FINDING EARTH TWINS WITHIN 10PC

A conference devoted to developing the Italian involvement in TOLIMAN

19-20 | NOV | 18

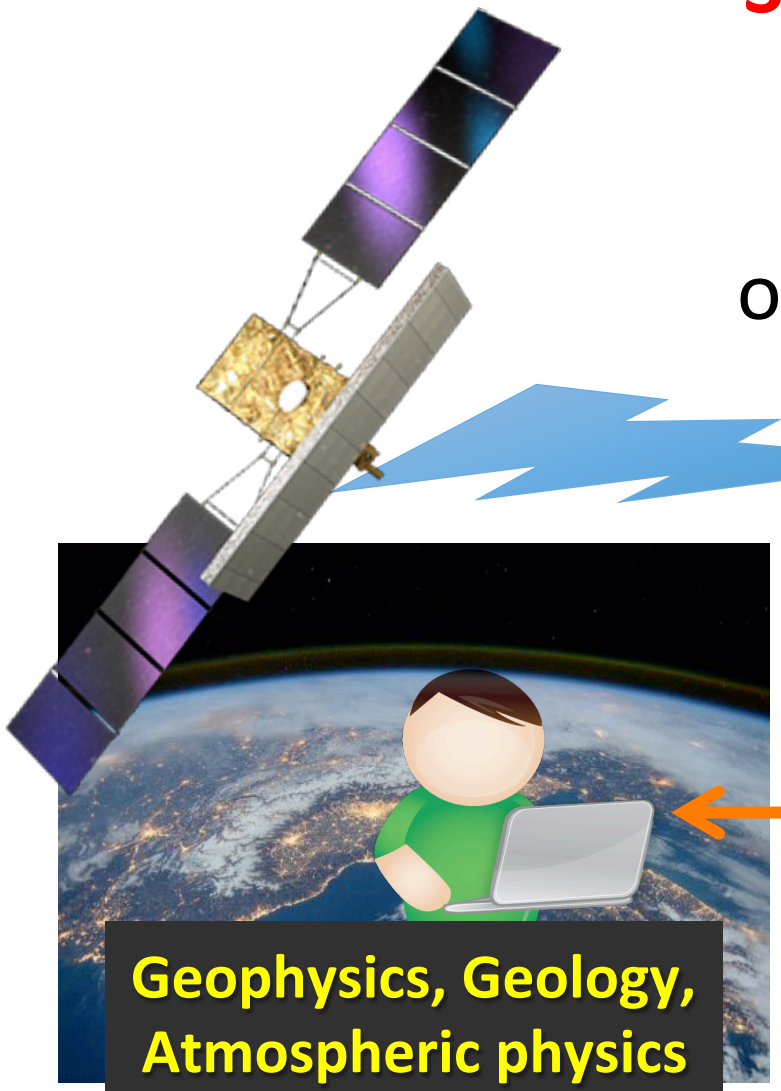
ASI Headquarters

The SSDC infrastructure and expertise for exoplanetary sciences

The Exoplanetary Science Team@ SSDC

Space Science Data Center

Space **S**cience **D**ata **C**enter
is a
Research Infrastructure
of the Italian Space Agency



Geophysics, Geology, Atmospheric physics

Astronomy, Astrophysics, Solar System Exploration, Exoplanets

Space Science Data Center

MAIN GOAL

Acquire, manage, process and distribute data (generally) coming from space missions using FAIR principles (Findable, Accessible, Interoperable, Reusable)

SSDC makes use of international standards assuring both long term preservation of the archives and interoperability with other data centers

