



Schweizerische Eidgenossenschaft  
Confédération suisse  
Confederazione Svizzera  
Confederaziun svizra

Federal Department of Economic Affairs,  
Education and Research EAER  
**State Secretariat for Education,  
Research and Innovation SERI**

Swiss Confederation

# Switzerland in Space

Dr. Renato Krpoun

**Swiss Space Office**

Observatoire de Genève | 23 May 2018

# Role of the Swiss Space Office

The Swiss Space Office is part of the State Secretariat for Education Research and Innovation (SERI), its role is to

- prepare and implement the Swiss Space Policy
- represent Switzerland in the ESA Council and its subordinate bodies
- implement the complementary national activities
- coordinate space activities at Federal level
- point of contact for industry and academia in Switzerland





# Swiss Space Policy

## 3 Pillars

- Development and utilization of space infrastructures of space applications and services
- Sustainable engagement in space research and exploration
- Switzerland – a competitive and reliable partner

Switzerland safeguards its national interests through targeted cooperation, mainly through its participation in ESA Programs and other European or international activities



# Swiss Space Budget in R&D

Budget 2018: ~ 156 Mio EUR

- 95% ESA
- 5% Complementary National Activities



Participation in ESA secures for Switzerland:

- Access to procurements
- Access to data
- International collaboration



# Main Swiss Actors

## Academic Expertise

- > 10 Science- and technical institutes involved in science
- Academic and industrial capabilities to develop complex scientific instruments

## Industry

- Roughly 70 industrial partners
- 4 Main actors: RUAG Space, APCO Technologies, Thales Alenia Space and ViaSat
- Most visible domains: scientific instruments, atomic clocks, payload fairings, optical communication, high precision mechanisms, spacecraft structures

