



# Welcome ARIEL in context of the ESA Science Program

Günther Hasinger, ESA Director of Science  
ARIEL 2020 conference, ESTEC, 14.1.2020

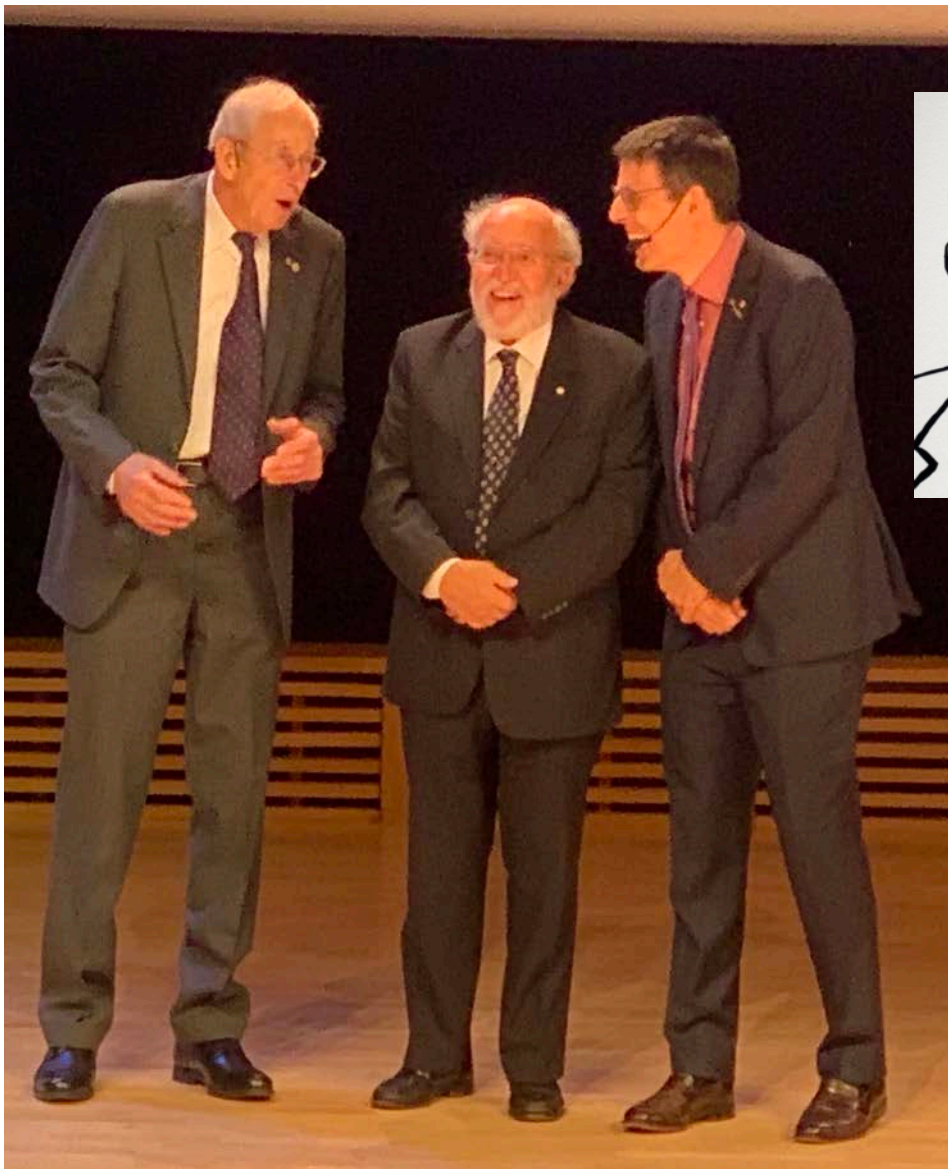


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European