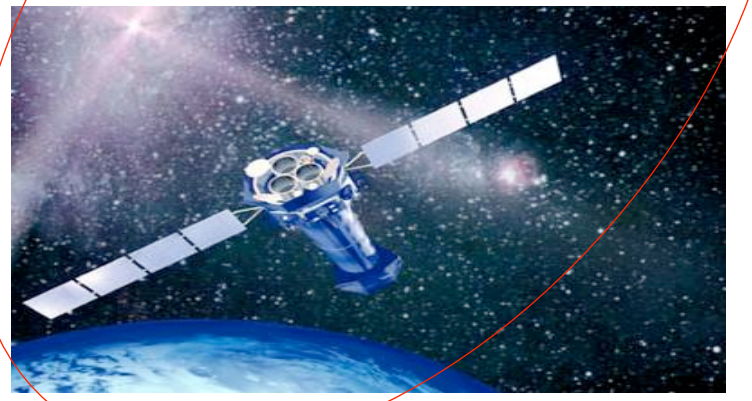
Space Science Data Center

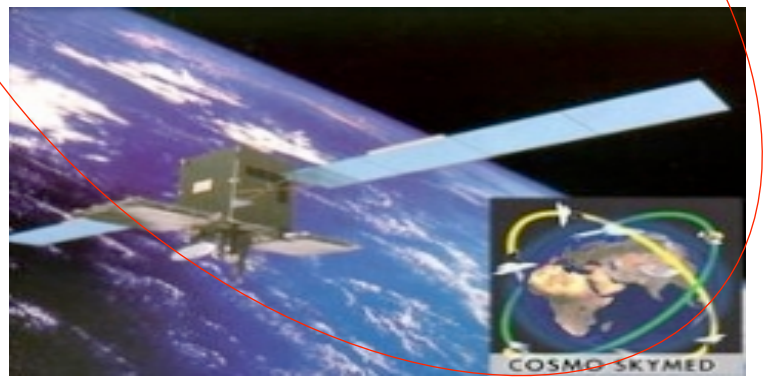
Space Science Data Center

formerly ASDC

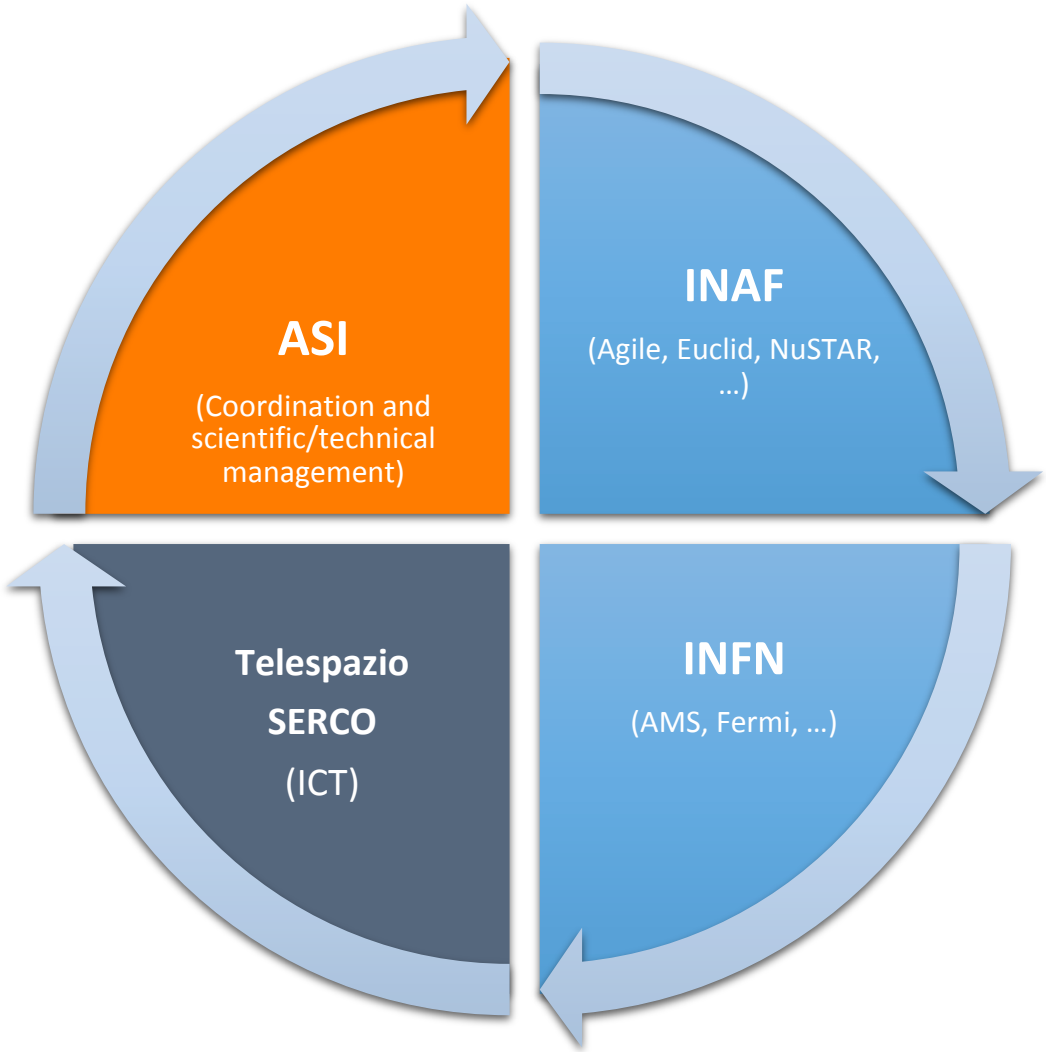
Work in progress

- Universe observation
- Information & Computing Technologies
- Earth observation





