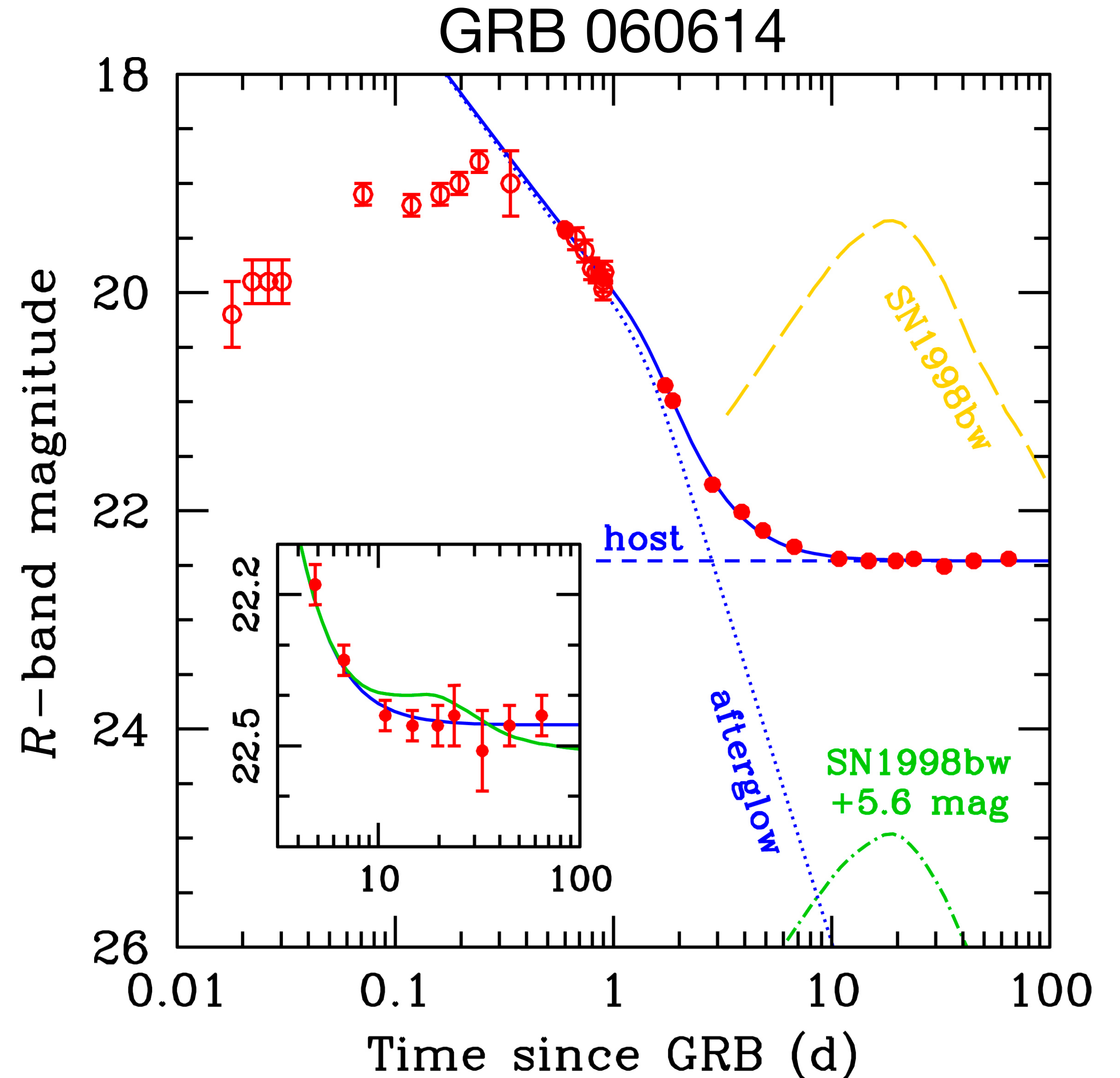
Swift/XRT flux curve of GRB 050509B



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GRB 080319B

