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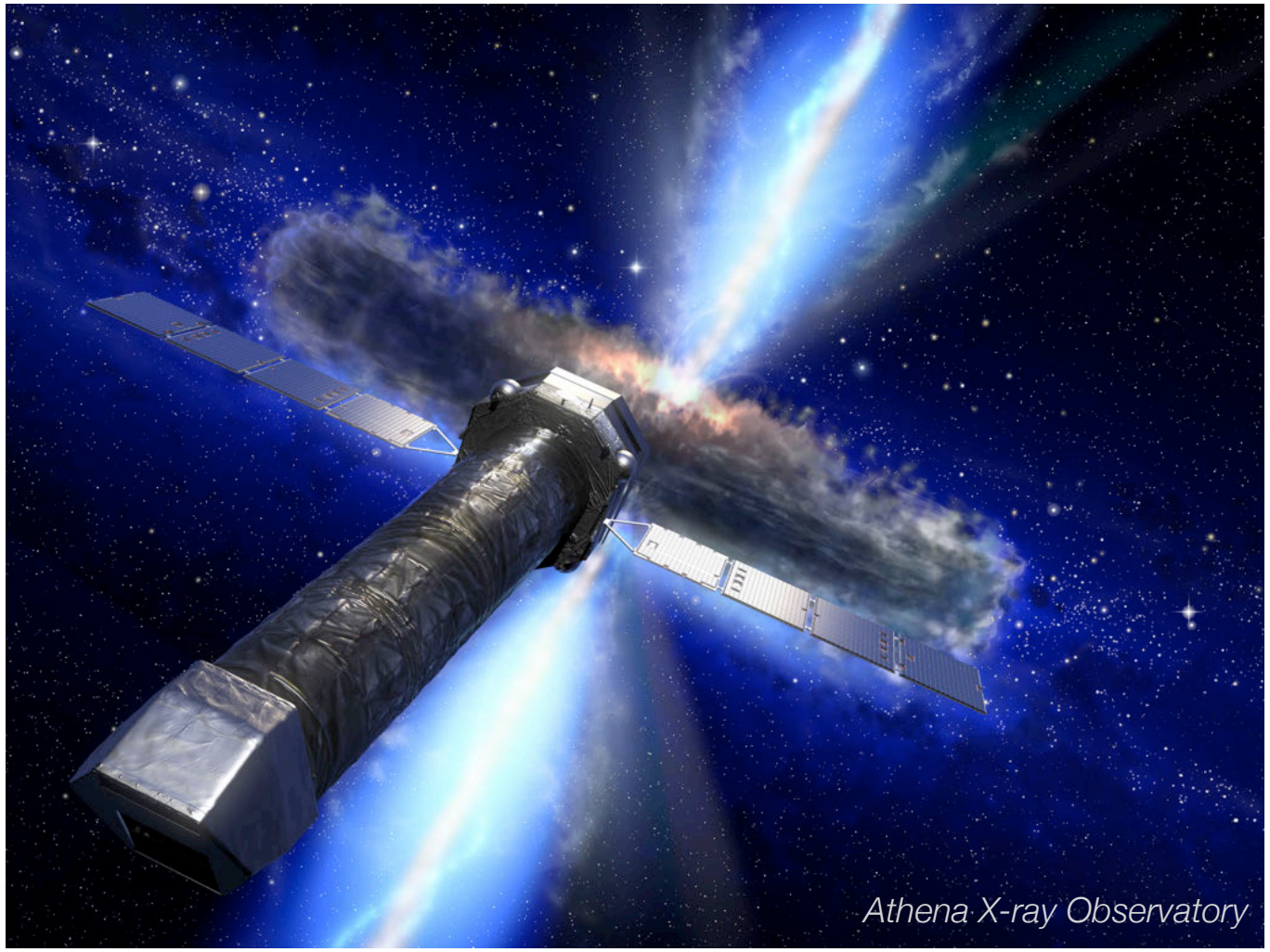
Space activities at Masaryk University