Space Agency





Nobel prize winners call the ISS





# Nobel Prize 2019 for Exoplanets & Cosmology



Michel Mayor "Nobel" lecture @ ESA

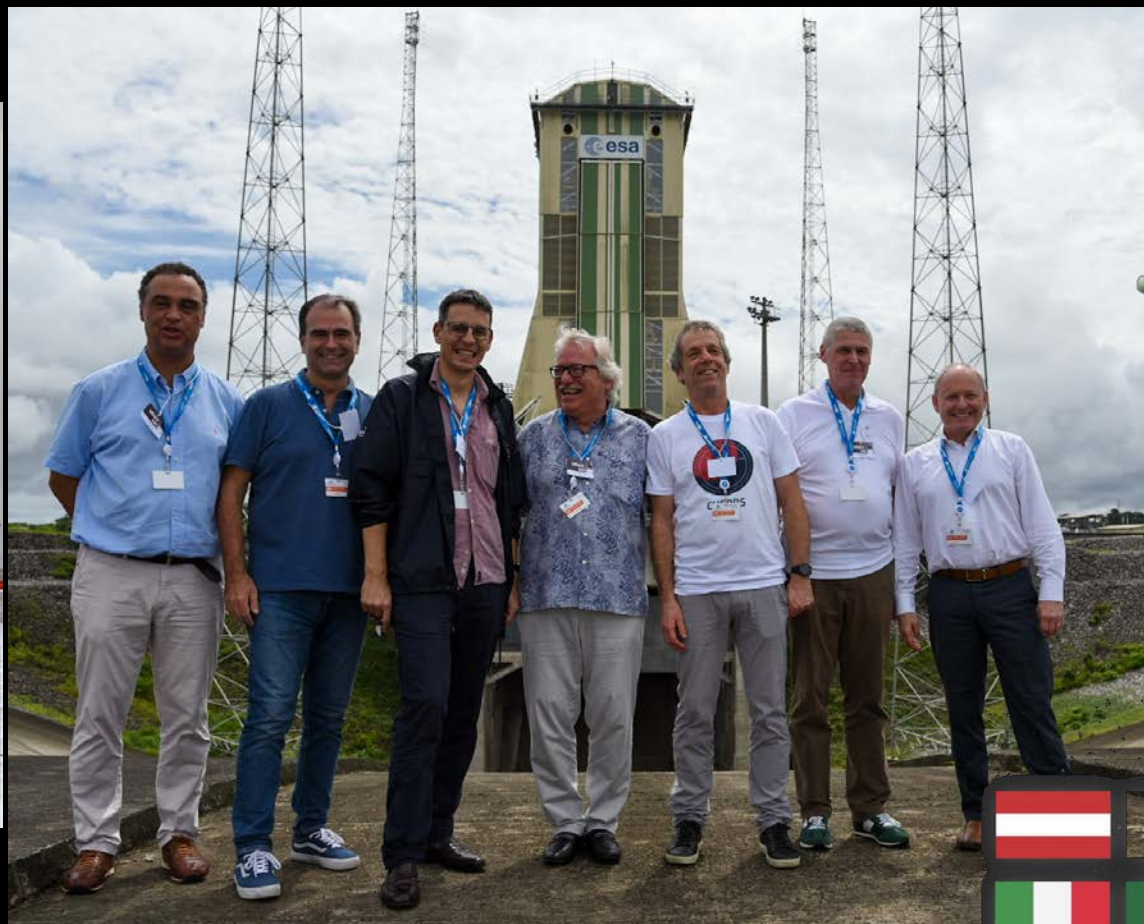