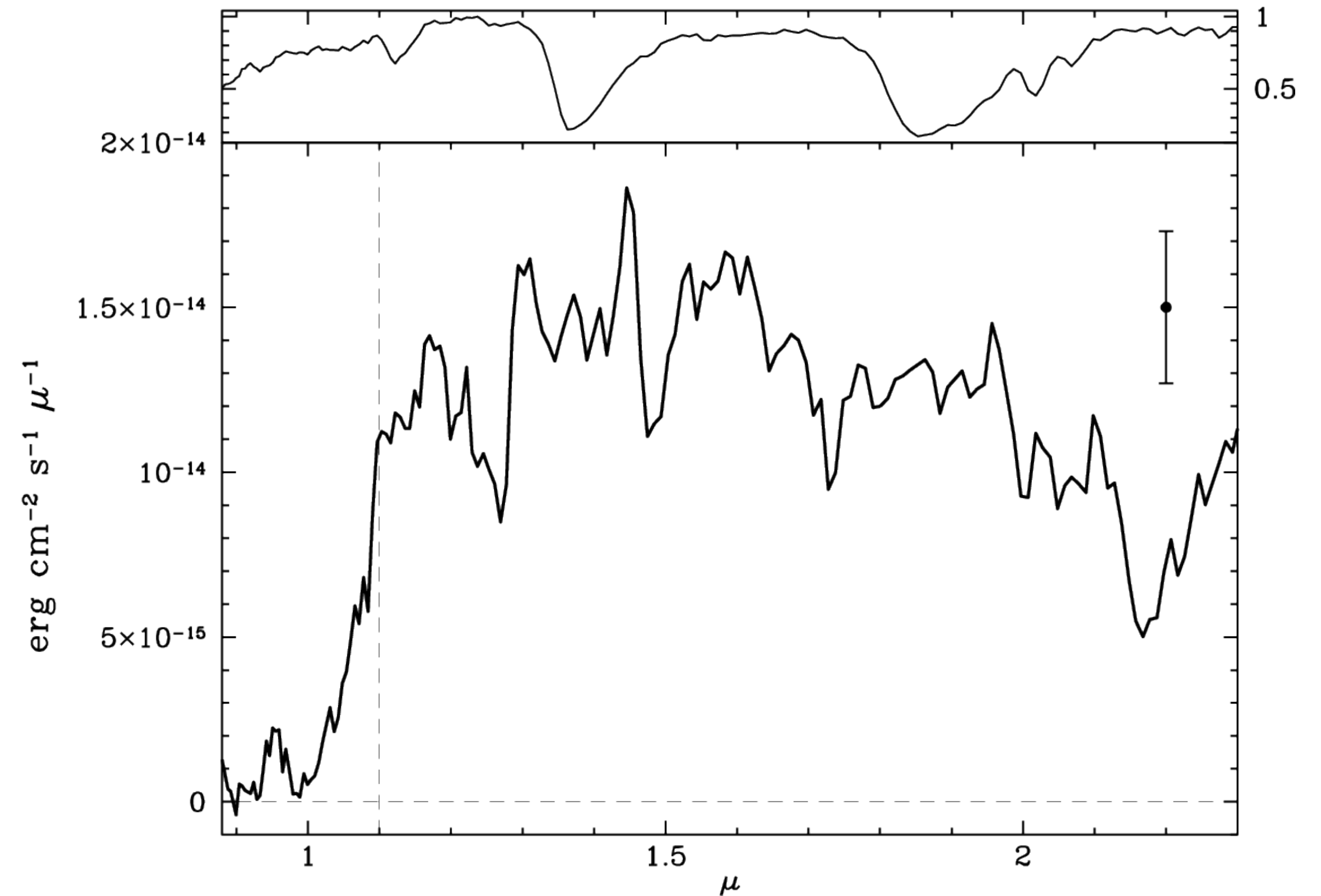


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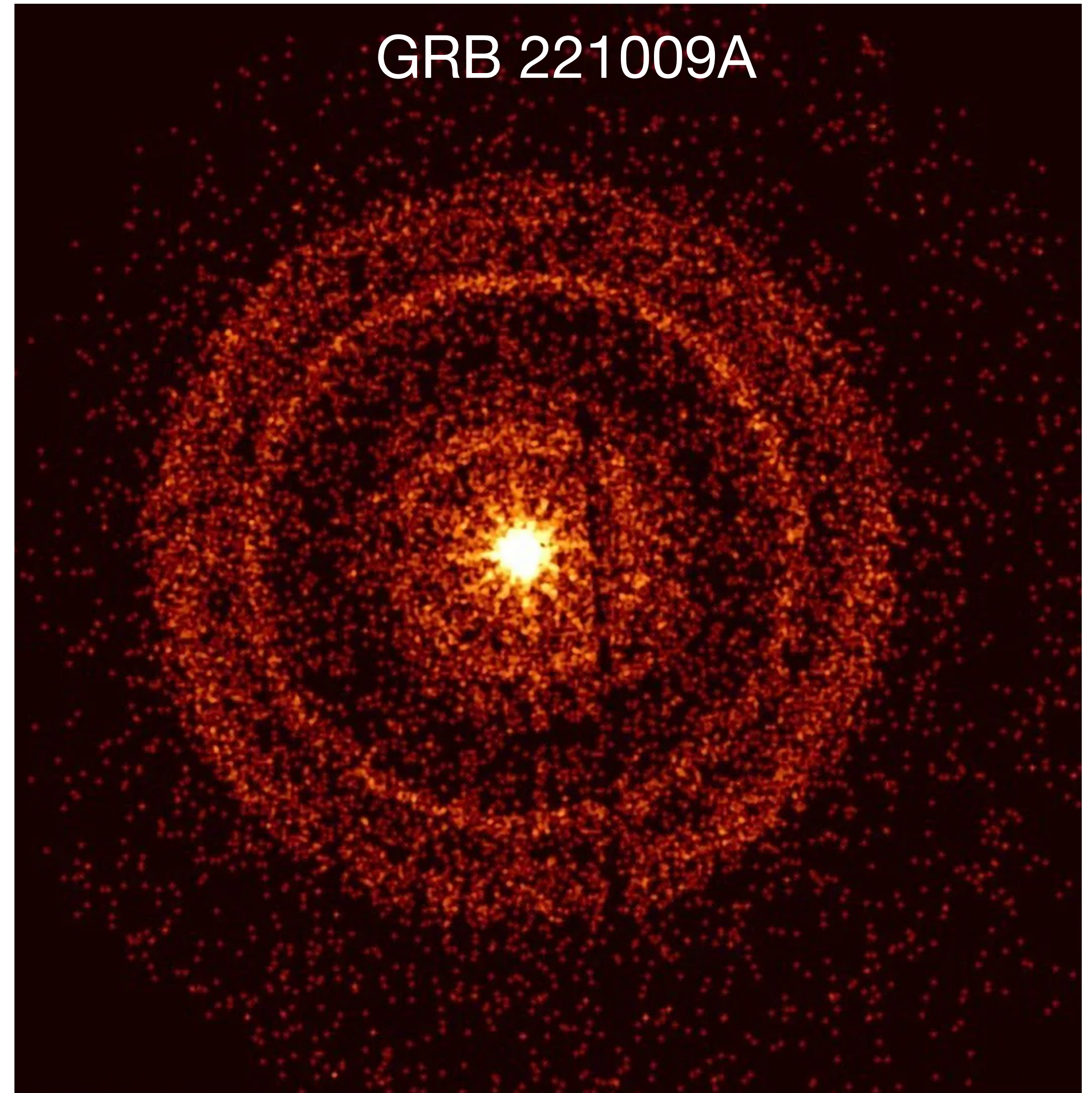
GRB 090423



