



Exoplan3T

The SSDC tool for exoplanetary science

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ARIEL-It Science Meeting
May 2022



Space Science Data Center



Outline



Present day exoplanetary science

- More than 4000 exoplanets discovered so far (... and counting)
- 3000 exoplanetary systems
 - At least 1 out of 5 of them has multiplicity $M > 1$

A detailed statistical study of these archives cannot be performed without dedicated tools!



Space Science Data Center



The Exoplan3T tool

Exoplanetary Analysis and 3D Tool

<https://tools.ssdsc.asi.it/exoplanet/>

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Helpdesk Privacy

SSDC Sky Explorer
Swift Simulator
NuSTAR Simulator
SSDC Angular Distance Calculator
SSDC Coordinate Conversion
SSDC Date Conversion
SSDC Energy Conversion
SSDC Photon Flux Conversion
SSDC Pimms
SSC/EC
MATISSE
Exoplan3T
GAIA Portal
SSDC SED Builder

SSDC Multi Catalog Search
CHEOPS EUCLID PLATO

SED BUILDER SKY EXPLORER MATISSE GAIA PORTAL COSMIC RAY DATABASE SSDC MULTIMISSION ARCHIVE FOR SPACE SCIENCE SSDC CATALOGS SSDC BIBLIOGRAPHY TOOL AGILE-LV3 data analysis

Exoplanet Analysis and 3D visualization

tools.ssdsc.asi.it/exoplanet/

SSDC **Exoplan3T**
Exoplanet Analysis and 3D visualization Tool

Version 0.3 For support and info please contact Angelo Zinzi

Search Query Results 3D visualization Plot

Query Conditions

Catalogue: NASA Exoplanet Archive Exoplanet.eu ExoMerCat

Logical Connector: AND OR

Add condition on **Default Columns** for:

Add condition on **Planet Columns** for:

Add condition on **Stellar Columns** for:

Add condition on **Photometry Columns** for:

Add condition on **Color Columns** for:

Define Output Fields

Default ALL	<input type="checkbox"/> Host Star Name	<input type="checkbox"/> Planet Letter	<input type="checkbox"/> Discovery Method	<input type="checkbox"/> Number of Planets in System
	<input type="checkbox"/> Orbital Period (days)	<input type="checkbox"/> Orbit Semi-Major Axis (AU)	<input type="checkbox"/> Eccentricity	<input type="checkbox"/> Inclination (deg)
	<input type="checkbox"/> Planet Mass or $M^* \sin(i)$ (Jupiter mass)	<input type="checkbox"/> Planet Radius (Jupiter radii)	<input type="checkbox"/> Planet Density (g/cm^3)	<input type="checkbox"/> TTV Flag
	<input type="checkbox"/> Kepler Field Flag	<input type="checkbox"/> K2 Mission Flag	<input type="checkbox"/> Number of Notes	<input type="checkbox"/> RA (sexagesimal)
	<input type="checkbox"/> Dec (sexagesimal)	<input type="checkbox"/> RA (decimal degrees)	<input type="checkbox"/> DEC (decimal degrees)	<input type="checkbox"/> Distance (pc)
	<input type="checkbox"/> Optical Magnitude [mag]	<input type="checkbox"/> Optical Magnitude Band	<input type="checkbox"/> Effective Temperature (K)	<input type="checkbox"/> Stellar Mass (solar mass)
	<input type="checkbox"/> Stellar Radius (solar radii)	<input type="checkbox"/> Date of Last Update	<input type="checkbox"/> G-band (Gaia) [mag]	

Exoplanet © SSDC 0 Query in background execution



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Exoplanet Analysis and 3D visualization Tool

tools.ssdc.asi.it/exoplanet/

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Exoplanet Analysis and 3D visualization Tool

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Search Query Results 3D visualization Plot

Query Conditions

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Add condition on **Default Columns** for Please Select

Add condition on **Planet Columns** for Please Select

Add condition on **Stellar Columns** for Please Select

Add condition on **Photometry Columns** for Please Select

Planet Letter
Orbit Semi-Major Axis (AU)
Planet Radius (Jupiter radii)
Kepler Field Flag
Dec (sexagesimal)
Optical Magnitude [mag]
Stellar Radius (solar radii)

Eccentricity
Planet Density (g/cm**3)
Number of Notes
DEC (decimal degrees)
Effective Temperature (K)
G-band (Gaia) [mag]