Norbert Werner

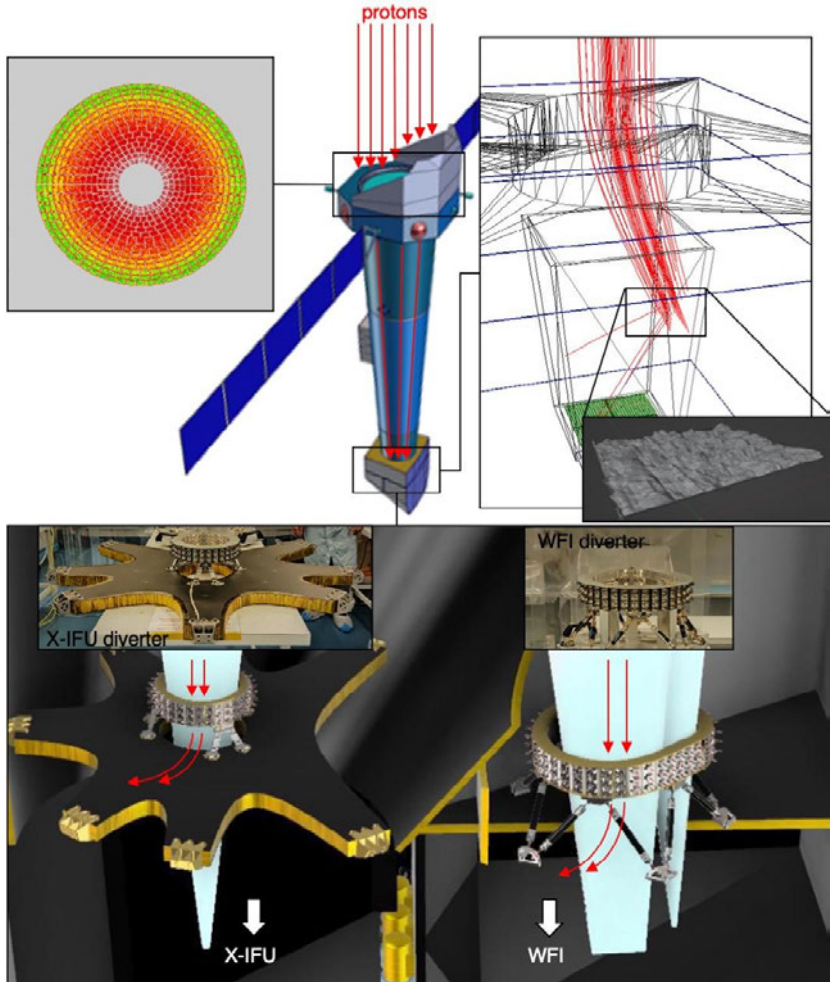
Masaryk University

- Ambition to develop excellent Space research, support of the leadership of Masaryk University, as well as the leadership of relevant faculties
- Faculty of Science, Faculty of Informatics, Institute of Computer Science
- Main topics: Astrophysics using satellites and ground based telescopes, involvement in the development of both large and small satellites for astrophysics, remote Earth observations, image processing, data analysis, modeling and interpretation of satellite data
- Member of the Brno Space cluster

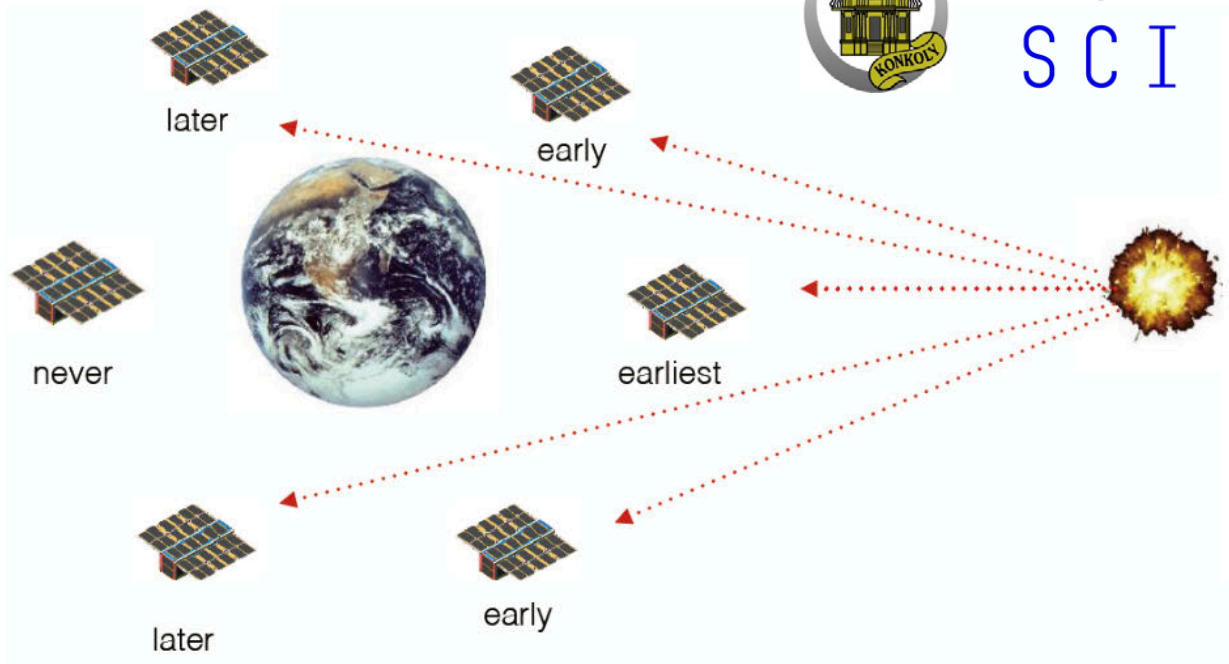
Athena Science Study Team (ASST)



Athena Charged Particle Diverter Simulations using GEANT4



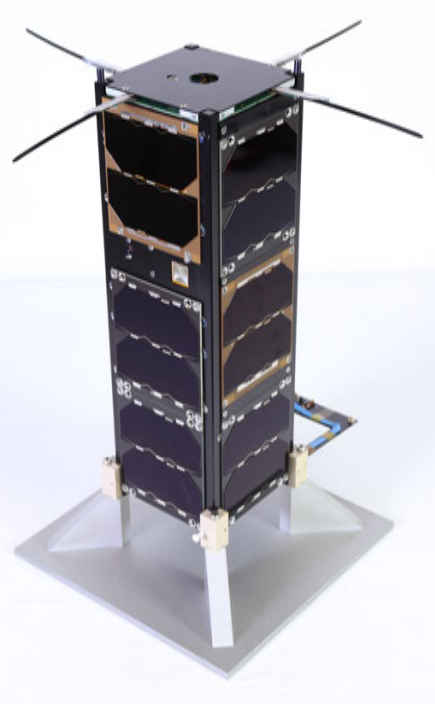
CAMELOT: Cubesat **A**rray for **ME**asuring and **LO**calising **T**ransients



The fleet of 9 (18) satellites will provide a sensitive all sky coverage with a localisation accuracy of ~ 1 deg^2

1. *GRBAlpha* and *VZLUSAT-2* test the detector
2. Prototype of the *CAMELOT satellite*
3. Full constellation