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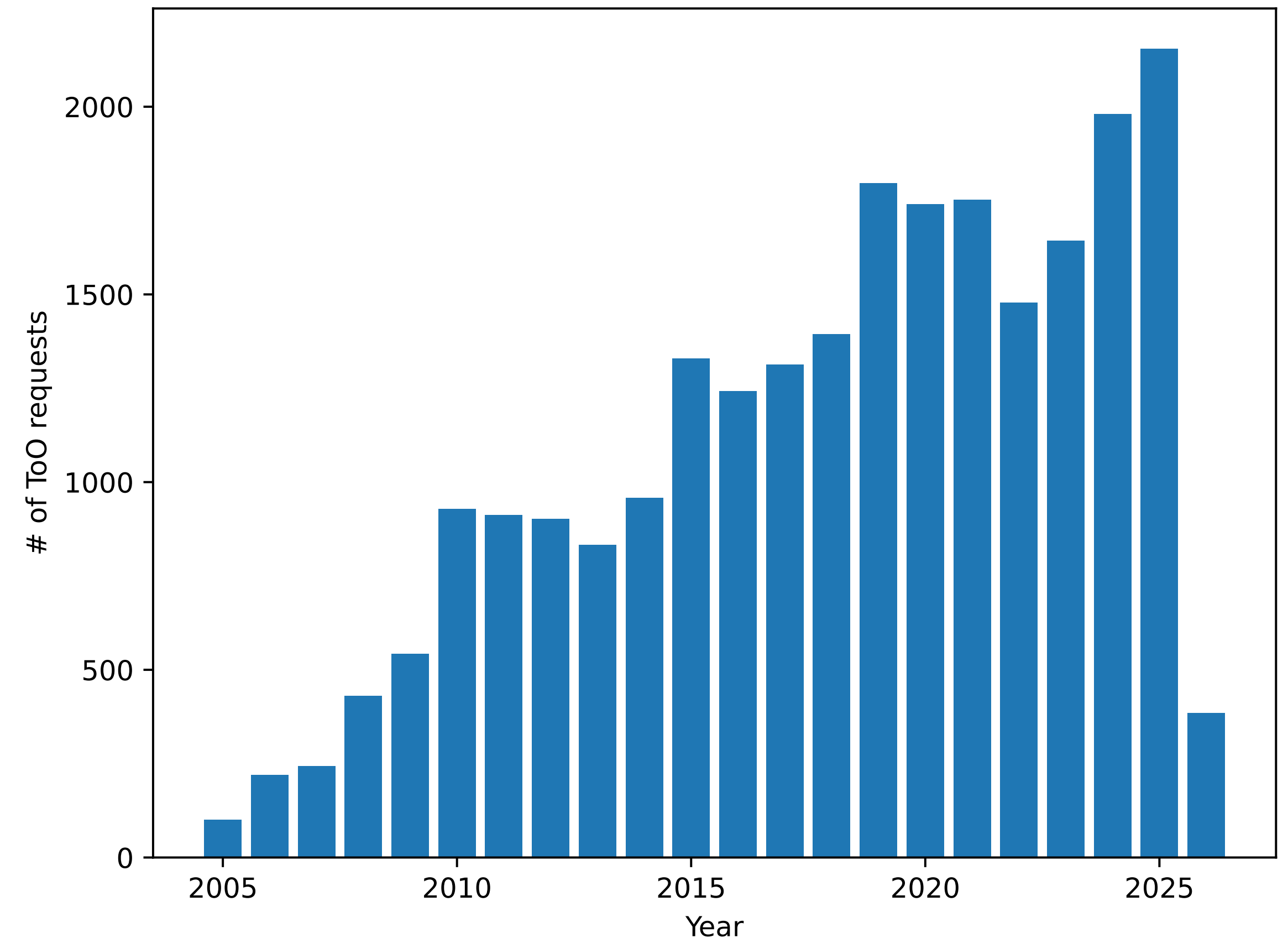
Swift other notable results

- 9 January 2008: Swift serendipitously detected the very early X-ray emission from SN2008D while observing another SN in NGC2770.
- 28 march 2011: first detection of a tidal disruption event (Swift J1644+57).
- 18 August 2017: first UV detection of a gravitational wave UV counterpart (GW170817).
- 23 September 2017: Swift is the first to identify TXS 0506+056 as the possible source of the IceCube-170922A extremely high energy neutrinos.
- 2025: UVOT observations discovers OH on 3I/ATLAS, indicating it has water.

What about ToOs?

How Swift became a TDAMM machine

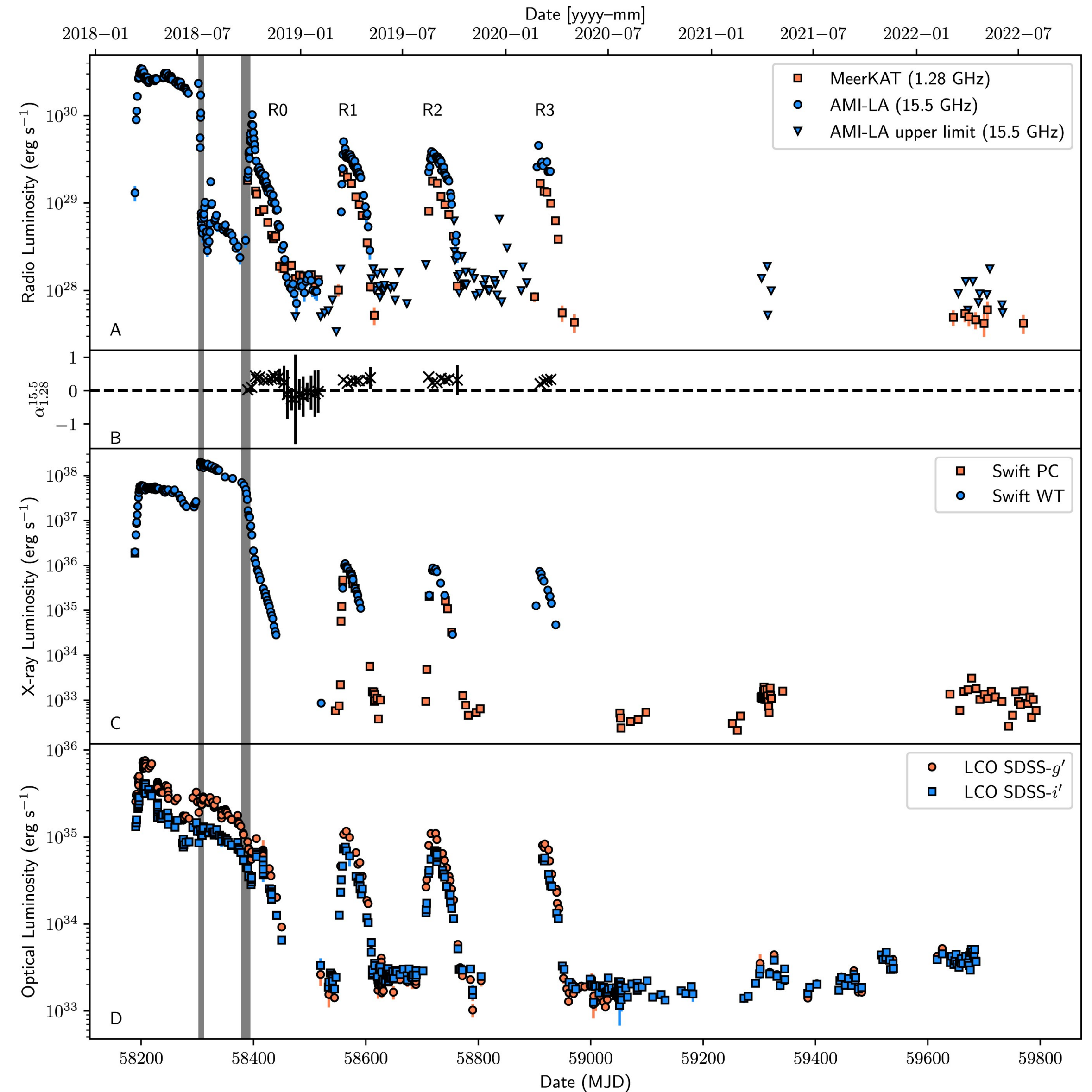
- Between GRBs, Swift observes all kinds of astrophysical sources.
- The fast repointing, quick planning and rapid response make Swift unique in its ability to detect, follow up, and monitor all manners of transient or variable sources.
- The near entirety of Swift time is DDT, and observations can be requested through Target of Opportunity program.
- ~24300 ToO requests received during the mission.
- ToO targets, slowly but steadily, became the core of Swift observations: Swift evolved from a GRB centric observatory to a multi wavelength TDAMM mission.
- Several capabilities have been added over the years, like XRT and UVOT tiling of large error regions, and queue scheduling (“urgency 0”, no human interaction needed to upload a disruptive ToO) of selected programs.