Space Science Data Center



SSDC scientific portal: www.ssdc.asi.it

Scientific tools give online access to data exploting a multi-wavelength environment

Online access to scientific mission data

SSDC scientific CHEOPS & PLATO mission pages: /cheops , /plato

- Links to public EXOplanets Catalogs
- A menu for online Scientific tools menu, currently ExoplAn3T

Space Science Data Center

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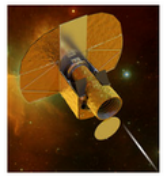
CHEOPS

oplanet catalogs | EXO-Tools | Links

CHaracterizing ExOPlanet Satellite (CHEOPS)



CHEOPS
CHARACTERISING EXOPLANET SATELLITE

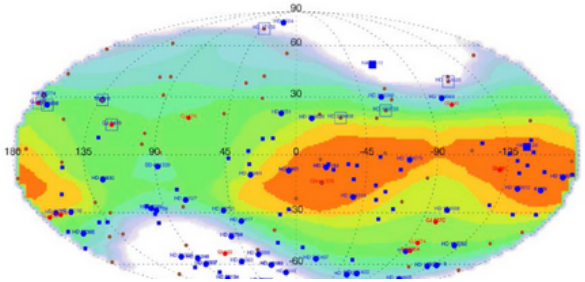
dopted by ESA on February 2014 - will be the first S-Class ESA Switzerland and with a number of contributing member states in . It will be the first mission entirely dedicated to search for ultra-high precision photometry of stars already known to host OPS launch date is December 2017.

e is the study of the structure of exoplanets smaller than Saturn, urrent ground-based high-precision spectroscopic surveys have ars hosting planets with masses in the range of $1 < M_{planet}/M_{Earth}$ h to Neptunes. Planned future ground surveys will continue to OPS studies of planets' transits of a sample of about 500 targets, n of 20 ppm in 6 hours of integration, will allow to measure radii for Neptune sized planets and so to estimate the bulk planet

cludes the provision of the CHEOPS Telescope, the Science cience Data Center, the preparation and fulfillment of the CHEOPS EOPS telescope is a very fast instrument whose design is driven high precision and stable photometry, that can be reached by trol the straylight.

CHEOPS is CHEOPS Definition Study Report (Red Book). A full an be found at the following links:

heops.unibe.ch
ESA website: http://sci.esa.int/cosmic-vision/49469-cheops/
INAF-OACT website: http://www.oact.inaf.it/cheops-it/Home.html



Latest CHEOPS News

- **(Apr 07, 2014)** CHEOPS Science Archive mirror @ ASDC
- **(Feb 21, 2014)** CHEOPS formal adoption by ESA

Space Science Data Center

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PLATO 2.0

PLATO Home

PLATO 2.0

PLAnetary **T**ransits and **O**scillations of stars

Mission Overview

PLATO 2.0 is the third medium-class mission in ESA's Cosmic Vision Program and its launch is foreseen by 2022-2024.
The main scientific objective of the mission is the discovery and characterization of extrasolar planetary systems.
It addresses fundamental questions like:

- How do planets and planetary systems form and evolve?
- Is our Solar System special? Are there other systems like ours?
- What makes planets habitable?
- Is the Earth unique or can life also develop elsewhere?

PLATO 2.0 will observe up to 1,000,000 stars and it will detect and characterize hundreds of small planets and thousands of giant planets, performing for each of them accurate measurements of radius, mass, mean density and age.

The final catalog will include Earth-like, potentially habitable planets.

The planetary science will be complemented by a huge impact on stellar and galactic science via asteroseismology as well as light curves of many different objects on the sky: not only all kinds of variable stars, but also extragalactic sources like AGN and blazars.
Together with the results of the Gaia mission (see http://gaia.ssdc.asi.it) the outcomes of PLATO 2.0 will provide a huge legacy to planetary, stellar, galactic and extragalactic science.

The mission will have a nominal lifetime of six years, operations will be divided in 2 phases (see figure 1):
- Long duration phase: PLATO 2.0 will observe two huge fields (2232 deg2) close to the galactic plane, the first field will be observed continuously for 2-3 years, the second for 2 years.
- Step and Stare phase: several other fields will be monitored for a period of several months each.

