

Space Weather Activities in Switzerland

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Reports



Space Research in
Switzerland
2012-2014

In preparation:
Space Research in
Switzerland
2015-2017

Reports

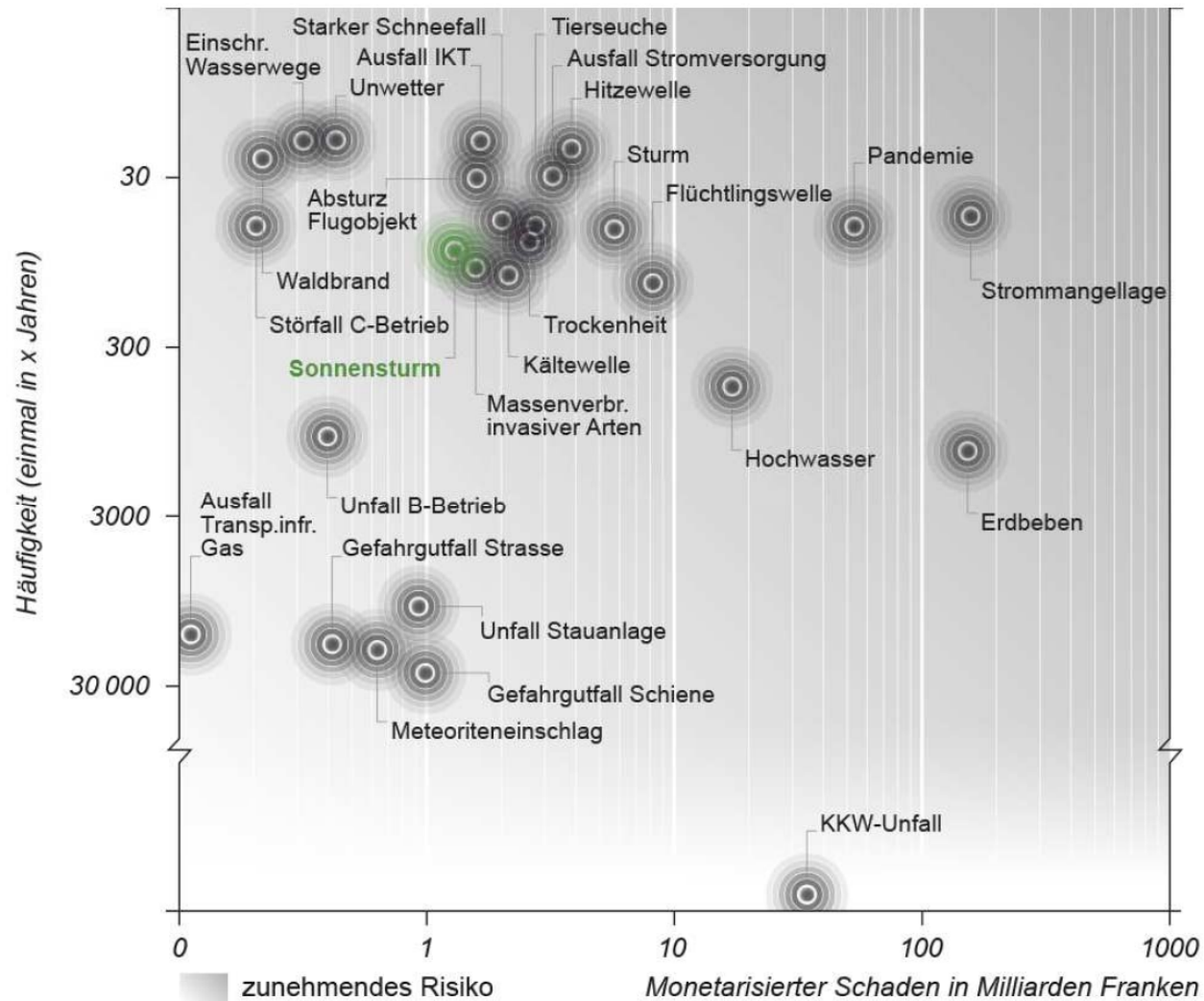


Analysis of
Natural and Societal
Threats in
Switzerland

Regular Revisions

First time:
Topic of Solar Storm
has been included

Analysis of Space Weather Threat



Outline of Swiss Activities

