A MISSION FOR THE INTERNATIONAL SPACE STATION

Atmosphere-Space Interactions Monitor

ASIM

severe thunderstorms and gigantic lightning flashes

esa

TERMA

Technical University of Denmark

DTU

ASIM SCIENCE

High-energy thunderstorm processes

- What makes thunderstorms discharge in gigantic lightning flashes reaching the ionosphere?
- How are photons created with energies up to 100 MeV?
- What is the proficiency of thunderstorm discharges in creating antimatter?

Image: Sprites above a distant thunderstorm (NHK)

Atmospheric science

- How do thunderstorms affect the stratosphere and thereby the climate?
- Can we predict severe storm intensification from lightning activity?
- To what extent is thunderstorm electrical activity affected by dust particles?

Image: Thunderstorm cloud under development

Atmosphere-space interactions

- Quantify energetic particle precipitation and its relation to auroral and to solar conditions
- Measure meteors to determine their origin
- How large is the thunderstorm source of high-energy electrons in the mesosphere?

Images: Aurora from the International Space Station (ISS)

ASIM OBSERVATIONS AND INSTRUMENTS

Observations

- Energetic photons from thunderstorm processes
- Optical and UV radiation from discharges above thunderstorms
- Optical lightning characteristics
- UV and optical radiation from clouds and other atmospheric processes

Image: Sprites

The Payload

- ASIM will be mounted outside the ESA Columbus module of the ISS in 2016
- Instruments: MXGS (Modular X- and Gamma-ray Sensor) and MMIA (Modular Multispectral Imaging Array)
- Payload computer, the DHPU (Data Handling and Power Unit)

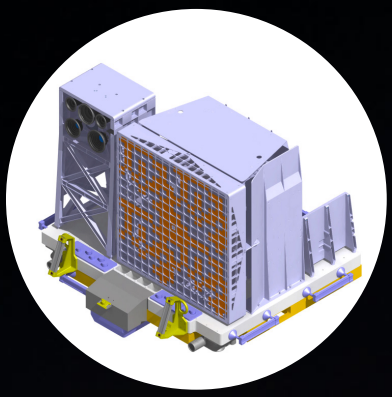

Image: The ASIM payload

The MXGS

- LED: low-energy detector (20-300 keV); 128 x 128 pixels and coded mask for source direction mapping (1 deg)
- HED: high-energy detector (0.2-20 MeV)
- Autonomous event-capture

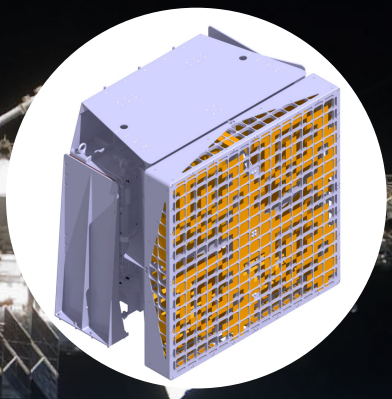

Image: The MXGS

The MMIA

- Cameras: 337nm/5nm and 777nm/5nm; 1 Mpixel; 12 fps; 400m resolution; light sensitive CCD
- Three photometers: 180-280nm, 337nm/5nm; 777nm/5nm; photon counting; 100 kHz sampling
- Autonomous event capture

Image: The MMIA

THE ASIM ORGANIZATION

Organization

- ASIM is developed by the European Space Agency (ESA) within the Directorate for Human Spaceflight and Operations. The ASIM Facility Science Team (FST) advices ESA on issues related to science and observations. The members are:
- Dr. Torsten Neubert, National Space Institute, Technical University of Denmark (DTU Space), Kgs. Lyngby, Denmark (Chair),
- Professor Nikolai Østgaard, Birkeland Centre for Space Science, University of Bergen, Norway,
- Professor Victor Reglero, Grupo de Astronomía y Ciencias del Espacio, University of Valencia, Spain,
- Dr. Elisabeth Blanc, Laboratoire Détection Géophysique (LDG), Commissariat à l'énergie atomique et aux énergies alternatives, Bruyères-le-Châtel, France