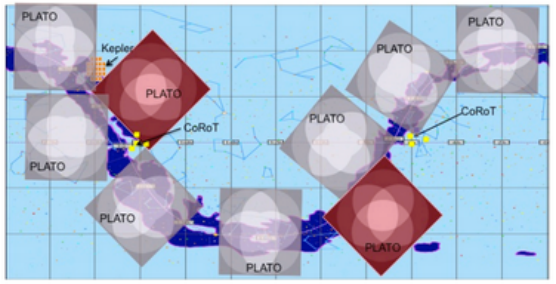
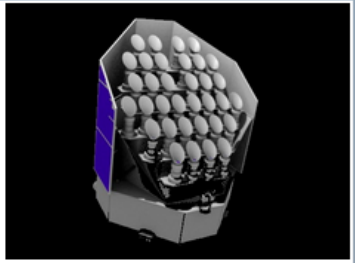


Fig.1: PLATO pointings, in red the long duration fields.

For more details:
PLATO 2.0 on ESA website: http://sci.esa.int/plato/

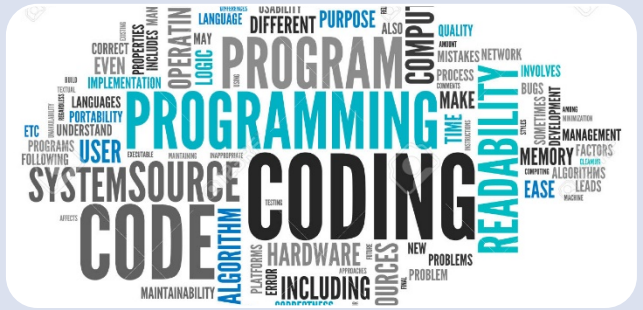


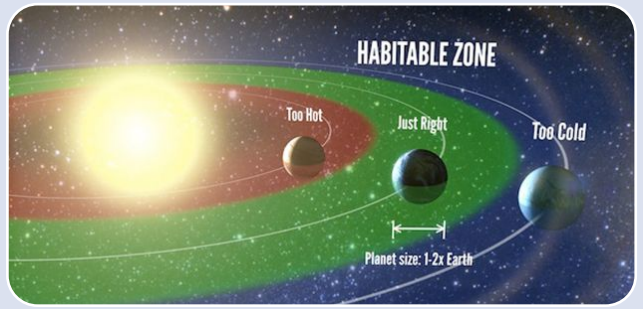
Latest PLATO News

- **(Feb 21, 2014)** PLATO selected by ESA!

Online access to scientific mission data Will be provided according to the data policy of each mission, when they will be available

