Space in Horizon 2020 (2014-2020)
Horizon Europe (2021-2027)

ESSC Plenary meeting “On-Line” 27 November 2020

Space Research, Innovation and Start-ups, DG DEFIS/B2
HORIZON 2020

European Union programme for research and innovation for 2014-2020
Priority 1
Excellent science
- European Research Council (ERC)
- Future and Emerging Technologies (FET)
- Marie Skłodowska-Curie Actions
- Research infrastructures

Priority 2
Industrial leadership
- Leadership in enabling and industrial technologies (LEIT)
  - Information and Communication Technologies (ICT)
  - Nanotechnologies
  - Biotechnology
  - Advanced manufacturing and Processing
  - Space
- Access to risk finance
- Innovation in SMEs

Priority 3
Societal challenges
- SC1 - Health, demographic change and well-being
- SC2 - Food security, sustainable agriculture and forestry, Marine, Maritime and Inland water research, and Bioeconomy
- SC3 - Secure, clean and efficient energy
- SC4 - Smart, green and integrated transport
- SC5 - Climate action, Environment, Resource efficiency and Raw materials
- SC6 - Europe in a changing world – Inclusive, Innovative and Reflective societies
- SC7 - Secure societies – Protecting freedom and Security of Europe and its citizens
HORIZON 2020

Opportunities in Priority 1
Excellent Science
The ERC offers…

INDIVIDUAL RESEARCHERS FROM ALL OVER THE WORLD
LONG TERM GRANTS
TO HIGH-RISK/HIGH-GAIN PIONEERING PROJECTS
IN ANY FIELD OF FRONTIER RESEARCH

- Life Sciences
- Physical Sciences and Engineering
- Social Sciences and Humanities
Marie Skłodowska-Curie Actions
HORIZON 2020

Opportunities in Priority 2

Space
H2020 PRIORITY 2: INDUSTRIAL LEADERSHIP

SPACE RESEARCH BUDGET IN HORIZON 2020

2014-2020

- Galileo/EGNOS: 29%
- Enabling Space Tech: 20%
- Copernicus: 16%
- Space entrepreneurship: 11%
- Access-to-space & IOD/IOV: 9%
- SST: 8%
- Science & Exploration: 4%
- SWE & NEO: 2%
- Other: 1%

1.479bn€
H2020 Priority 2: Industrial Leadership

Space Research

Maximising benefits of space for society and EU economy

- EO market uptake
- Copernicus mission and services evolution

- EGNSS market uptake
- EGNSS infrastructure, mission and services evolution

Space-EO

Space-EGNSS

Globally competitive and innovative space sector

- Technologies for European non-dependence and competitiveness
- Space robotics
- Electric propulsion
- Generic space technologies
- EO and SatCom technologies

- Scientific instrumentation and technologies for exploration
- Scientific data exploitation

Space-TEC

Space-SCI

Access to space & Secure and safe space environment

- Access to space
- In-Orbit-Demonstration/Validation (IOD/IOV)

- Space weather (SWE)
- Space traffic management (STM)
- Space Surveillance and Tracking (SST)
- Near Earth Objects (NEOs)

Space-TEC

Space-SCI

Space-BIZ

- Support to space hubs
- Space outreach and education
- EIC Horizon Prize on "Low cost Space Launch"
- InnovFin Space Equity Pilot (ISEP)
- SME-instrument
- FTI – Fast Track to Innovation

European Commission
Science and exploration
Funded projects by area

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<td>Project Group</td>
<td>UPWARDS</td>
<td>MIARD</td>
<td>PTAL</td>
<td>SBNAF</td>
<td>PPOSS</td>
<td>PLANMAP</td>
<td>ROADMAP</td>
<td>RADIOFOREGR</td>
<td>StarFormMapper</td>
<td>BeyondPlanck</td>
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**Sci 2014-2020 Calls for proposals**

- **Total EU contribution (M€):** 54.15

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*2 additional proposals in GAP NEMESIS and XMM2ATHENA not included on this slide*
Funded projects by area