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# CHEOPS

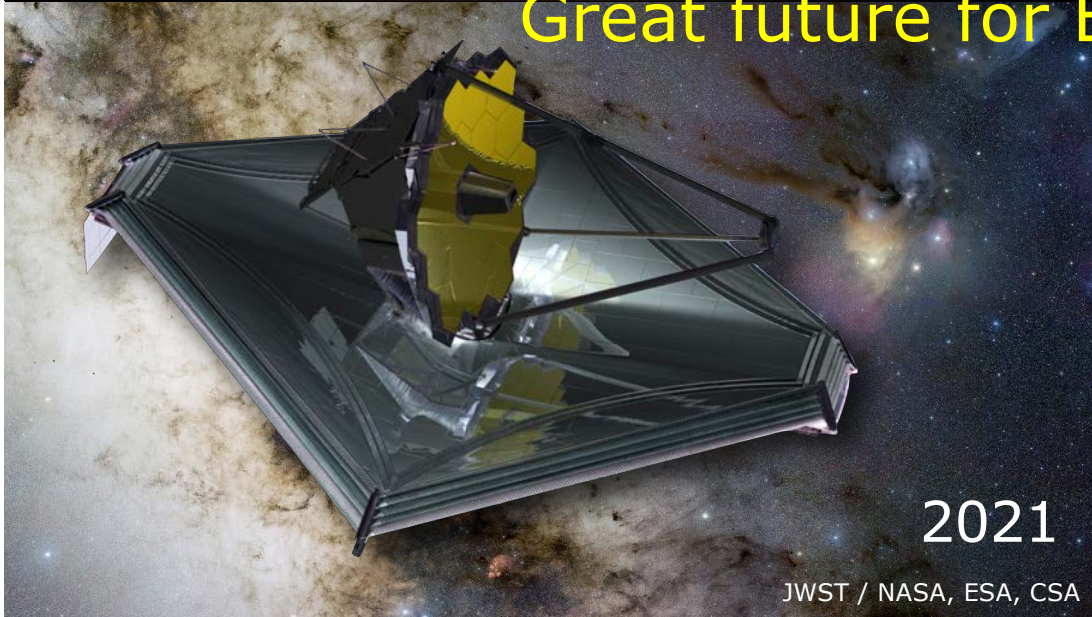
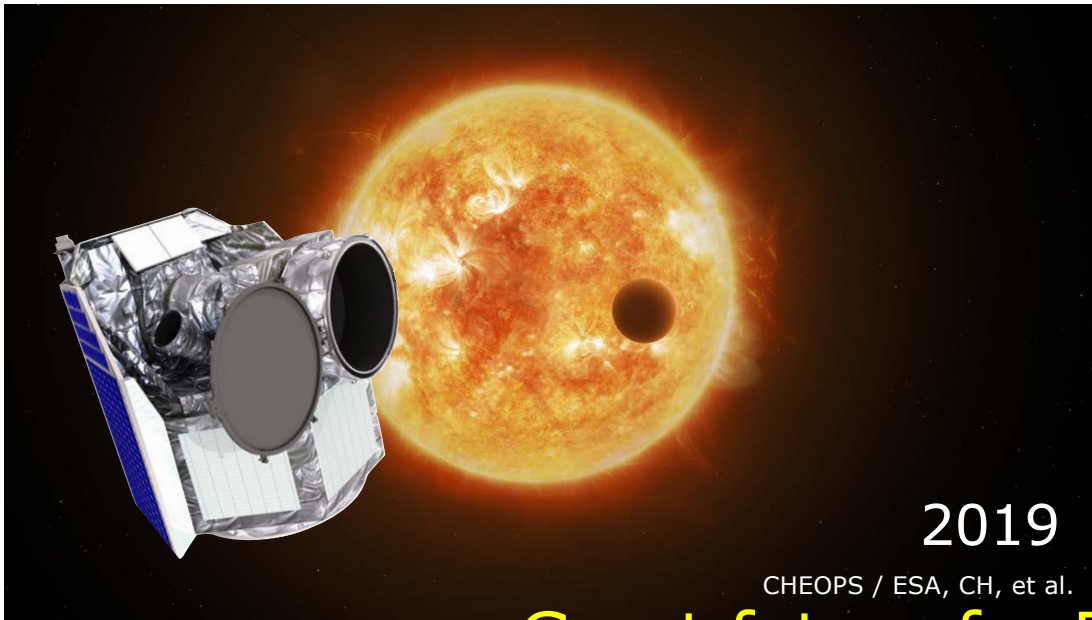


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Great future for Exoplanets at ESA!