Space Science Data Center



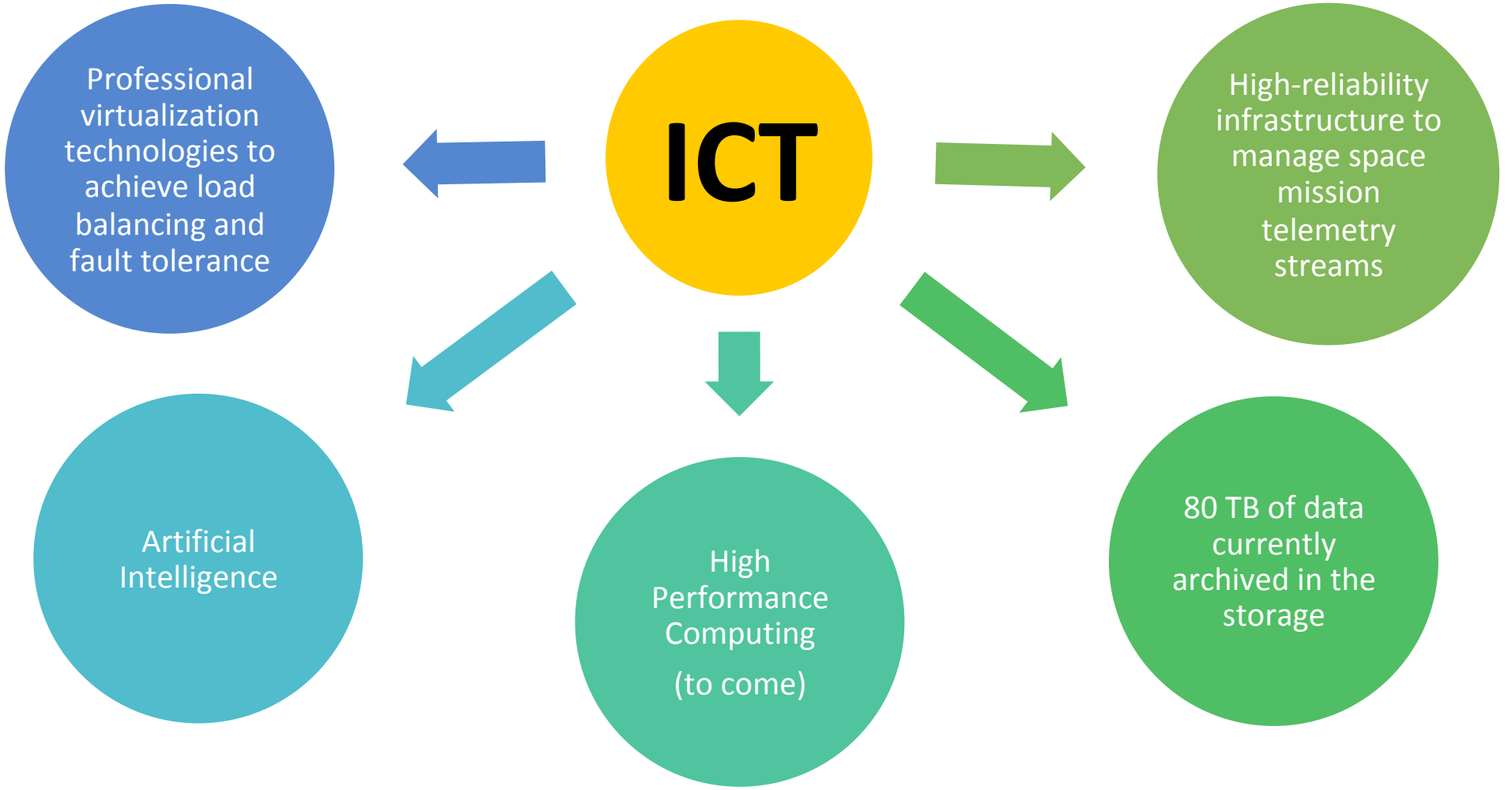


Data storage and management for space missions and HPC infrastructure (work in progress)

Scientific tools development for astronomy, solar system exploration, exoplanetary science

Expertise in exoplanetary sciences (with different techniques) and individual mission memberships (Plato, ChEopS, ARIEL, …)

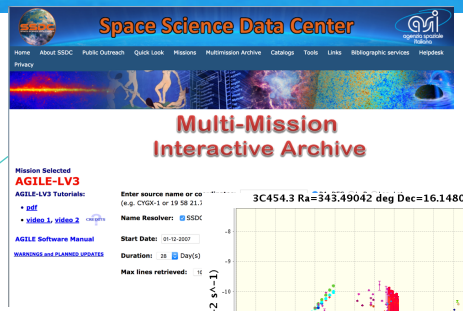
Space Science Data Center



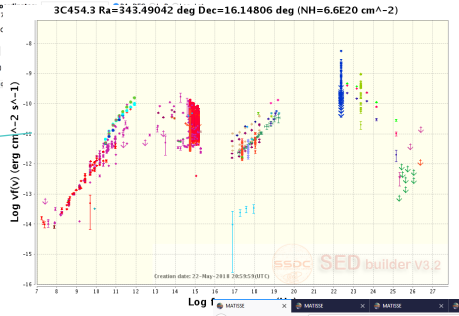
Space Science Data Center

Scientific Tools

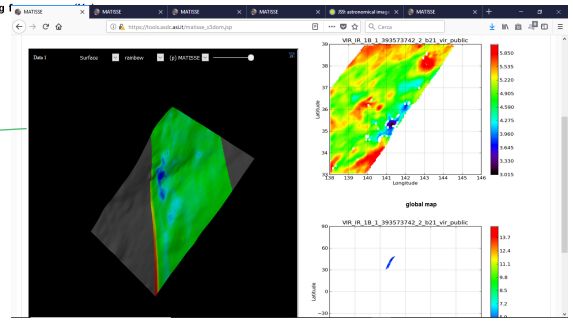
- High-energy astrophysics
- Solar System
- Exoplanets