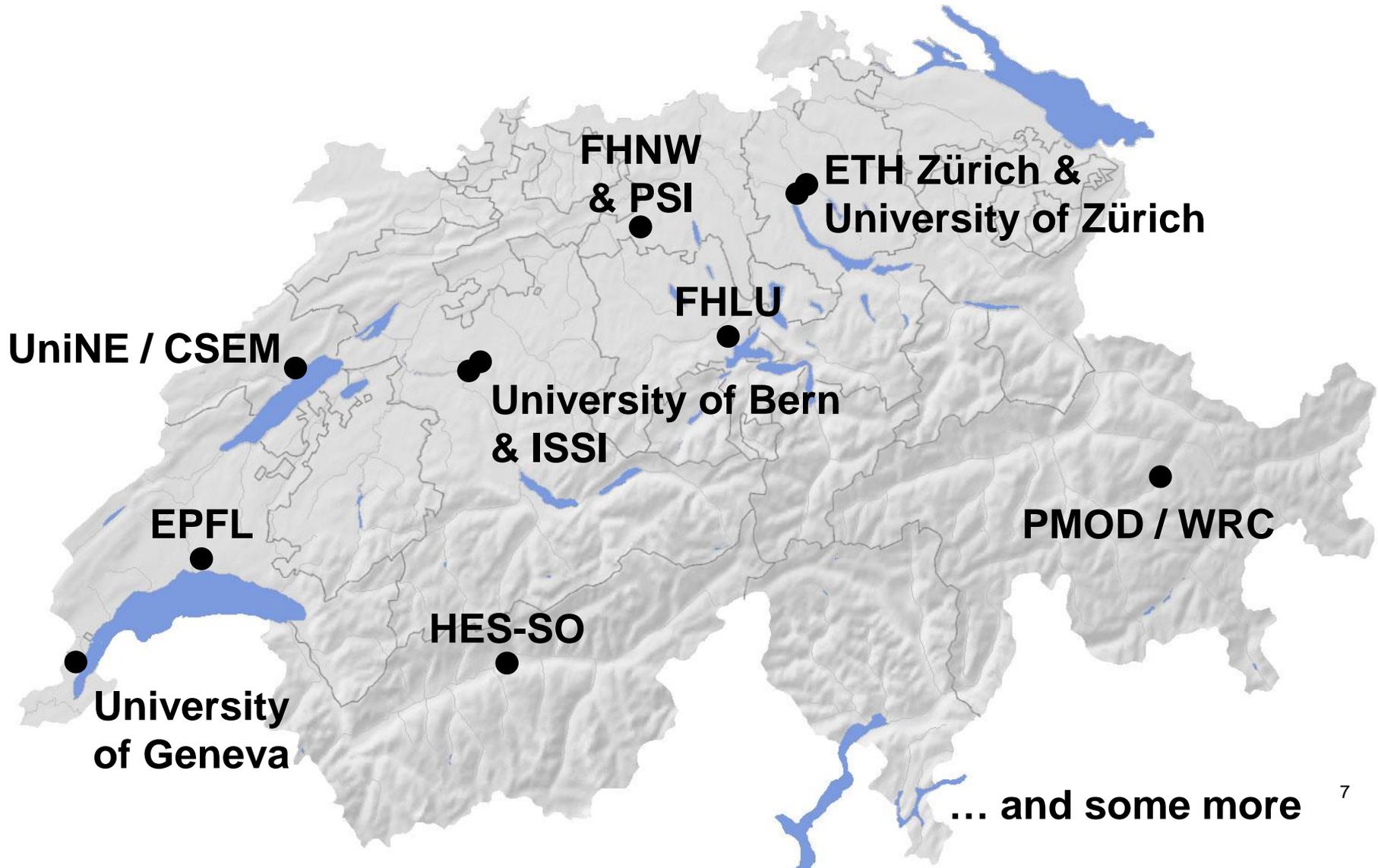


# Impressions





# Main University Actors in Space and Earth Sciences

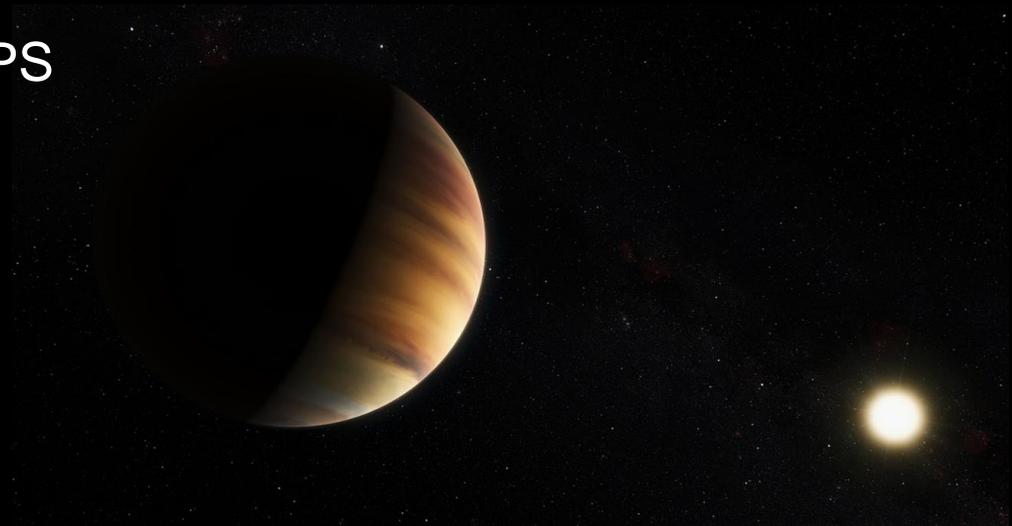




# Scientific Highlights

## ExoPlanets

- Swiss track record in Planetary Formation and ExoPlanet research
- Ground-based Instrument: HARPS and HARPS-N ... and now ESPRESSO
- National Centre of Competence in Research PlanetS «PlanetS» on national level
- upcoming: CHEOPS