MAXI J1820+070

Black hole X-ray binary

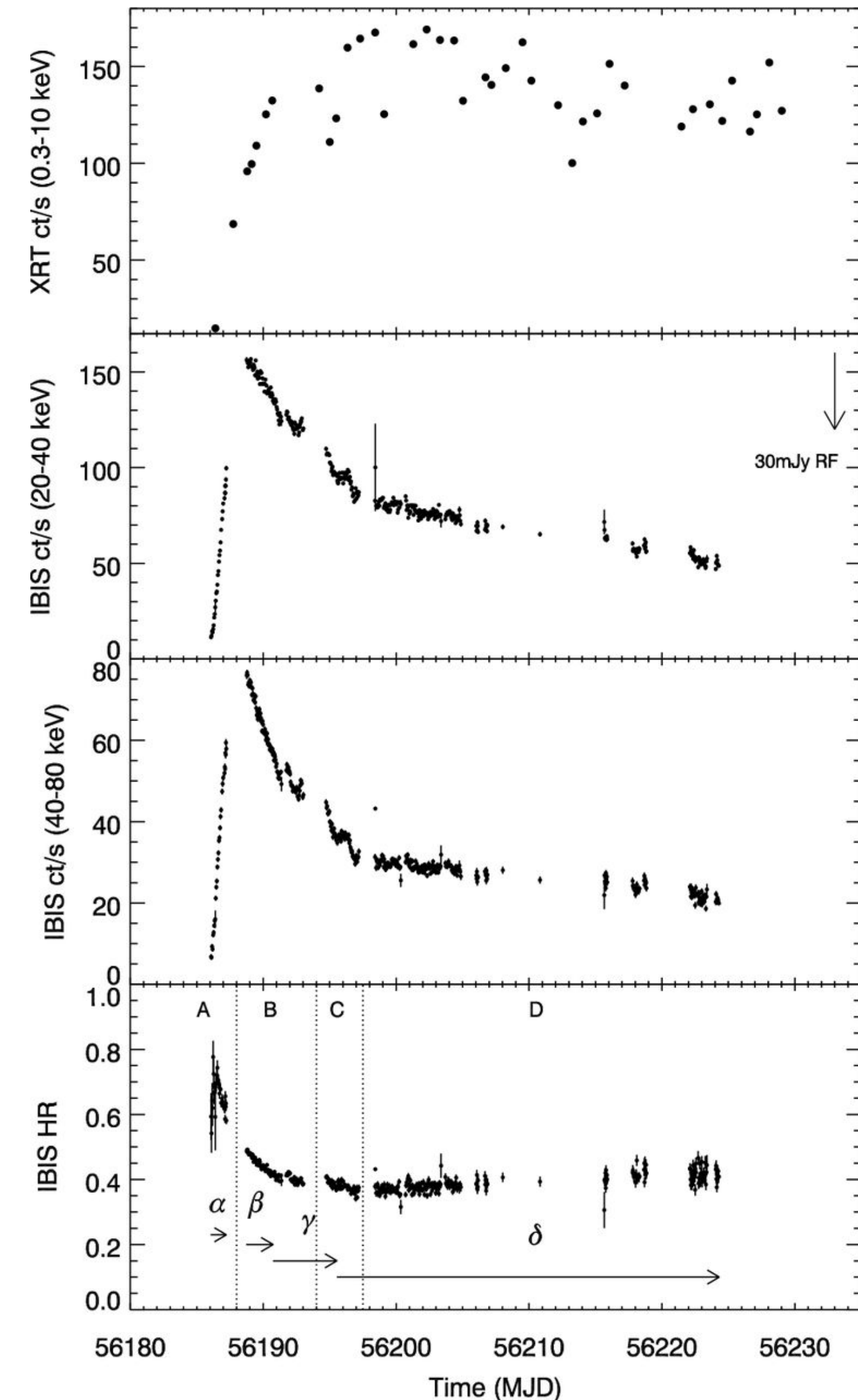
- March 6 2018 – optical discovery as ASASSN-18ey.
- March 11th 2018 – MAXI detection in X-rays.
- March 13th 2028 – Swift/BAT trigger.
- Target of 66 ToO requests, ~350 ks of data, across 4 years of monitoring.
- Coordinated and/or triggered observations with ground and space based facilities (NuSTAR, AMI, MeerKAT, XMM...)