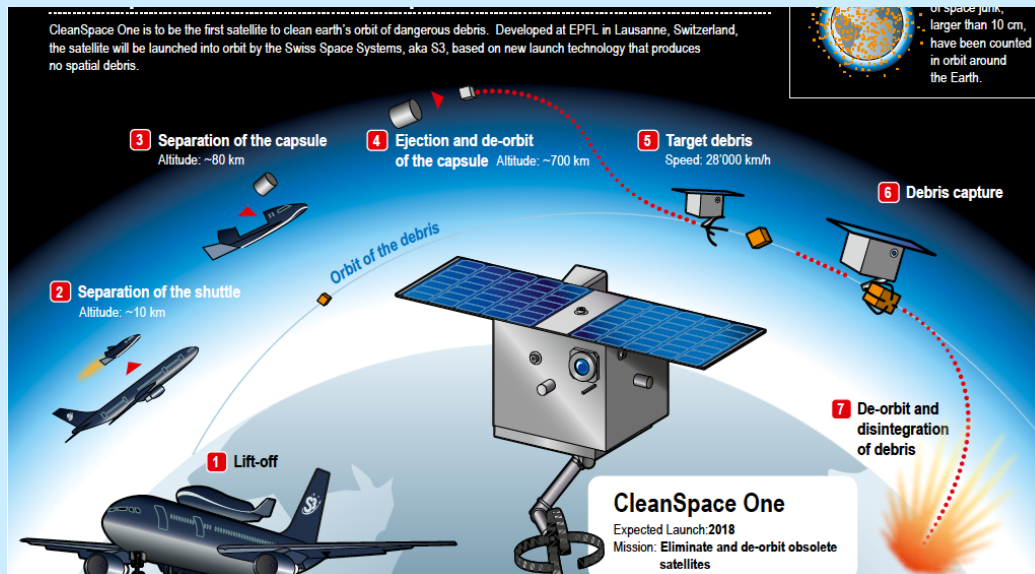
- ESA SSA:
 - Space Surveillance and Tracking (SST): watching for active and inactive satellites, discarded launch stages and fragmentation debris orbiting Earth
 - Space Weather (SWE): monitoring conditions at the Sun and in the solar wind, and in Earth's magnetosphere, ionosphere and thermosphere, that can affect spaceborne and ground-based infrastructure or endanger human life or health
- Research Projects
- Nowcast of Earth's atmosphere