# CHEOPS

## CHaracterizing ExOPlanet Satellite

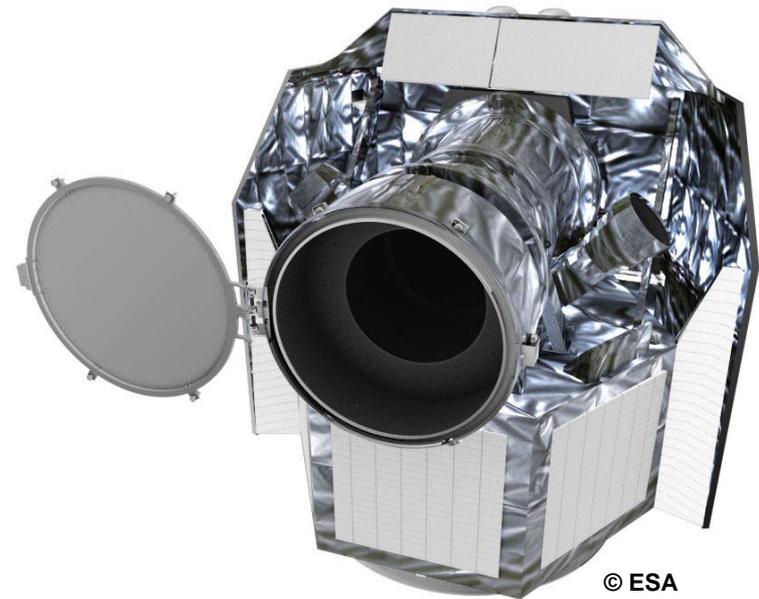
*u<sup>b</sup>*

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- First ESA S-Class
- Mission under Swiss scientific leadership.
- Launch in early 2019



Telescope: University of Bern

Scientific Ground Segment: University of Geneva

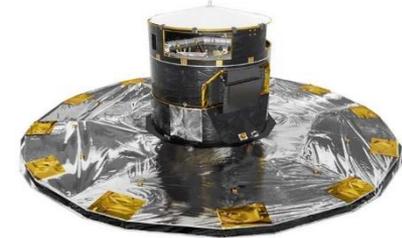


# Scientific Highlights

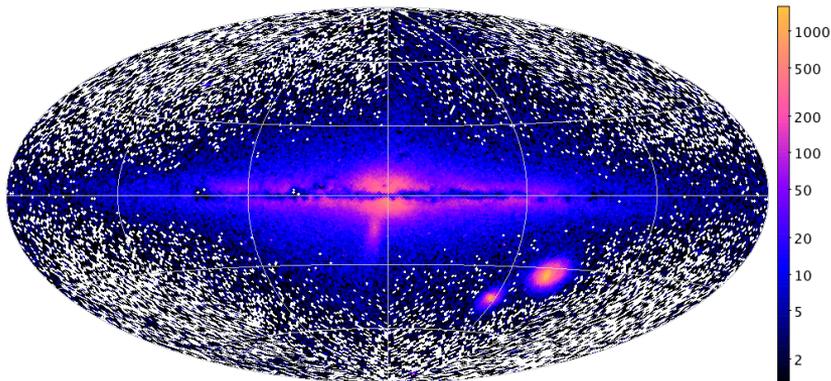
## GAIA CU7 Variable stars

### Data Release 2

- 550'737 variable stars
- entire sky covered
- astrometry & photometry included in analysis

