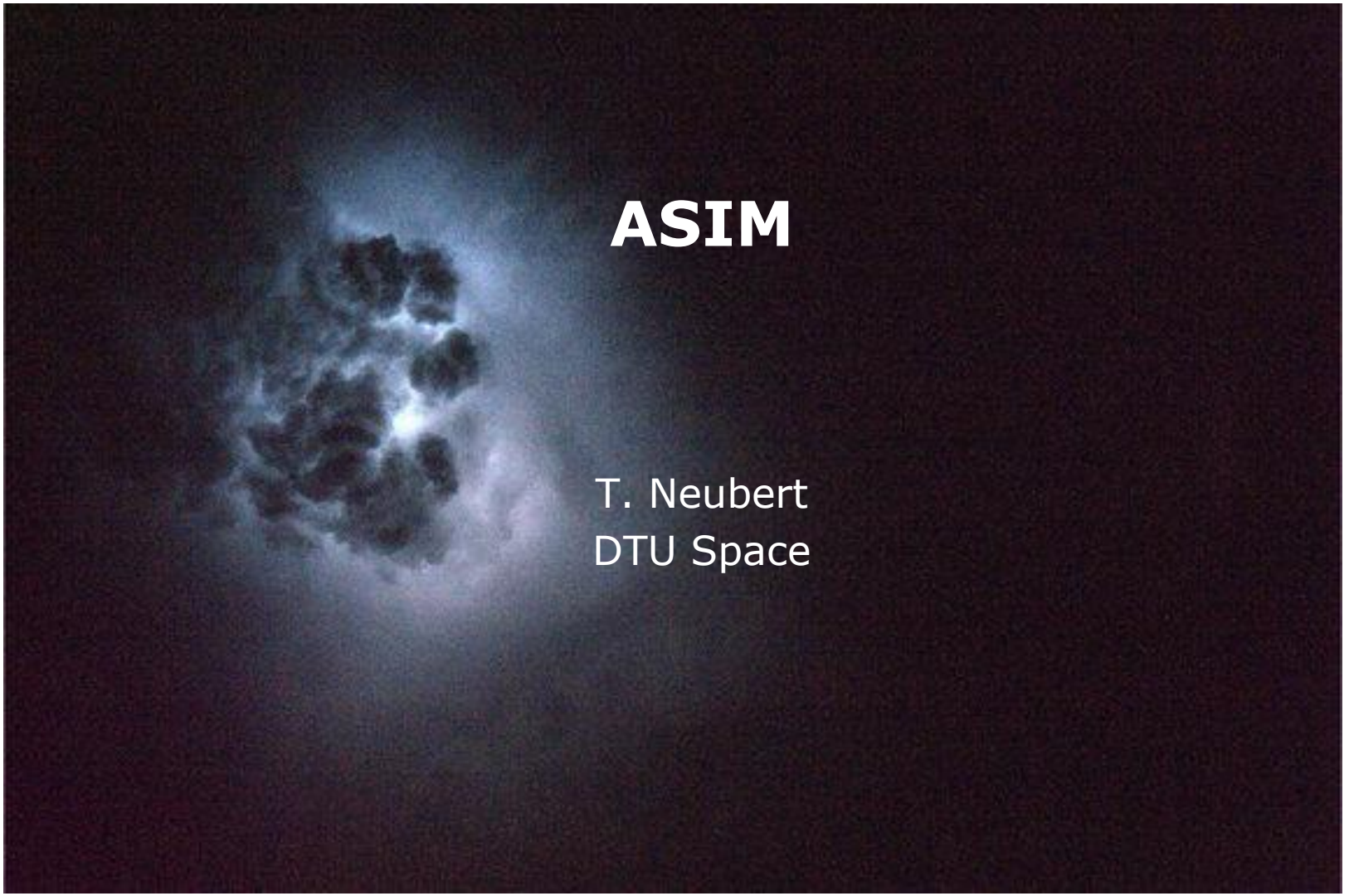

ASIM

T. Neubert
DTU Space

DTU Space
National Space Institute

Overview

- ASIM Science
- ASIM Mission
- ASIM Context

Overview

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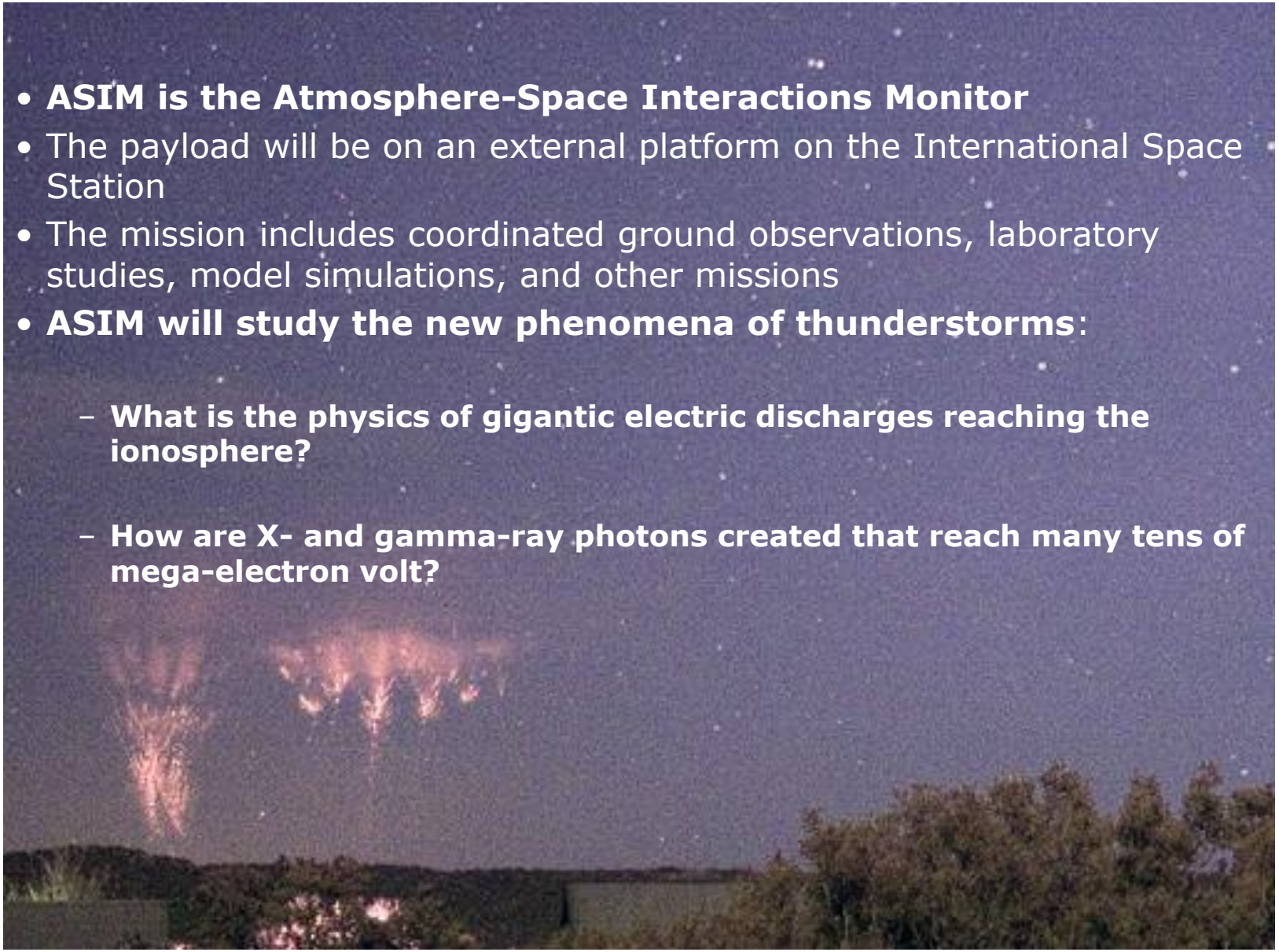