Monitoring Space Debris

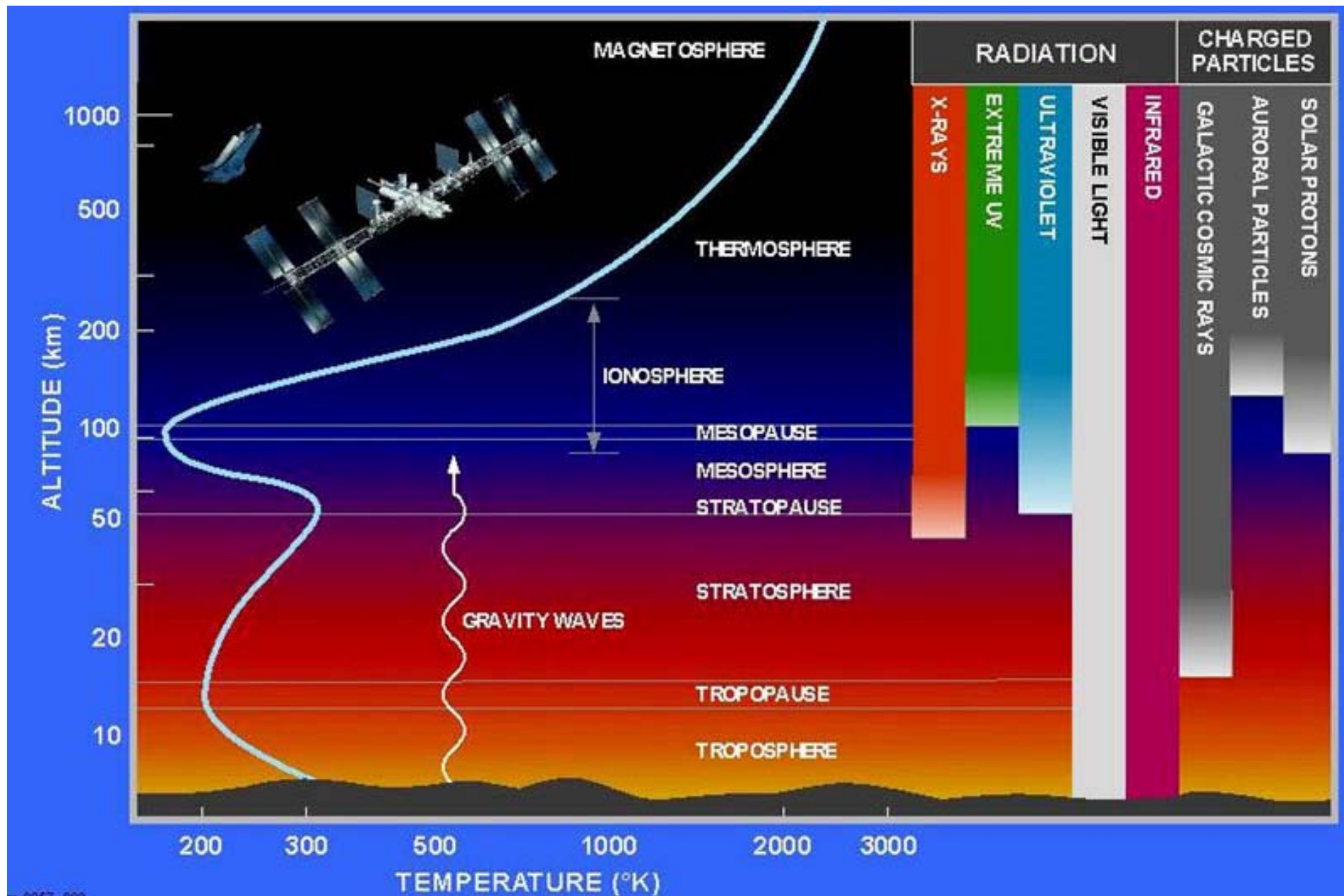


- Zimmerwald observatory
- Laser beam transmitted from the 1-meter Zimmerwald Laser and Astrometry Telescope (ZIMLAT)
- measure high accuracy distances of artificial satellites

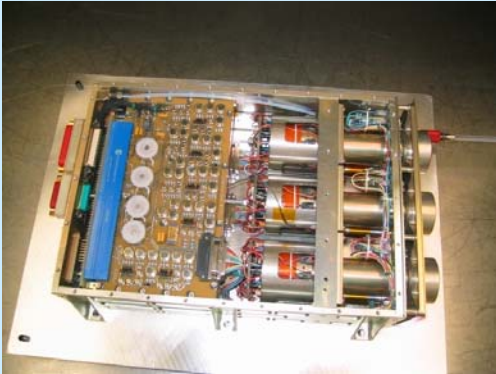
CleanSpace One: Space Debris



- EPFL, Lausanne
- CleanSpace One will de-orbit space junk
- After ejection from the launch vehicle propulsion maneuvers will be performed (radar and GPS)
- Approach manoeuvres will be performed based on optical or radar technologies
- Launch 2018



