

Scientific proposal

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Spectral analysis of Gamma-Ray Bursts detected by the Atmosphere Space Interactions Monitor and cross-calibration with Konus-WIND

The Atmosphere Space Interactions Monitor (ASIM) is an ESA mission dedicated to earth observation and operational onboard the International Space Station since 2018. Its payload includes two high-energy detectors overall sensitive in the 50 keV - 30 MeV energy range, whose primary target is the observation of Terrestrial Gamma-ray Flashes (TGF), short and bright gamma-ray bursts of atmospheric origin. In addition to TGFs, ASIM proved to be also an effective detector for cosmic Gamma-Ray Bursts (GRB), especially for short and bright ones.

Goal of this proposal for a data analysis trans-national access is to establish an effective collaboration between the ASIM team, the high-energy astrophysics team at the University of Ferrara, and the Konus-WIND team at the Ioffe Institute, Saint-Petersburg, Russian Federation, aimed at maximizing the scientific return of the ASIM mission in the GRB field.

To reach this goal, we will pursue a cross-calibration of ASIM with Konus-WIND by joint spectral analysis of a common sample of GRBs. This in turn will result in the following outcomes:

1. Measurement of the high-energy spectral index (beta) and assessment of its uncertainty (statistical and systematic)
2. Measurement of the normalization constants between ASIM-MXGS and Konus-WIND and assessment of its uncertainty (statistical and systematic)
3. assessment of the reliability of the spectral analysis dependent on incoming direction
4. assessment of the minimum detectable GRB flux for ASIM

We have already identified a sample of 11 GRBs detected by ASIM in the period June 2018 - December 2021 and more events will be added as soon as all

triggers are processed. All the GRBs detected so far by ASIM are also detected by Konus-WIND. Many of them are bright and short bursts, well suitable for joint spectral analysis. After the burst list is complete, we will rank it in accordance with the Konus-WIND team giving highest priority to the brightest events. Then we will prepare data files corresponding to the Konus-WIND spectral data files, taking into account the expected light-travel-time delay between the two instruments, in order to compare corresponding data periods. All data and response matrices from ASIM will be prepared as OGIP-compatible FITS files in order to allow joint spectral fitting using a well-established software package such as XSPEC. The results obtained will be at the core of my Master Thesis work, expected to be delivered in March 2023.

Ranked list of proposed host institutes:

1. First choice: Ferrara
2. Second choice: Geneva
3. Third choice: INAF Trieste

Explanation of choice of hosts: This is an application for data analysis
- host priority list is: Ferrara, INAF Bologna

We started a collaboration between our team in Bergen, the high-energy astrophysics group at the University of Ferrara, and the Konus-WIND team at the Ioffe Institute, Saint-Petersburg, Russian Federation, aimed at the scientific goals outlined in the proposal above. The data analysis proposed will be the main scope of my Master Thesis work. My work will strongly benefit from direct interaction with the Ferrara group, thanks to their strong expertise in GRB data analysis. The outcome of my stay in Ferrara will be further enhanced by a coordinated visit of my supervisor, Prof. Martino Marisaldi, and a researcher from the Konus-WIND team. We aim at a one-week visit in the period July 4. - July 8, 2022.