- Understanding Planet Mars With Advanced Remote-sensing Datasets and Synergistic Studies
  - Multi-instrument analysis of Rosetta data – Establishing a new paradigm for cometary activity
  - Planetary Terrestrial Analogues Library
  - Small Bodies: Near and Far
  - Planetary Protection of Outer Solar System
  - Planetary Mapping
  - Ultimate modelling of Radio foregrounds: a key ingredient for cosmology
  - A Gaia and Herschel Study of the Density Distribution and Evolution of Young Massive Star Clusters
  - Beyond Planck - delivering state-of-the-art observations of the microwave sky from 30 to 70 GHz for the next decade
  - Exoplanet Atmosphere New Emission Transmission Spectra Analysis
  - Enabling Weak lensing Cosmology
  - Artificial Intelligence Data Analysis

Projects:
- UPWARDS
- MIARD
- PTAL
- SBNAF
- PPOSS
- PLANMAP
- RADIOFOREGRONUDS
- StarFormMapper
- BeyondPlanck
- ExoplanETS A
- EWC
- AIDA

Years: 2015-2024
**Funded projects by area**

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<th>Year</th>
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* proposals from the Reserve list in GAP
ROADMAP

Role and Impact of Dust and clouds in the Martian Atmosphere: from lab to space

- Improve our understanding of the Martian atmosphere, with focus on aerosols (dust and ice clouds);

- Define and create a more adequate and representative Martian dust analogue

- Obtain relevant laboratory measurements to improve the radiative modelling of the Martian dust and clouds;

- Develop specific models to improve the parameterization of dust and clouds within Global Circulation Models (GCMs);

- Improve the analysis of past and current missions to Mars considering the new laboratory data and the new tools/models;

- Improve the modelling of the global Martian climate through specific models and through GCMs to provide a more realistic atmospheric climatology
Innovative Scientific Data Exploration and Exploitation Applications for Space Sciences

- Deployment of machine learning (ML) and advanced visualization tools to achieve efficient, user-friendly, realistic exploitation of scientific data from astrophysics and planetary space missions, as well as from supporting ground-based massive surveys.

- Development of 6 high-level tools and methods implemented as Scientific Data Applications, which address large scientific audience:
  - Two related to Lunar observation,
  - Two related to Galactic Science
  - Two related to stellar characterization

- Available on a dedicated cloud solution - EXPLORE-TEP
- Available on existing cloud platforms ESCAPE Science Application Platform and the ESA Datalabs
Who is In, and Who is Not? Determining the Gaia Survey Selection Function

- Develop a detailed mathematical formulation of a survey selection function* with focus on the Gaia survey,

- Develop a detailed description and modelling of the Gaia survey selection function and for the combination of Gaia and other surveys

- Practical implementation of the Gaia selection function in the form of auxiliary data,
  - accessible through the ESA Science Data Centre, and open source tools
  - made available through code hosting platforms.
- Develop tools to incorporate the selection function in scientific analyses

- Application of the selection function tools to example science cases.

* the probability that an object with certain observed properties at a given position on the sky would be catalogued by Gaia.
Solar Energetic Particle Analysis Platform for the Inner Heliosphere

- A major step in understanding large and widespread gradual Solar Energetic Particle (SEP) events
- Motivated by the science objectives of Solar Orbiter and Parker Solar Probe
- Building the world’s most advanced platform for SEP studies, including:
  - high-level data products, catalogs and datasets,
  - analysis and
  - visualization tools.
SHARP

SHocks: structure, AcceleRation, dissipation

- Advances understanding of the physics of charged particle acceleration and heating and collisionless dissipation in Collisionless Shocks (CSs) across a range of scales in the Universe

- Exploitation of the wide diversity of CSs observed by ESA and NASA heliospheric missions

- Improved understanding of
  - the acceleration of particles at CSs
  - particle acceleration at astrophysical shocks

- Developing a high-level databases of shocks and advanced tools for the shock analysis
**Success story**

**SBNAF**

*Coordinator: MPE/Germany*

[www.sbnaf.eu](http://www.sbnaf.eu)