- **ASIM is the Atmosphere-Space Interactions Monitor**
- The payload will be on an external platform on the International Space Station
- The mission includes coordinated ground observations, laboratory studies, model simulations, and other missions
- **ASIM will study the new phenomena of thunderstorms**:
  - **What is the physics of gigantic electric discharges reaching the ionosphere?**
  - **How are X- and gamma-ray photons created that reach many tens of mega-electron volt?**

The new phenomena

The Sprite in 1989

Courtesy of NHK

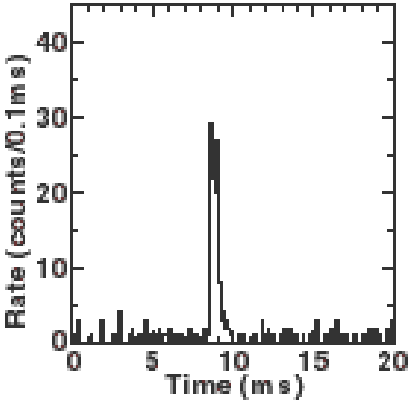
The Blue Jet in 1994

Wescott et al., JGR, 2001

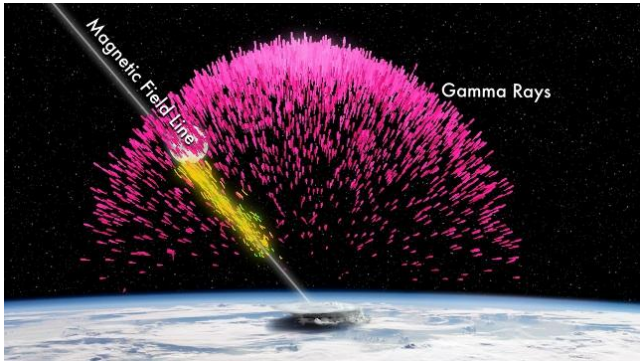
The Gigantic Jet in 2001

Su et al., Nature, 2003

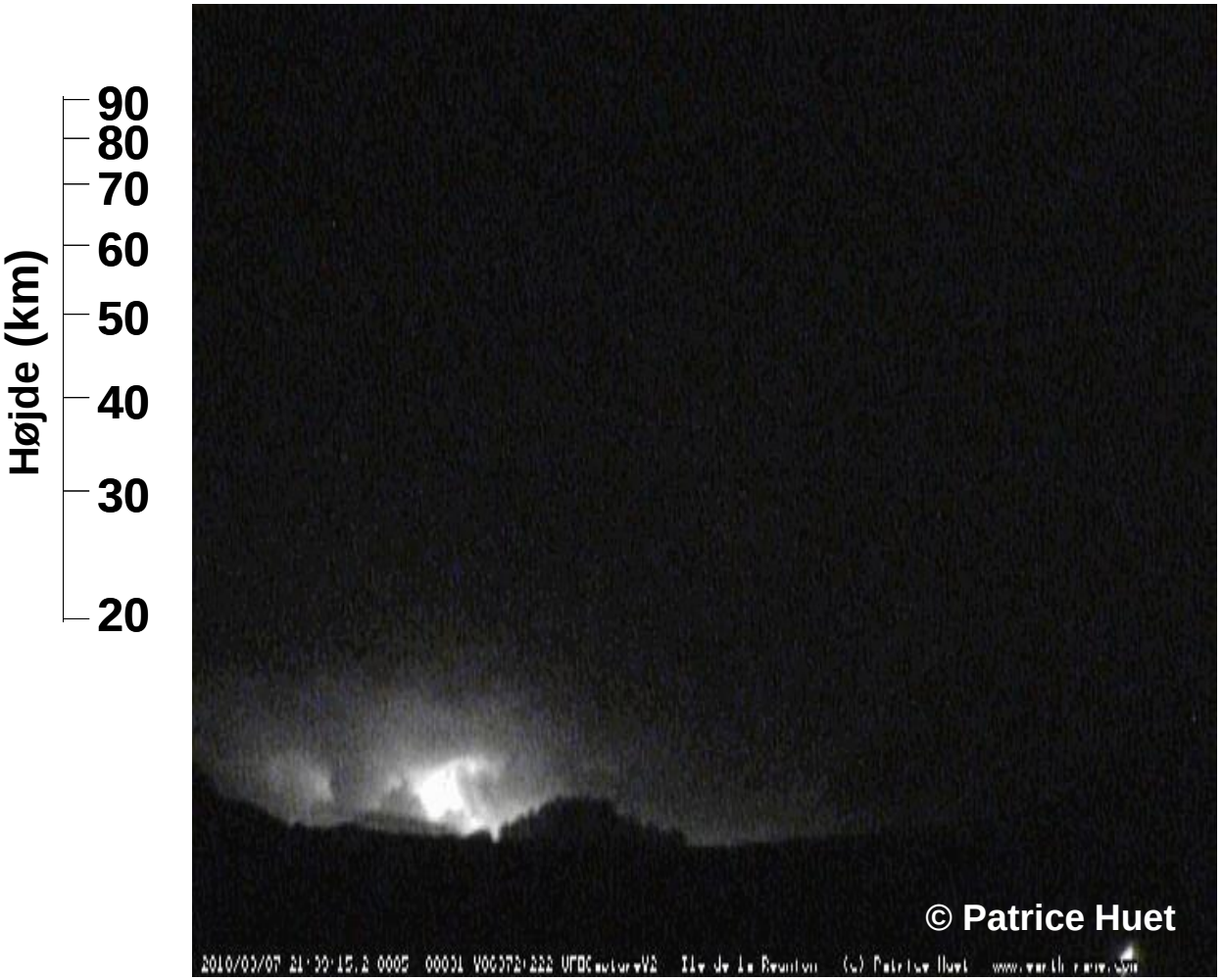
Terrestrial Gamma-ray Flashes in 1994



Fishman et al. Science, 1994

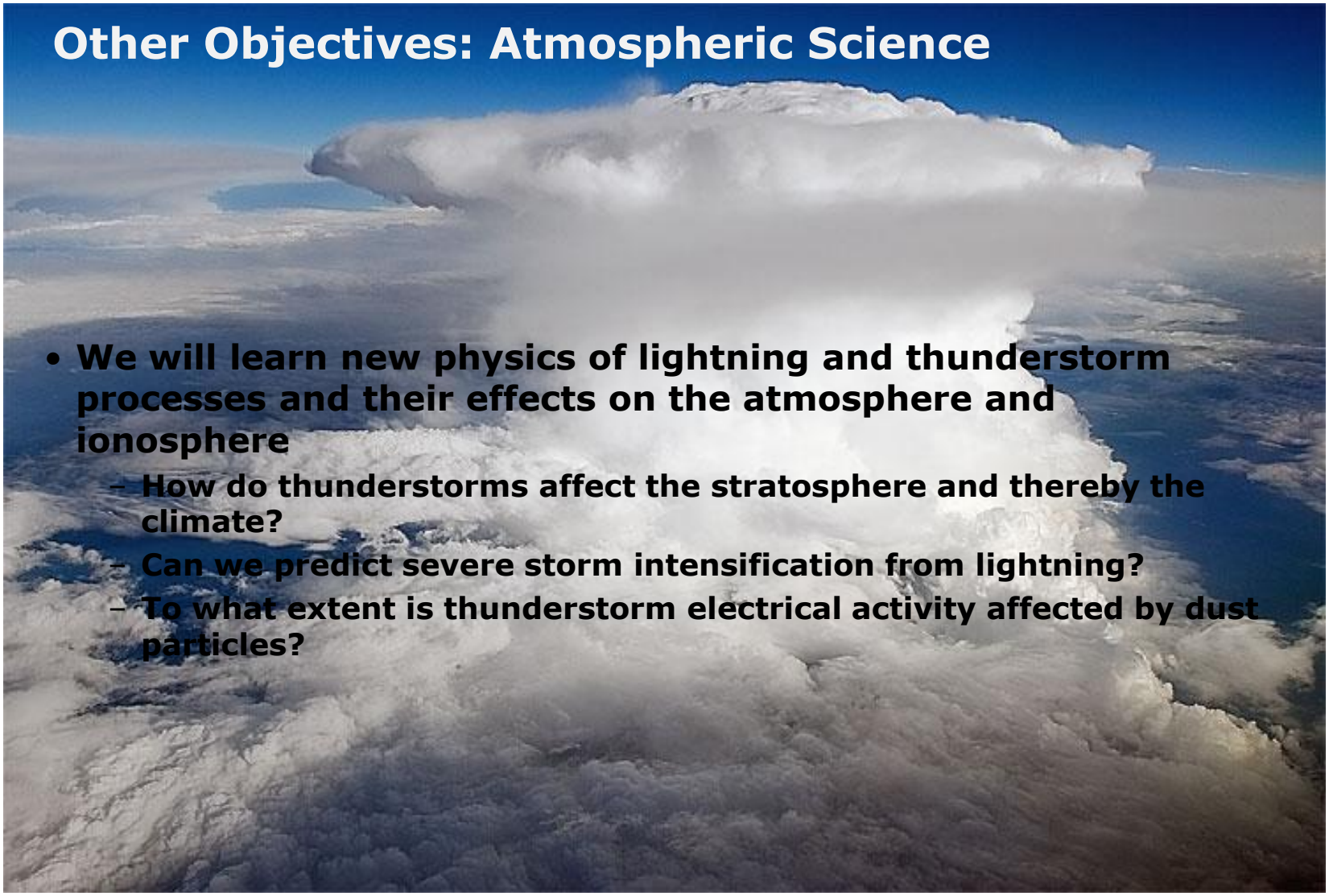


Giants – discovered in 2005



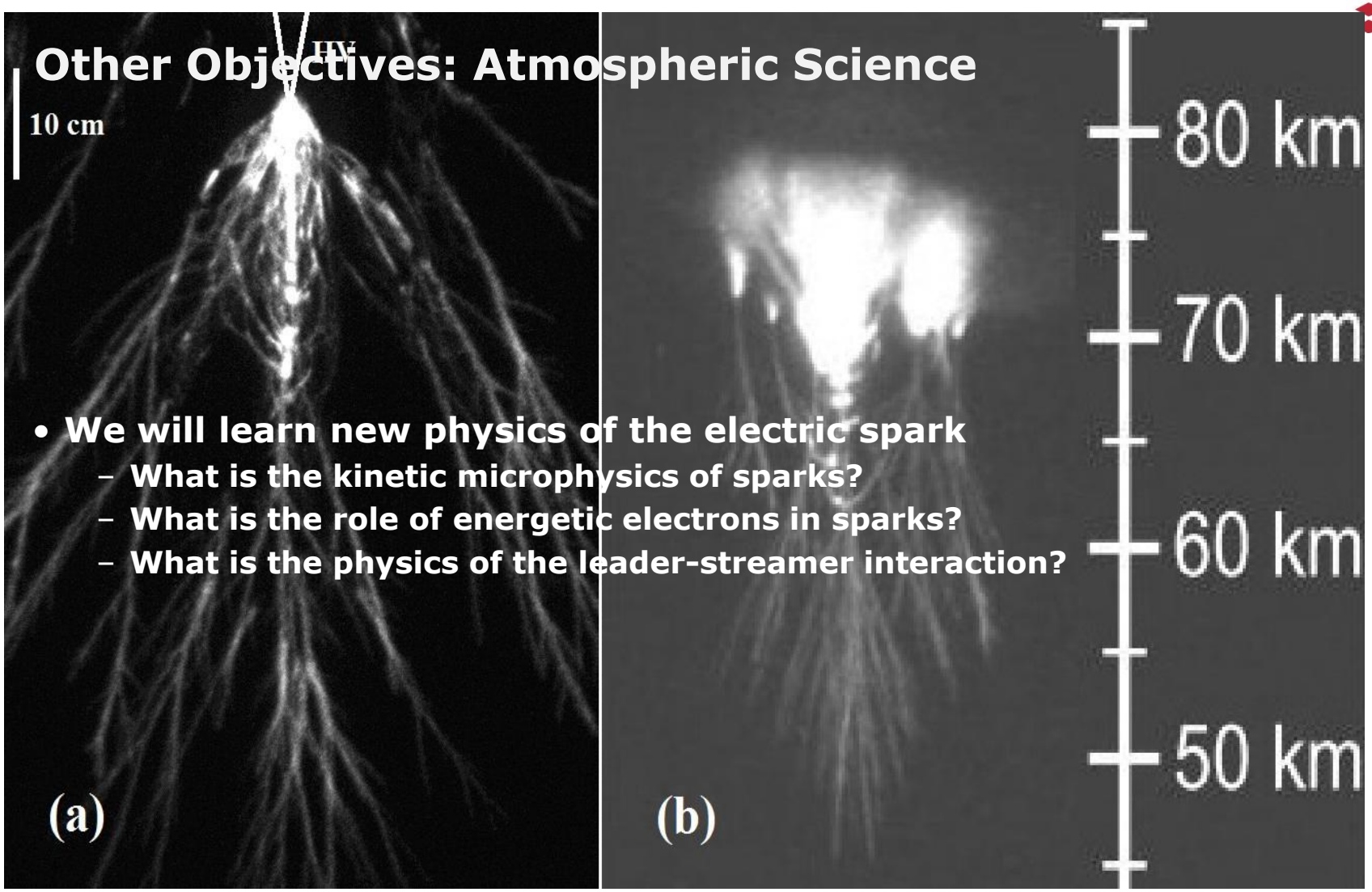
Serge Soula, J. Geophysical Research, 2011.