LYRA onboard PROBA-2

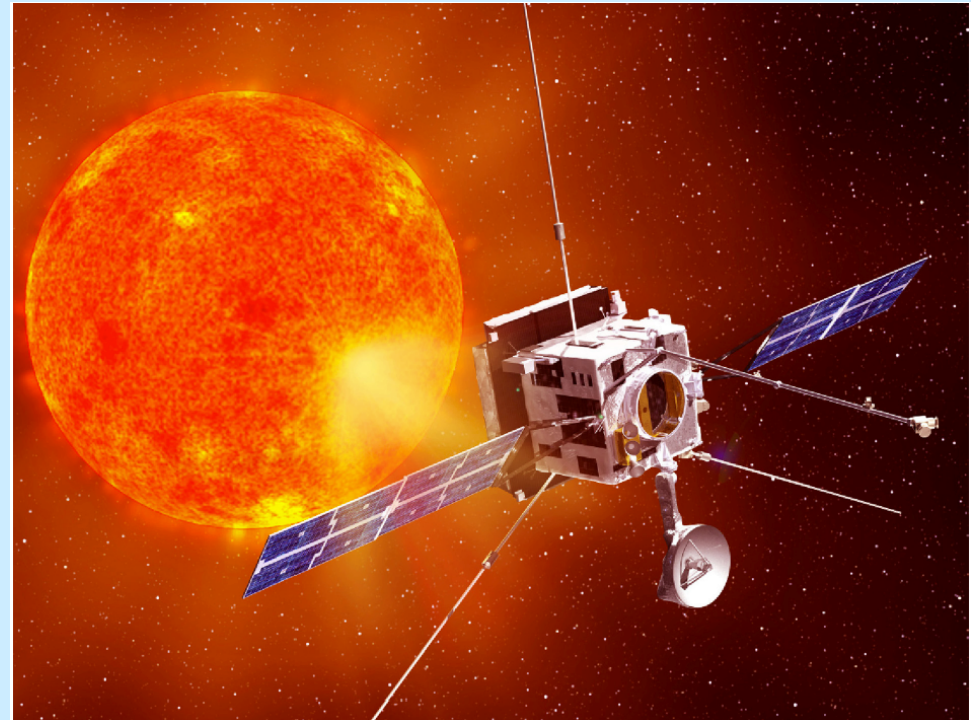


- LYRA developed and built at PMOD/WRC
- Measures the solar EUV/UV radiation
- Onboard PROBA-2 Mission
- Launch date: 2009
- operational since then

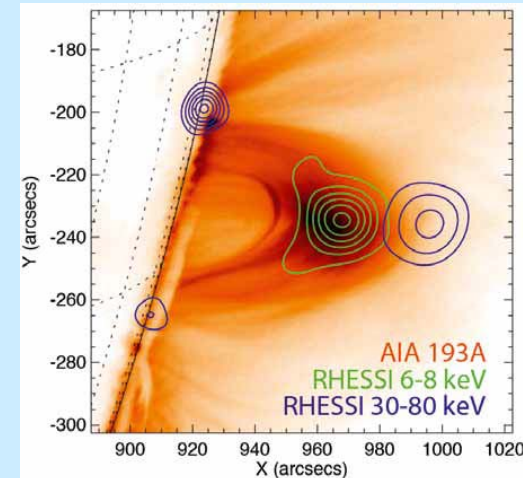
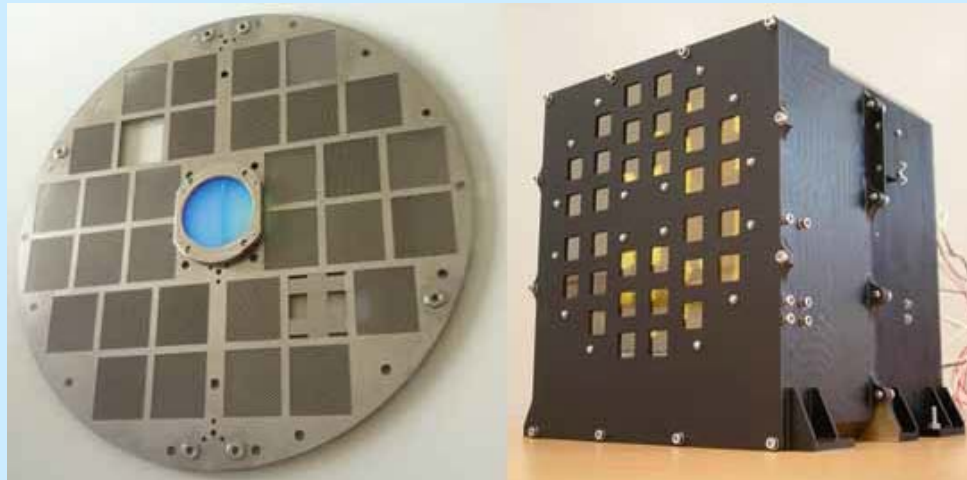
Swiss involvement in the ESA/NASA Mission Solar Orbiter