Distance (pc)
Stellar Mass (solar mass)

Planet Name
Planet Transit Flag
Planet RV Flag
Planet Imaging Flag

Exoplanet © SSDC

0 Query in background execution

Remote query to different archives

A first query searches for planets with required characteristics


Then a query is performed to look for all the planets in the found systems



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Output page


Exoplan3T
Exoplanet Analysis and 3D visualization Tool
Version 1.1

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[Query Results](#)
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1517386950304

Query: pl_pnum>=7

Show 10 entries

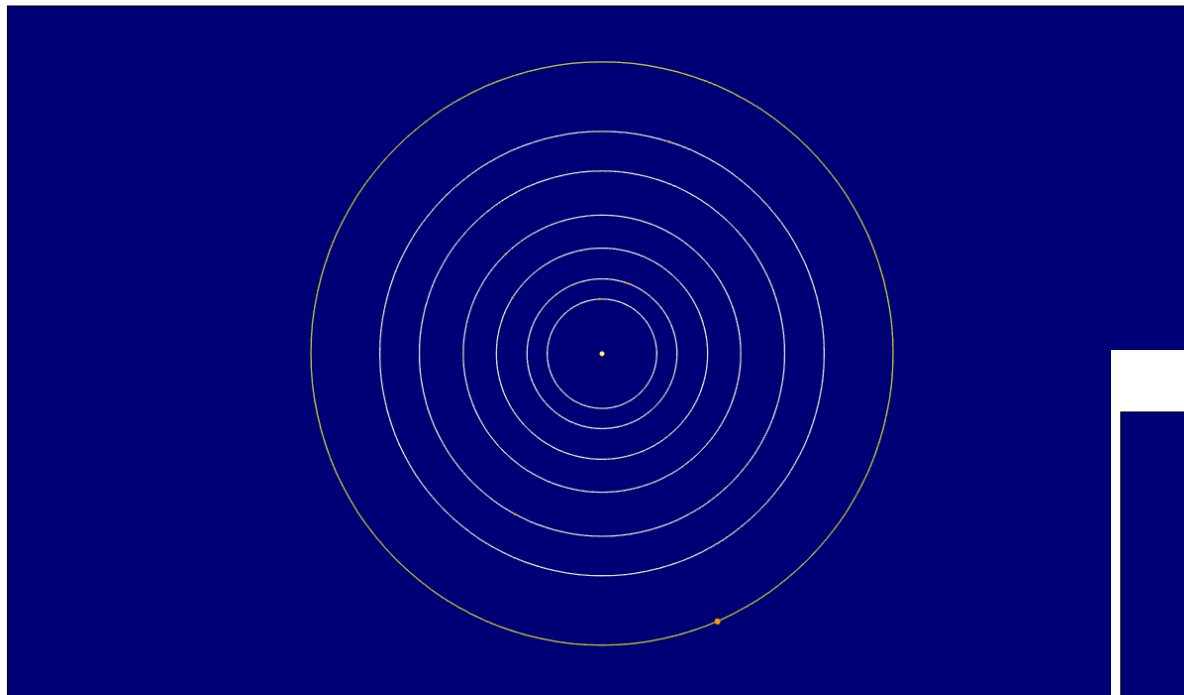
Search:

Downloadable table to perform further analysis

Name	st_teff	pl_pnum									
 KOI-351	6080	8									
 TRAPPIST-1	2559	7									
pl_name	pl_ratror	pl_ratdor	st_rad	pl_orbsmax	pl_orbeccen	pl_orbeccenerr1	pl_orbeccenerr2	pl_orbincl	pl_orbinclerr1	pl_orbinclerr2	pl_instrument
TRAPPIST-1 b		20.5	0.12	0.01111	0.081			89.65	0.22	-0.27	TRAPPISTCAM
TRAPPIST-1 c		28.08	0.12	0.01521	0.083			89.67	0.17	-0.17	TRAPPISTCAM
TRAPPIST-1 d		39.55	0.12	0.02144	0.07			89.75	0.16	-0.16	TRAPPISTCAM
TRAPPIST-1 e		51.97	0.12	0.02817	0.085			89.86	0.1	-0.12	Multiple Instruments
TRAPPIST-1 f		68.4	0.12	0.0371	0.063			89.68	0.034	-0.034	Multiple Instruments
TRAPPIST-1 g		83.2	0.12	0.0451	0.061			89.71	0.025	-0.025	Multiple Instruments
TRAPPIST-1 h	0.0588	109	0.12					89.76	0.05	-0.04	Multiple Instruments