Other Objectives: Atmospheric Science



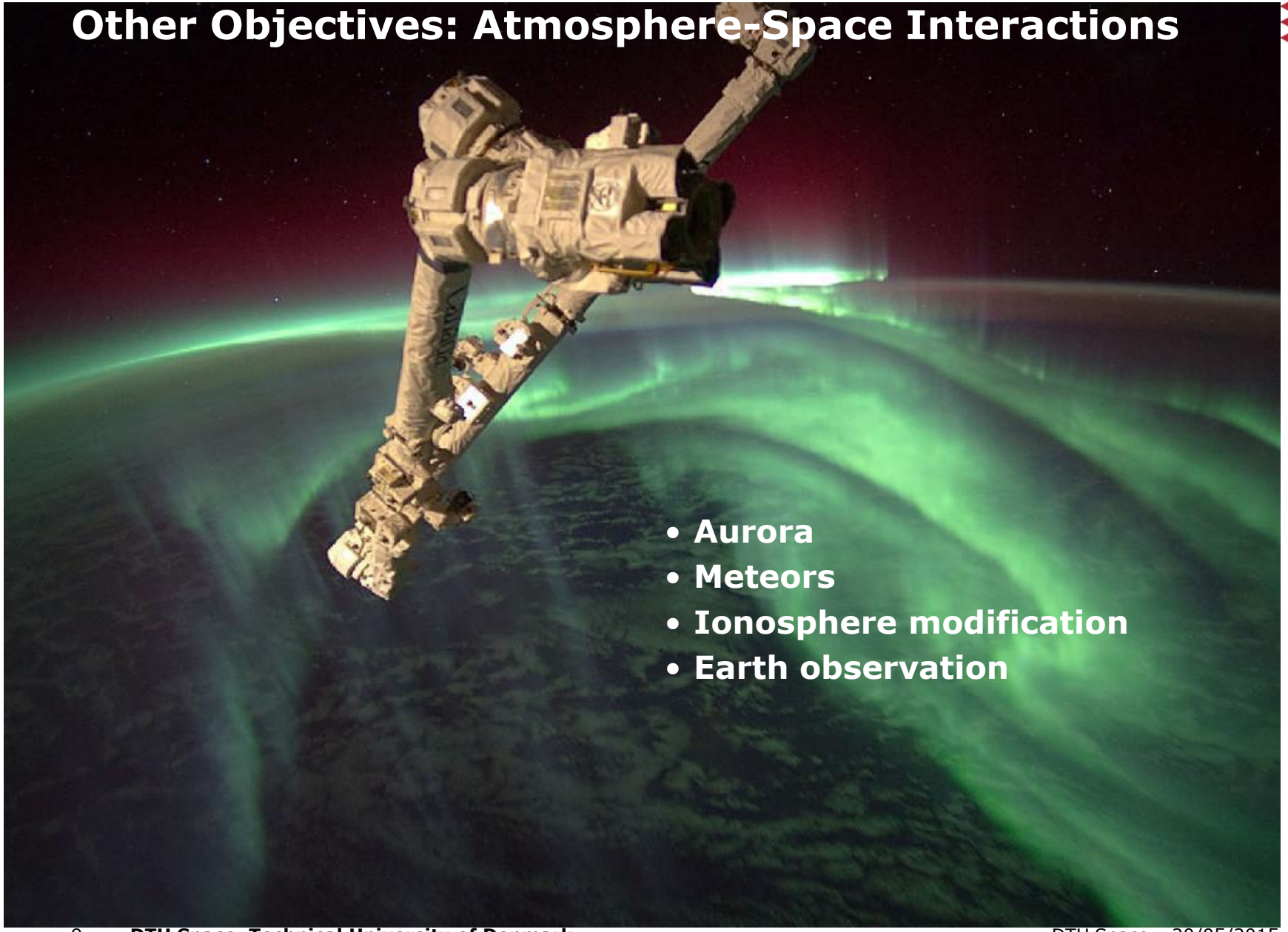
- **We will learn new physics of lightning and thunderstorm processes and their effects on the atmosphere and ionosphere**
  - **How do thunderstorms affect the stratosphere and thereby the climate?**
  - **Can we predict severe storm intensification from lightning?**
  - **To what extent is thunderstorm electrical activity affected by dust particles?**

Other Objectives: Atmospheric Science



- We will learn new physics of the electric spark
  - What is the kinetic microphysics of sparks?
  - What is the role of energetic electrons in sparks?
  - What is the physics of the leader-streamer interaction?

Other Objectives: Atmosphere-Space Interactions



- Aurora
- Meteors
- Ionosphere modification
- Earth observation

Overview

- ASIM Science
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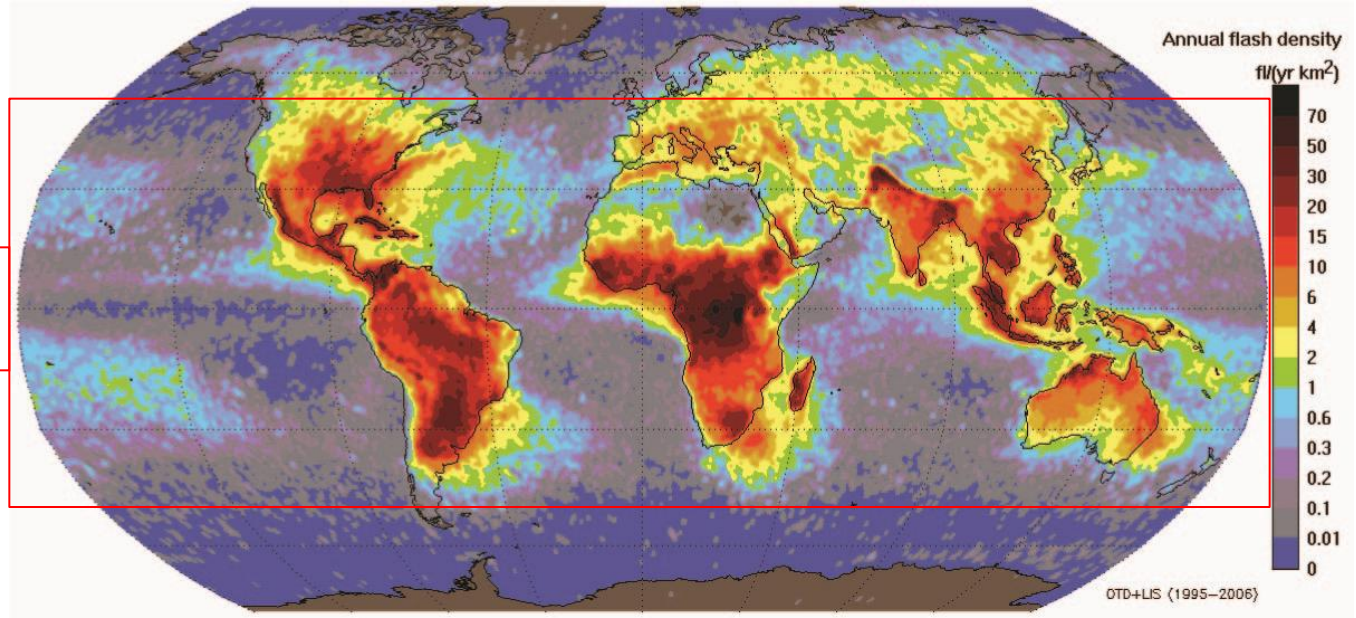
The global lightning distribution

