

Gamma-Ray Burst 221009A The Brightest of All Time (The BOAT)

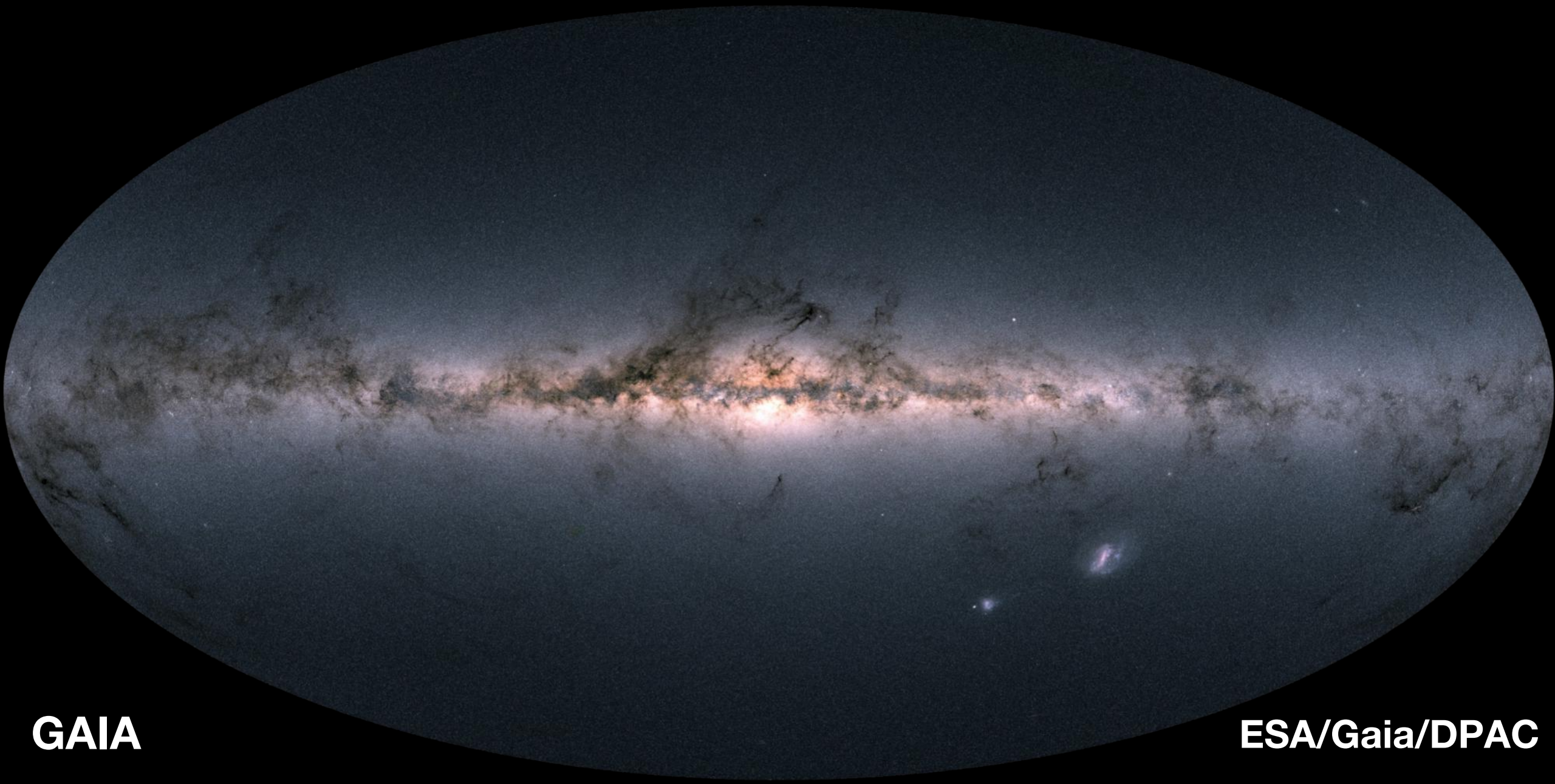
Eric Burns

ericburns@lsu.edu

Assistant Professor

Louisiana State University

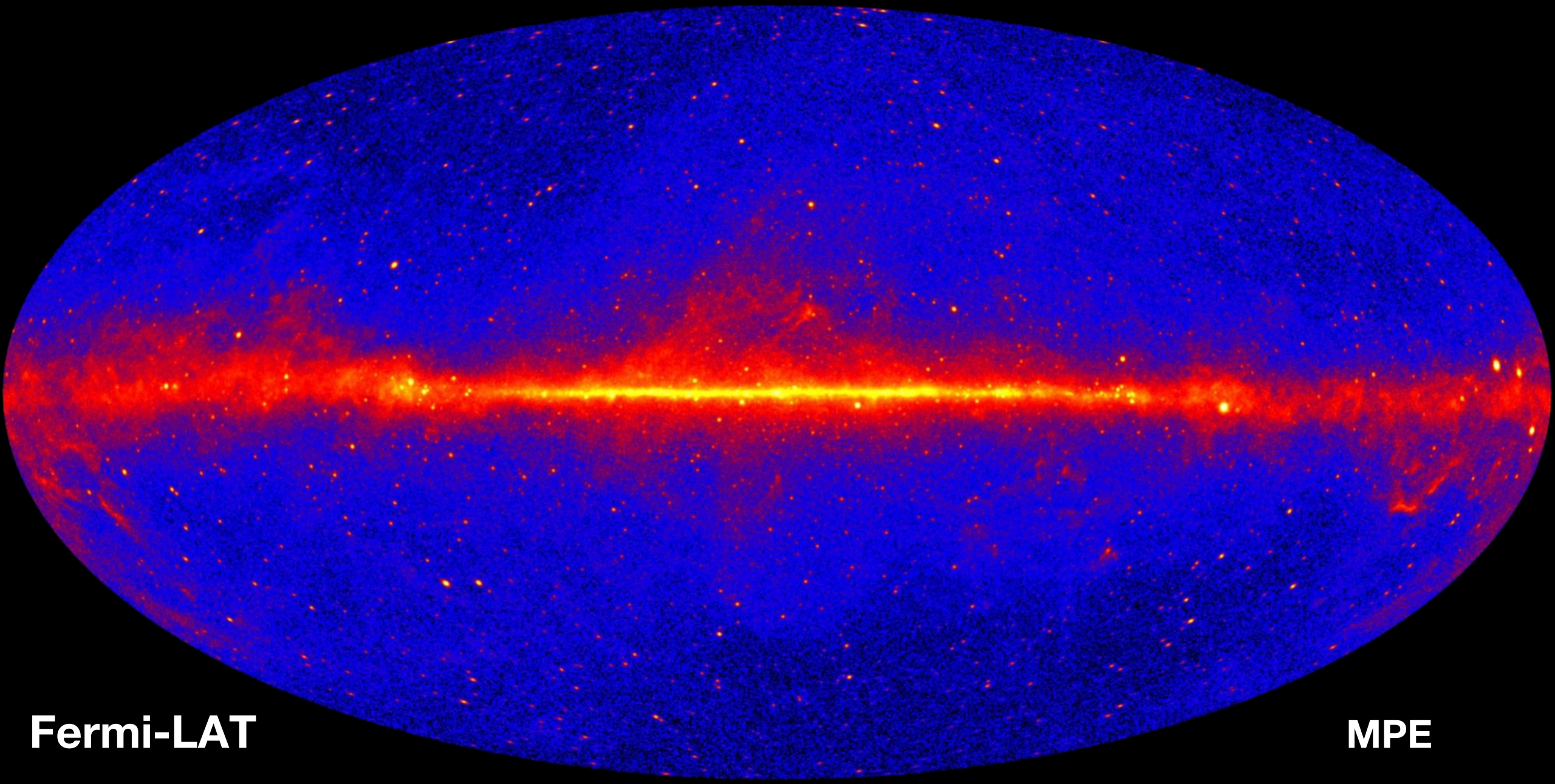
The Optical Sky



GAIA