GRBAlpha
Launched: 22. 3. 2021



VZLUSAT-2
Launched: 13. 1. 2022

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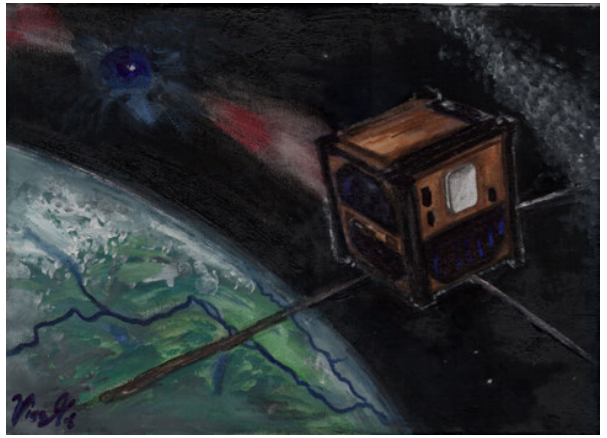
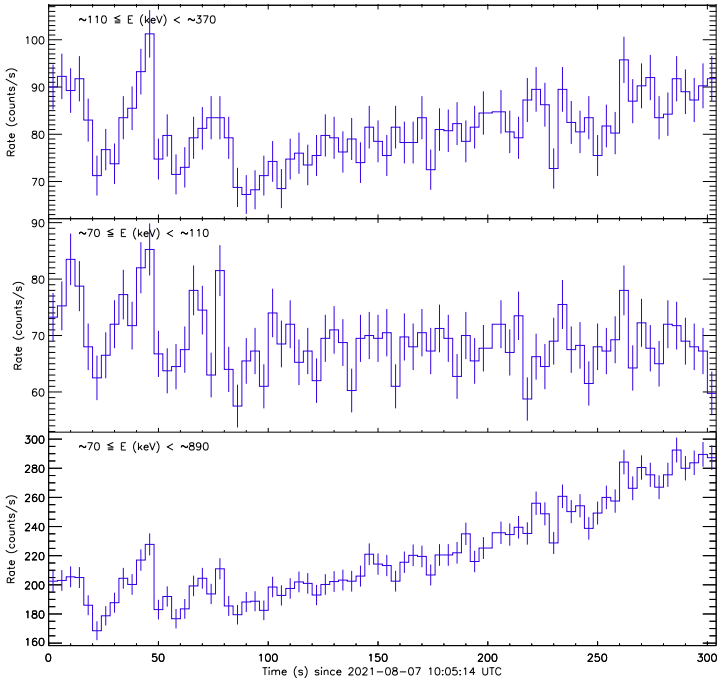
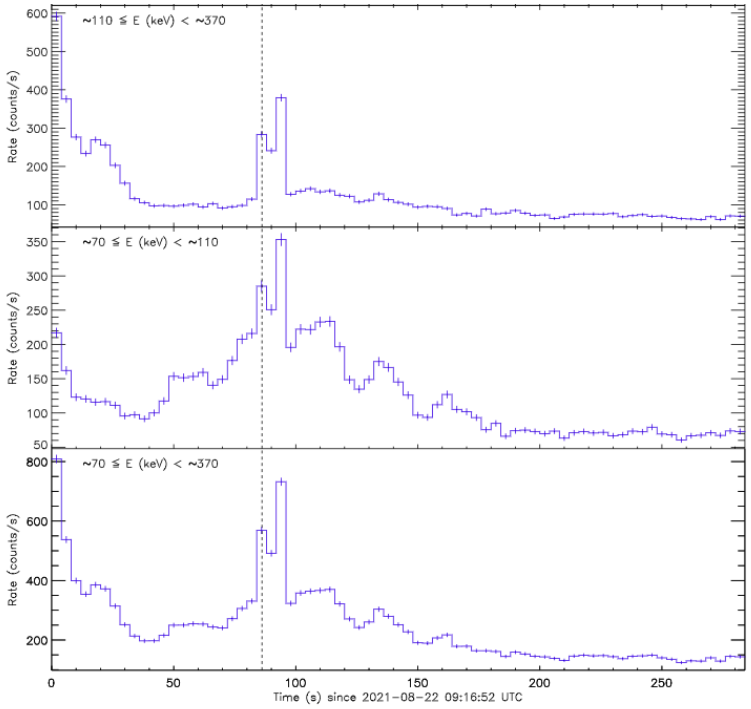
GRBAlpha