# How Stars and Planets are formed



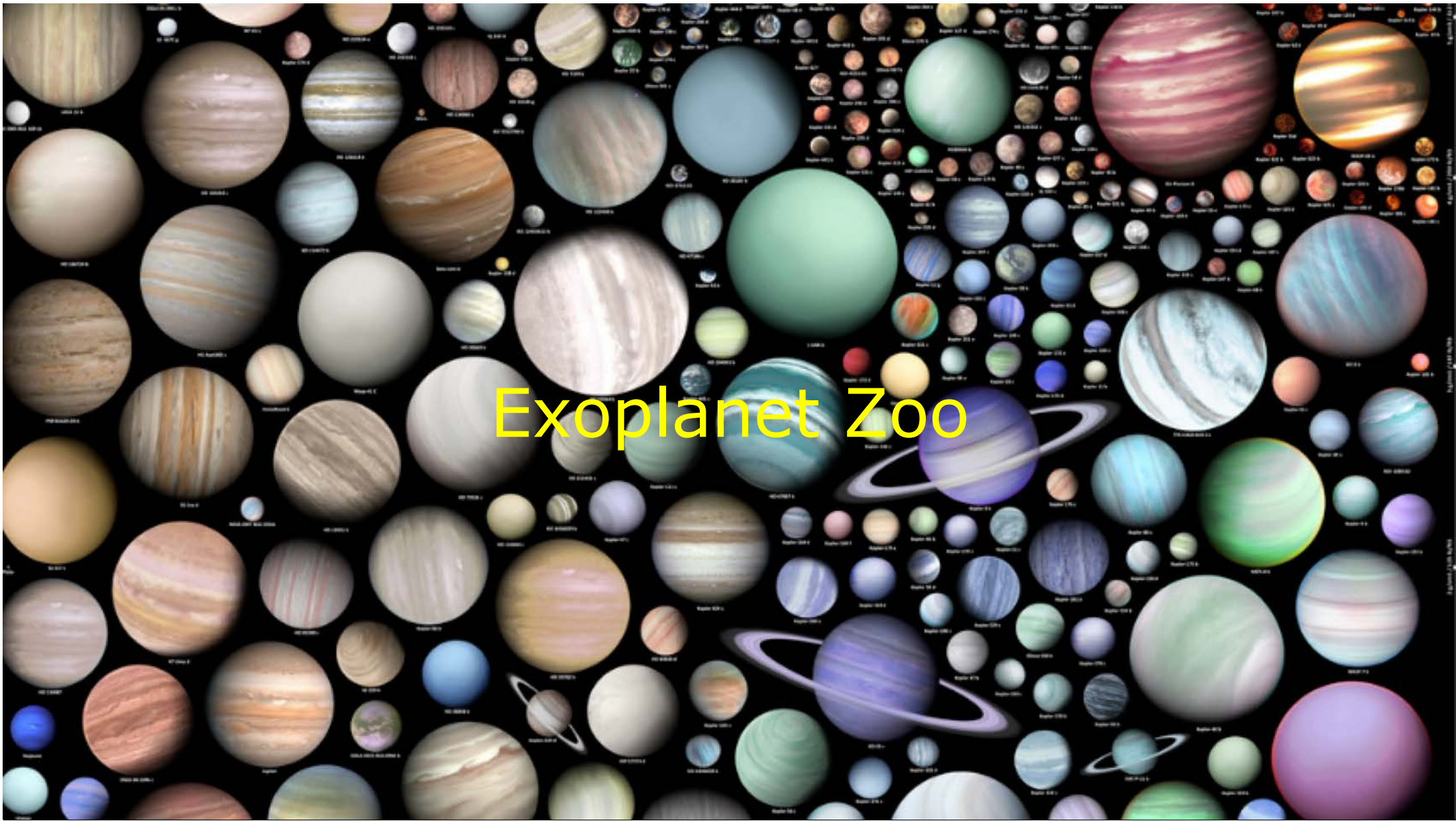
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