

Outer Planets Assessment Group meeting
11-12 September 2018



ESA Science Programme and the Ice Giants study

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European Space Agency

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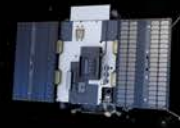


soho
Facing the Sun



proba-3
Solar Coronagraph

proba-2
Observing coronal dynamics and solar eruptions



bepicolombo
Exploring Mercury

exomars
Europe's new era of Mars exploration

juice
Studying Jupiter's icy moons



cassini-huygens
Studying the Saturnian system and landing on Titan



venus express
Studying Venus' atmosphere

smile
Solar Wind Magnetosphere Ionosphere



mars express
Investigating the Red Planet



rosetta
Chasing and landing on a comet

solar orbiter
The Sun up close

cluster
Measuring Earth's magnetic shield

ESA Astrophysics Missions



**lisa
pathfinder**
Testing the technology
for gravitational
wave detection



jwst
Observing the first light



cheops
Characterising exoplanets



plato
Exoplanets & stars



gaia
Surveying a billion stars



herschel
Unveiling the cool
and dusty Universe



euclid
Exploring the dark Universe




xmm-newton
Seeing deeply into the hot
and violent Universe



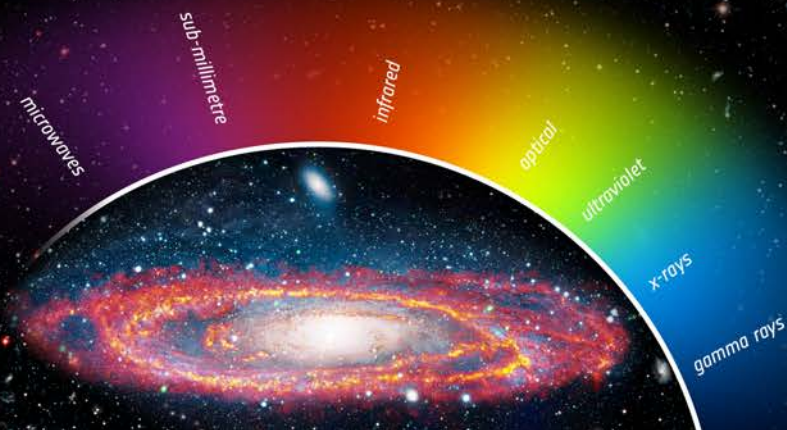
planck
Looking back
at the dawn of time



hst
Expanding the frontiers
of the visible Universe

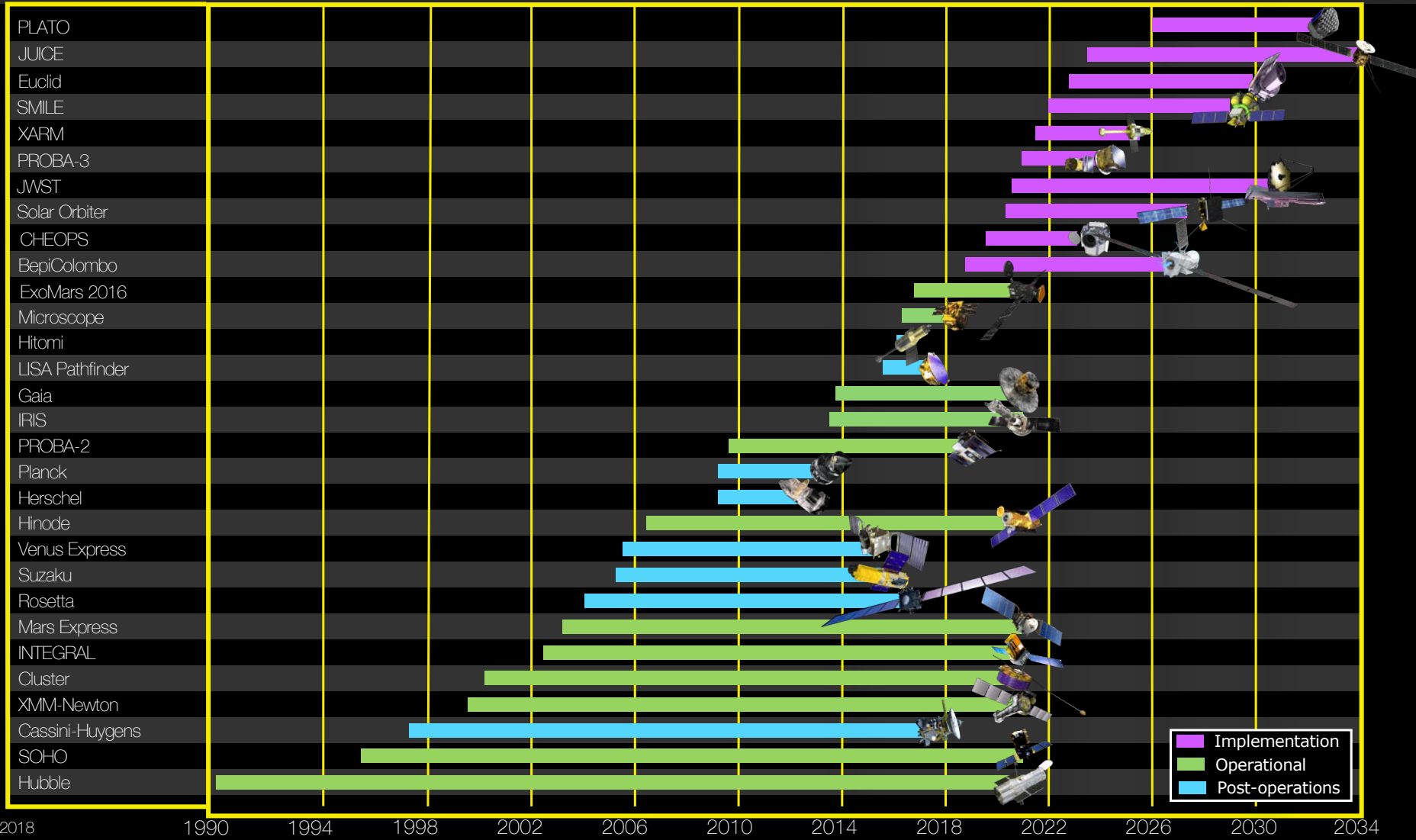


xrism
Formation of the
elements



integral
Seeking out the extremes
of the Universe

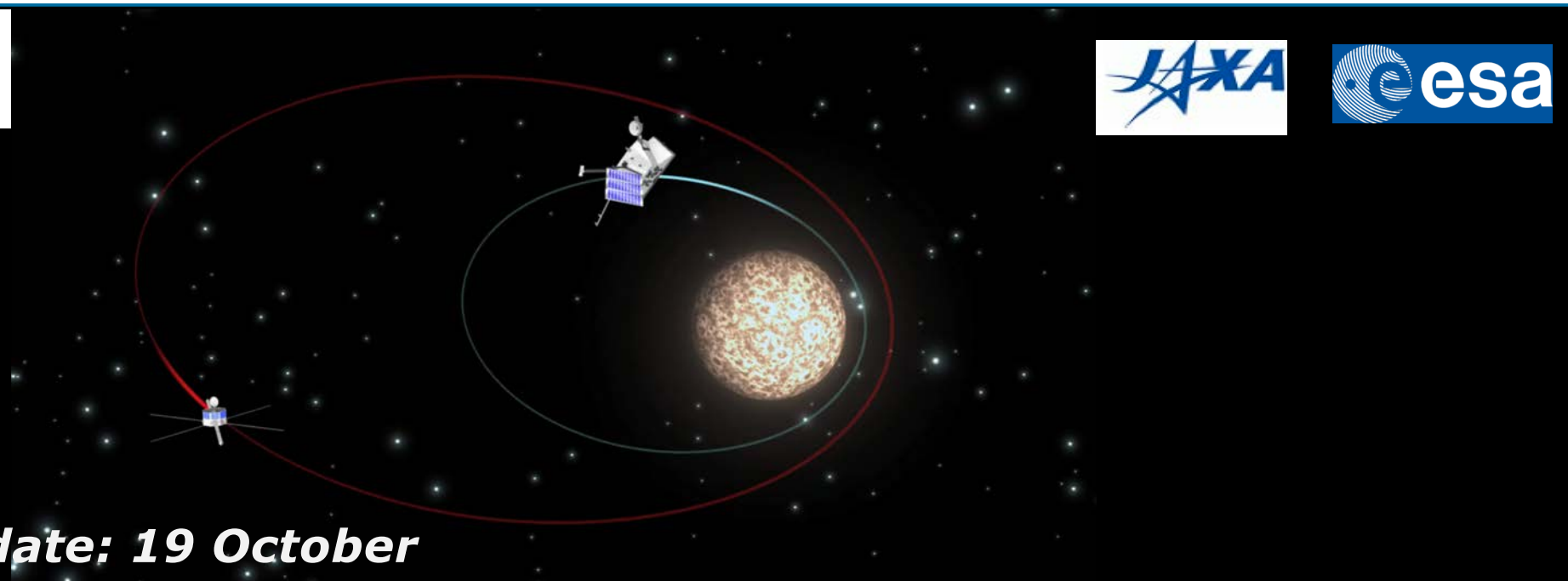
ESA Space Science Missions



Last update: May 2018

1990 1994 1998 2002 2006 2010 2014 2018 2022 2026 2030 2034

Implementation
Operational
Post-operations



Launch date: 19 October



5 October 2018
Launch



Earth flyby

1st Venus flyby

2nd Venus flyby

1st Mercury flyby

2nd Mercury flyby

3rd Mercury flyby

4th Mercury flyby

5th Mercury flyby