Swift J174510.8-262411

A bright, failed outburst

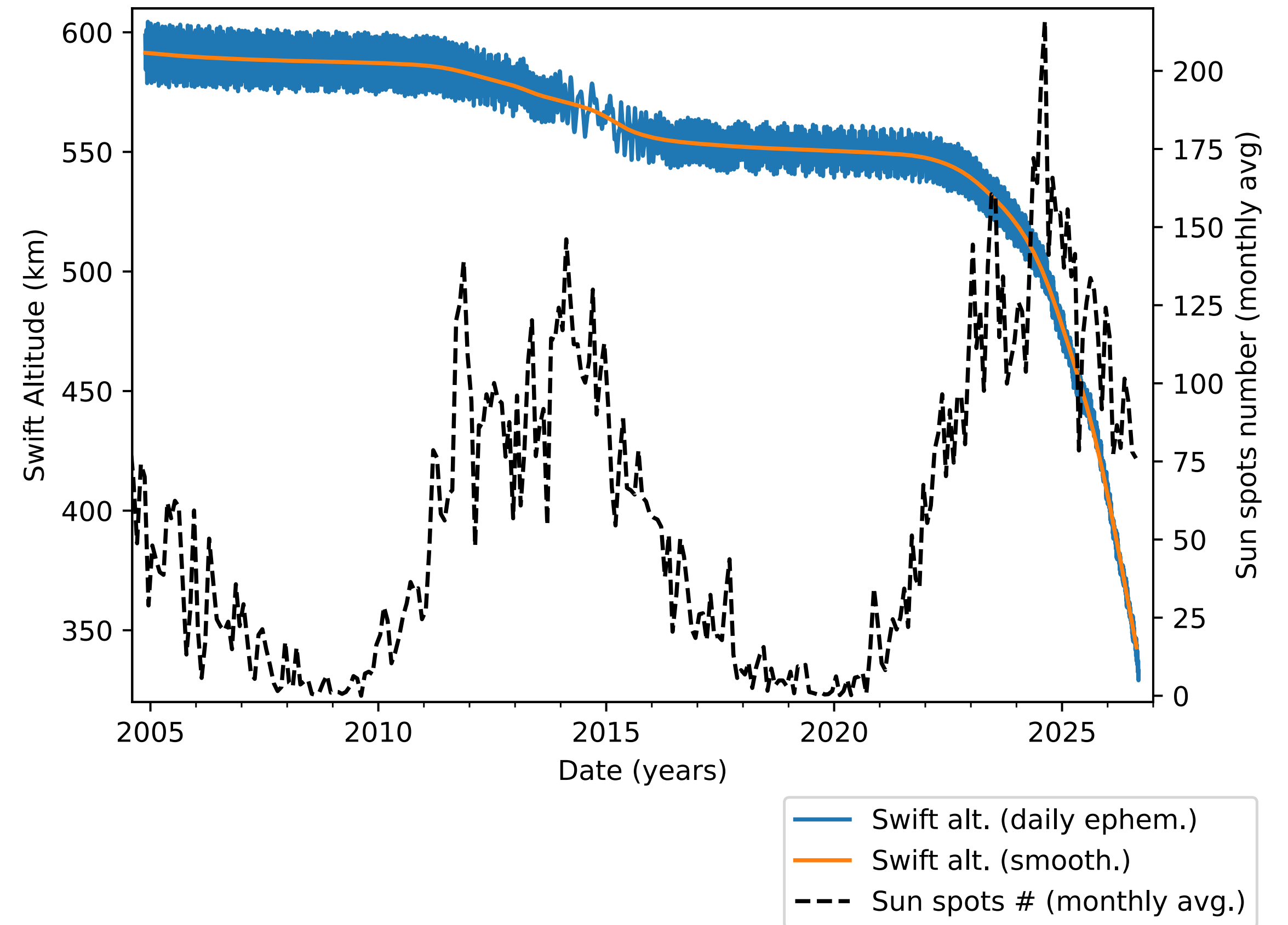
- Swift/BAT triggered on a bright, hard X-ray source on Sept. 16 2012.
- Targeted by INTEGRAL (~650 ks) and XRT (56 ks) follow up campaigns.
- While extremely bright in Hard x-rays (~ 1 Crab), this was a failed outburst: the source never reached the soft state.



Orbital decay

The trouble of Low Earth Orbit

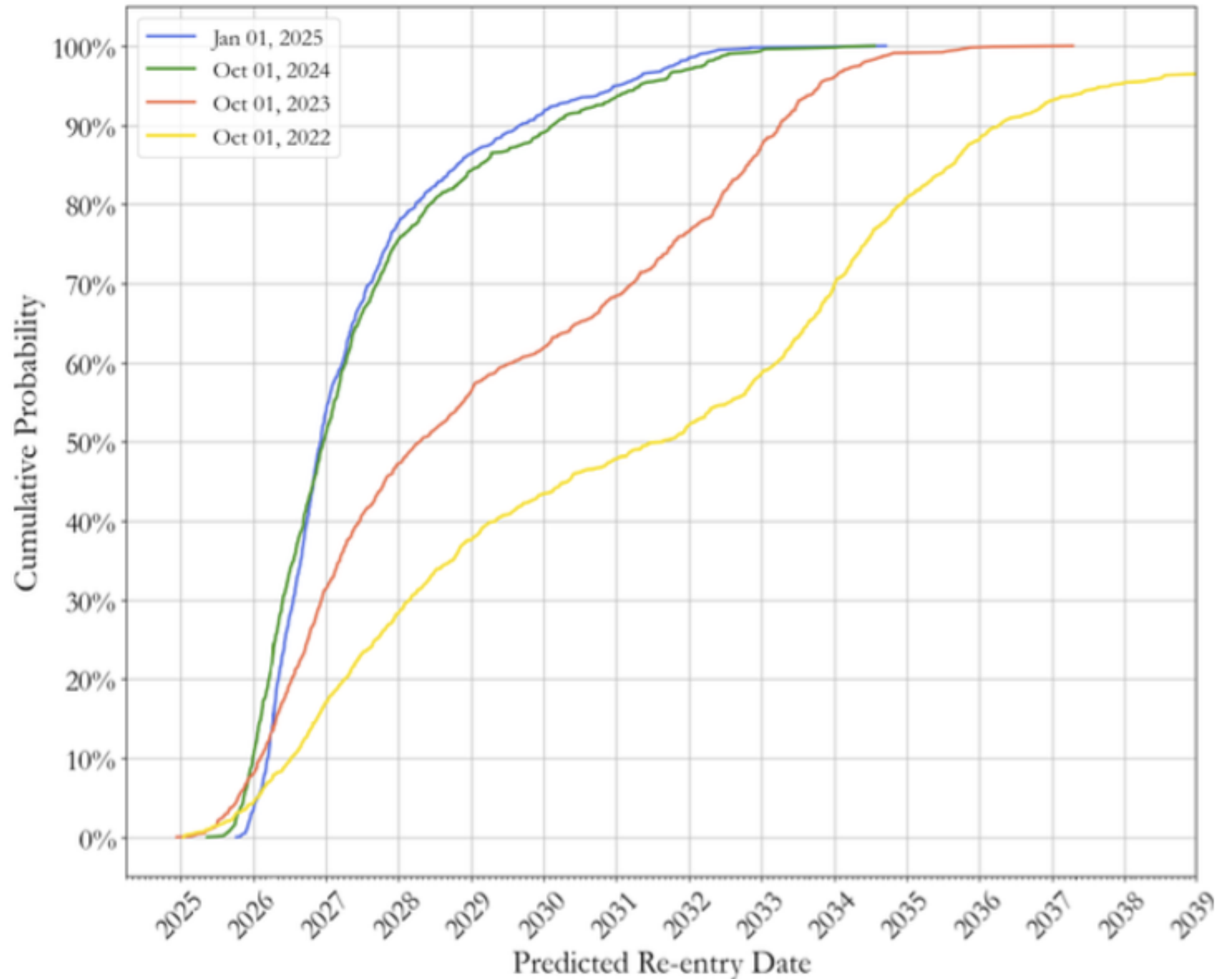
- At LOE altitudes Earth's atmosphere is very rarefied, but still present $\Rightarrow$ there is drag.
- Drag makes the orbit decay slowly but steadily.
- Lower altitude $\Rightarrow$ increased density $\Rightarrow$ higher drag.
- Atmospheric density is influenced by solar activity. Higher activity $\Rightarrow$ atmospheric swelling $\Rightarrow$ increased drag.
- Approaching solar maxima the decay rate steepens.