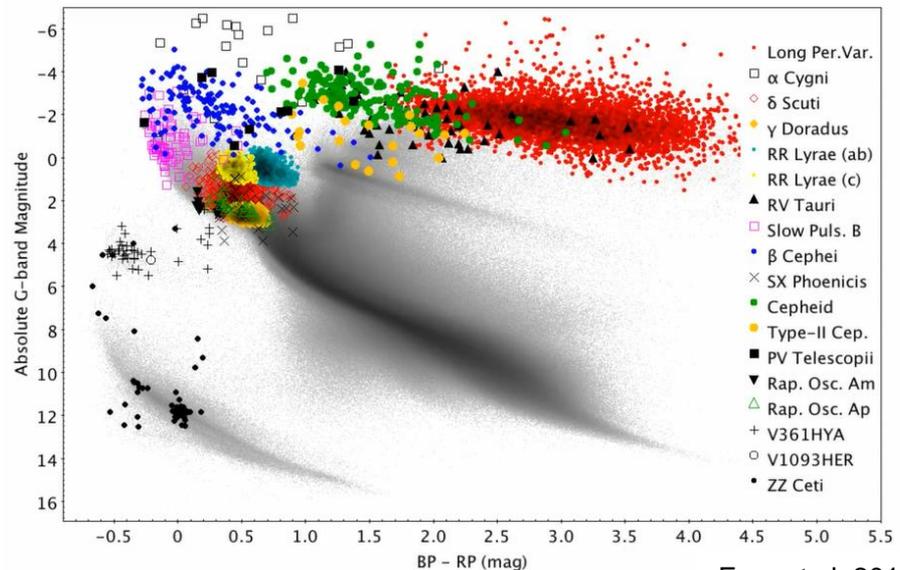


### Sky source densities



Classif.: ALL

Holl et al. 2018



10

Eyer et al. 2018

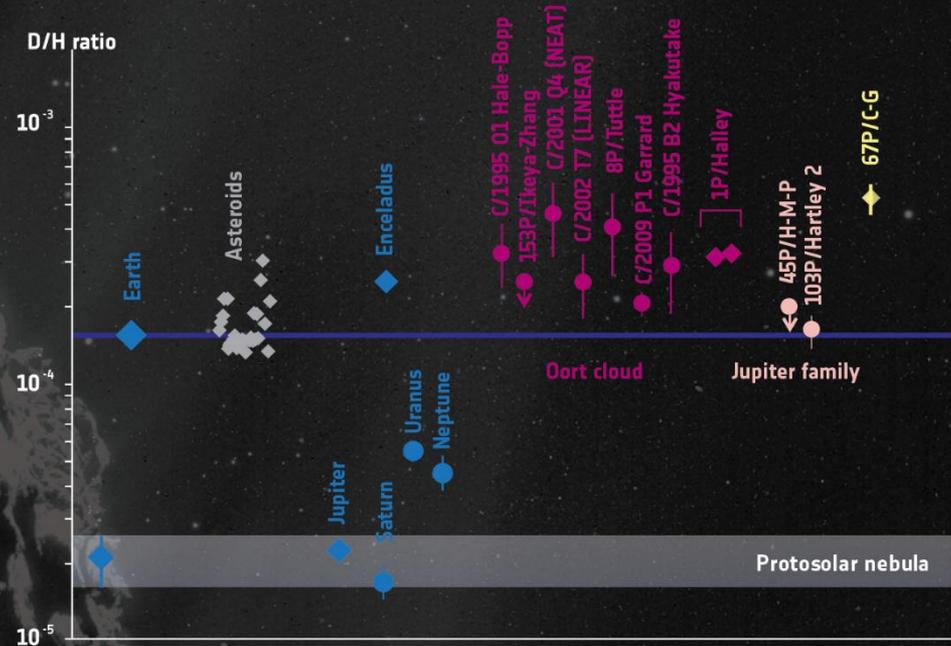
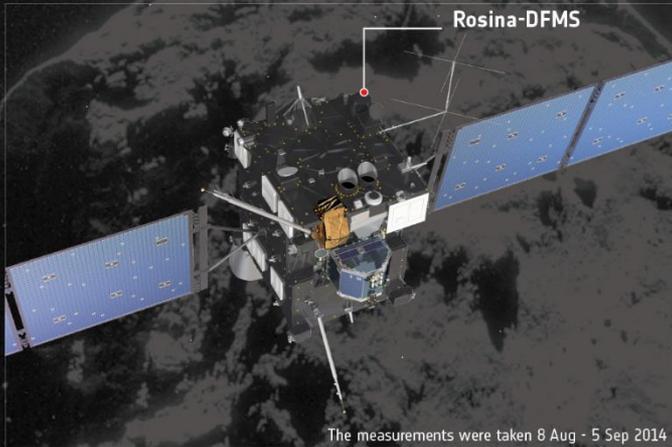


# Scientific Highlights Rosina Rosetta

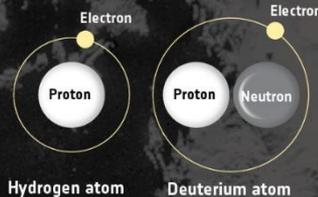
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Rosetta's ROSINA instrument finds  
Comet 67P/Churyumov-Gerasimenko's  
water vapour to have a significantly  
different composition to Earth's oceans.