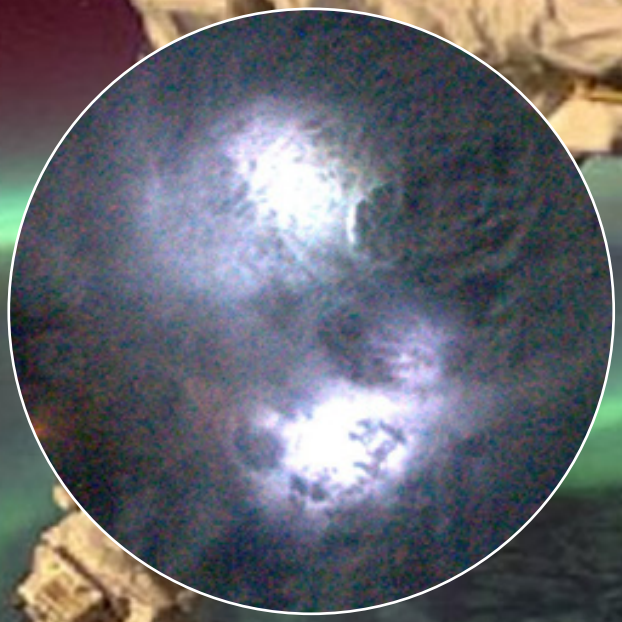

Image: Lightning seen from the International Space Station (ISS)

The Industrial Consortium

- TERMA A/S, Denmark: Main contractor and leads the MMIA consortium. Develops the MMIA cameras and participates in the development of the instrument computer
- DTU Space, Denmark: Leads the MXGS consortium; participates in the MMIA consortium with the photometers; leads the instrument computer development of the MXGS and MMIA
- University of Valencia, Spain: Mechanical structure of the MXGS
- University of Bergen, Norway: Low and high energy detectors of the MXGS
- Space Research Center, Poland: Power supply for the MXGS
- Compagnia Generale per lo Spazio, Italy: Payload computer

Image: A meteor

ASIM SCIENCE COLLABORATION

The Science Team

- The ASIM International Science Team (AIST) includes more than 90 research groups from 30 countries
- The ASIM Topical Team is funded by ESA and supports science collaboration of research teams primarily in ESA member states
- The TEA-IS network (Thunderstorm Effects on the atmosphere-ionosphere) is a Research Networking project funded by the European Science Foundation (ESF) (2010-2015)
- Countries Participating in the Science: Algerie, Belgium, Brazil, Bulgaria, Canada, Czech Republic, Cuba, Denmark, Finland, France, Germany, Greece, Hungary, Italy, India, Israel, Japan, Netherland, New Zealand, Norway, Poland, Romania, Russia, South Africa, Spain, Sweden, Taiwan, Turkey, United Kingdom, USA

Image: High-energy radiation from thunderstorms (NASA)

Image: Hurricane seen from the ISS

Collaborations

- The AIST overlaps the team of the French satellite TARANIS which has similar science objectives and will be in orbit simultaneously
- The AIST participates in the COBRAT (Coupled Observations from Balloon related to ASIM and TARANIS) balloon campaign planned with CNES
- The US Lightning Imaging Sensor (LIS), previously flown on TRMM, is considered by NASA for the ISS to complement ASIM
- The Meteosat Third Generation (MTG) satellite will include an optical lightning sensor. The data from ASIM are planned for validation.
- The AIST is fielding instruments in Southern Europe and other locations for complementary observations

ASIM FIRSTS

Image: A gigantic lightning discharge to the bottom ionosphere (Serge Soula)

- ASIM is the first dedicated payload for studies of energetic radiation from thunderstorm processes with both X- and Gamma-ray, UV and optical measurements
- The MXGS has unprecedented sensitivity in X- and Gamma-ray band with directional determination of radiation

Contact

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