A SUCCESSFUL IN-ORBIT DEMONSTRATION

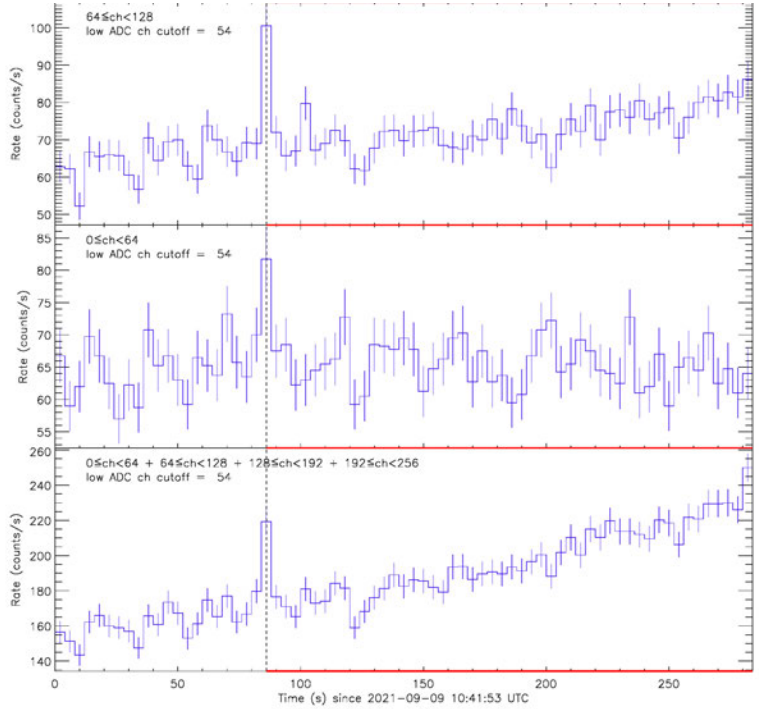




GRB 210807A



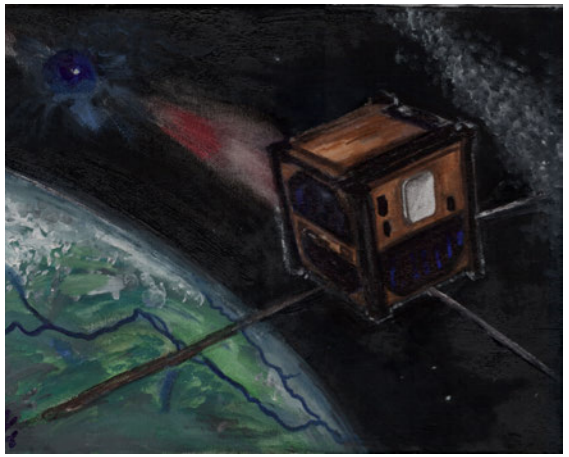
GRB 210822A

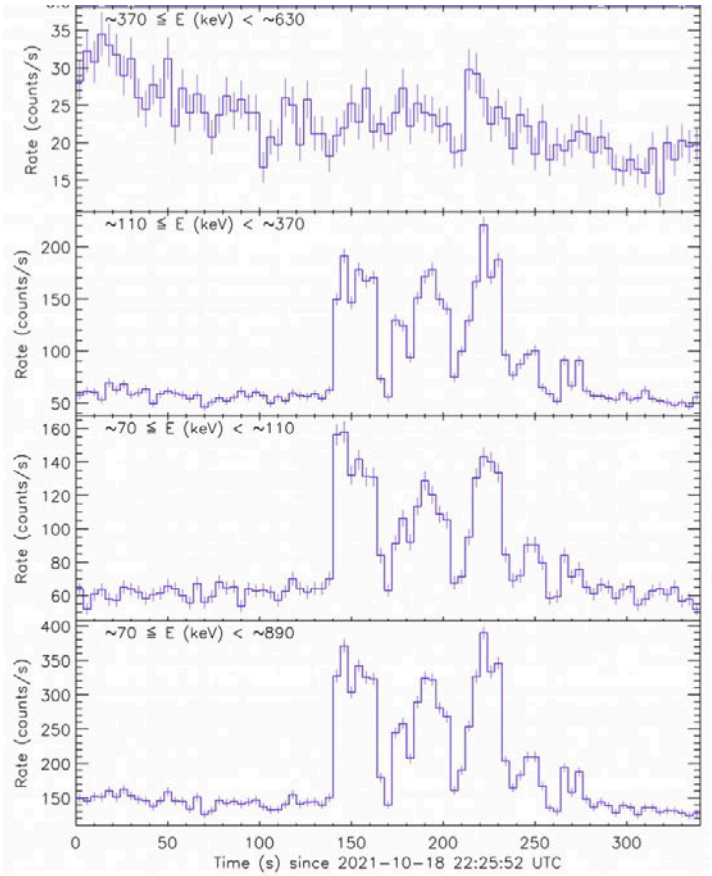


GRB210909A

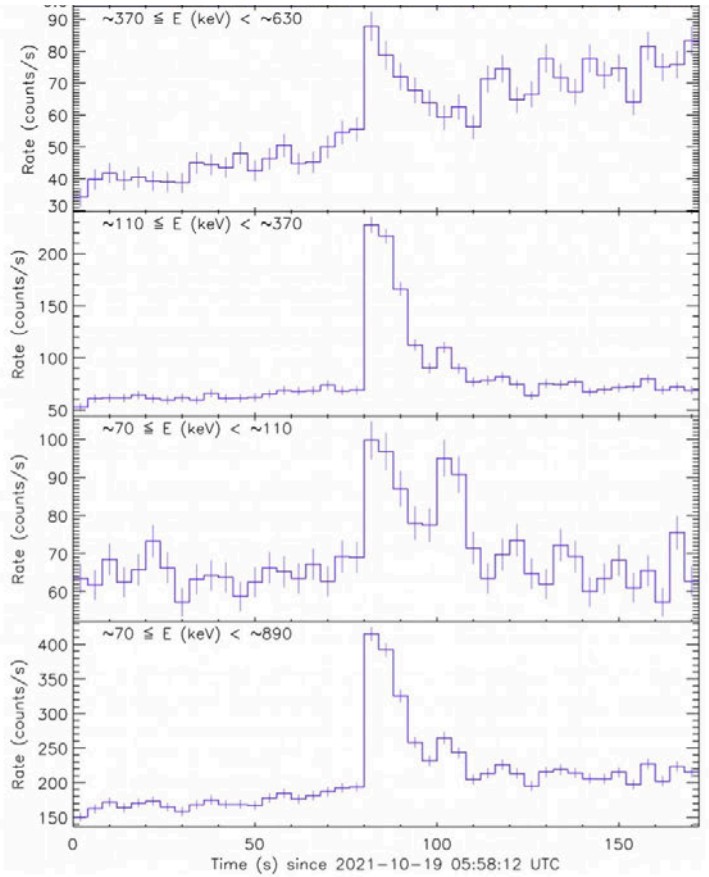
GRBAlpha