6th Mercury flyby

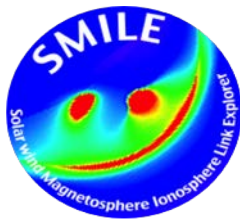
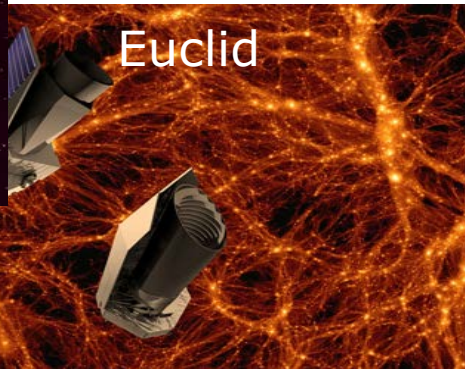
5 December 2025
Arrival at Mercury

End of nominal mission

End of planned extended mission



Science Programme



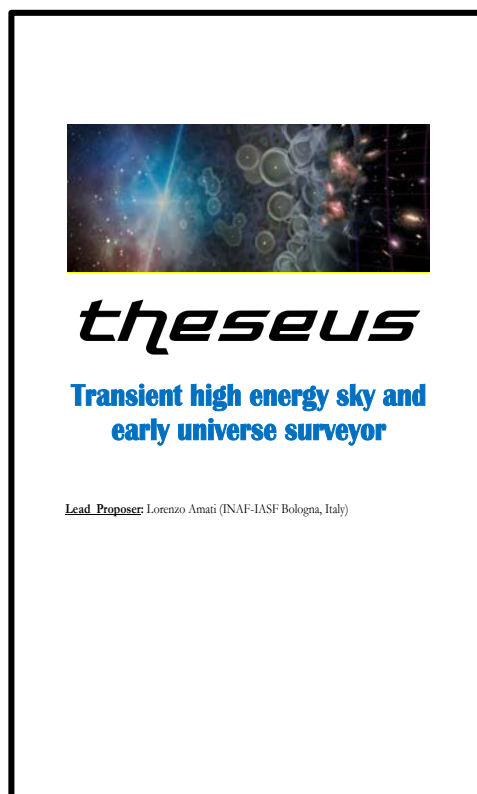
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PAG Meeting | 11.09.2018 | Slide 7



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M5 candidates for study



"F" mission Call open

<https://www.cosmos.esa.int/web/call-for-fast-mission-2018>



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- Phase-1 proposal
- Workshop
- Phase-2 proposal
- Endorsement letters
- Q & A

CALL FOR A FAST (F) MISSION OPPORTUNITY IN ESA'S SCIENCE PROGRAMME FOR A LAUNCH IN THE 2026-2028 TIMEFRAME

16 July 2018

The ESA Director of Science solicits proposals from the scientific community in ESA Member States for a Fast (F) mission to be launched in the 2026-2028 timeframe.