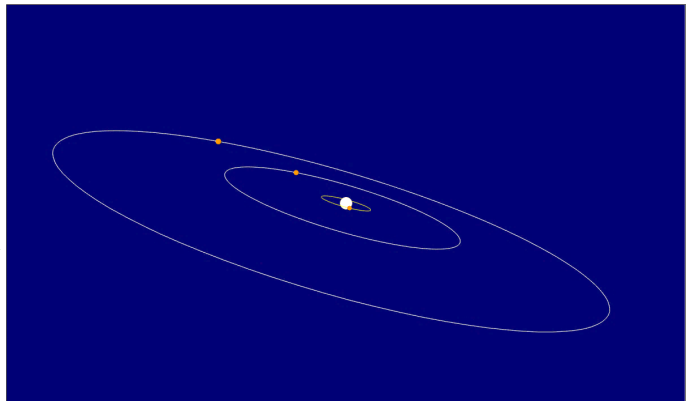
MMIA 2.0



SED builder



MATISSE



ExoplAn3T

Space Science Data Center

- SSDC is **coordinating the Italian contribution to DPAC-CU9**, responsible for the realization of the Catalogue and the release of the Gaia data.
- SSDC **developed access, data extraction, data mining tools** to enable the astronomical community to handle and fully exploit the scientific potential of this enormous archive. In addition.
- SSDC is **responsible for the cross-match of the Gaia catalogue** with the largest public available optical and near-IR catalogues and several other catalogues from radio to X-ray domain, ensuring an all-sky, multi-wavelength panchromatic vision of the universe.