- ESA M-Class Mission to study the link of the Sun and formation heliosphere
- 10 instruments: remote sensing and in-situ
- Launch 2018
- **Extra-ordinary orbit:**
 - Out of ecliptic orbit
 - 0.3 AU



STIX on Solar Orbiter



Krucker & Battaglia (2014)

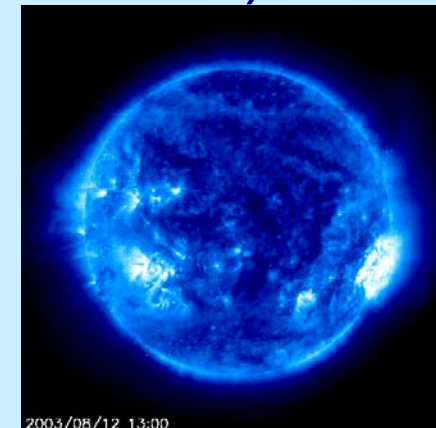
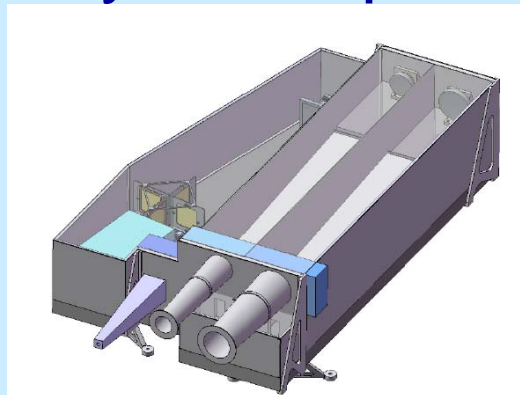
- STIX is a Swiss-lead instrument, PI. Sam Krucker
- Through hard X-ray imaging and spectroscopy
- STIX will provide information of heated (> 10 MK) plasma and accelerated electrons produced as magnetic energy is released during solar flares

EUI on Solar Orbiter

- *Extreme UV Imager (EUI)* onboard Solar Orbiter
- Belgium-lead instrument: PI Pierre Rochus, CSL
- Observation of the full solar disk and high-resolution images of selected areas
- 30.4nm, 17.4 nm, Lyman alpha (121.6nm)



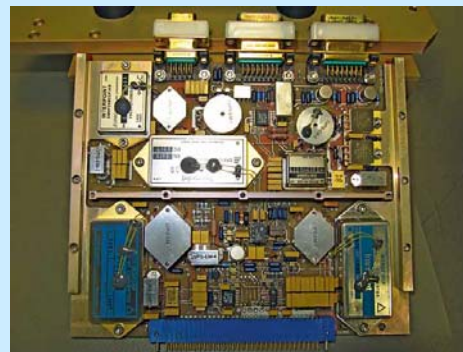
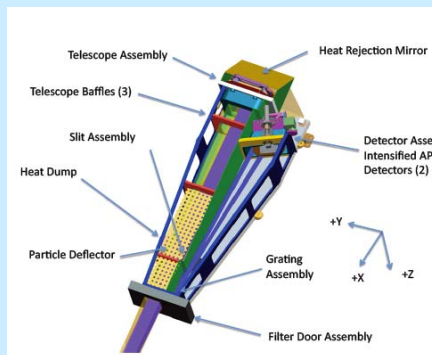
12th EUI Consortium Meeting
held 4–6 December 2013