The ratio of deuterium to hydrogen in water is a key diagnostic to determining where in the Solar System an object originated and in what proportion asteroids and comets may have contributed to Earth's oceans



D/H ratio for different Solar System objects, grouped by colour as planets and moons (blue), chondritic meteorites from the Asteroid Belt (grey), comets originating from the Oort cloud (purple) and Jupiter family comets (pink). Comet 67P/C-G, a Jupiter family comet, is highlighted in yellow. ◆ = data obtained in situ ● = data obtained by astronomical methods

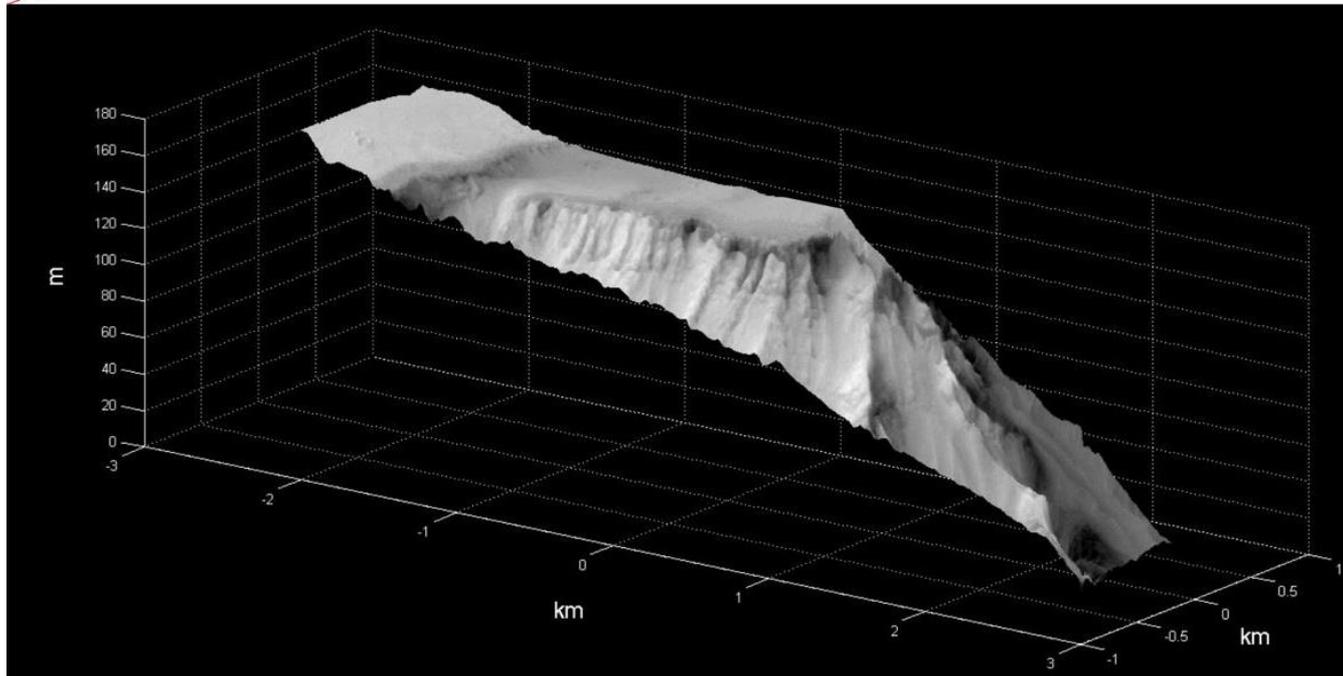
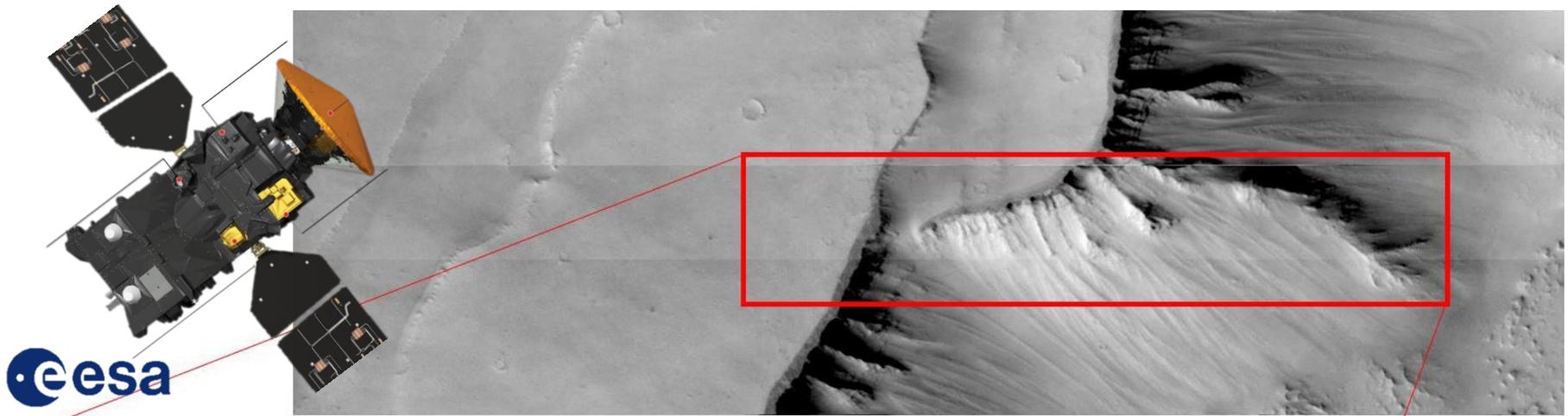