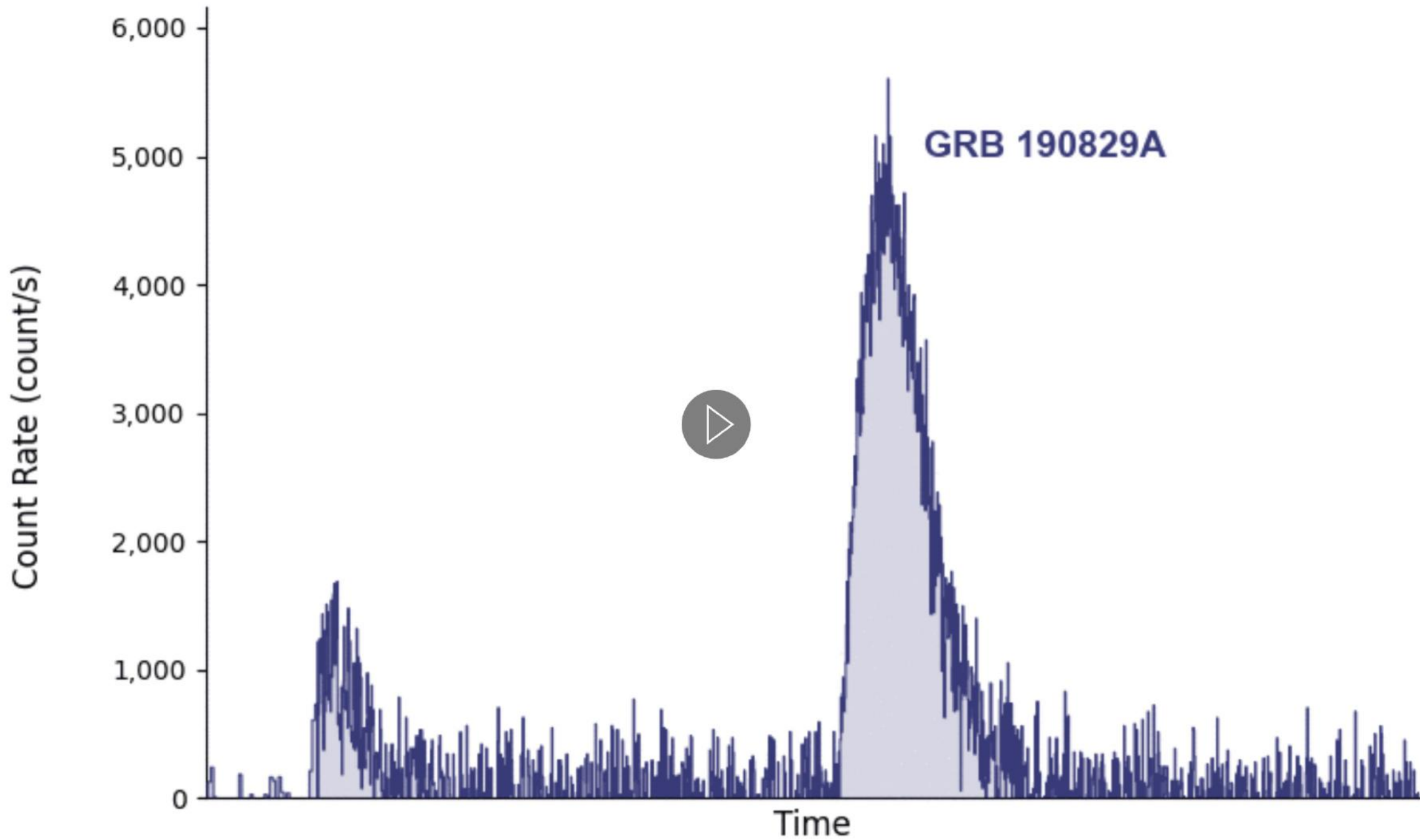
ESA/Gaia/DPAC

The Gamma-ray Sky



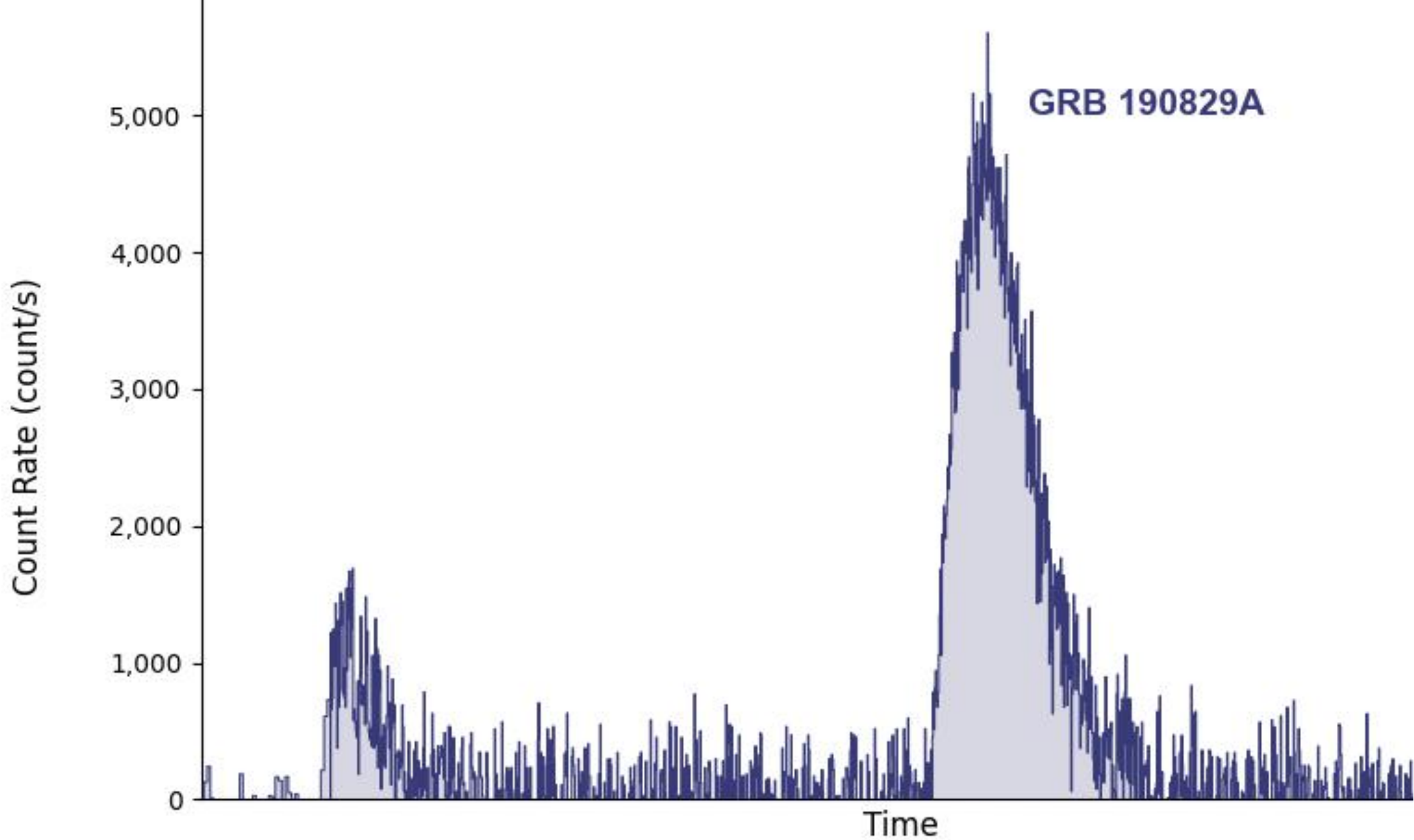
Fermi-LAT

MPE



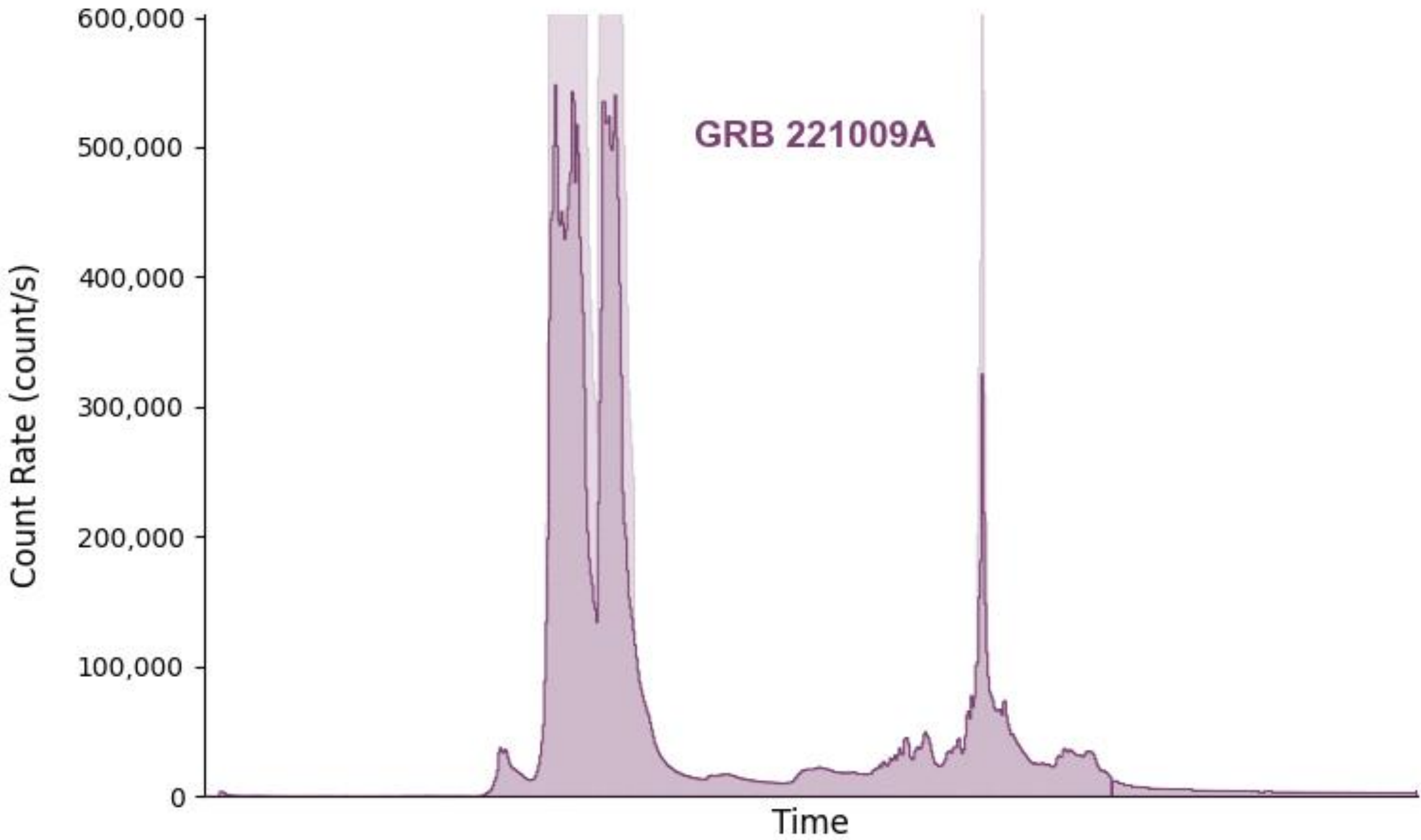
GRB 190829A

Credit: Adam Goldstein (USRA)