SPICE onboard Solar Orbiter

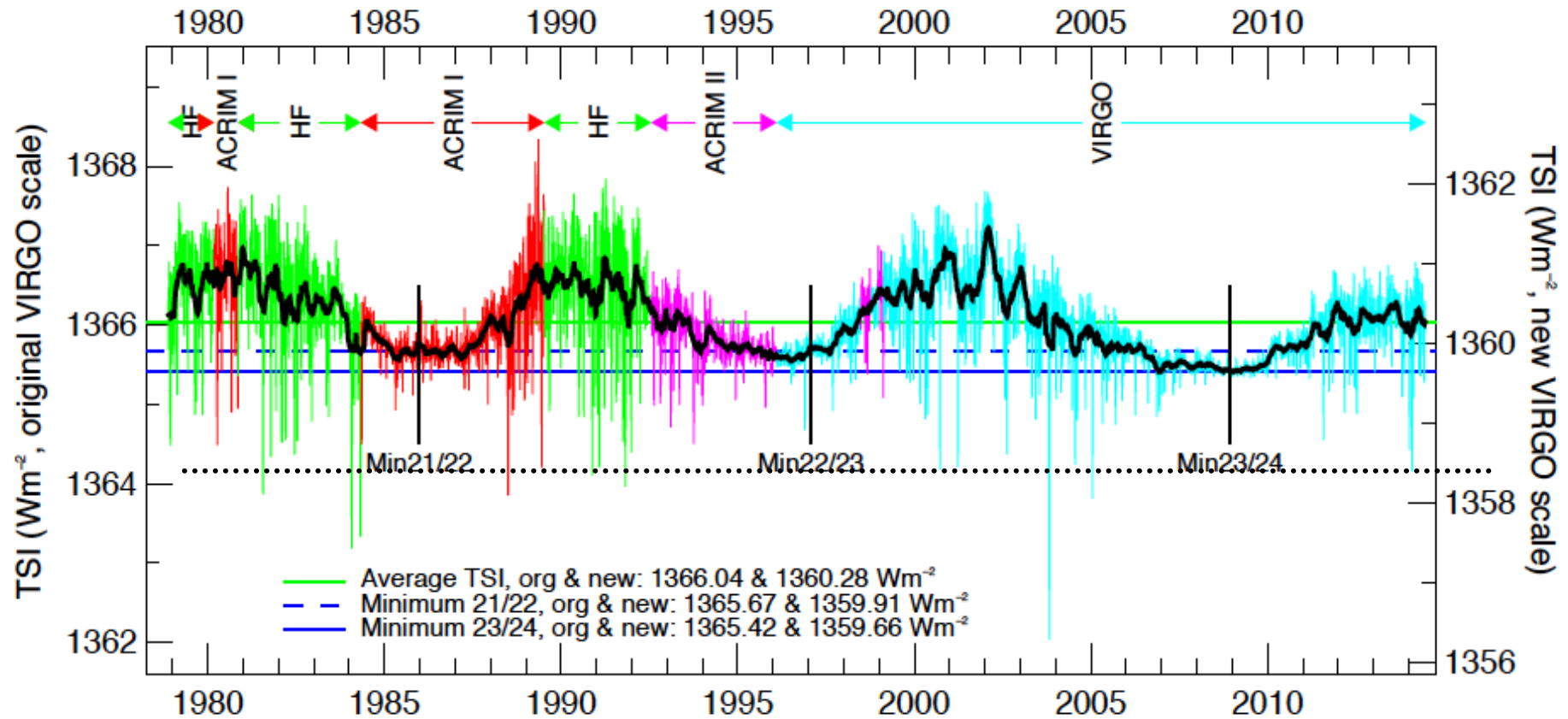


- *Spectral Imaging of the Coronal Environment (SPICE)* spectrograph
- ESA facility Instrument
- Improve our understanding of the parameters and dynamic in the solar atmosphere
- Detailed observation of spectral lines in the EUV