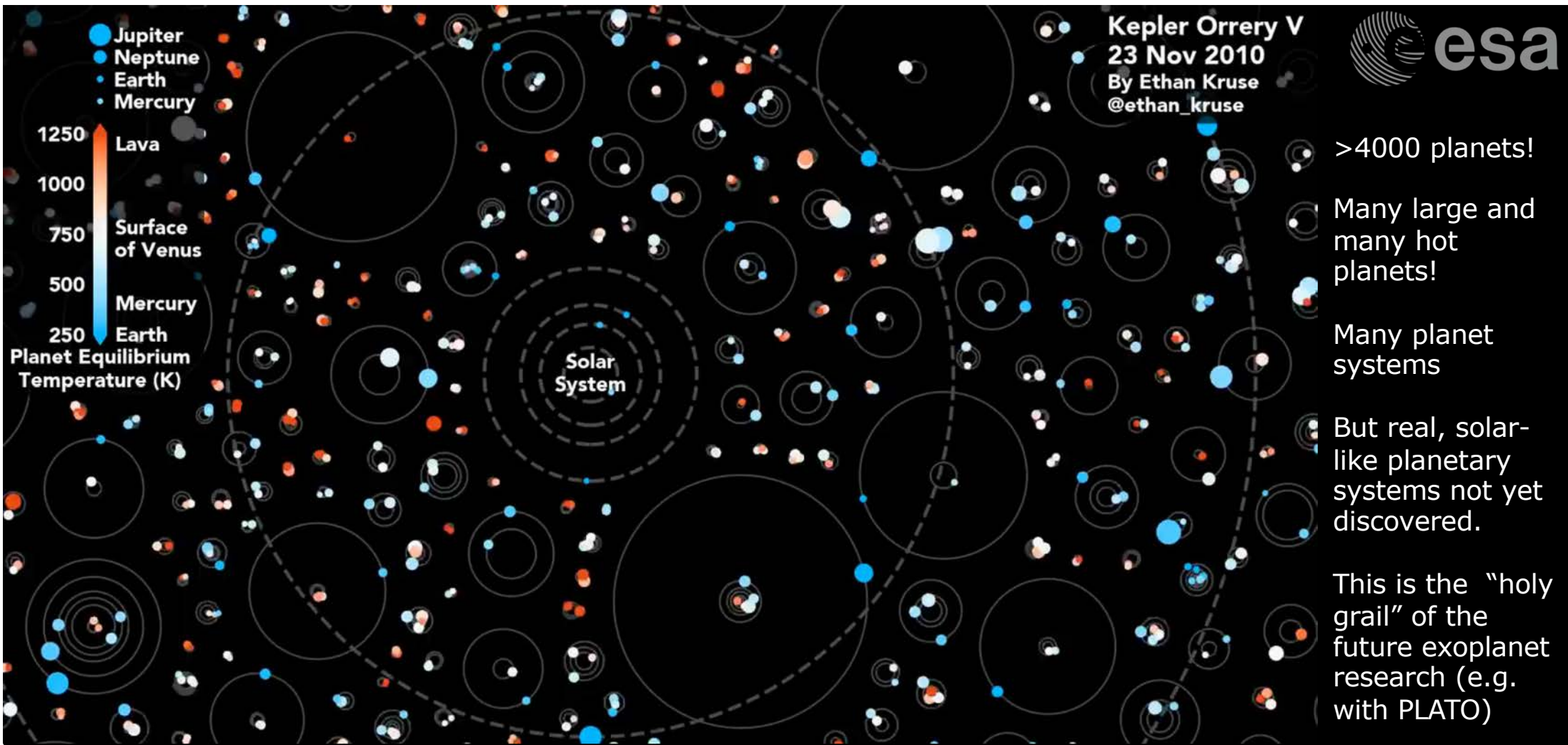
Movie credit: Gemini/STScI ([www.youtube.com](http://www.youtube.com)) Hasinger, ARIEL Conference | 14.1.2020 | Slide 6