Orbital decay

The trouble of Low Earth Orbit

- Swift dropped about 50 km in the first 17 years, mostly around the 2014 solar maximum.
- The 2014 maximum was among the weakest on record. Initial predictions expected a similar intensity for the 2025 maximum.
- With that assumption, Swift was expected to stay in orbit until the early 2030s.
- By the early 2020s, it became apparent the next maximum was shaping up to be more intense
- Reentry predictions started to shift towards earlier dates



The Swift Boost mission

Racing against the clock to save Swift

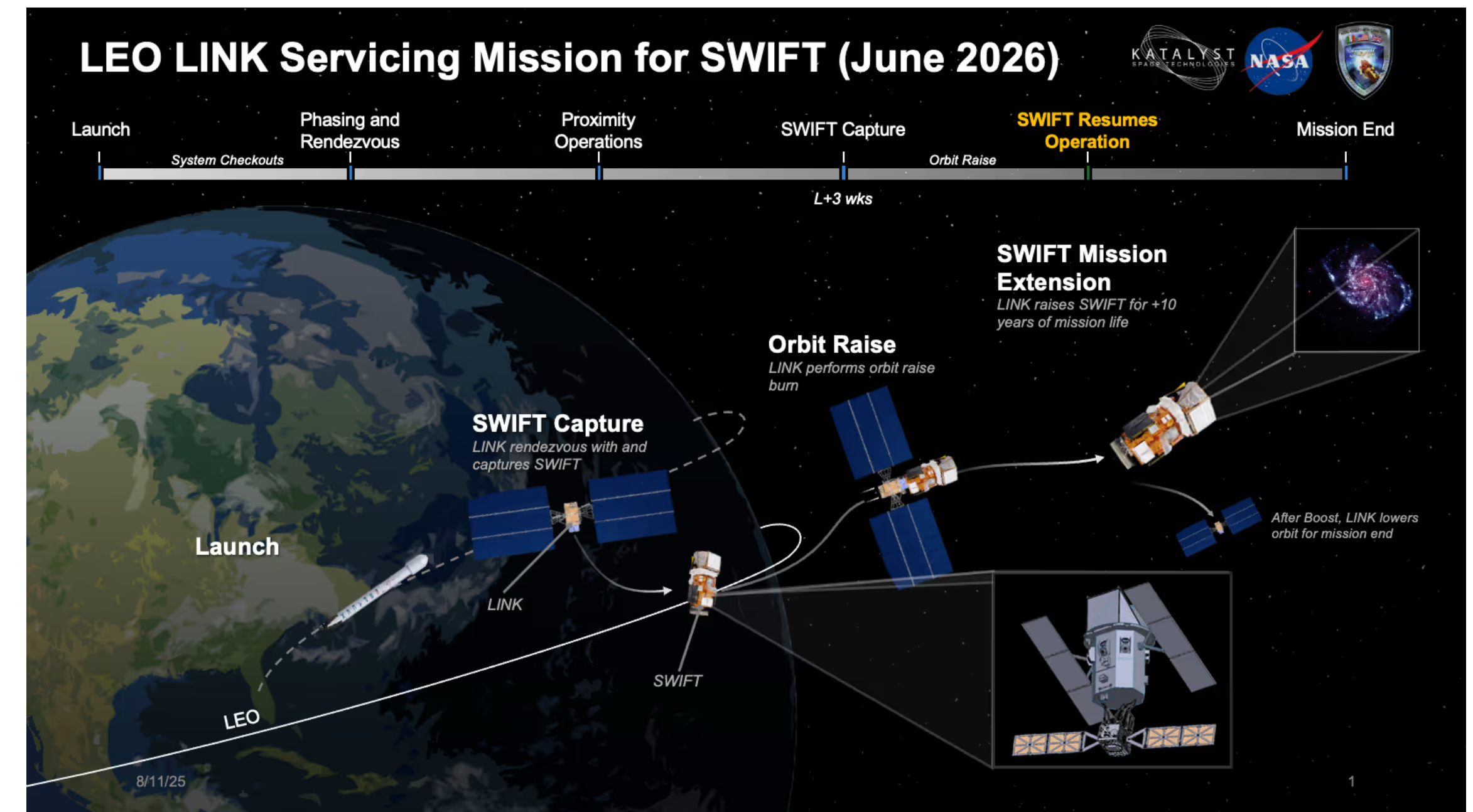
- In 2025, it became apparent that re-entry was likely to happen before the end of 2026.
- In August 2025 NASA awarded 2 private sector companies a Small Business Innovation Research phase III contract for a concept design study for a Swift boost mission.
- In September 2025 one of the companies, Catalyst, was awarded a 30 million \$ contract to move forward with implementation.