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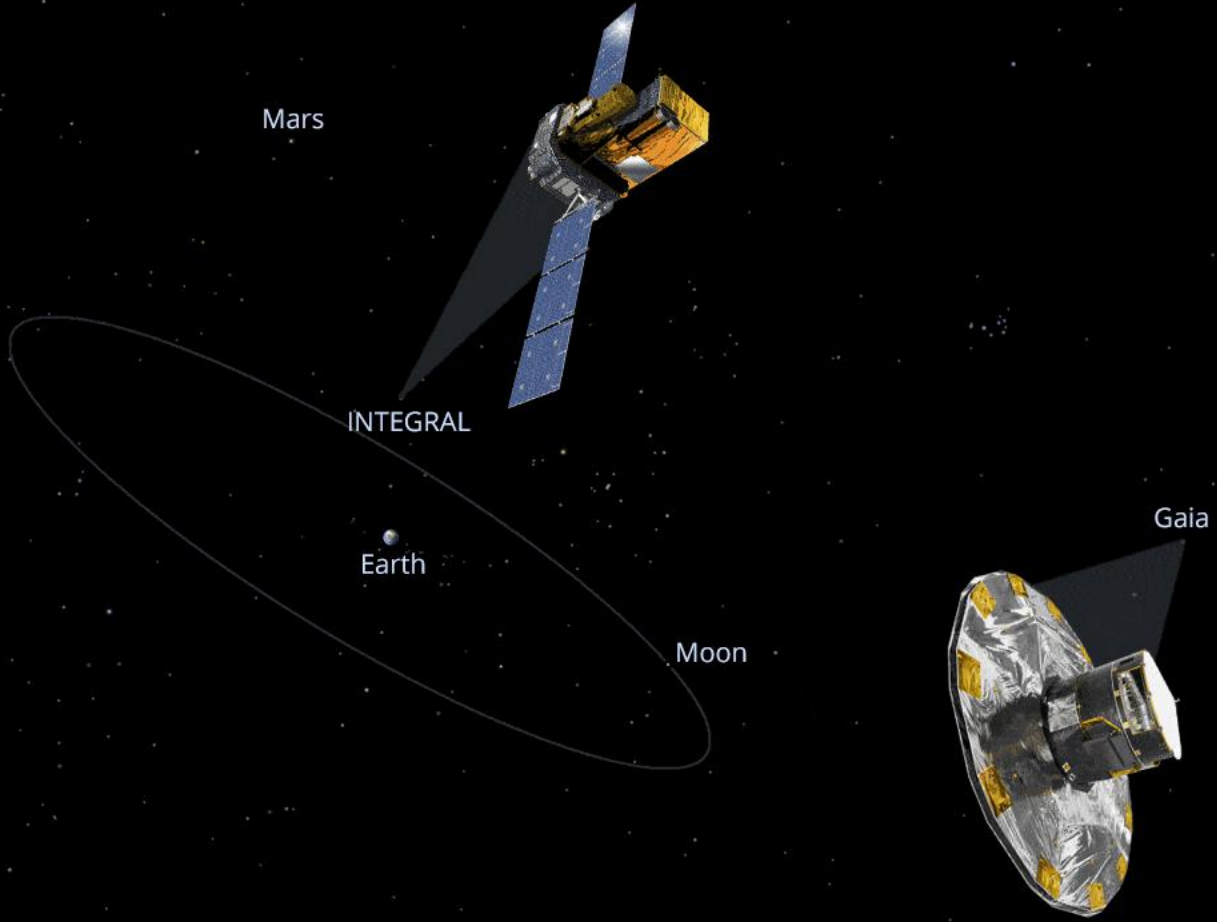


GRB 221009A

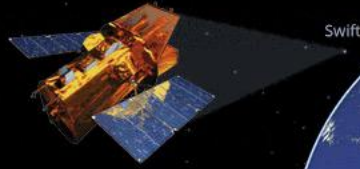
Credit: Adam Goldstein (USRA)



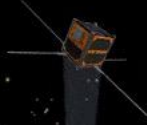
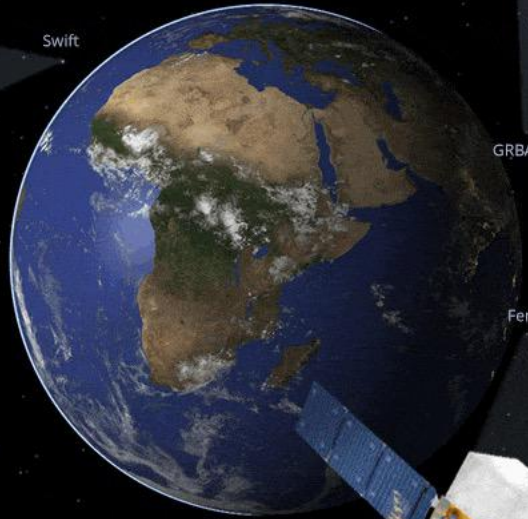
Voyager 1