ESA's Science Programme is based on long-term planning of scientific goals. The Cosmic Vision plan (available as [ESA BR-247](#)) was established in 2005 on the basis of a bottom-up process that started with a consultation of the broad scientific community. The plan contains the wide-ranging and ambitious scientific questions to be addressed by missions in the ESA Science Programme.

SCHEDULE FOR THIS CALL AND IMPORTANT DATES

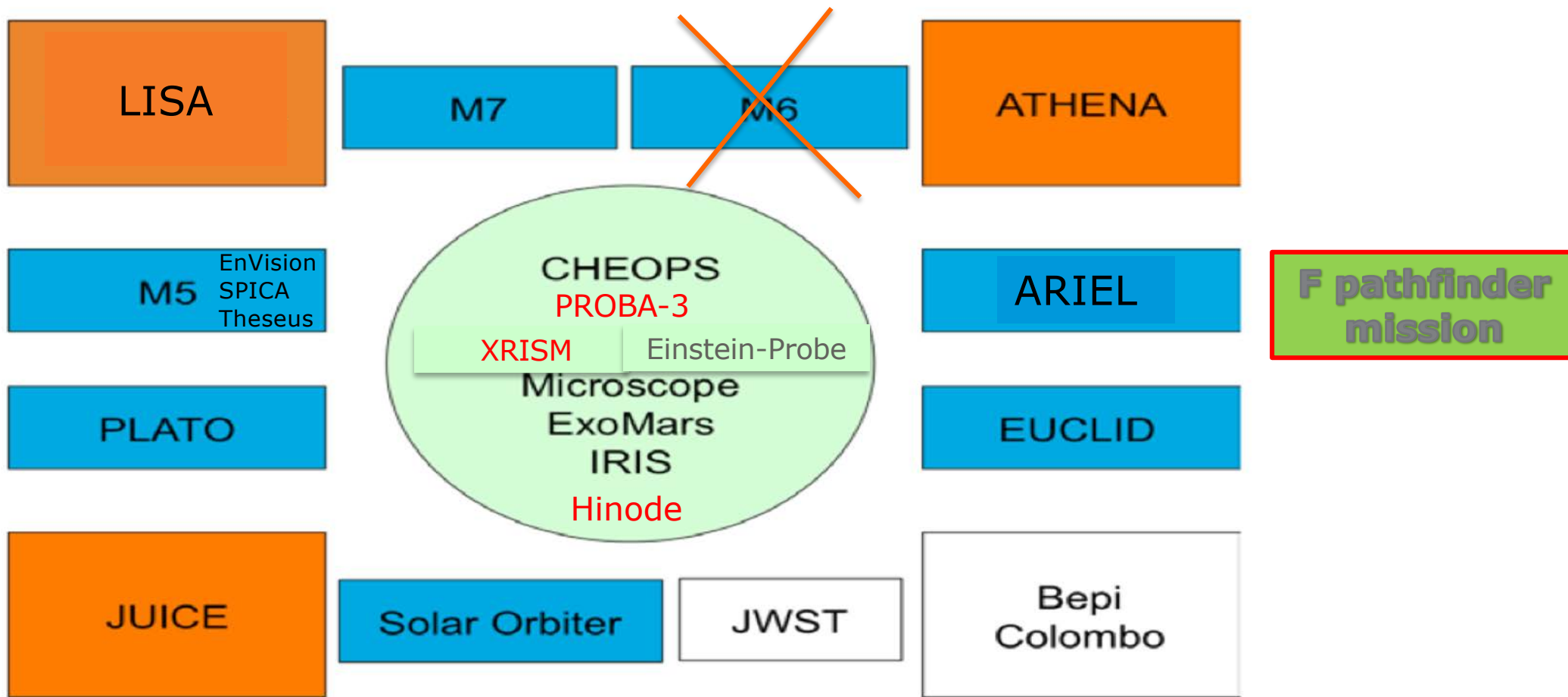
Activity	Date
Release of the Call for a Fast (F) mission	16 July 2018
Phase-1 proposal submission deadline	25 October 2018 – 12:00 (noon) CEST
Phase-1 proposal assessment	November 2018
Workshop for Phase-2 proposers	11 December 2018 (TBC)
Phase-2 proposal submission deadline	20 March 2019 – 12:00 (noon) CET
Letters of Endorsement deadline	10 April 2019 – 12:00 (noon) CEST
Proposal evaluation and scientific ranking	April – July 2019
Phase 0 study	July – December 2019
Selection of candidate mission	February 2020
Phase A/B industrial kick-off	September 2020
Mission adoption	November 2022
Mission CDR	June 2024
Spacecraft launch readiness	December 2027