# Scientific Highlights

## ExoMars CaSSIS

*u<sup>b</sup>*

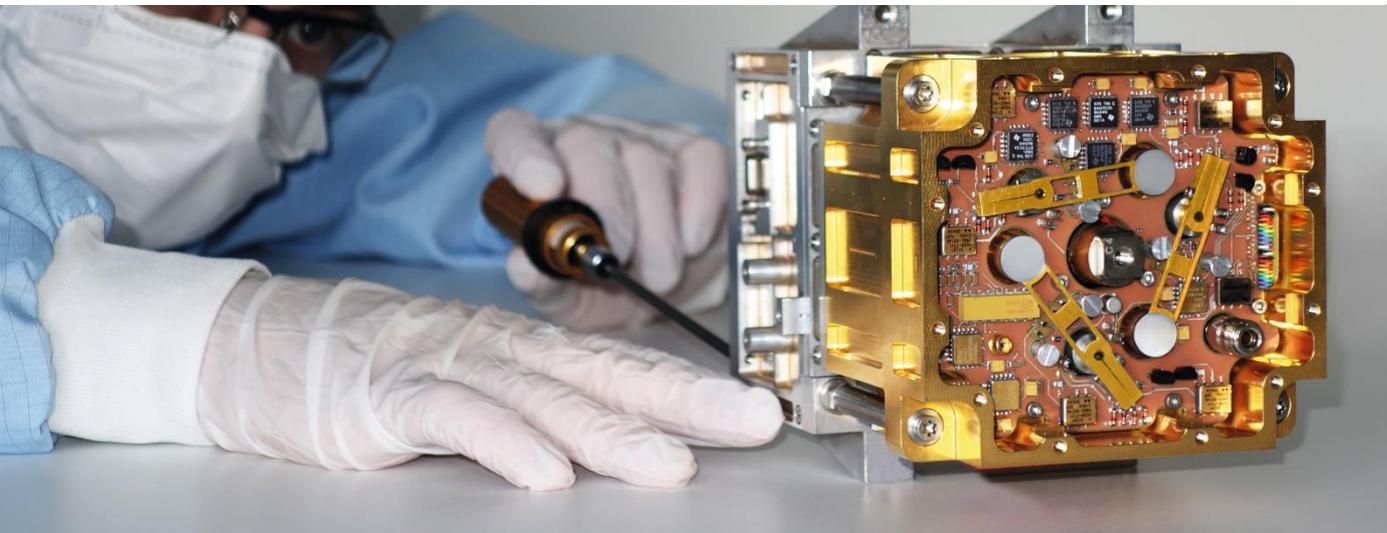
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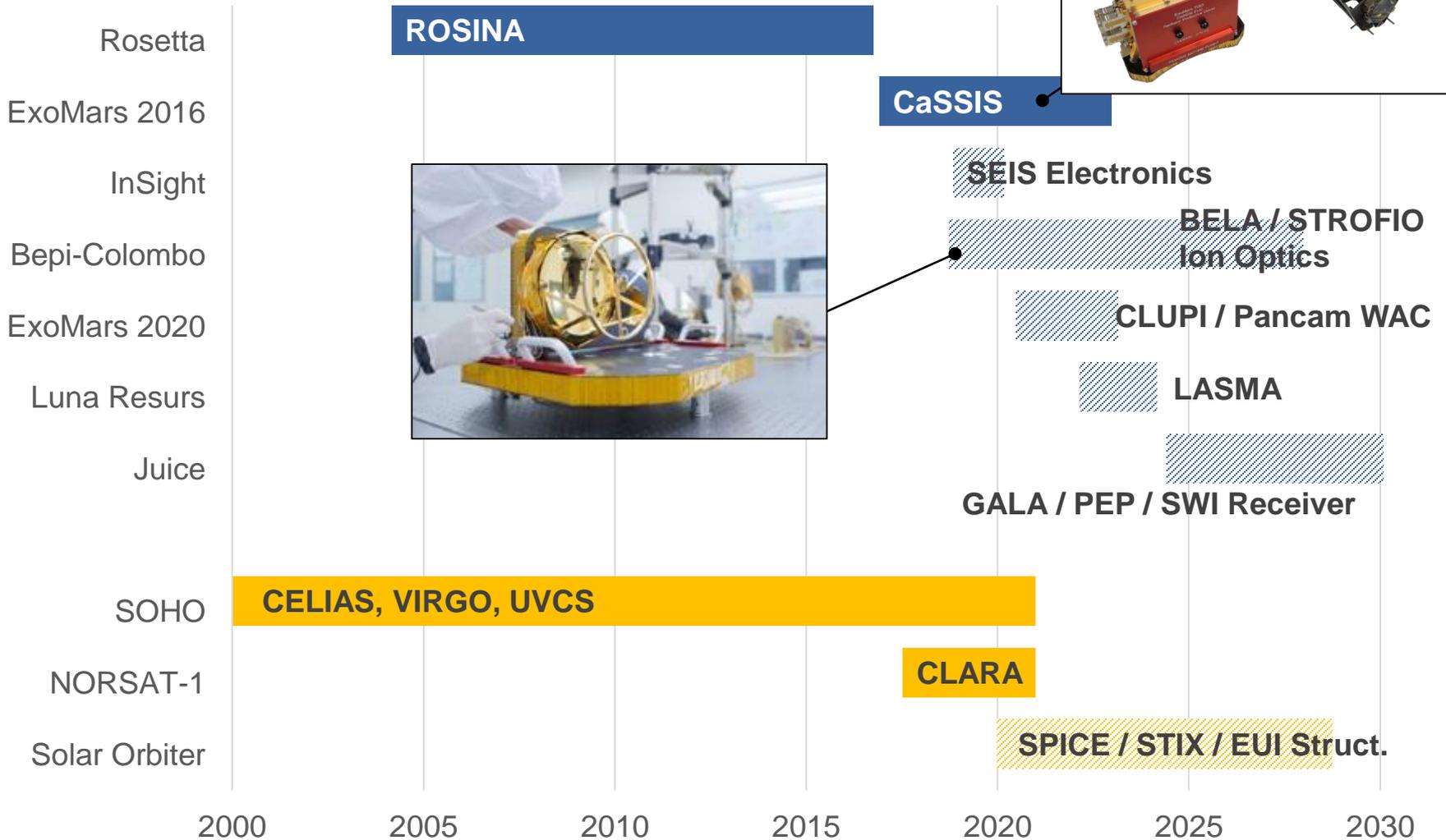
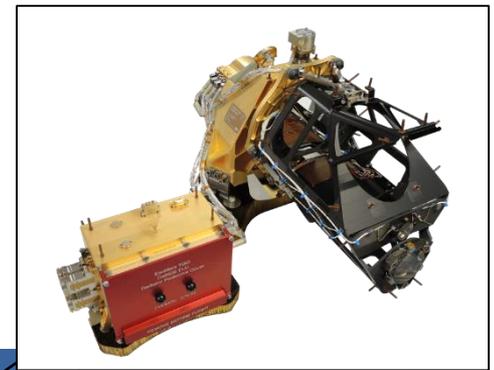
# CLARA on Norsat-1

- Compact Lightweight Absolute Radiometer (CLARA) will monitor the Sun's energy input to the Earth in the coming years through measurement of the Total Solar Irradiance (TSI)
- Launch on Norsat-1 in July 2017
- Future instrument DARA on PROBA-3