Mars



Swift



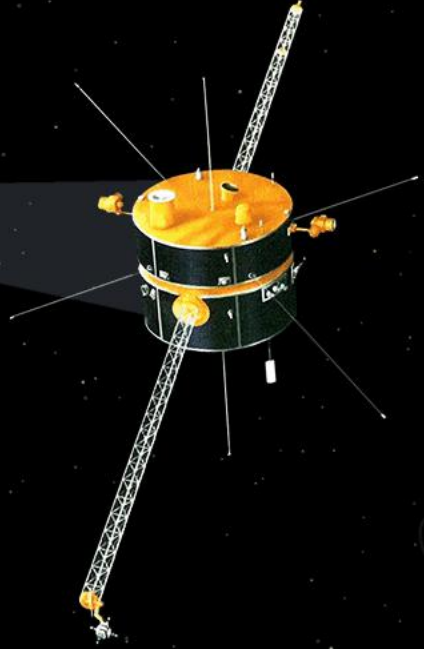
GRBAlpha

Fermi

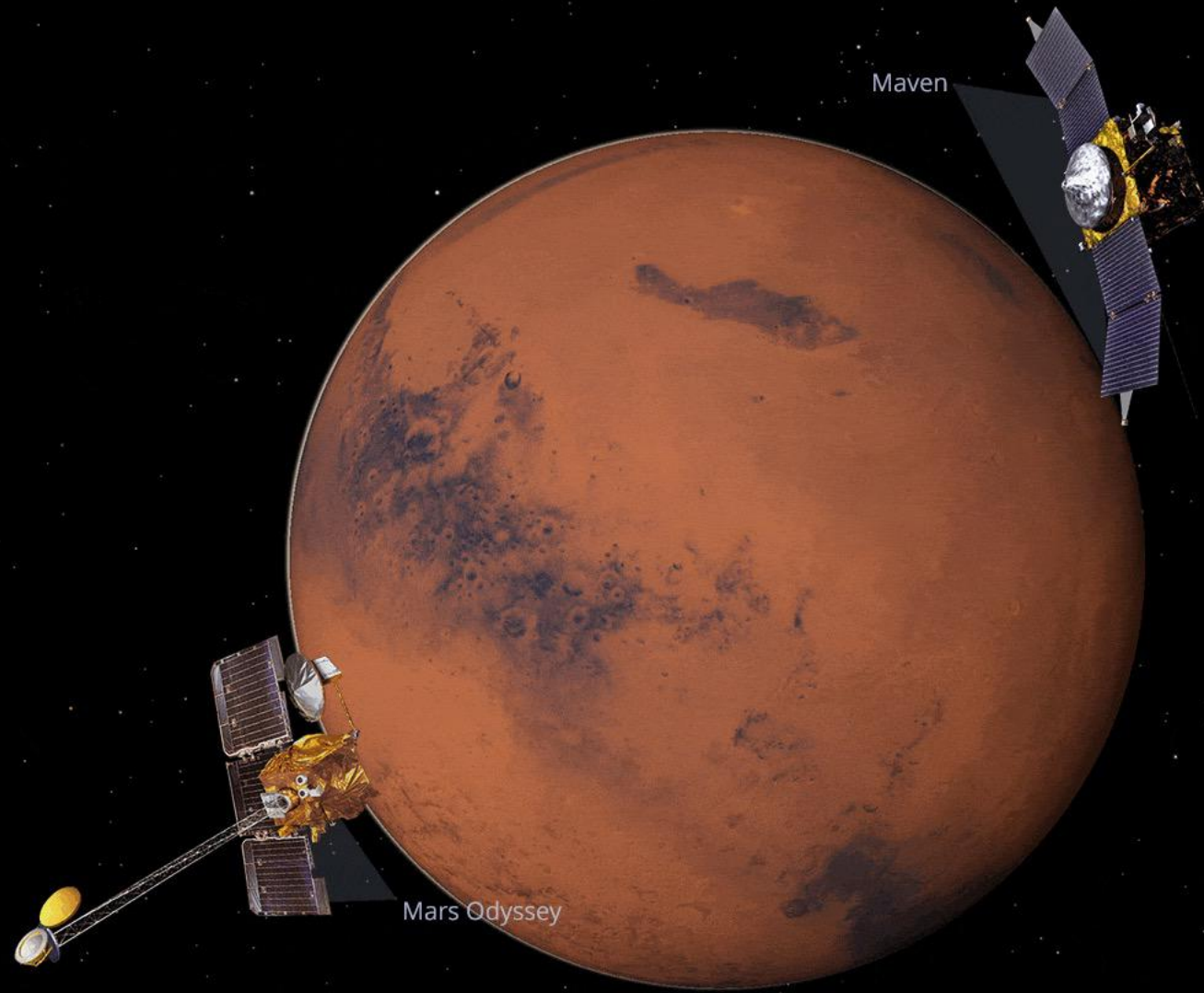


ACE

Wind



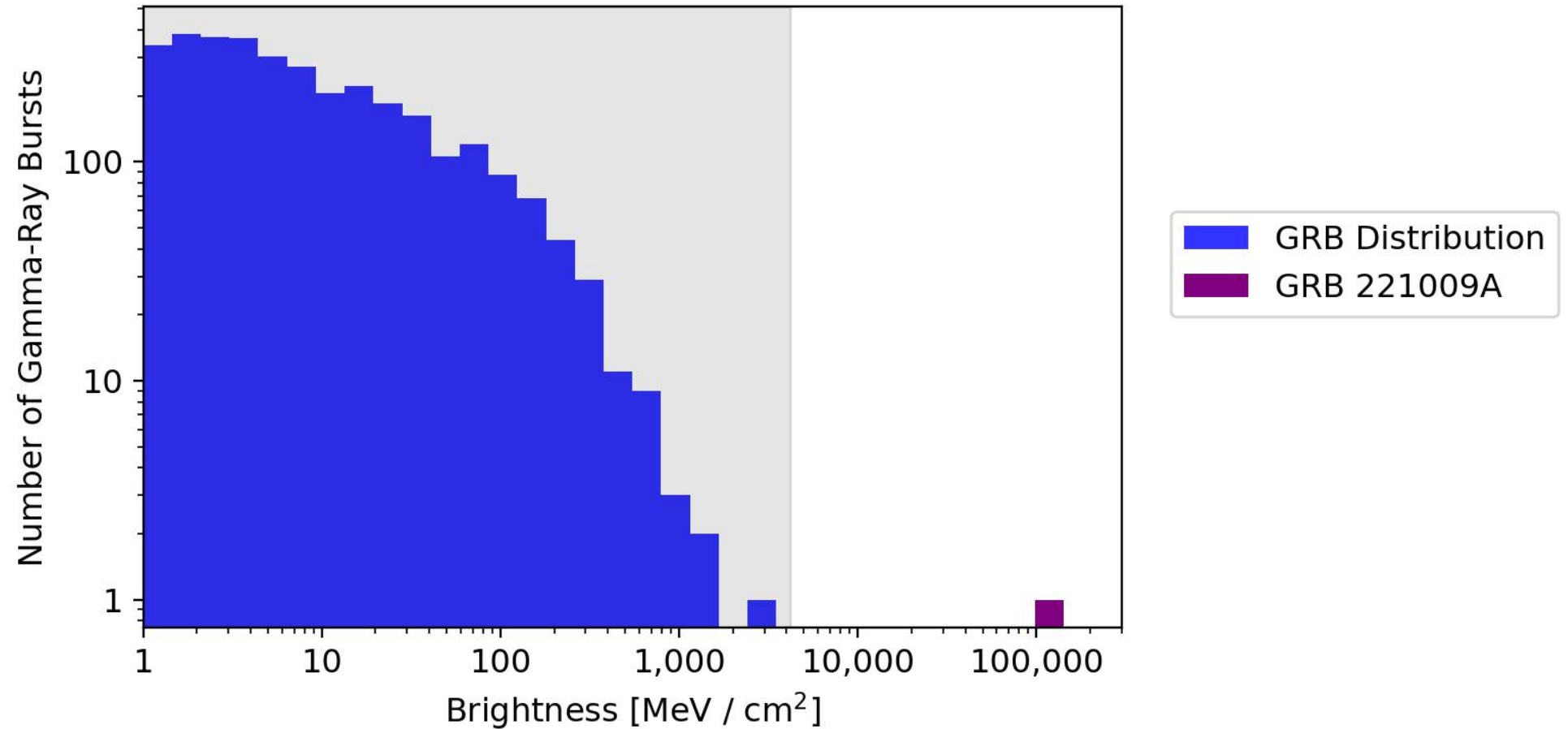
Earth



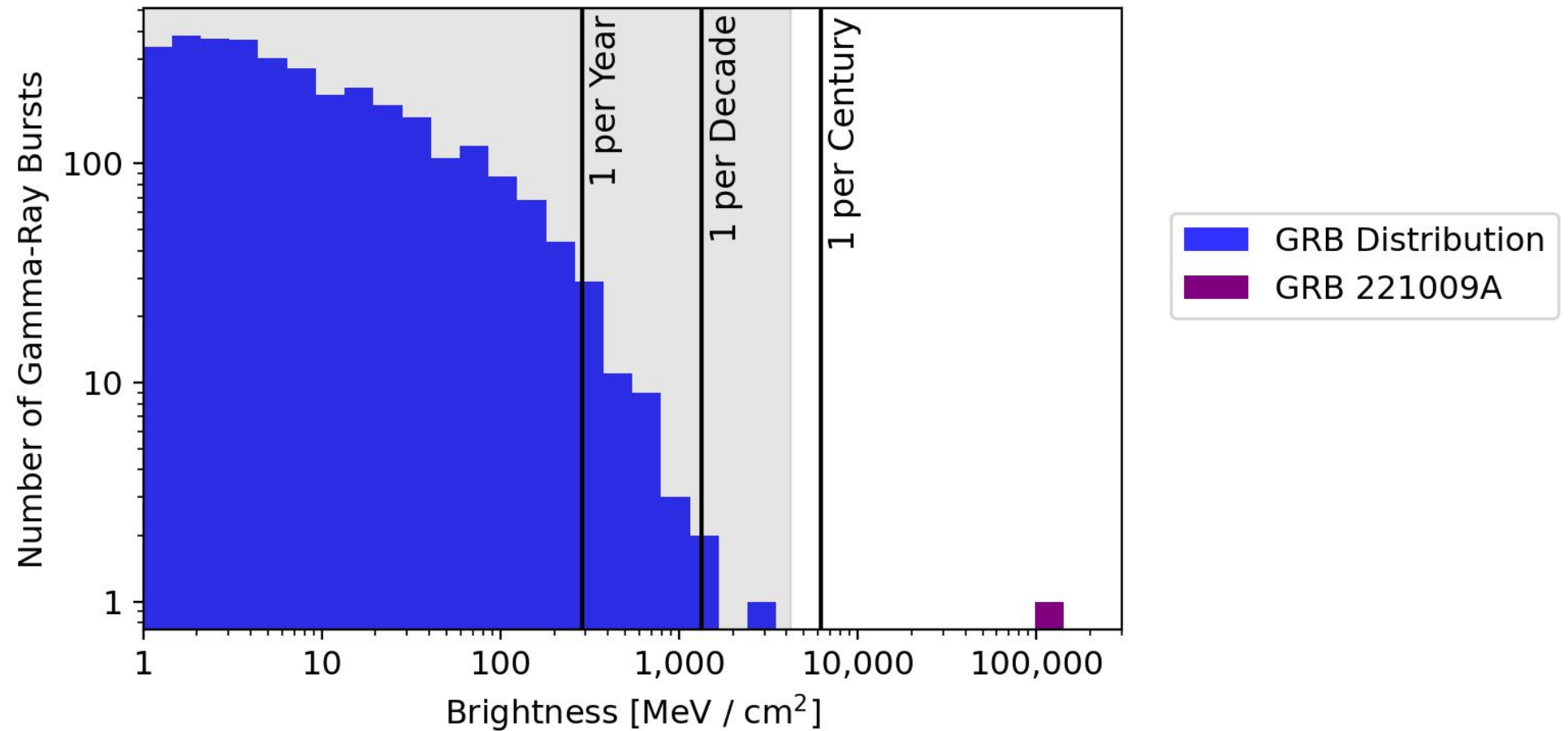
Maven

Mars Odyssey

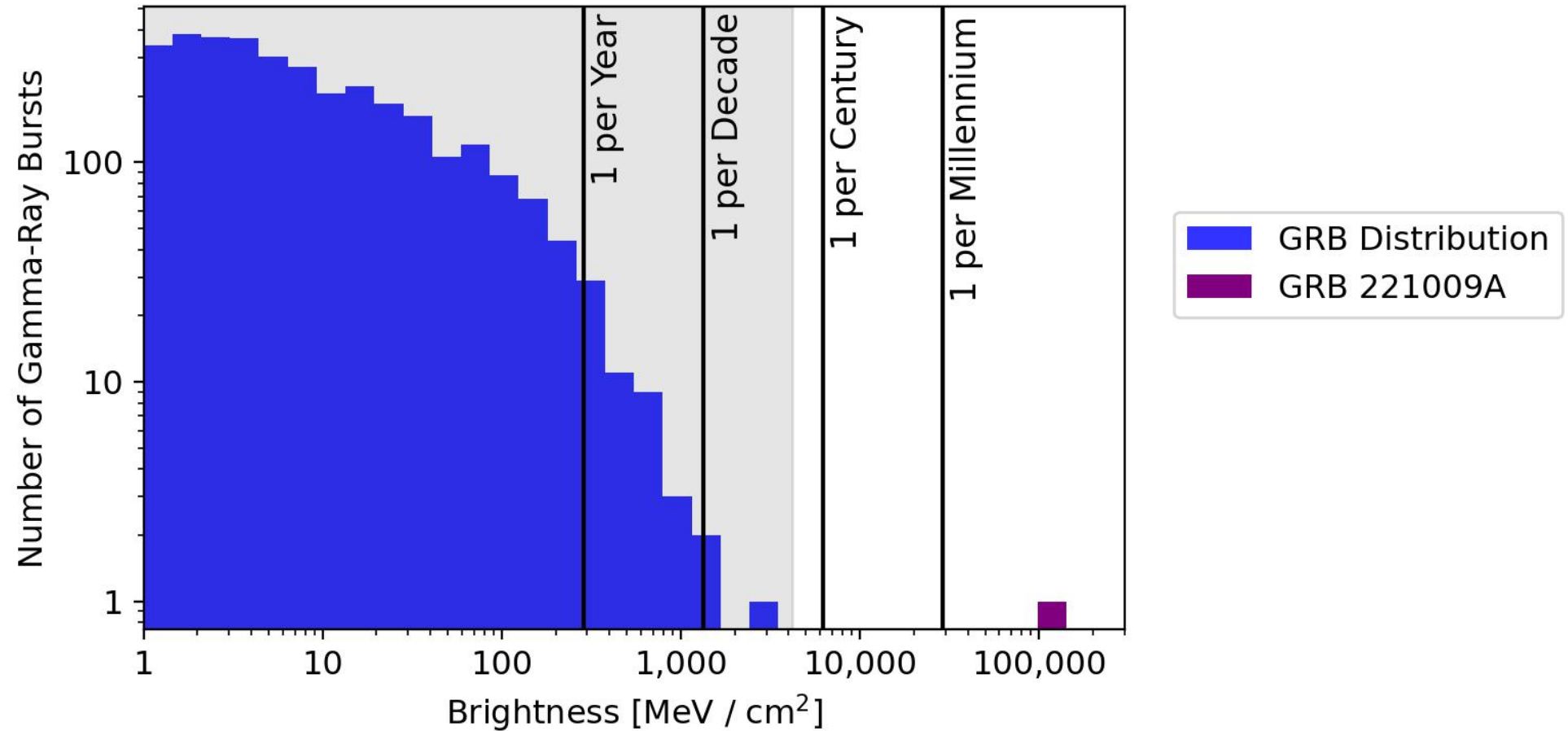
GRB 221009A in context



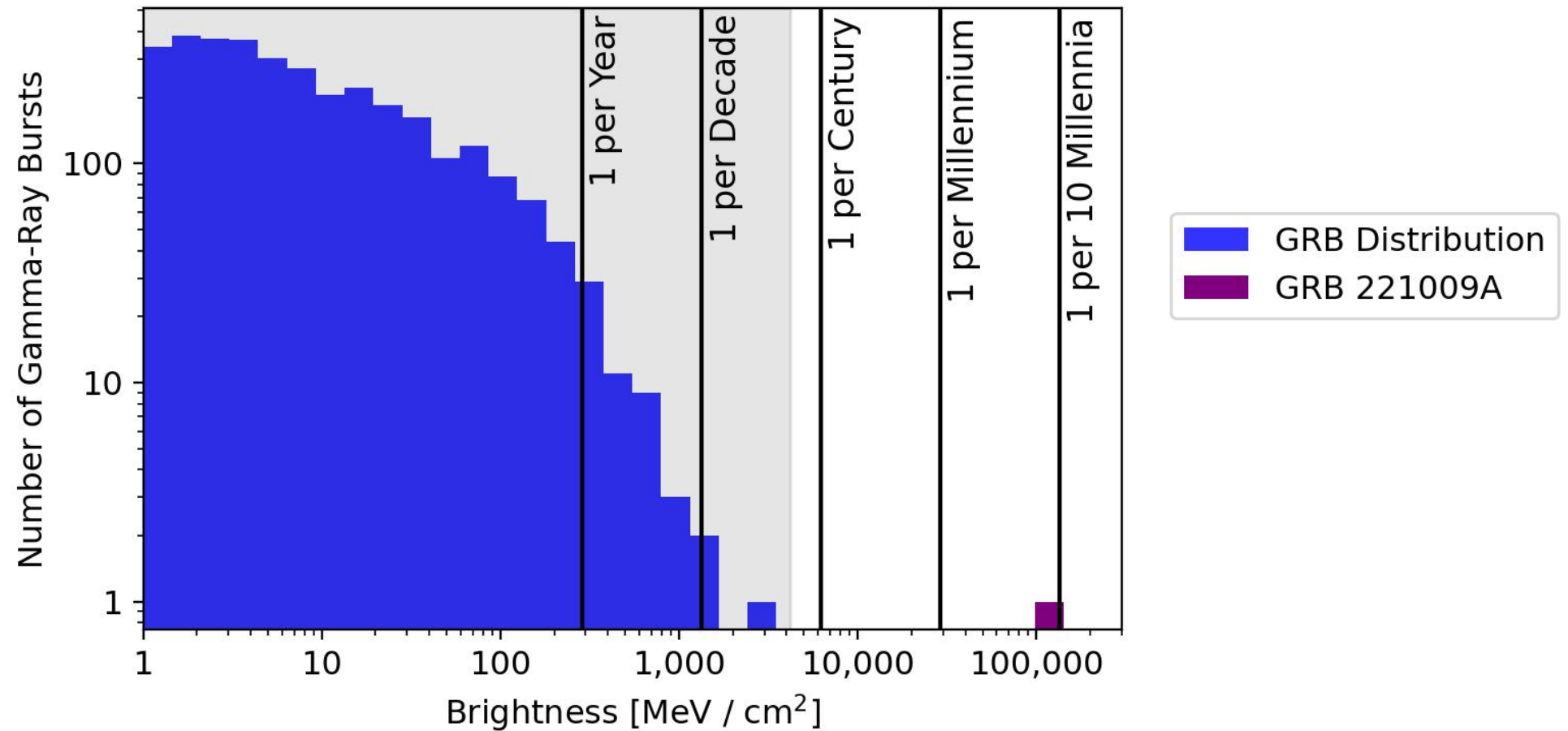
GRB 221009A in context



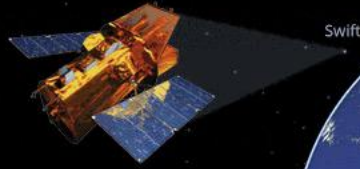
GRB 221009A in context



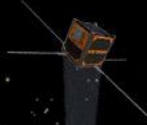
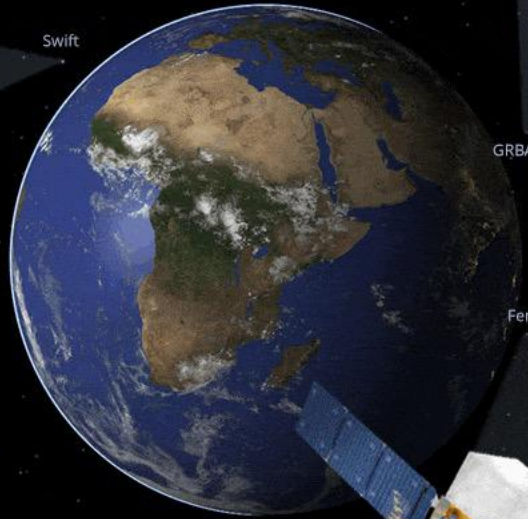
GRB 221009A is a 1 in 10,000 year event



Mars



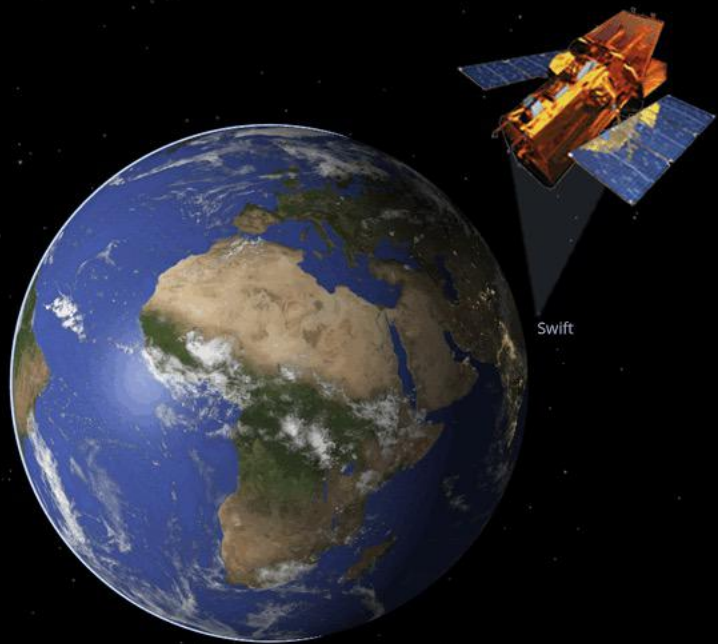
Swift



GRBAlpha

Fermi





Swift

The BOAT:

Studied with humanity's astronomical resources

Observed by

- Telescopes on all 7 continents
 - The highest energy photons seen from a gamma-ray burst by LHAASO
- 25 satellites
 - Orbiting 3 planets
 - And 1 in interstellar space

Contributions from hundreds of scientists

Notes for me from Frank

- Sergio: A&A link?
- Michela: 'Ehi there'

- Request to Frank: afterglow blue
- ADD BOATS

- FULLY DISMISS THE ZOOM OVERLAY ->

Image showing all detecting telescopes

Prompt (i.e. IPN or particle detectors)

- Fermi - LEO
- Konus-Wind - Sun-Earth L1
- GAIA - Sun-Earth L2 (basically opposite Earth for Konus, both being several times further than the Moon)
- HEND on Mars Odyssey - Mars
- MAVEN - Mars
- BepiColombo - Mercury
- INTEGRAL - highly elliptical Earth orbit
- AGILE - LEO
- STIX - I do not know the exact orbit, but it approaches the Sun, so inner solar system
- ART-XC - L2
- GRBAlpha – LEO Sun-synch polar orbit
- SIRI-2
- HEBS (I do not know the orbit)
- INSIGHT (I do not know the orbit)
- STEREO
- ACES
- Voyager 1

Prompt (other)

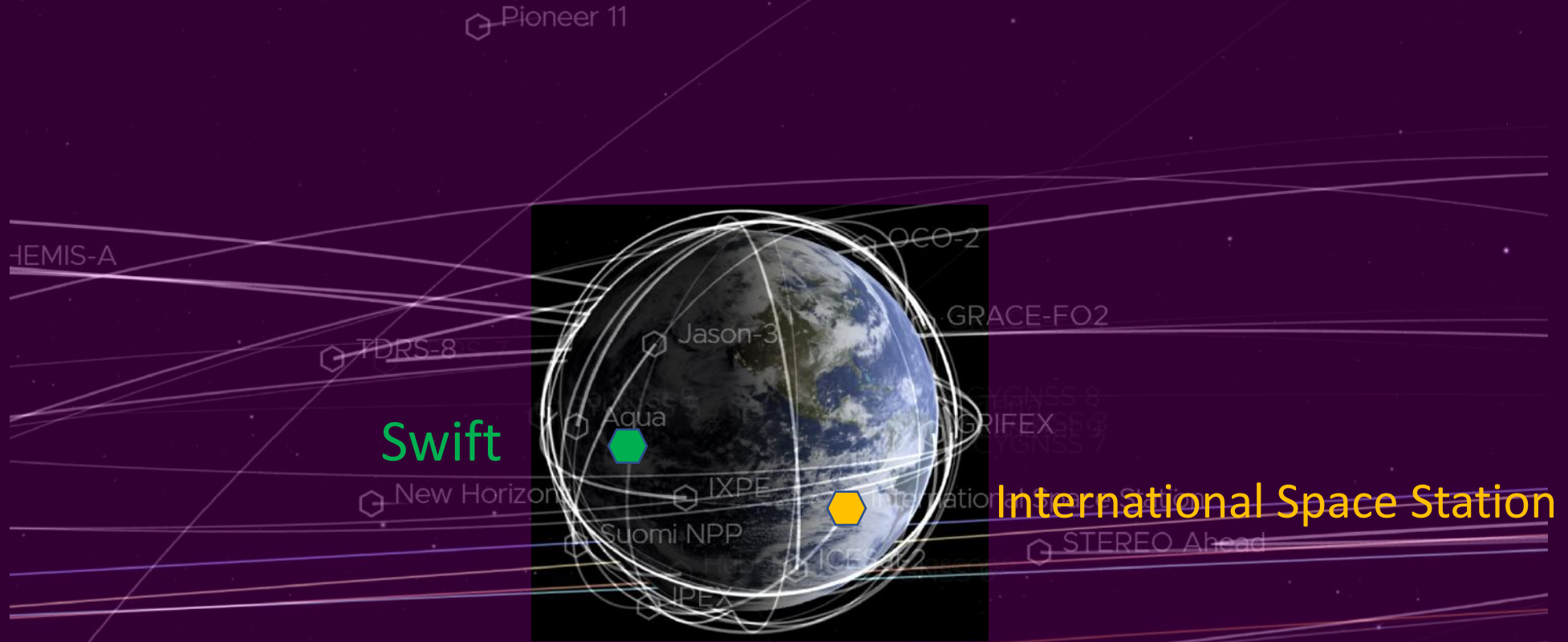
- LHAASO - China
- IceCube (neutrino upper limits, but useful ones) - Antarctica
- Baikal GVD, KM3NeT (upper limits, maybe useful) - Lake Baikal, Russia; Mediterranean
- Desert Fireball Camera upper limits from Raw War Road and Mundrabilla