A successful In-Orbit Demonstration





GRB 211018A



GRB 211019A

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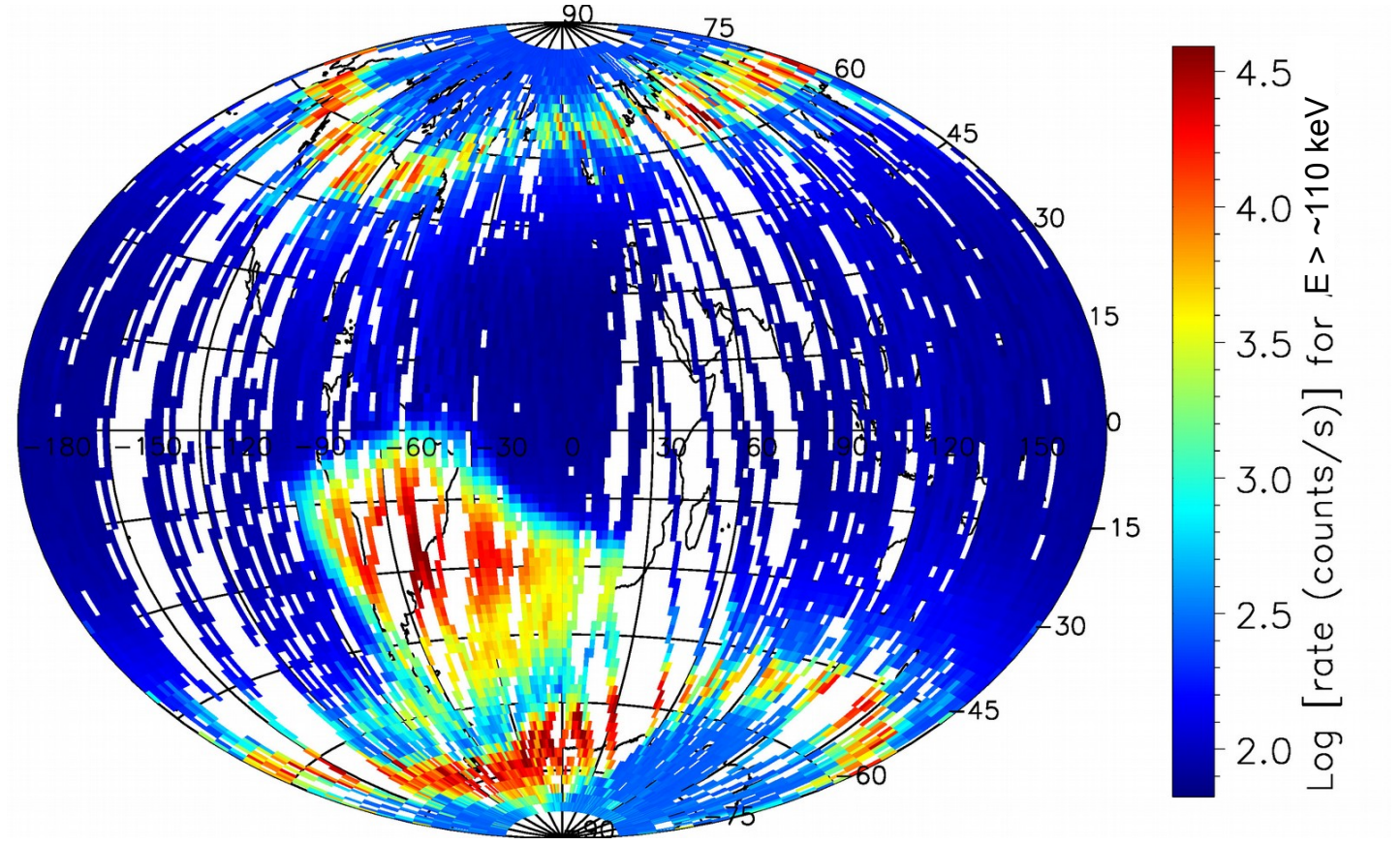
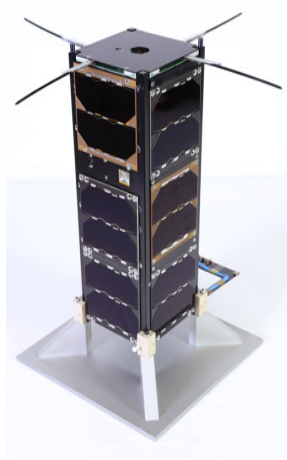
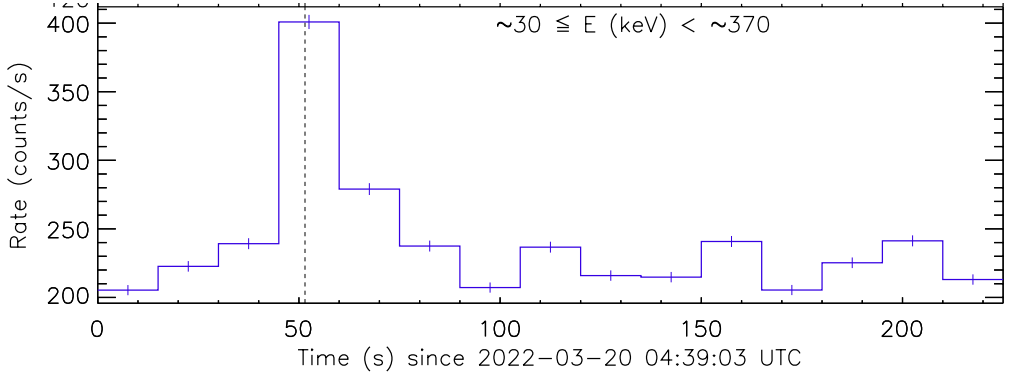
Background map