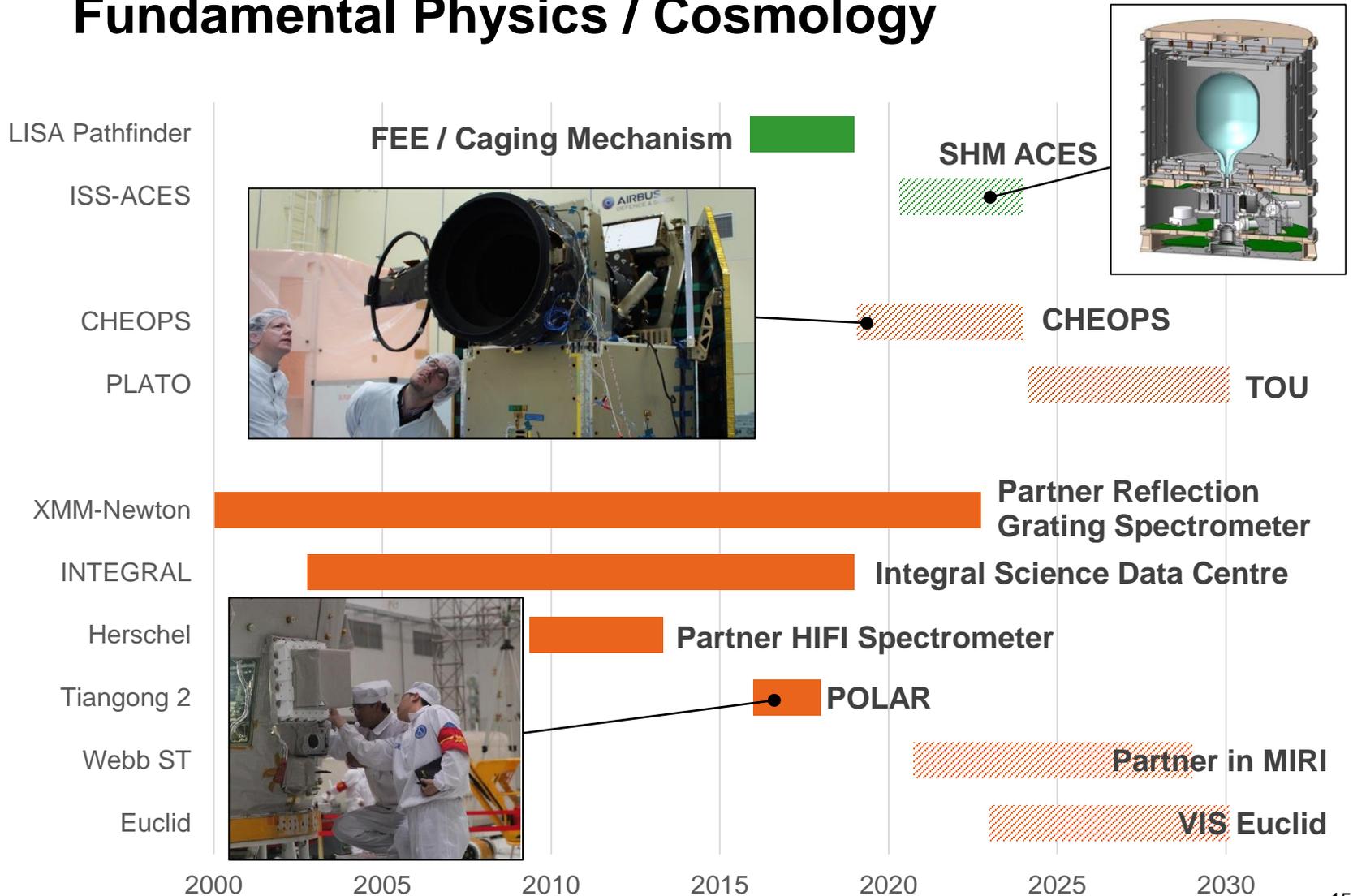


# Swiss Space Science Community Solar System & the Sun





# Astrophysics, Astronomy, Exoplanets and Fundamental Physics / Cosmology





# Conclusion

- Switzerland a competent and reliable partner in space with strong international orientation
- Over 50 years of heritage in space science and technology
- Competitive niche player in academia and industry with unique capabilities at global level
- Cultural focus on excellence and quality