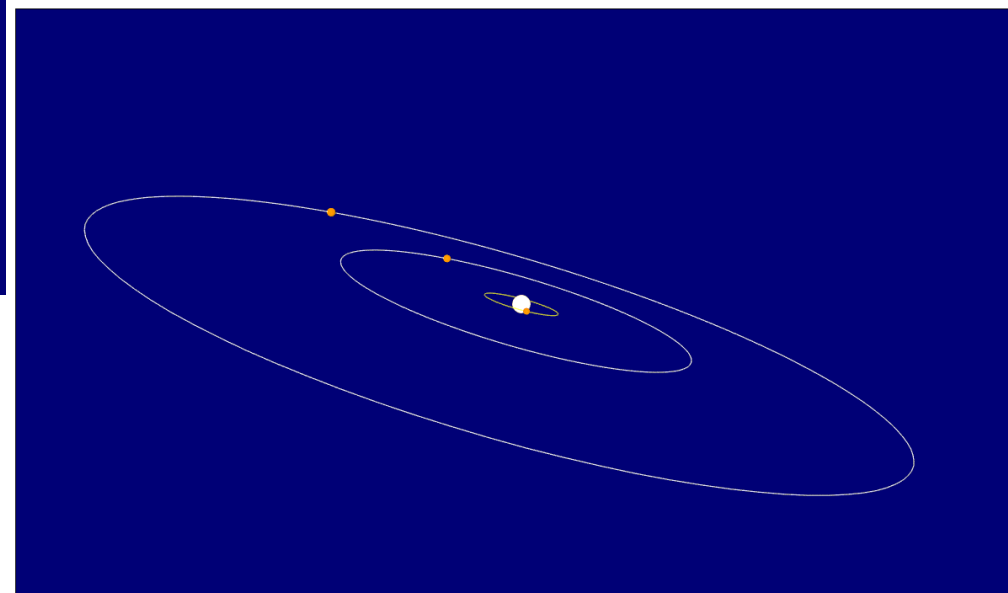
3D visualization

TRAPPIST-1



Visual analysis of the main features of the system

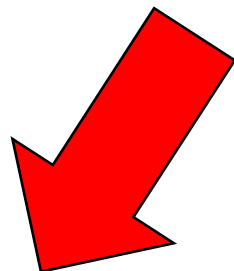
HD-3167



- Star color computed from temperature
- In scale star radius – planet orbits
- Planet radius magnified 20X
- Real orbital eccentricities and inclinations

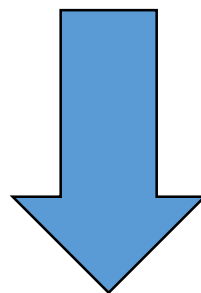


Latest updates

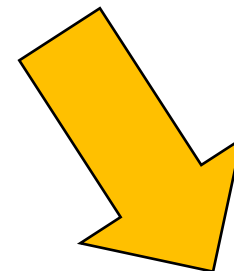


**Translation to
Python 3**

Also to speed up some
queries, e.g. to
ExoMerCat



**Listed on EMAC /
GSFC**



**Adaptation to new
protocols**

NASA Exoplanet Catalog
recently changed its
query protocol



Science with ExoPlan3T

Using the tool it is possible to perform statistical studies on multiple systems with desired architectures



A&A 605, L4 (2017)
DOI: 10.1051/0004-6361/201731595
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**Astronomy
&
Astrophysics**


LETTER TO THE EDITOR

Anti-correlation between multiplicity and orbital properties in exoplanetary systems as a possible record of their dynamical histories

A. Zinzi^{1,2} and D. Turrini^{3,4}

A&A 636, A53 (2020)

Normalized angular momentum deficit: a tool for comparing the violence of the dynamical histories of planetary systems