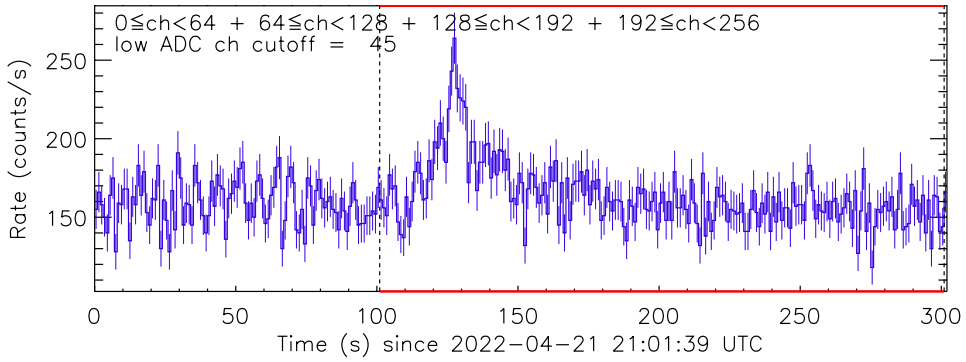


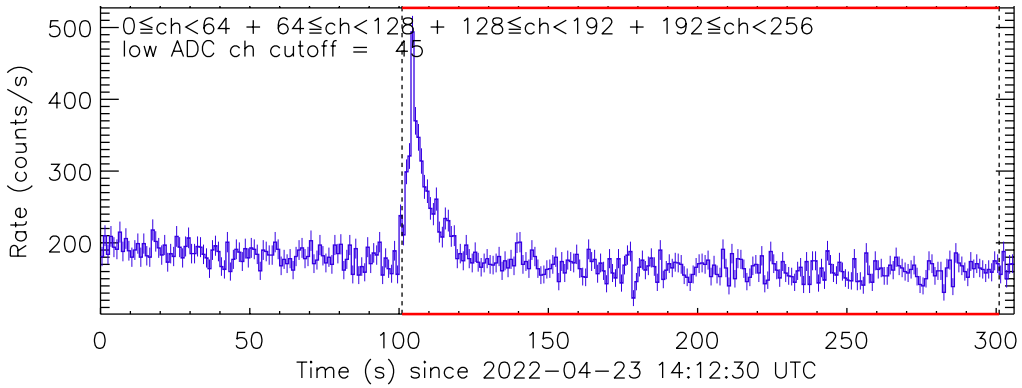
VZLUSAT-2

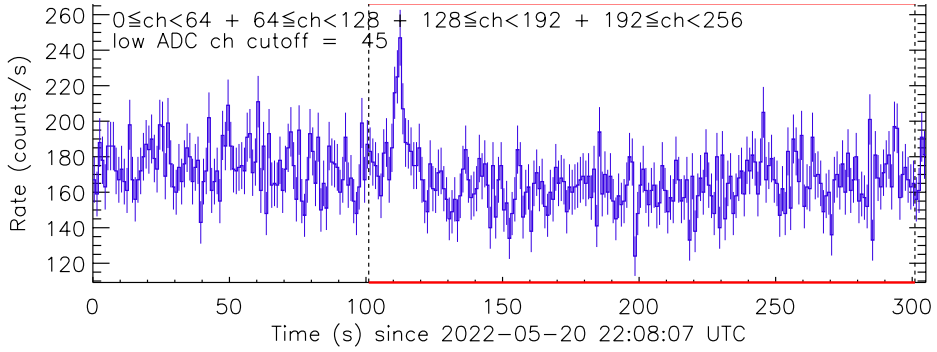
ANOTHER SUCCESSFUL IN-ORBIT DEMONSTRATION



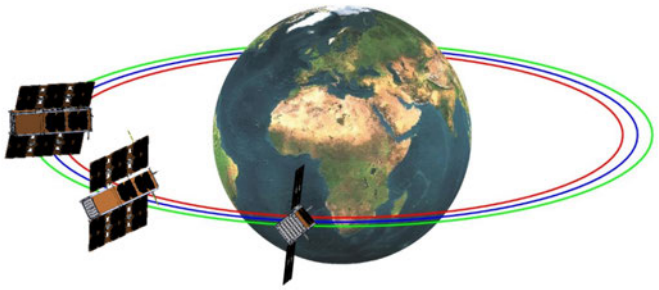


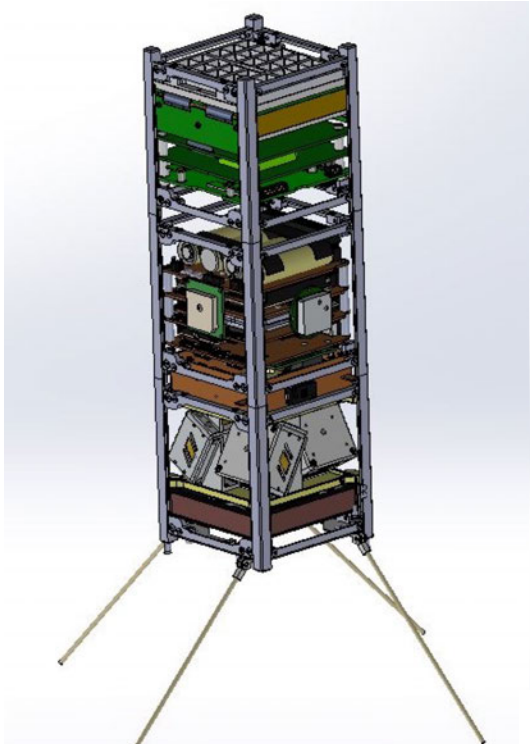


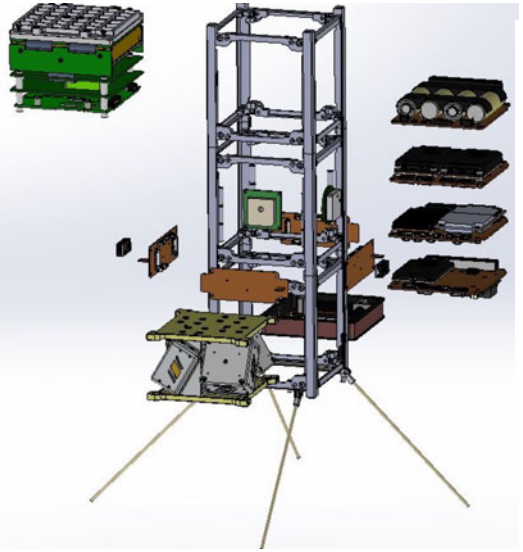


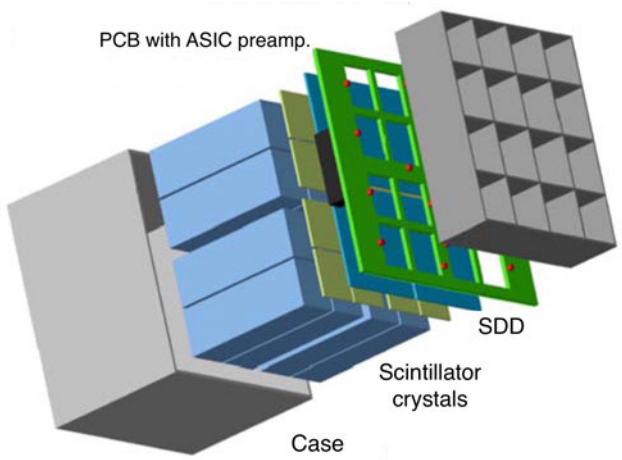


HERMES - 7 NEW CAPABLE GRB DETECTING SATELLITES IN 2023

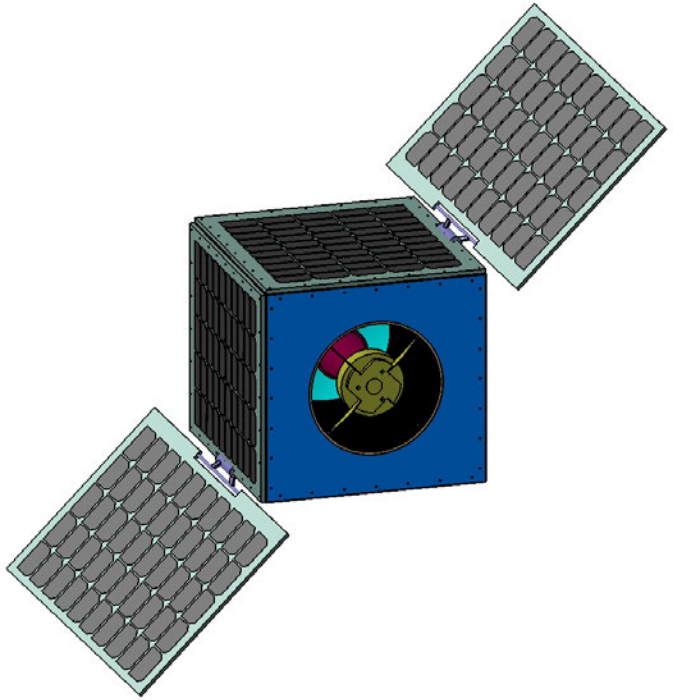








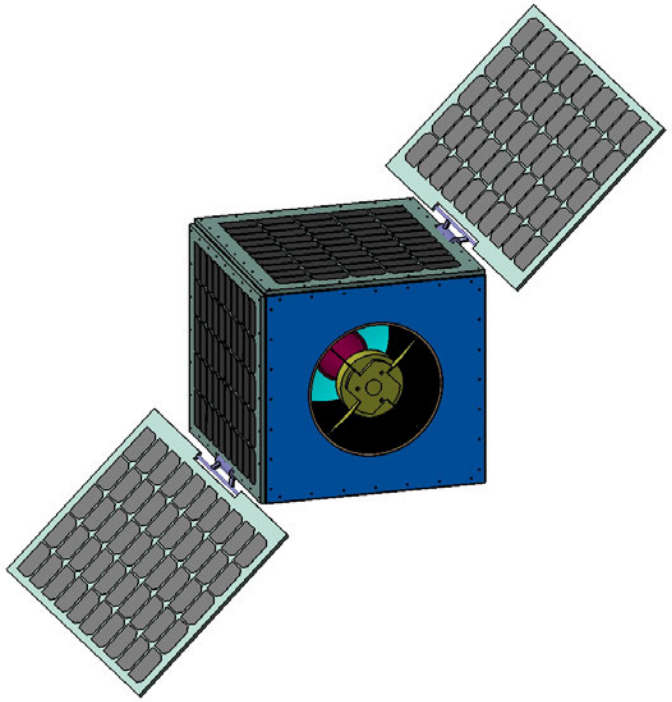
M U N I ***QUVIK:*** Quick Ultra Vlolet Kilonova surveyor



An ambitious Czech science and technology mission

Czech Aerospace Research Centre VZLU (prime), **Masaryk University** (science PI),
TOPTEC (telescope), **PEKASAT** (communication)

QUVIK: Quick Ultra Vlolet Kilonova surveyor



- **UV Space Telescope** with a collecting area of at least 200 cm^2 and a field of view between 1.5—5 deg^2. Its primary objective is photometry of kilonovae detected by gravitational wave observatories.