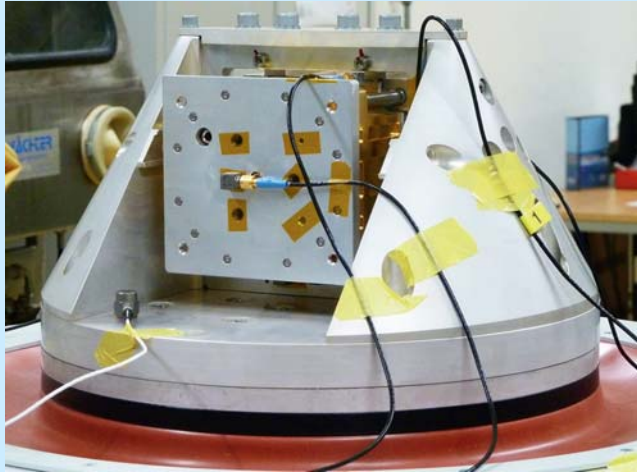
Solar Activity – Total Solar Irradiance



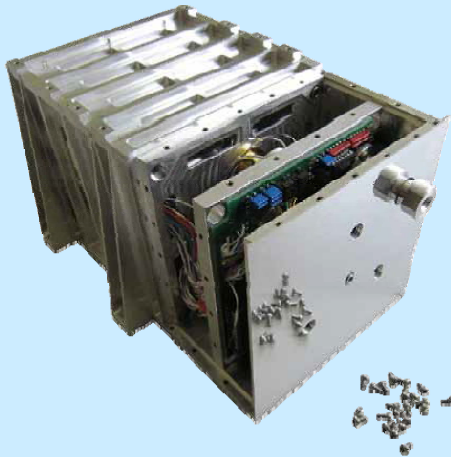
Claus Fröhlich

<http://www.pmodwrc.ch/pmod.php?topic=tsi/composite/SolarConstant>

Monitoring of TSI – Total Solar Irradiance



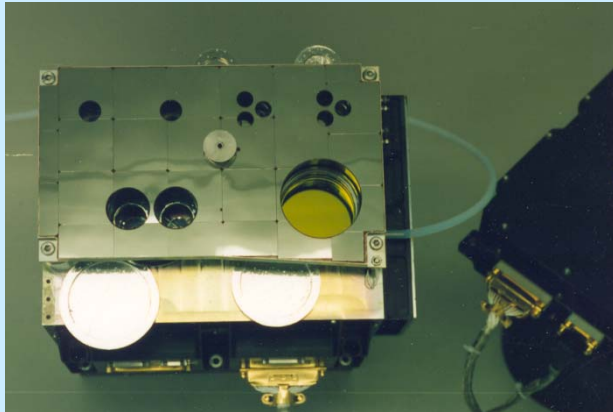
- CLARA on NORSAT-1
- Monitoring of Total solar irradiance
- Instrument is placed NORSAT-1
- Instrument is delivered
- Launch 2016



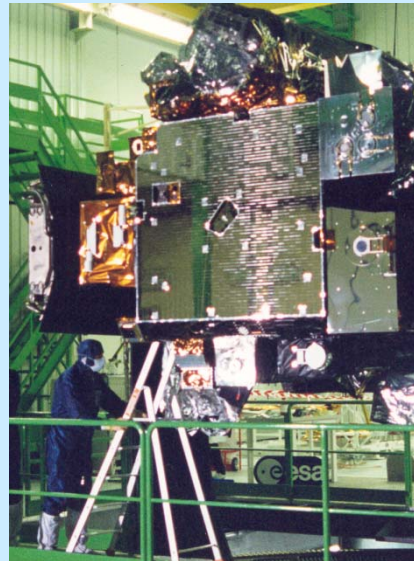
- DARA onboard PROBA-3
- Instrument is placed on the occulter of the coronagraph ASPIICS
- Launch 2018