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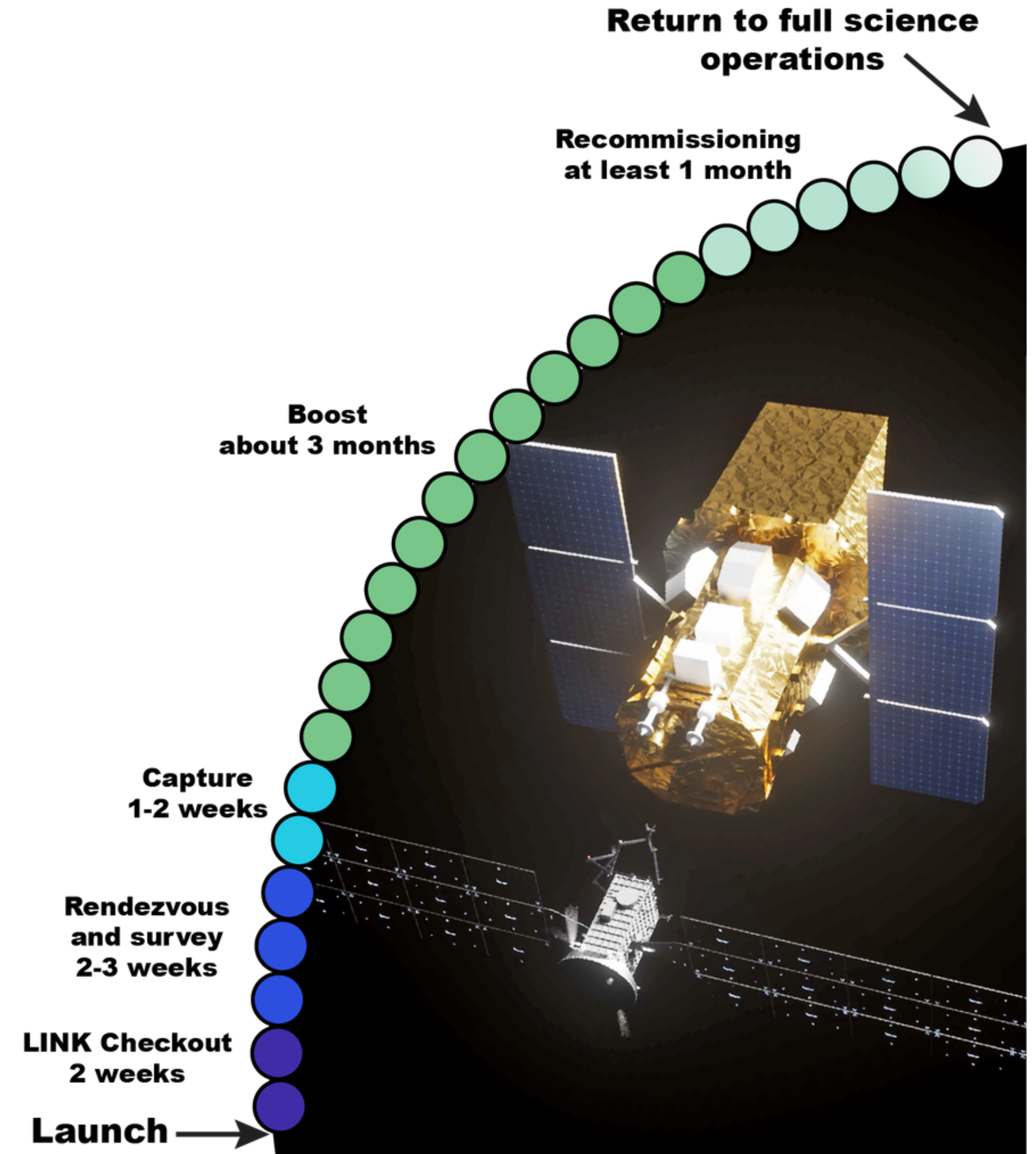
- The booster spacecraft, LINK, immediately started development with an accelerated schedule (8 months to launch).
- Unlike Hubble, Swift has no docking or grappling structures, which added the challenge of building a capture mechanism able to grab Swift without damage.
- After capture, LINK planned to use Xenon ion thrusters to slowly raise the orbit of Swift, granting up to 10 more years in orbit.



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- November 2025 – Pegasus XL is selected as the launcher.
- December 2025 – Swift ops team alters observing strategies to reduce atmospheric drag
- February 2026 – Swift stops science operations with XRT and UVOT to adopt a drag minimisation pointing strategy.
- April 2026 – LINK finishes integration. The spacecraft is about 1.8 meters tall, weighs around 400 kilograms, and has three robotic arms and three Xenon-fueled thrusters. Each of its two solar arrays span around 6 meters. BAT also stops science ops.
- May 2026 – LINK completes vibration and thermal vacuum testing at NASA's Goddard Space Flight Center, using the Space Environment Simulator chamber, which Swift also used over 20 years ago.



The Swift Boost mission

Racing against the clock to save Swift

- June 5, 2026 – LINK arrives at the NASA Wallops facility for installation into the launcher
- June 9, 2026 – LINK installation into the Pegasus XL air completed.
- June 18, 2026 – Pegasus XL leaves Wallops on board of Northrop Grumman Stargazer aircraft
- June 25, 2026 – Stargazer arrived in Kwajalein Atoll, part of the Republic of the Marshall Islands in the South Pacific Ocean.
- July 3, 2026 – LINK launched into orbit on the Pegasus XL rocket, which was deployed by Stargazer at an altitude of about 40,000 feet.