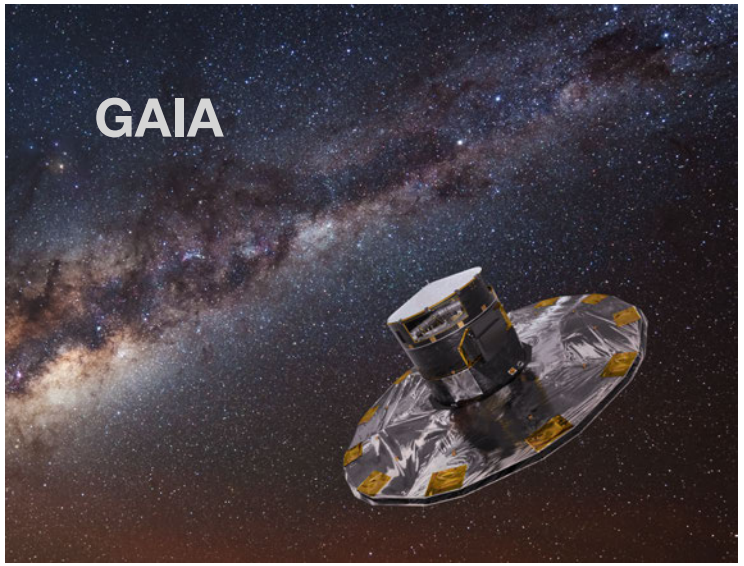
- On a micro-satellit platform by the Czech Aerospace Research Centre VZLU

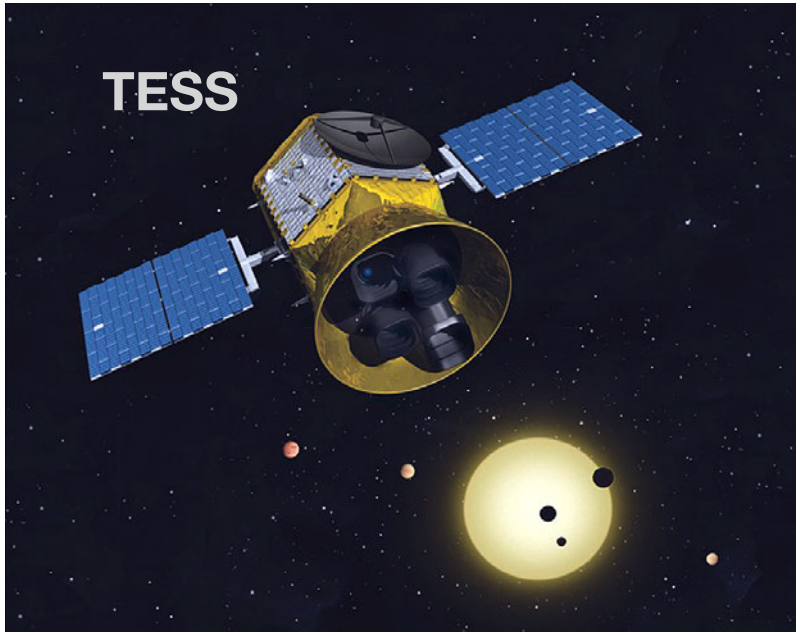
- The satellite will have a fast a repointing capability

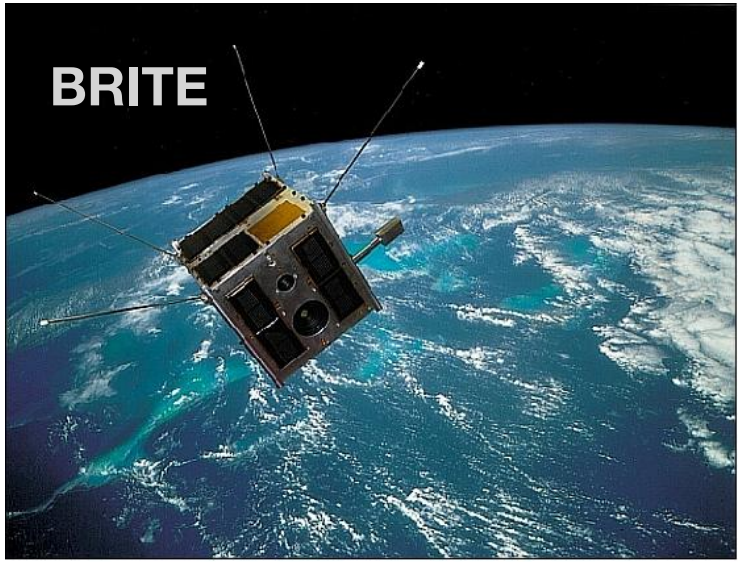
- Many secondary science objectives (TDEs, exoplanets, GRB afterglows, hot stars, etc.)

- Masaryk University is responsible for science (Science PI)

Stellar Astronomy from Space at the Department of Theoretical Physics and Astrophysics







Earth Observations – EO – interpretation of image data

- Department of Geography, Faculty of Science MU - long-term experience in the use of satellite data in environmental applications
- Main areas of research - use of satellite data and data from UAVs for addressing global change, monitoring and modelling of environmental change, modelling of adaptation mechanisms and adaptation strategies, modelling in the field of precision agriculture, use of remote sensing data in virtual reality
- Main tools - SW for satellite data processing (ArcGIS Pro, Envi, Geomatica, 3D Survey, freely available QGIS, SNAP), satellite data from the Copernicus program

Earth Observations – EO – interpretation of image data

- Institute of Computer Science MU - experience with interdisciplinary cooperation, including in the field of processing and analysis of environmental data
  - long-term cooperation with CzechGlobe

- Main areas of research - development and operation of powerful computer systems and data processing (operation of the national computer and storage center CERIT-SC)
  - Specialising in demanding calculations (and their acceleration - GPU accelerators), Big Data techniques, machine learning and artificial intelligence,...

- Main tools - application and development of BigData analysis tools, data infrastructure, creation of new solutions
  - prototype of the ENVision portal - https://envision.cerit-sc.cz

Image processing

Faculty of Informatics MU – long-term experience in the field of image processing

Main areas of research – image segmentation, detection and tracking of objects in time

Main tools – artificial intelligence (deep learning), mathematical morphology

Current challenges – big data, many dimensions / modalities including spectral

Possible optimisation – for speed (real-time), for hardware requirements (memory, GPU, ...)

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