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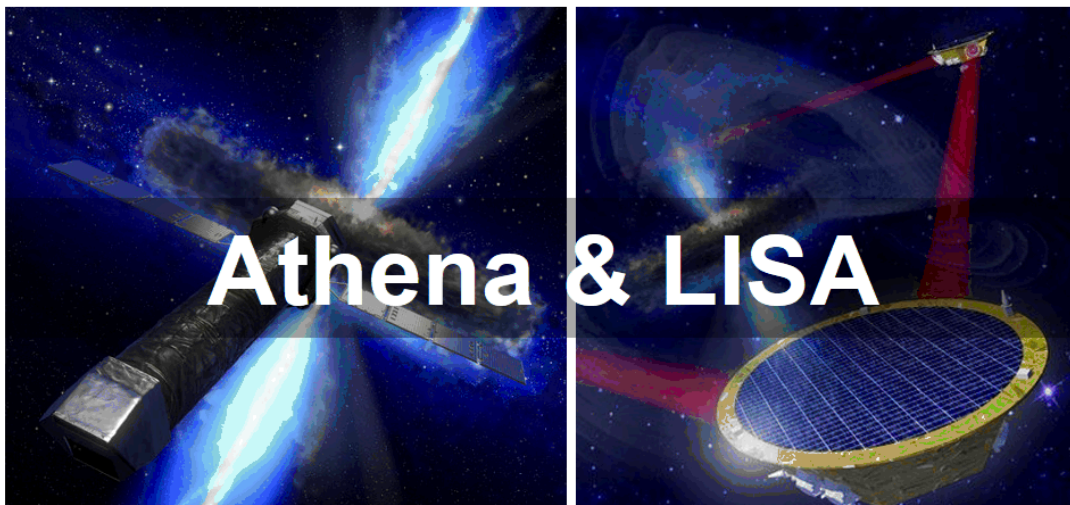


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Scientific Programme – the future



Space Science at CM19



F-missions in sync with M-missions (joint launch) → new line of opportunities with special emphasis on novel implementations

Unique celestial opportunity to explore Ice Giants

Planet Size (relative to Earth)	Fraction of Stars with at least one planet
0.8 - 1.25 (Earth)	~16%
1.25 - 2 (Super-Earth)	~20%
2 - 4 (Mini-Neptune)	~20%
4 - 6 (Large Neptune)	~2%
>6 (Gas Giant)	~2%

Payload system provision → alleviate/facilitate/support Member State provision

Preparation of Cosmic Vision in the 2050 time frame

Scientific Themes for a Mission to the Ice Giants

<http://sci.esa.int/cosmic-vision/53261-report-on-science-themes-for-the-l2-and-l3-missions/#>