- High-quality predictions for occultation events resulting in successful detections of occultation's of transneptunian objects and Centaurs;
- Numerous outreach events;
- 74 scientific publications among which article about the discovery of ring around the Haumea dwarf planet in Nature “The size, shape, density and ring of the dwarf planet Haumea from a stellar occultation” [https://www.nature.com/articles/nature24051](https://www.nature.com/articles/nature24051)

- Addressed critical points in the reconstruction of physical and thermal properties of near-Earth, main-belt, and trans-Neptunian objects.
- Established the first database of thermal infrared observations of small bodies in the solar system, with more than 170,000 thermal infrared measurements of asteroids from space infrared telescopes.
- Developed high-quality 3D shape models for selected asteroids.
- Upgraded Interactive service for asteroid models (ISAM); it includes models and data for more than 1600 asteroids.
Sample Curation Facility

Technology demonstrator concepts for exploration

Life Support Technologies

Scientific Instrumentation (gamma ray, magnetometers, seismometer, water detection) and concepts for Lunar exploration

EUROCARES
IRENA
DEMOCRITOS
EDEN ISS
TIME SCALE
BIOWYSE
LUVMI
NEWTON
HERMES-SP
LUVMI-X
PIONEERS

|------|------|------|------|------|------|------|------|------|
LUVMI-X is a small, autonomous lunar rover with big ambitions. Equipped with innovative instrumentation, it aims to search out water and other volatiles on the lunar surface.
HERMES-SP (2018 - ongoing)

**Mission:**
GRB detectors in a constellation of small satellites
- 3 CubeSats HERMES-SP
- 3 CubeSats (Italian Space Agency - HERMES-TP)
- Launch to be managed by ASI, possibly in 2022
- 1 additional payload (Australian Space Agency)

**Scientific Objective:**
Detection and accurate localization of Gamma Ray Bursts (GRB)

**Achievements**
- Exploitation of previous technological studies for the design and the realization of the GRB detector (cutting-edge instrumentation for scientific missions)
- Constellation of detectors to improve the localization performance compared to the actual systems
- Interest of the scientific community since the early stage of the project / international cooperation
Secure and safe space environment

- Space Weather
- NEOs
- Debris Mitigation
- GovSatCom
- STM
- SST
H2020 LEIT SPACE
Secure and safe space environment

**2014 SPACE Call**
- **Enhanced scientific knowledge...**
- **Increased operational orientation**
- **Improving scientific knowledge and operational characterisation of the NEO population;**
- **Preparing large scale international NEO threats mitigation initiatives**
- **Preventing for operational implementation of mitigation solutions (equipment and ops)**
- **Using existing MS capabilities to build a European orbits traffic Surveillance and Tracking infrastructure with increasing performance and autonomy potential**

**2015 SPACE Call**

**2016 SPACE Call**

**2017 SPACE Call**

**2018 SPACE Call**

**2019 SPACE Call**

**2020 SPACE Call**

**Governmental Satcom**
- 2014
- 2015
- 2016
- 2017
- 2018
- 2019
- 2020

**Space Surveillance & Tracking**

**Near Earth Objects**

**Space Debris mitigation**

**Space Traffic Management**

**Multidisciplinary Preparatory studies**

**Preparatory studies**

**SEC 2014-2020**
Calls for proposals and ad-hoc calls
Total EU contribution (M€): 153.5

21 projects
H2020 LEIT SPACE
Space Weather

FLARECAST - Flare likelihood and region eruption forecasting
HESPERIA High energy solar particle events forecasting and analysis
PROGRESS - Prediction of geospace radiation environment and solar wind parameters
EUHFORIA_2.0 European heliospheric forecasting information asset 2.0

SWAMI - Space weather atmosphere model and indices
SafeSpace - Radiation belt environmental indicators for the safety of space assets
PAGER - Prediction of adverse effects of geomagnetic storms and energetic radiation

TechTIDE - Warning and mitigation technologies for travelling ionospheric disturbances effects
ESC2RAD - Enabling smart computations to study space radiation effects

Heliosphere focused research and applications
Magnetosphere focused research and applications
Ionosphere focused research and applications
Radiation effects


9 projects
M€ 17.8
Find projects’ descriptions and results
https://cordis.europa.eu/

Thank you for your attention

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