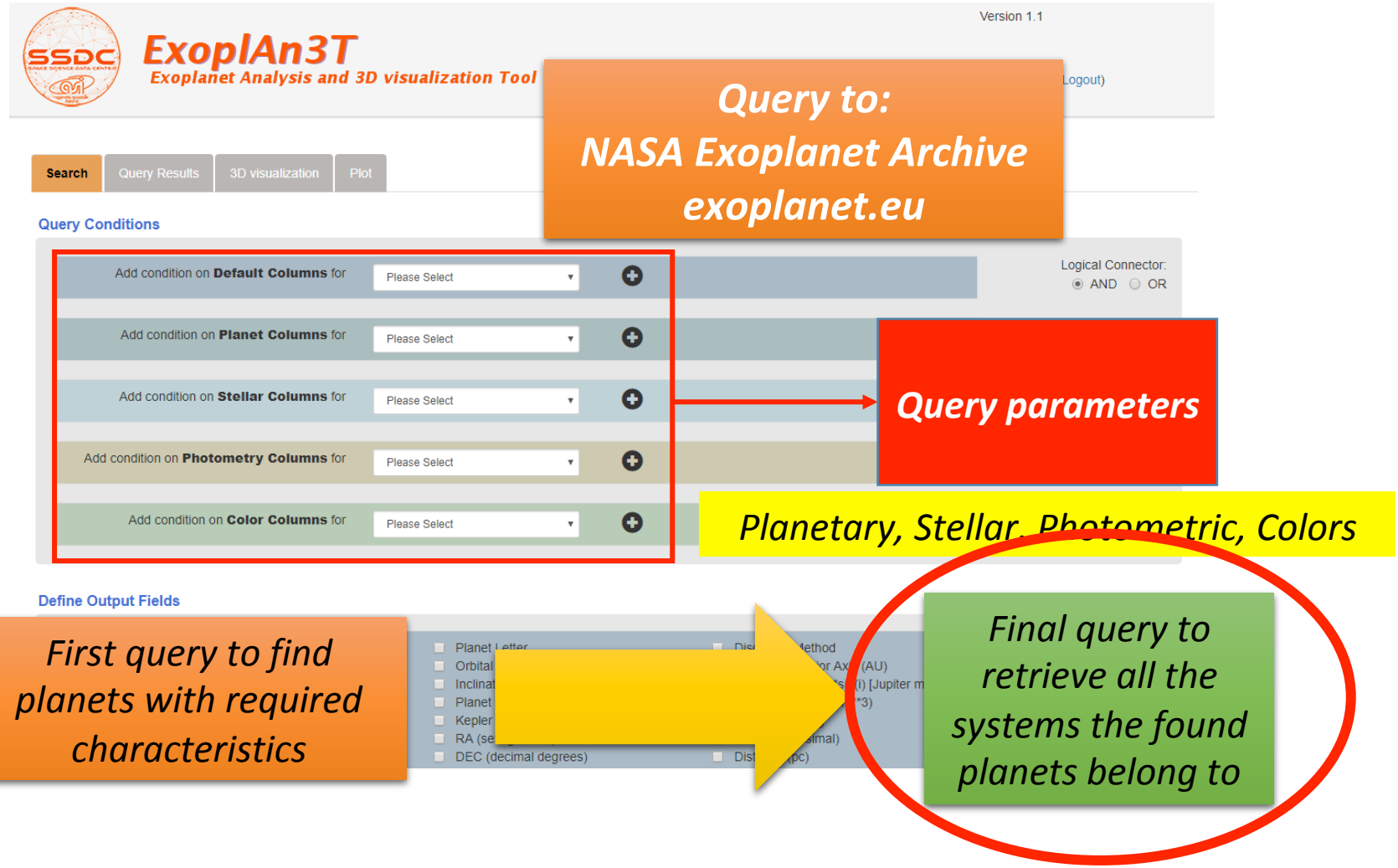
ExoplAn3T stands for

Exoplanetary Analysis and 3D Tool

Is the new SSDC webtool to study exoplanetary systems

https://tools.ssdc.asi.it/exoplanet/

Space Science Data Center



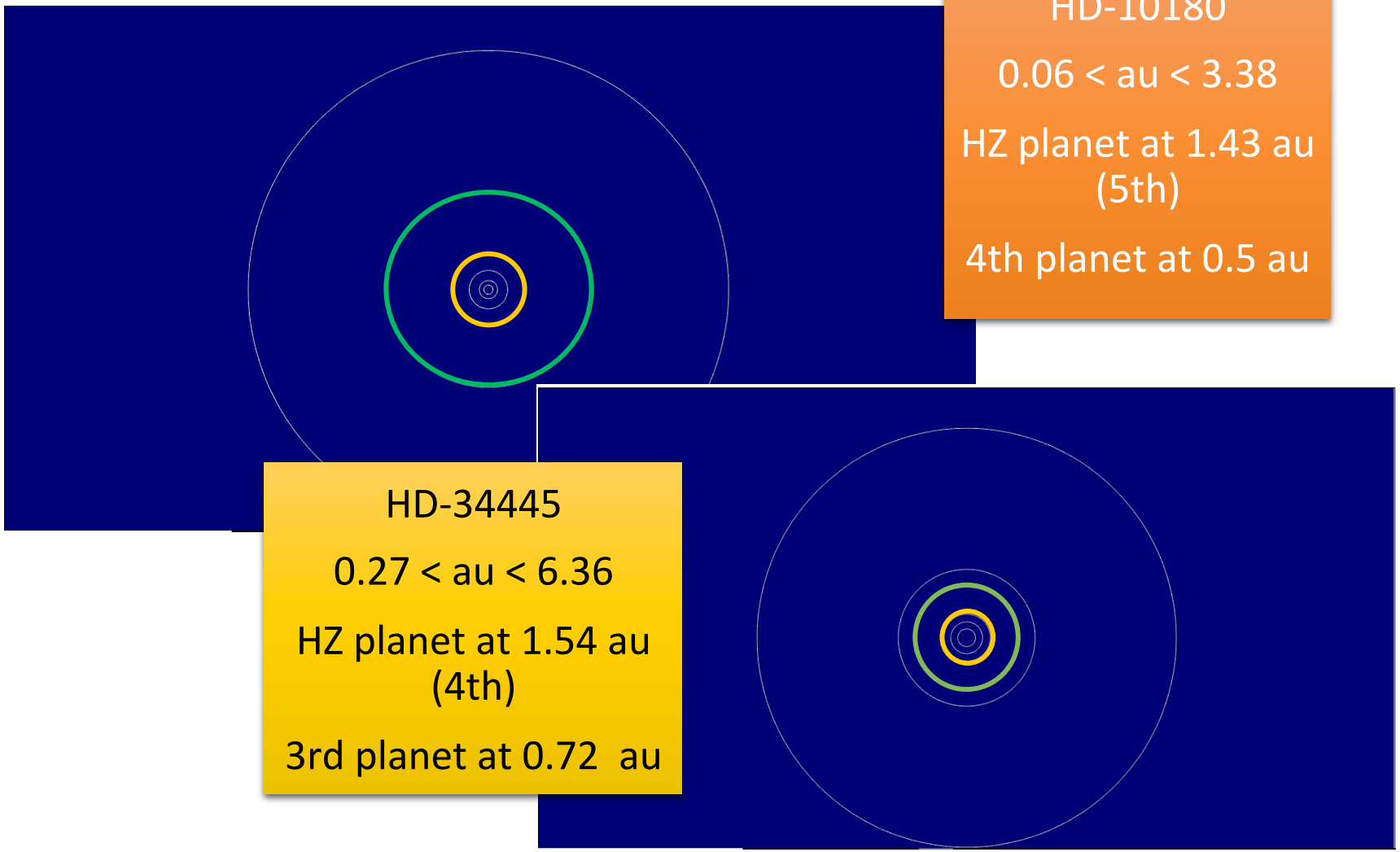
An operative example: Study habitable planets around G stars