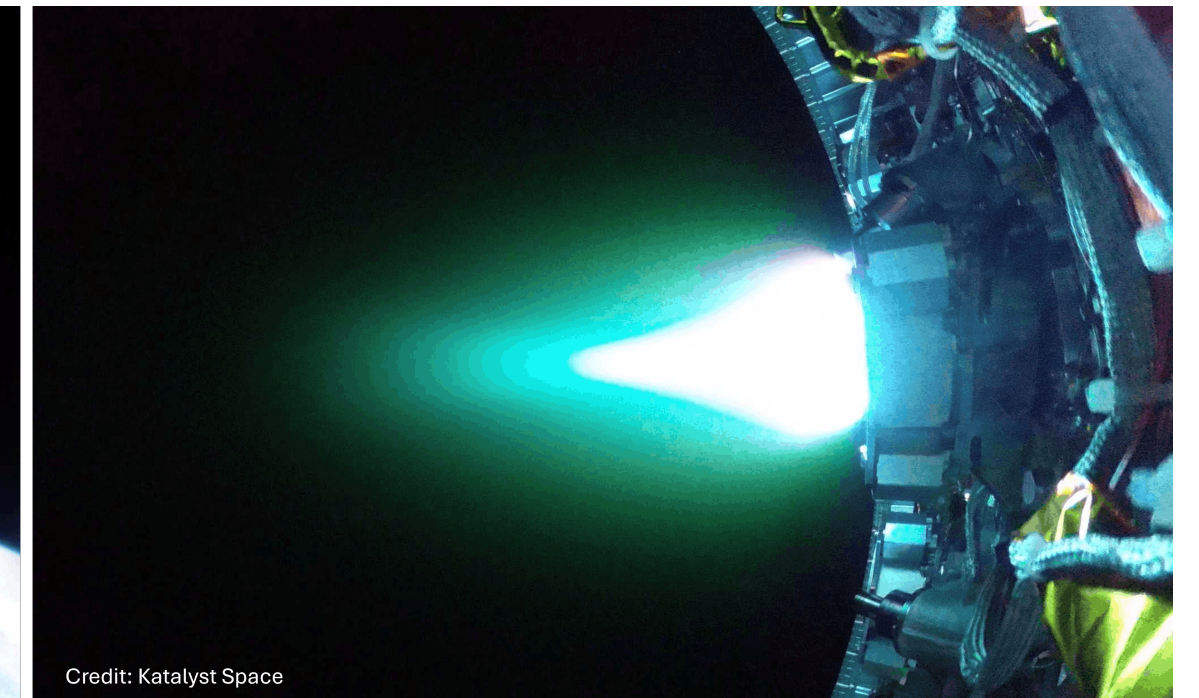
The Swift Boost mission

LINK commissioning

- The commissioning of LINK became in earnest immediately after launch.
- July 15 2026 – The initial phase of commissioning proceeded on track. A first issue with communications and attitude control. Involving one of the three reaction wheels was addressed by a software patch.
- July 28, 2026 – Over the July 25 weekend more issues with attitude control manifested, putting LINK into a spin. Two of the reaction wheel appeared to be inoperable. The electric thrusters were fired to recover attitude control
- July 31 2026 – LINK continued a series of thruster burns to stop the spinning, recover attitude control and start approaching Swift.
- August 11, 2026 – Another software update was uploaded to LINK, to stabilise the attitude and allow control with the remaining actuator systems.
- August 19, 2026 – NASA and Katalyst announce the descoping of the LINK mission. Capture will not be attempted, and LINK will proceed only to conduct rendezvous and proximity operations.



Credit: Katalyst Space

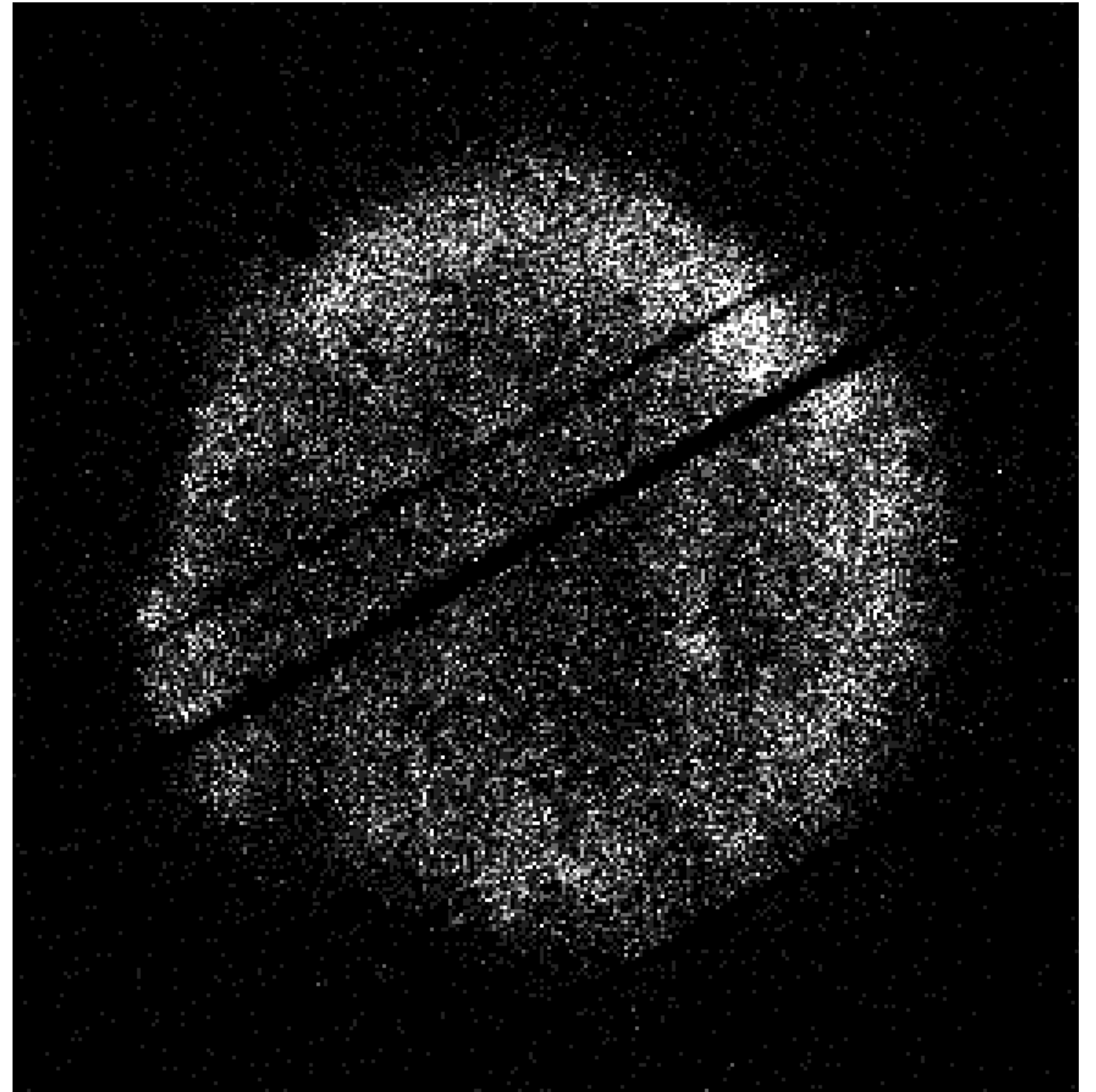


Credit: Katalyst Space

The Swift Boost mission

After descoping

- Without the boost, Swift is expected to re-enter the atmosphere before the end of 2026
- NASA and the Swift team decided to resume normal science operations.
- XRT and UVOT were switched back on on August 26 and started calibration and scientific observations.
- Medium and low priority ToOs submission resumed on August 31.
- The team is working to resume BAT observations and triggering, and higher priority ToOs ASAP.



Swift

What's in the future

- Swift will keep observing as long as possible before re-entry.
- After the end of operations, the team will work on the final archive and calibration database releases.
- Swift changed the landscape of TDAMM astronomy. Its absence will have a huge impact on the field. Of the existing and planned observatories, none has the accessibility, flexibility and speed Swift has shown.