VIRGO Instrument auf SOHO

Variability of solar IRadiance and Gravity Oscillations



**VIRGO
Experiment**



**SOHO
(Satellit)
Integration**



**Start
1995/12/02**



SOLID

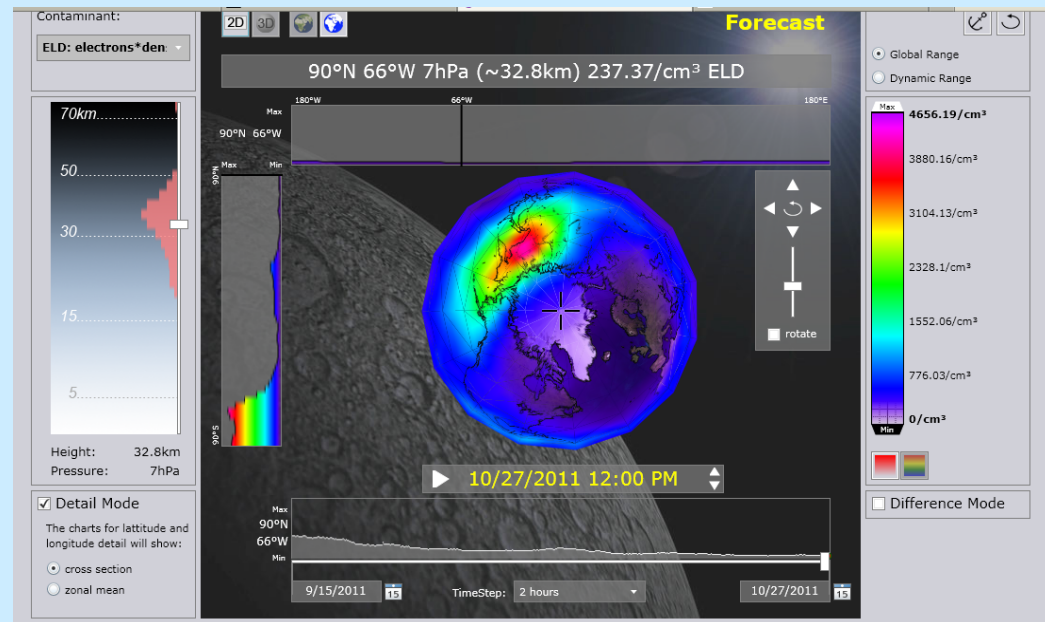
- FP7 SPACE Project SOLID 313188, Collaborative project
- Project Coordinator: PMOD/WRC, Prof. Werner Schmutz/Margit Haberreiter (Project Manager)
- 10 Beneficiaries, 1 Collaborator
- Start: 1 December 2012
- Duration: 3 years

No	Name	Short name	Country
1	SCHWEIZERISCHES FORSCHUNGSINSTITUT FUER HOCHGEBIRGSKLIMA UND MEDIZIN IN DAVOS	PMOD-WRC	Switzerland
2	CENTRE NATIONAL DE LA RECHERCHE SCIENTIFIQUE	CNRS	France
3	KONINKLIJKE STERRENWACHT VAN BELGIE	ROB	Belgium
4	UNIVERSITY OF BRADFORD	UNIBRAD	United Kingdom
5	UNIVERSITAET BREMEN	UBre	Germany
6	IMPERIAL COLLEGE OF SCIENCE, TECHNOLOGY AND MEDICINE	Imperial	United Kingdom
7	MAX PLANCK GESELLSCHAFT ZUR FOERDERUNG DER WISSENSCHAFTEN E.V.	MPG	Germany
8	ISTITUTO NAZIONALE DI ASTROFISICA	INAF	Italy
9	THE CHANCELLOR, MASTERS AND SCHOLARS OF THE UNIVERSITY OF CAMBRIDGE	UCAM	United Kingdom
10	ARISTOTELIO PANEPISTIMIO THESSALONIKIS	AUTH	Greece



Now-Casting of the Earth's Atmosphere

- Collaboration between PMOD/WRC and FHNW
- PMOD/WRC provides die nowcast and the 2D and 3D Visualization of the Earth's atmosphere
- Every 2 hours
- Parameters studied:
 - O₃, NO, NO₂, OH, H₂O density, electrons and proton density, temperature



<http://projects.pmodwrc.ch/lyra>

FLARECAST: a new H2020 Space Weather Project

Flare Likelihood and Region Eruption Forecasting

FLARECAST

Main goals

- Understanding the drivers of flare activity **and improving flare forecasting**
- Provide highly accurate, **near real-time flare-forecasting** services
- Providing a **globally-accessible flare prediction service** that facilitates expansion
- **Engaging** with space-weather end users and informing policy makers and the public
- Coordinated by Greece, Swiss Involvement

- 2015: Foundation of the Swiss National Committee
- 2016: First Swiss SCOSTEP Workshop Oct 4/5, International Space Science Institute Bern, Switzerland
- Strengthen the synergies in research related to Solar-Terrestrial Physics