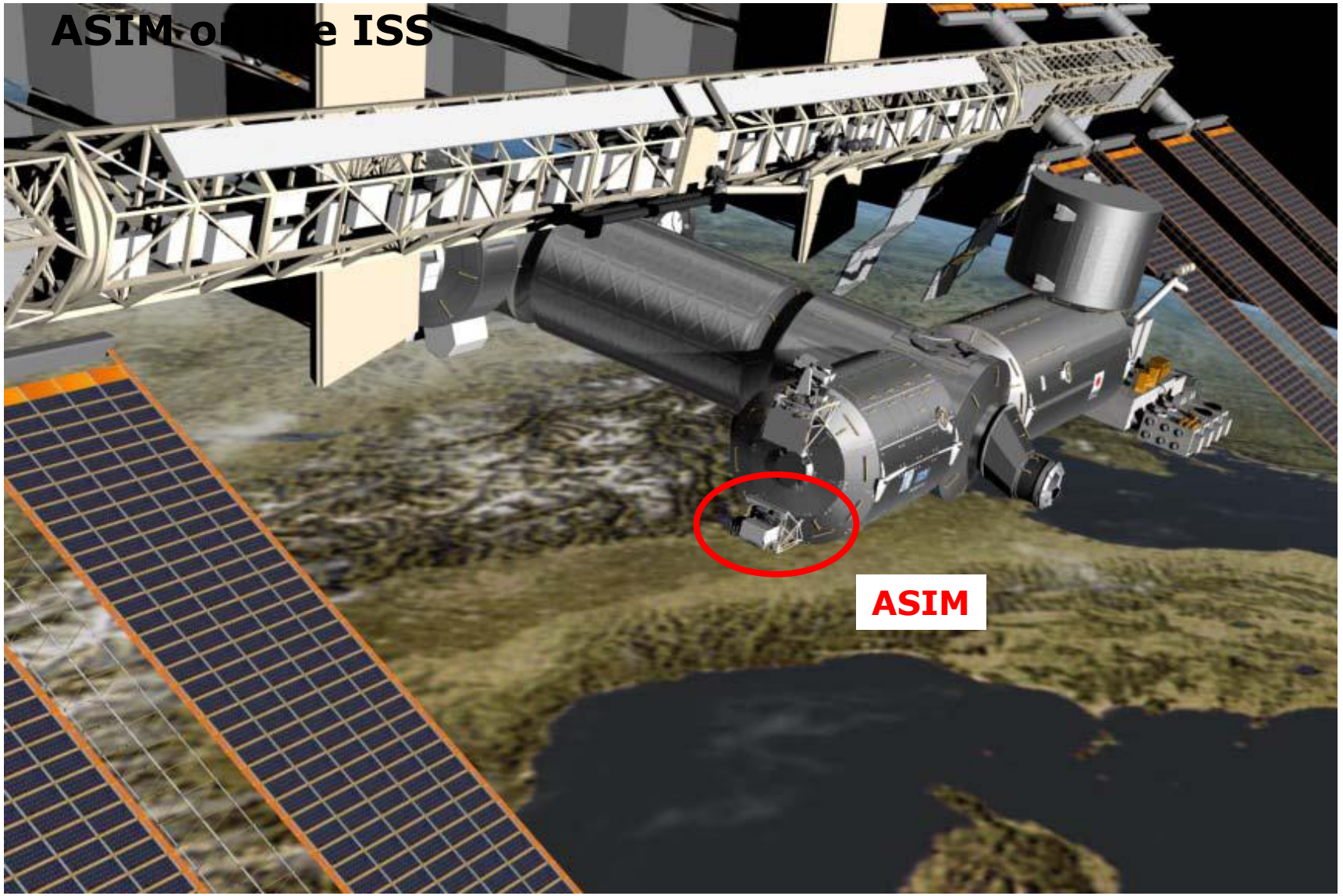


ISS coverage

- Total lightning flash density (per square kilometer per year)
- Lightning is primarily at lower latitudes and over land

From two satellite detectors, Optical Transient Detector (5 years) and Lightning Imaging Sensor (5 years). Courtesy of H.J. Christian, NASA /Marshall Space Flight Center and Ulrich Finke, University of Bremen.

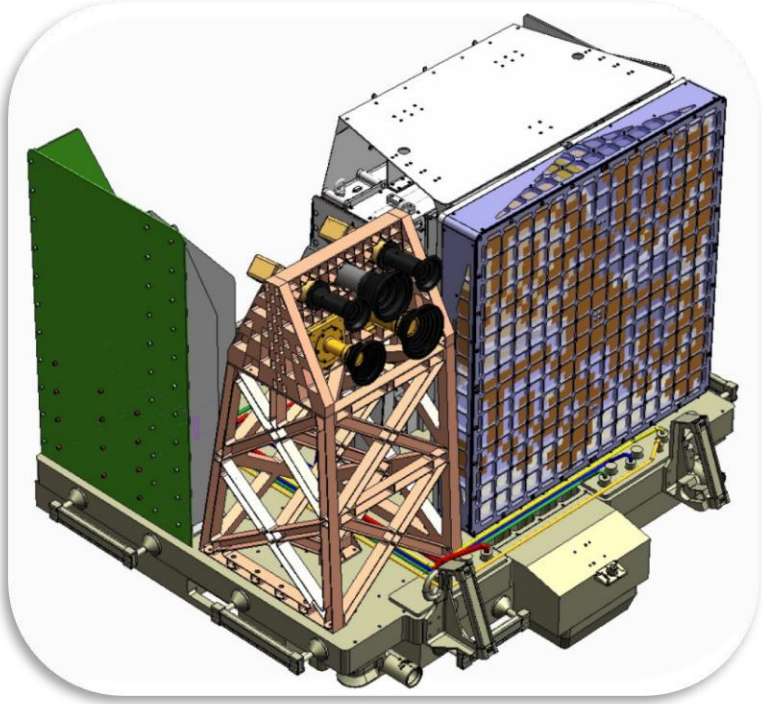
ASIM on the ISS



The Payload

- MMIA (The Modular Multispectral Imaging Array):
  - three photometers
  - two cameras

- MXGS (The Modular X- and Gamma-ray Sensor):
  - low-energy detector (LED)
  - high-energy detector (HED)

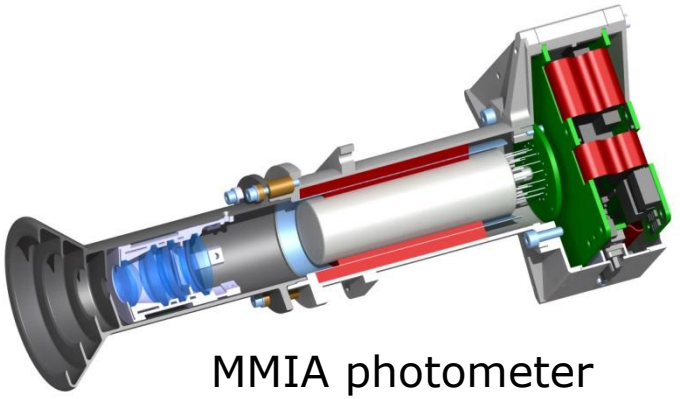


The MMIA

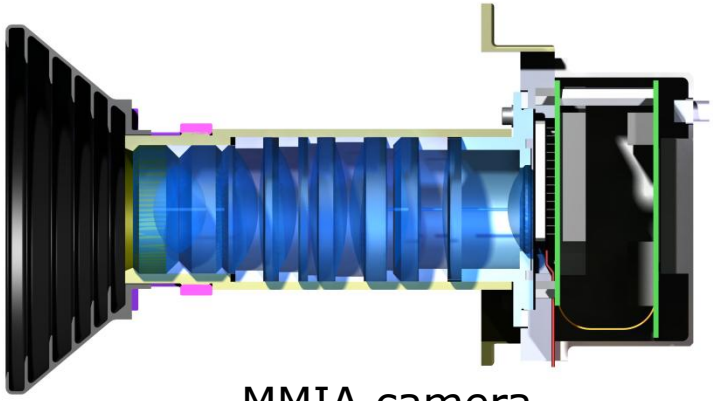
- Three photometers:
  - 180-250 nm
  - 337.0 nm/5 nm band
  - 777.4 nm/5 nm band
  - 100 kHz sampling
  - photon counting