Follow-up

- Swift - LEO
- JWST - Sun-Earth L2
- HST - LEO
- XMM - highly elliptical Earth orbit
- Chandra - highly elliptical Earth orbit
- IXPE - LEO
- NICER, MAXI - ISS
- NuSTAR - LEO

- All the ground-based things I don't know well

1:17 pm on Sunday, October 9th 2022 – GRB 221009A arrives at Earth and is reported by *Fermi*



To be replaced with a new version from Frank

2:10 pm on Sunday, October 9th 2022 – GRB 221009A is localized by *Swift*

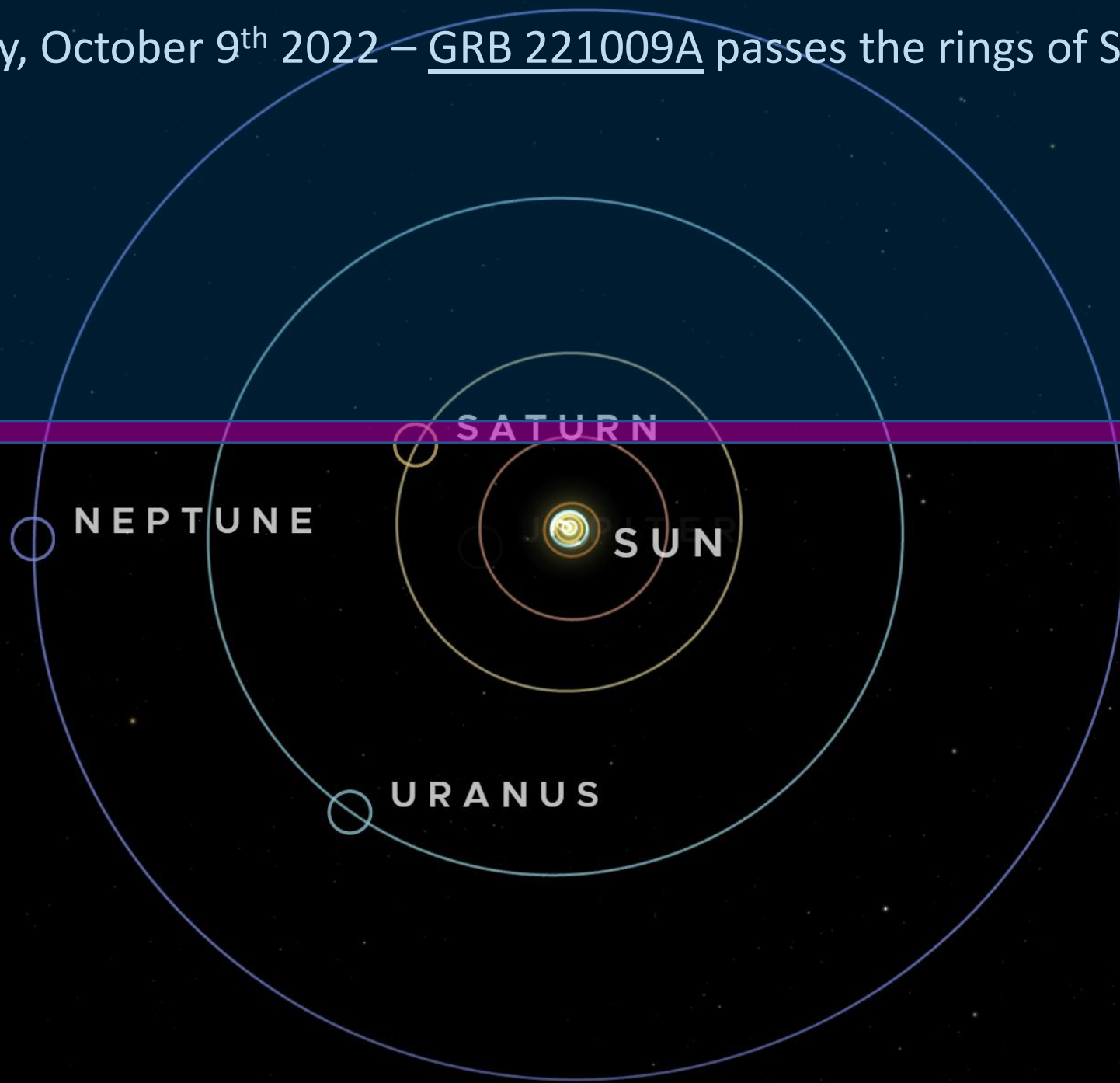


To be replaced with a new version from Frank

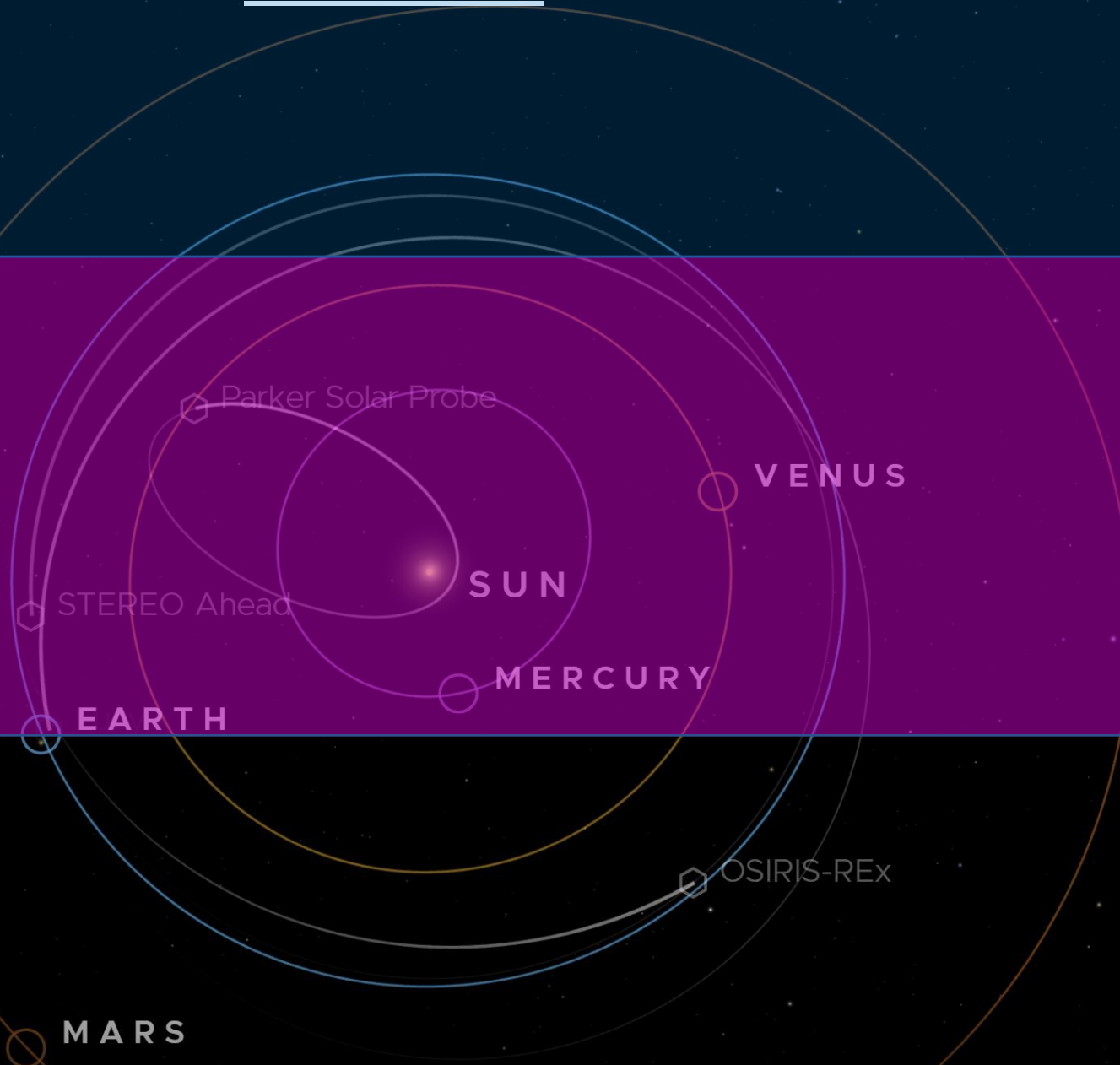
6:15 pm on Saturday, October 8th 2022 – GRB 221009A arrives at Voyager 1