INTERIORS

ATMOSPHERES

MAGNETOSPHERES

MOONS

RINGS

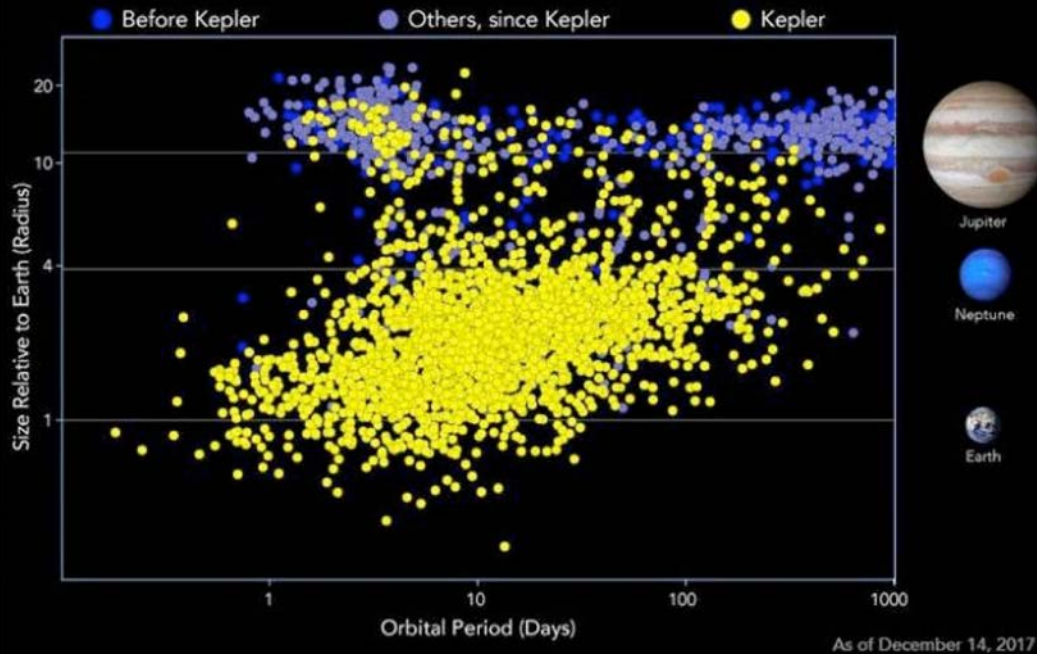
ORIGINS

From L2 and L3 Science Themes Meeting, Paris September 2013

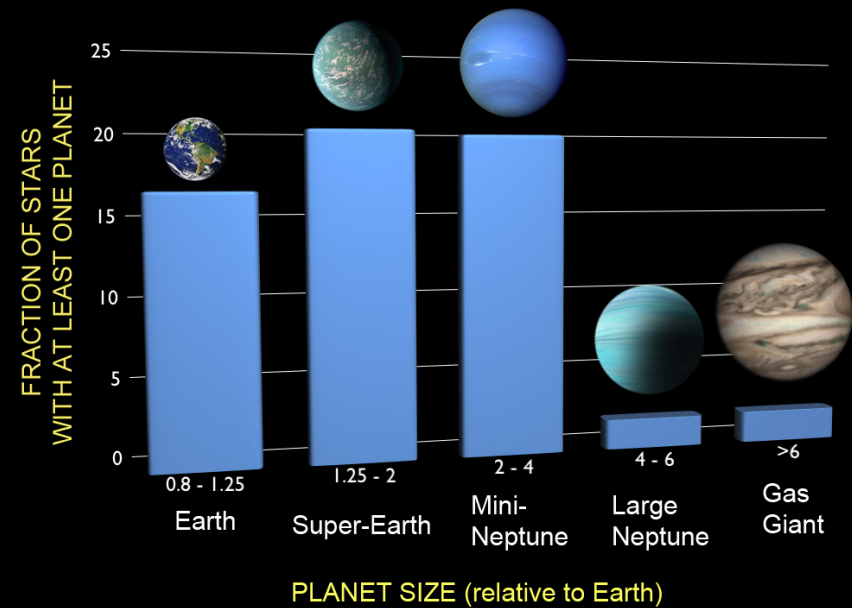
C. Arridge 2013



Exoplanet and Solar System Synergies

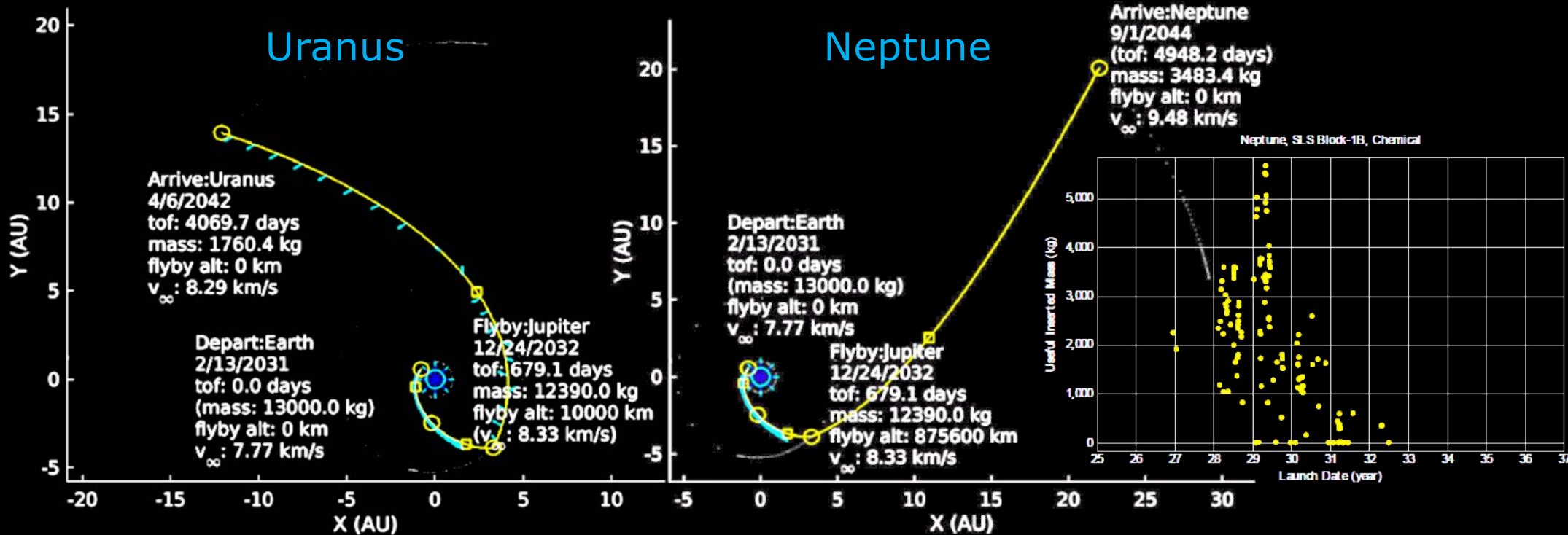


Uranus/Neptune-size planets and super-Earths are the most abundant classes of exoplanets.



The only ground-truth we have on these types of objects thus far is from Voyager 2 flybys of Uranus (1986) and Neptune (1989). An exploration mission to our ice giants will play a critical role understanding our own planetary system and those beyond

M*: Uranus & Neptune Trajectories with Jupiter Flyby



NASA Ice Giant pre-decadal study final report (2017)



Phase 0 study on the ESA potential contribution to a NASA-led mission to the Ice Giants



- A mission to the icy giants (Neptune and Uranus) will be among the ones examined by the next Planetary Sciences Decadal, also in view of the launch opportunity with a Jupiter swing-by that would allow to reach both planets in the late 2020s or early 2030s
- ESA, with NASA involvement, is exploring potential ESA participation in a NASA-led mission to the ice giants
- ESA and NASA agreed to study a palette of possible configuration of varying cost to ESA and complexity, keeping in mind the need for clear interfaces. These are:
 - An atmospheric probe for one of the ice giants;
 - A lander on one of the satellites (Triton is of particular interest);