- Two cameras
  - 337.0 nm/5 nm band
  - 777.4 nm/5 nm band
  - 1 M-pixel
  - 400 m resolution
  - 12 frames/sec
  - e2v CCD with on-chip amplification

- Event detection
- Cross-trigger to/from MXGS

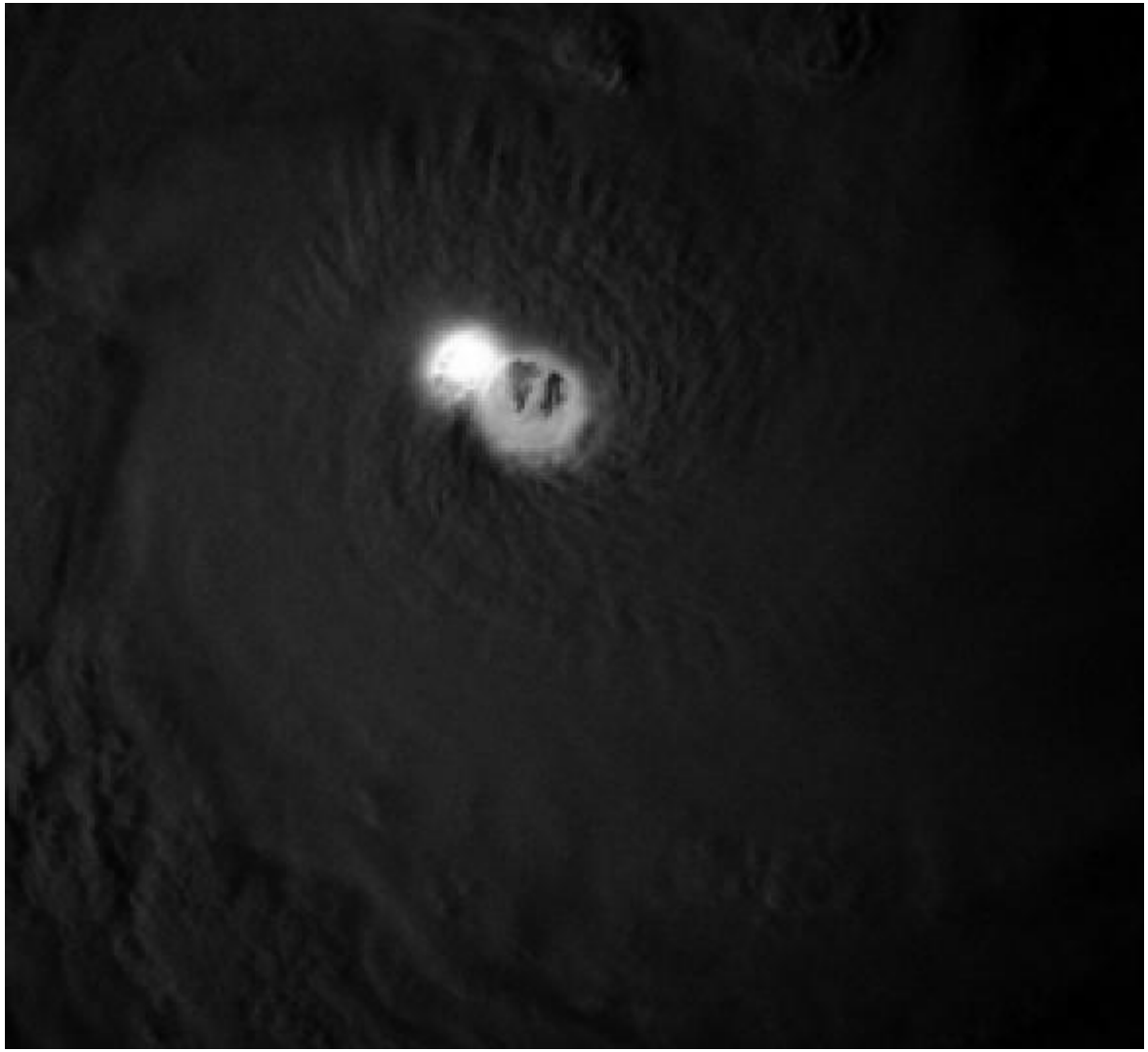


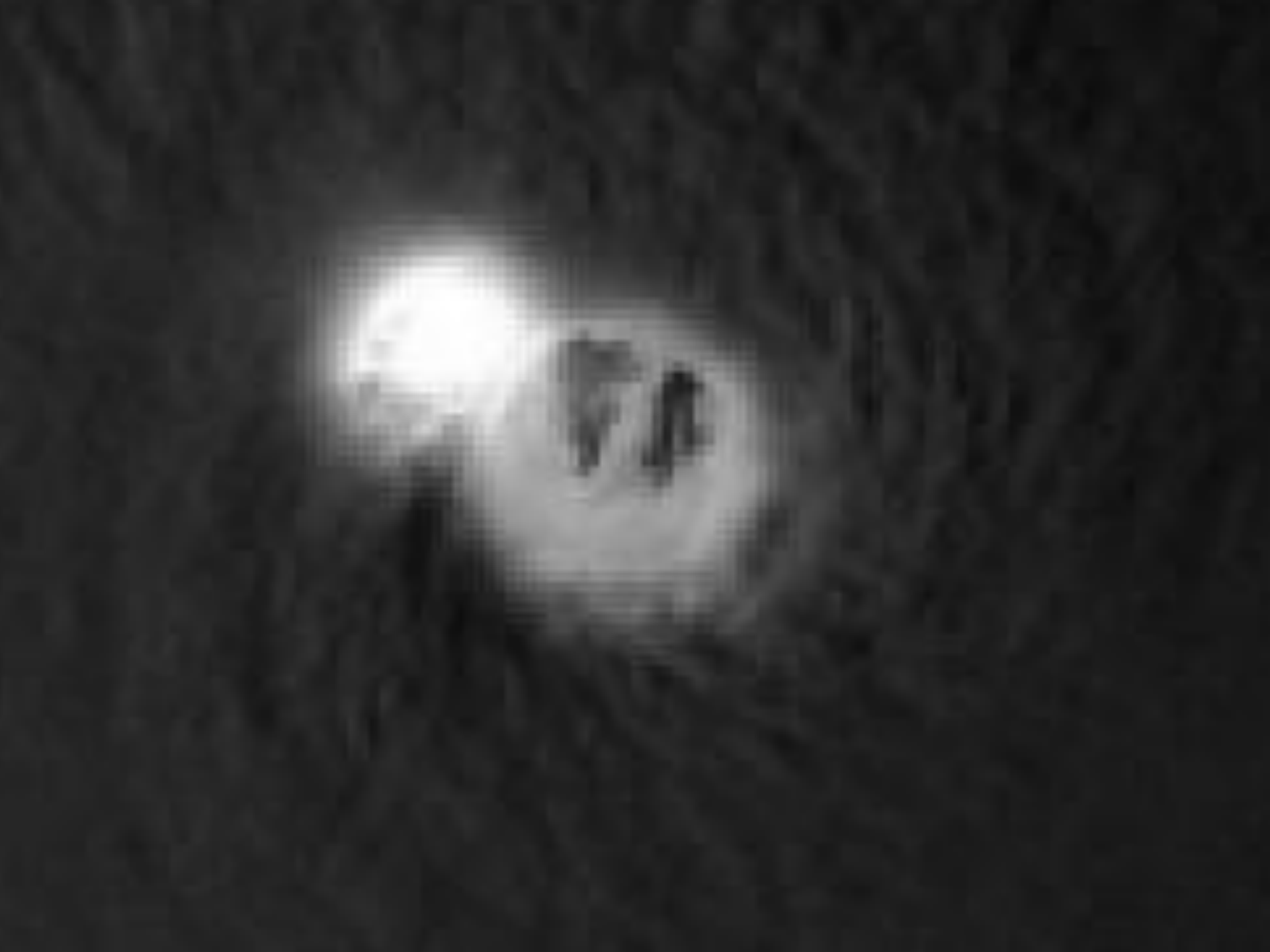
MMIA photometer



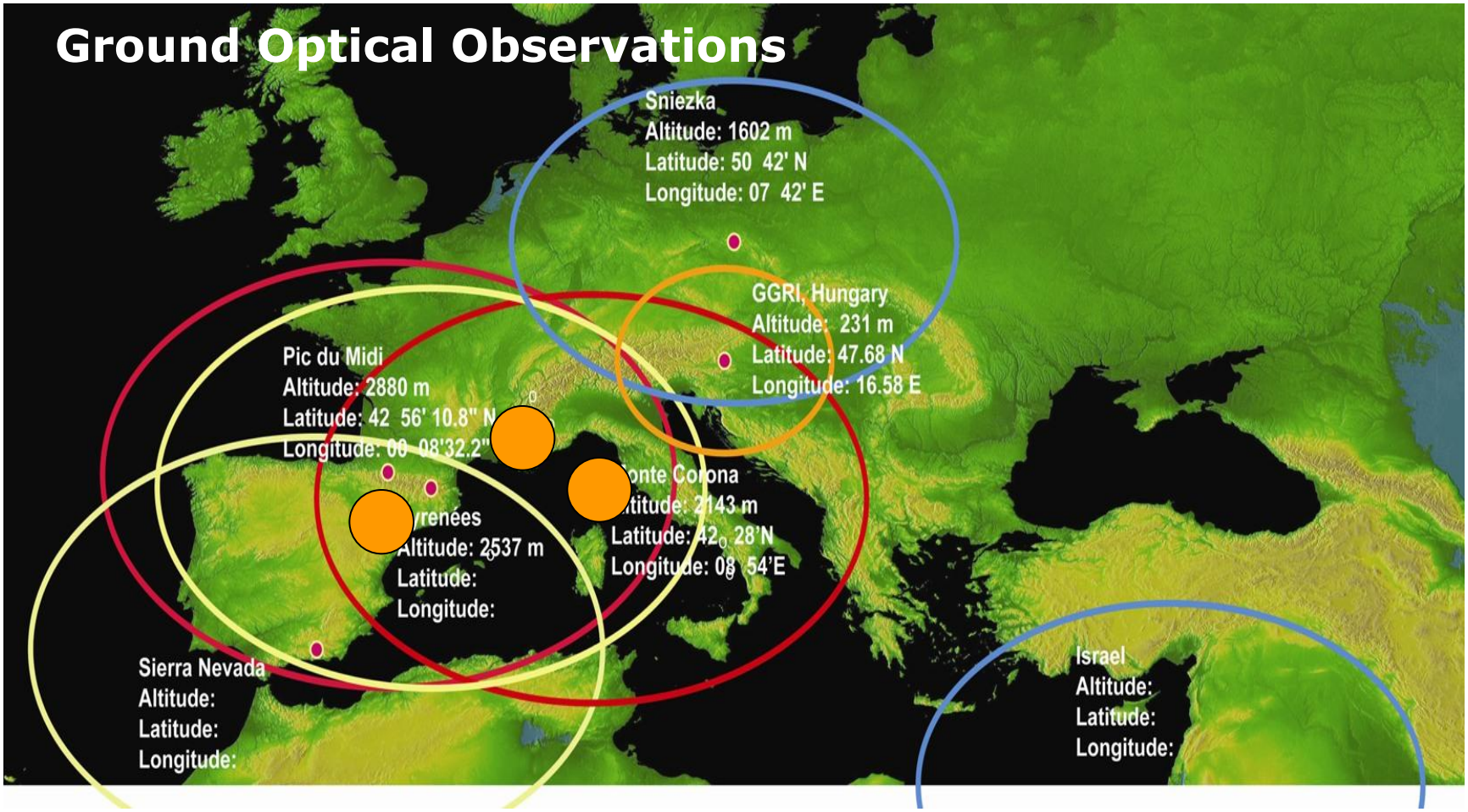
MMIA camera

- m





Ground Optical Observations



The ASIM Consortium

- Terma
  - DTU Space; Denmark
  - University of Bergen, Norway
  - Space Research Institute, Poland
  - University of Valencia, Spain
  - Carlo Gavvazzi, Italy
- Facility Science Team
  - Torsten Neubert, Chair (DTU Space)
  - Elisabeth Blanc (CEA)
  - Victor Reglero (University of Valencia)
  - Nikolai Østgaard (University of Norway)
- ASIM International Science Team of ~80 groups internationally