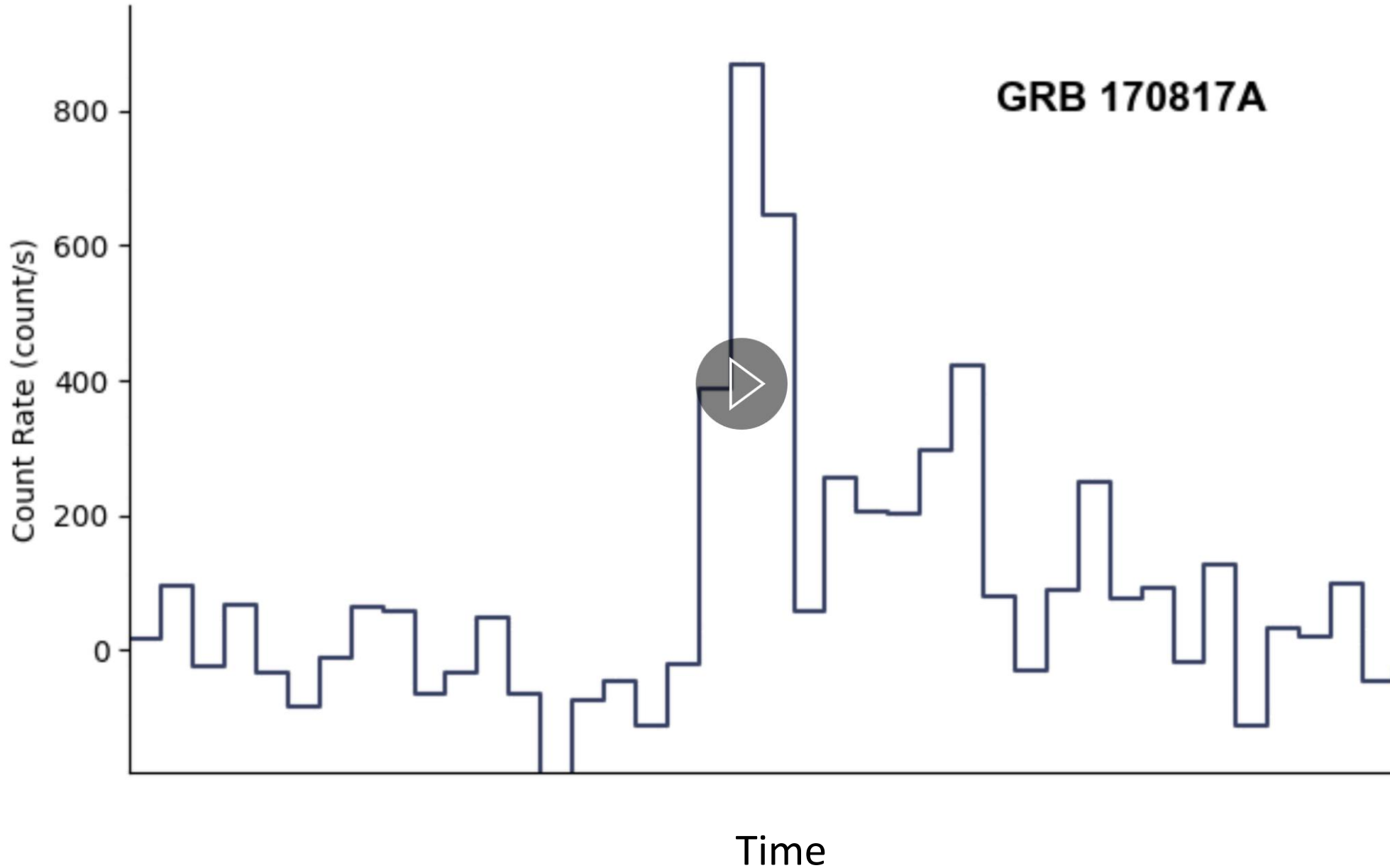
8:36 pm on Sunday, October 9th 2022 – GRB 221009A passes the rings of Saturn



On Sunday, October 9th 2022 – GRB 221009A arrives at Earth and is detected

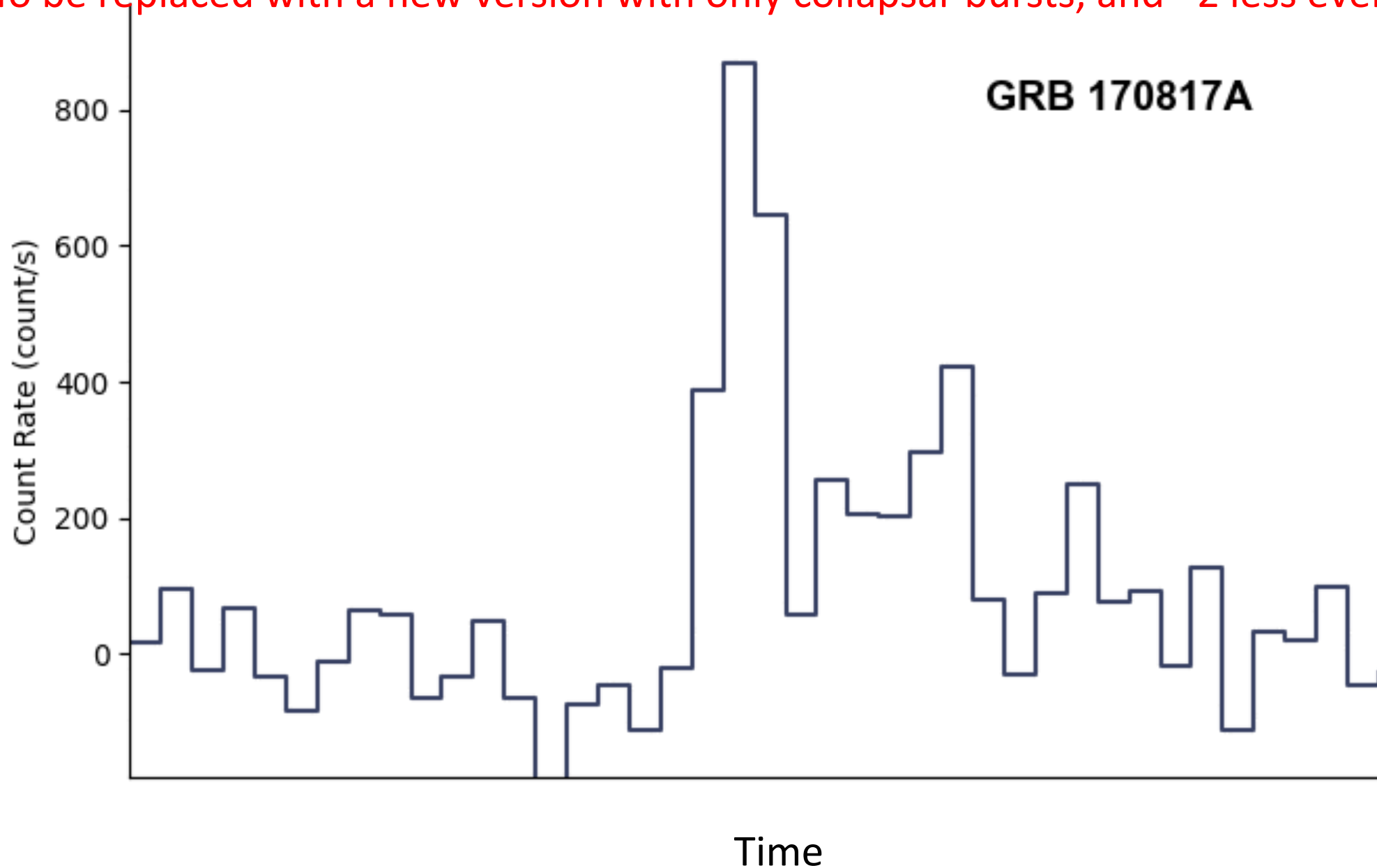


To be replaced with a new version with only collapsar bursts, and ~2 less events total



Credit: Adam Goldstein (USRA)

To be replaced with a new version with only collapsar bursts, and ~2 less events total



Credit: Adam Goldstein (USRA), Stephen Lesage (UAH)

To be replaced with a gif switching from unsaturated to saturated