 - TBD contributions enabling a two-S/C configuration allowing to visit both ice giants with a single launch.



Phase 0 study on the ESA potential contribution to a NASA-led mission to the Ice Giants



- ESA will carry out an internal phase 0 study in November-December 2018 to analyse the three configurations above. The cap for a potential ESA contribution is “an M class” mission size, to which scientific P/L provided by ESA Member States would be added.
- The actual availability of any funding will be assessed following the next decision on the funding of the Science Programme (CM19), planned at the end of 2019.
- Implementation of an ESA participation to the mission will be contingent on the approval by the Science Programme Committee in due time.
- Implementation of the mission by NASA is contingent on the outcome of the next Planetary Science Decadal Survey (to be released in 2022) and to budget allocation by Congress.



Phase 0 study on the ESA potential contribution to a NASA-led mission to the Ice Giants



- An ESA Study Team (ST) led by an ESA Study Manager (SM), will be in charge of the technical studies.
- NASA will provide necessary information to enable the ESA study, including boundary conditions, constraints, etc.
- A Science Study Team – SST (typically 4 European scientists) will be nominated by ESA to support the scientific assessment and trade-offs during the study activities.
- NASA will appoint a scientific point of contact to support the SST and an engineering point of contact to support the phase 0 study.



Thank you very much!