 D. Turrini¹,  A. Zinzi² and J. A. Belinchon³

TASSEL project

An interdisciplinary pathway to the identification
of solar-system analogs

PI Alessandro Sozzetti



Space Science Data Center



Agenzia Spaziale Italiana

Future works dedicated to Ariel



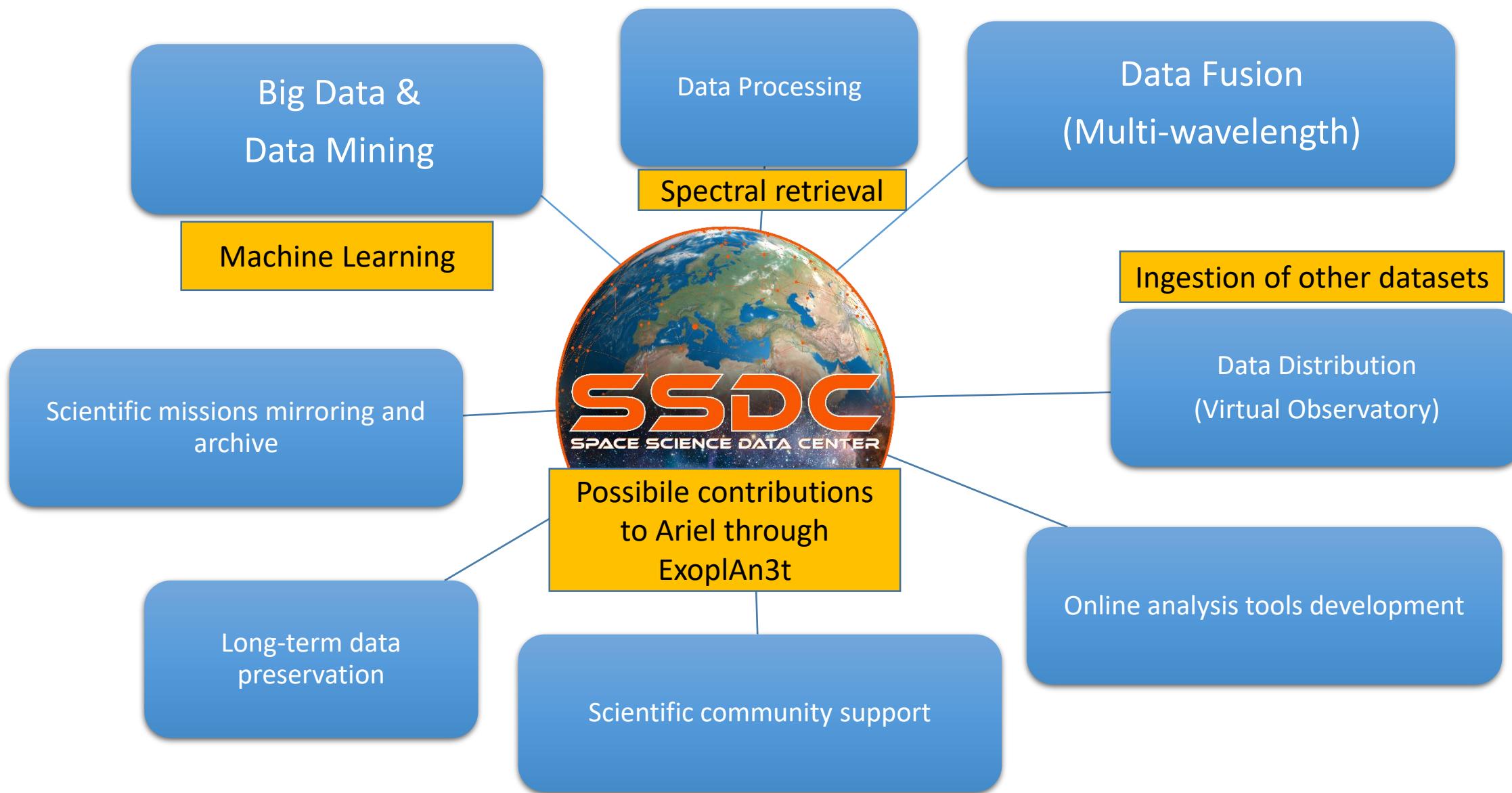
SSDC MAIN AIM

acquire, manage, process and distribute space mission data following FAIR principles (Findable, Accessible, Interoperable, Reusable).

SSDC uses international standards assuring both the long-term archive preservation and the interoperability with other data centers.



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A stronger collaboration inside the different WG we are involved in will be aimed at making valuable steps towards the best exploitation of ExoPlan3T for Ariel studies



Agenzia Spaziale Italiana

Thank you for the attention

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