Overview

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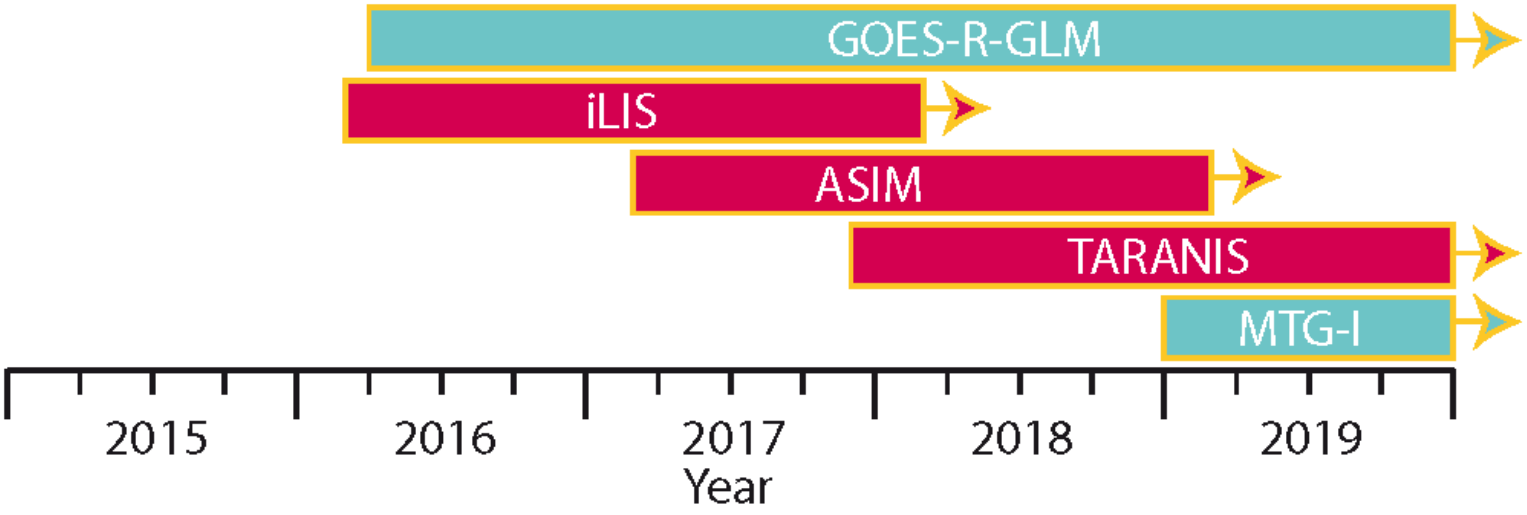
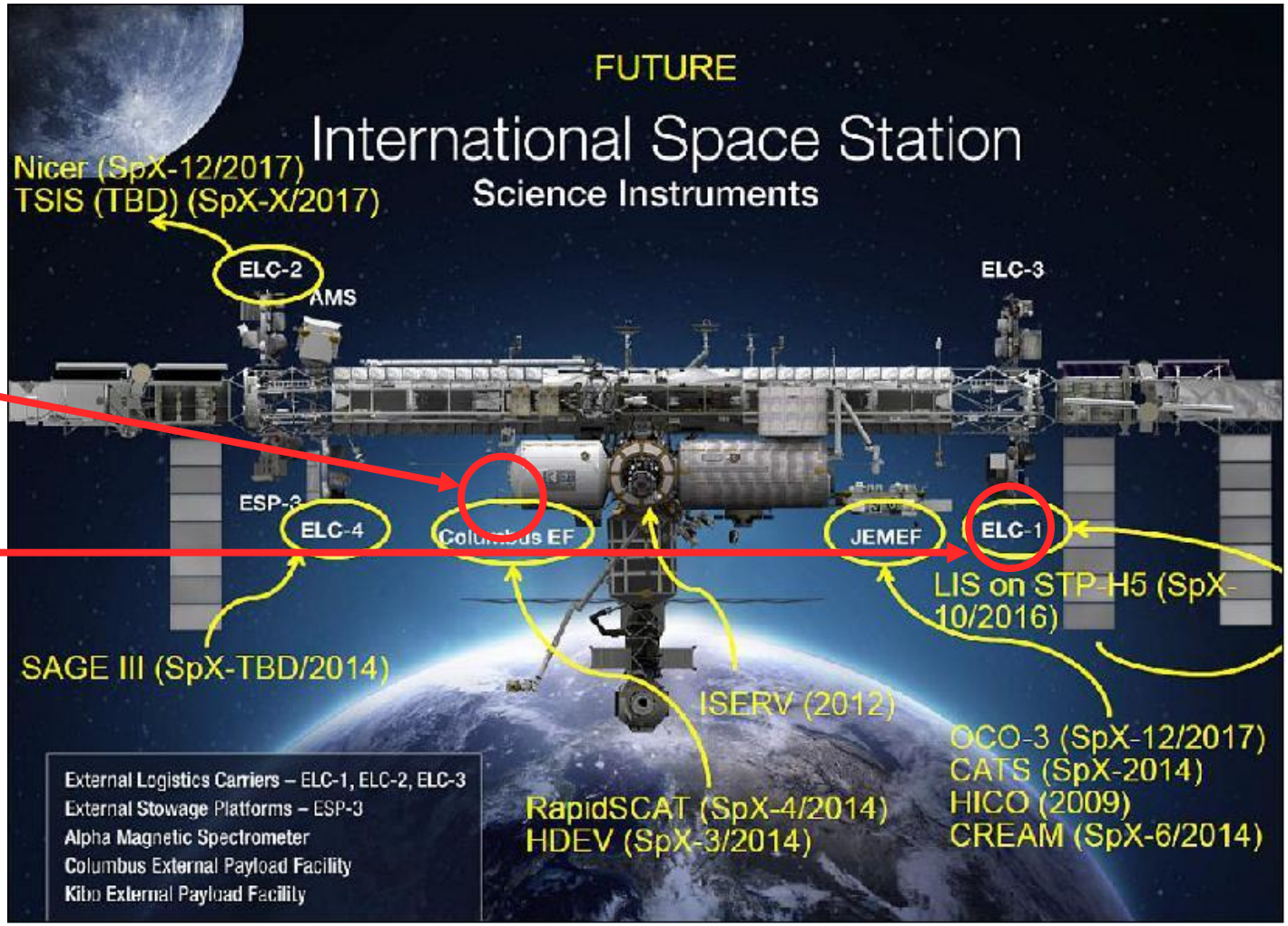
The opportunities: the other space missions

- Next years will see significant space infrastructure for studies of electric storm processes



- ASIM will be on the ISS with iLIS

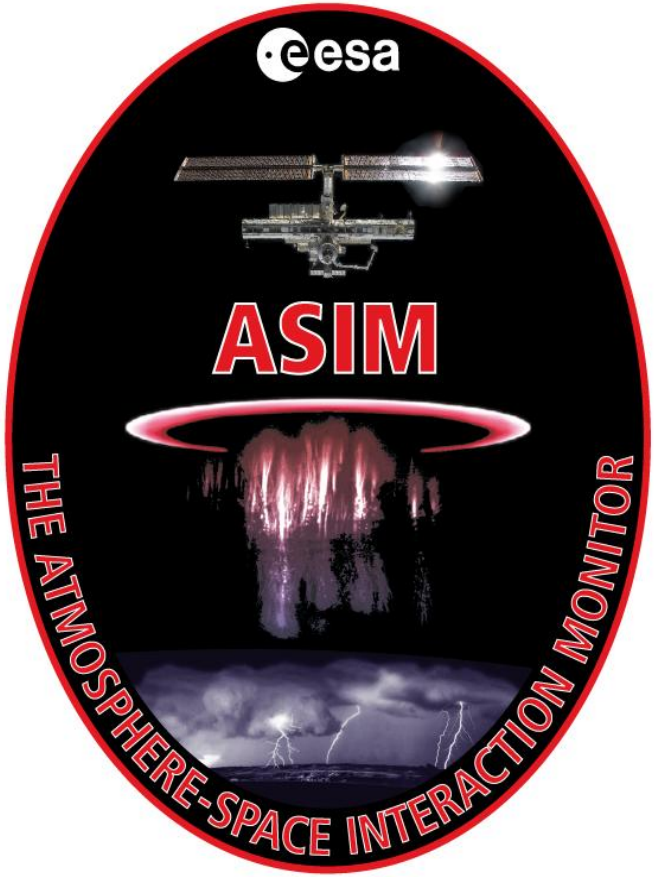
ASIM and LIS on the ISS



The ASIM Context – summary

- **ASIM will be launched in a very strong context:**
  - **Other complementary missions**
  - **New sensors for on-ground measurements**
  - **New generation of simulation codes and models**
- **Many international collaborators are preparing for the mission**
- **ASIM of use for GLM and LI?**
  - **iLIS and ASIM complementary w. one band in common (777.4nm)**
  - **Cross-correlate ASIM/MMIA and iLIS**

FIN



- Low-Energy Detector (LED)
  - 15-400 keV
  - CZT
  - Detector area: 1024 cm^2
  - Energy resolution < 10% at 60 keV
  - Angular resolution:
    - Point source < 0.7^o
    - Diffuse source < 2^o
- High-Energy Detector (HED)
  - 0.2-200 MeV
  - BGO
  - Energy resolution < 15% at 662 keV
- Event detection
- Cross-trigger to/from MMIA