«*The two limits for the outer edge are nearly the same, about 1.7–1.8 au for a Sun-like star. At the inner edge, though, the theoretical runaway greenhouse limit from the model of Kopparapu et al. (2014) is 0.99 au, whereas the recent Venus limit remains at 0.75 au*» (Kane et al., 2016)

0.75 au < Conservative Habitable Zone < 1.8 au

Found (NASA Exoplanet Archive):

- 56 planets
- 21 systems



HD-10180

0.06 < au < 3.38

HZ planet at 1.43 au (5th)

4th planet at 0.5 au

HD-34445

0.27 < au < 6.36

HZ planet at 1.54 au (4th)

3rd planet at 0.72 au

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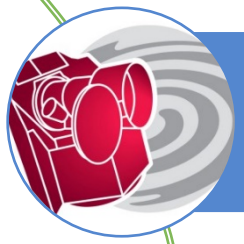
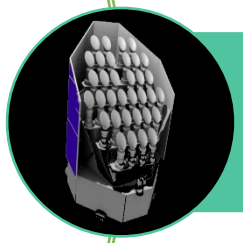


Official scientific archive mirror

Support to the Italian community

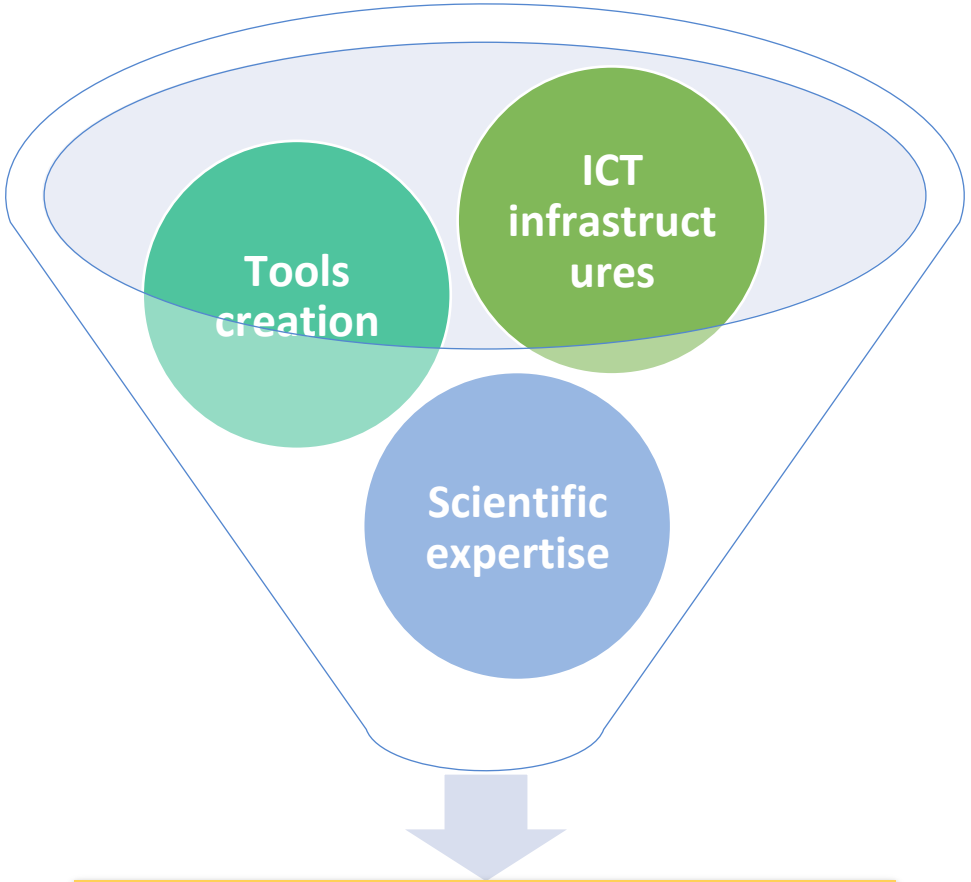


Input catalog (from Gaia catalogs)

Individual memberships (spectral modeling / atmospheric retrieval)

Studying novel activities to be developed

Space Science Data Center



Possibilities of new collaborations inside TOLIMAN

For example, may the capabilities of the ExoplAn3T tool can be useful for the task of Appendix 2 («Statistical probability for Alpha Cen hosting an Earth-like planet»)?

Maybe yes, by showing all the systems with stars similar to those of Alpha Cen with terrestrial planets

Thank you for the attention

angelo.zinzi@ssdc.asi.it