# Exoplanet Zoo



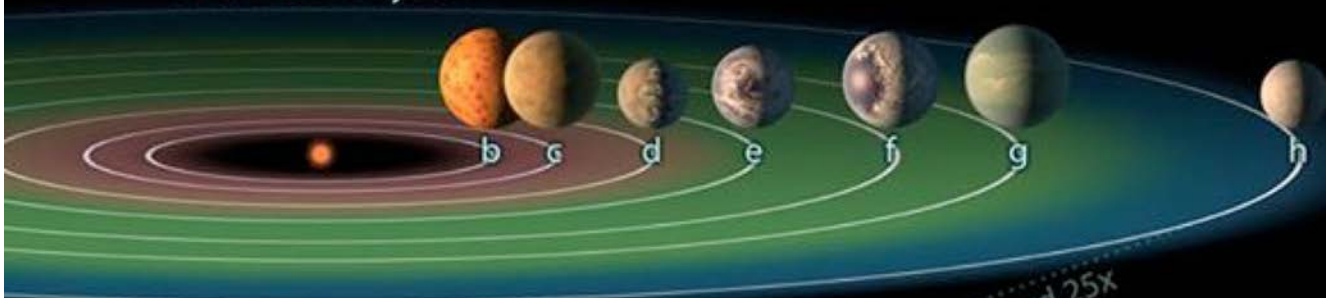




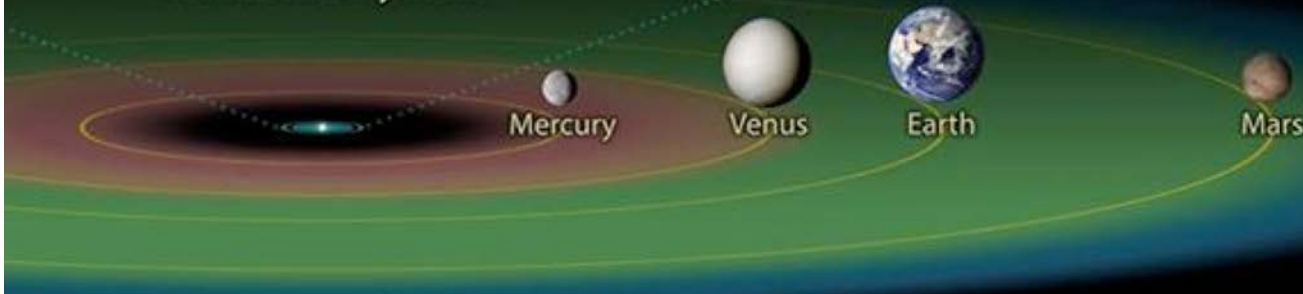
## Jupiter & Major Moons



## TRAPPIST-1 System



## Inner Solar System



Trappist-1: Seven temperate Earth-like planets around a Jupiter-size red dwarf star at a distance of 40 light years

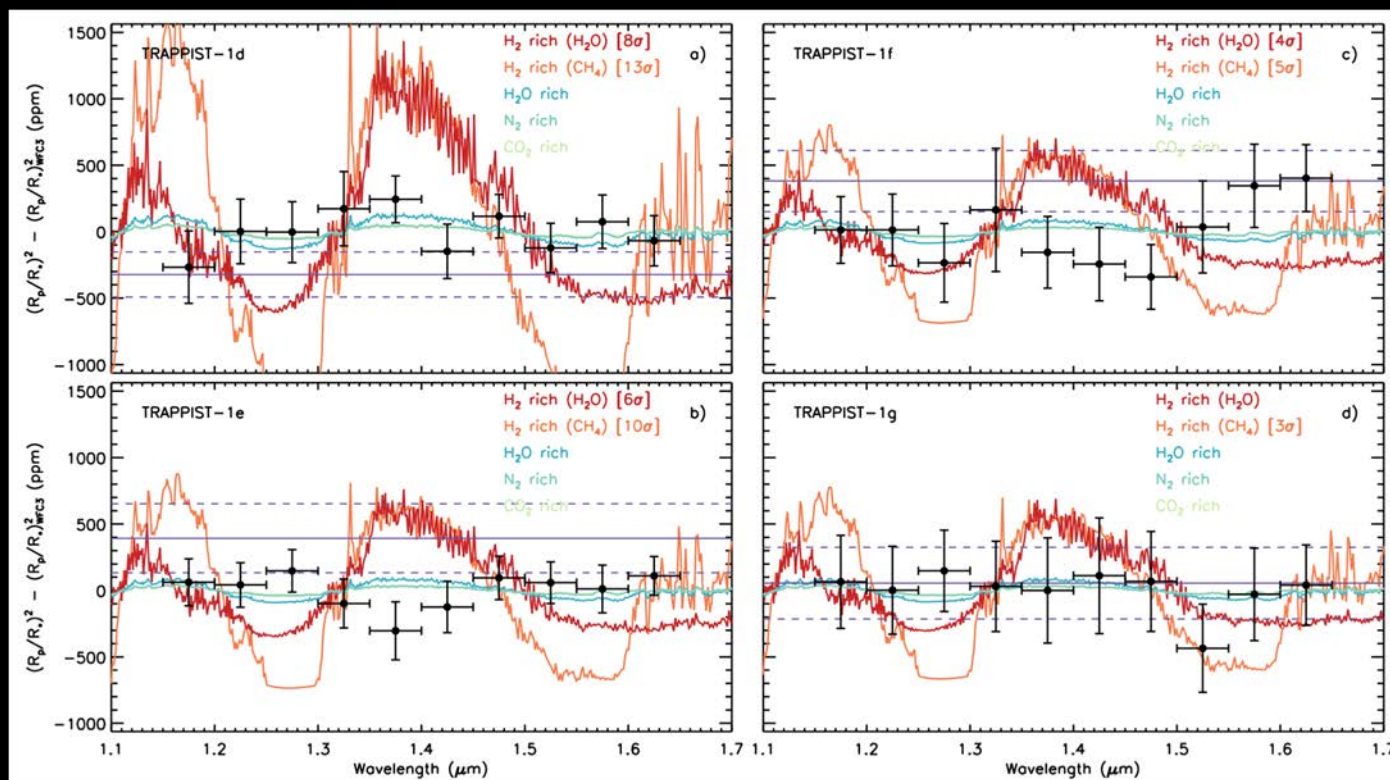
Illustration

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# HST transmission spectroscopy of four TRAPPIST-1 planets



de Wit et al.  
2018, Nature

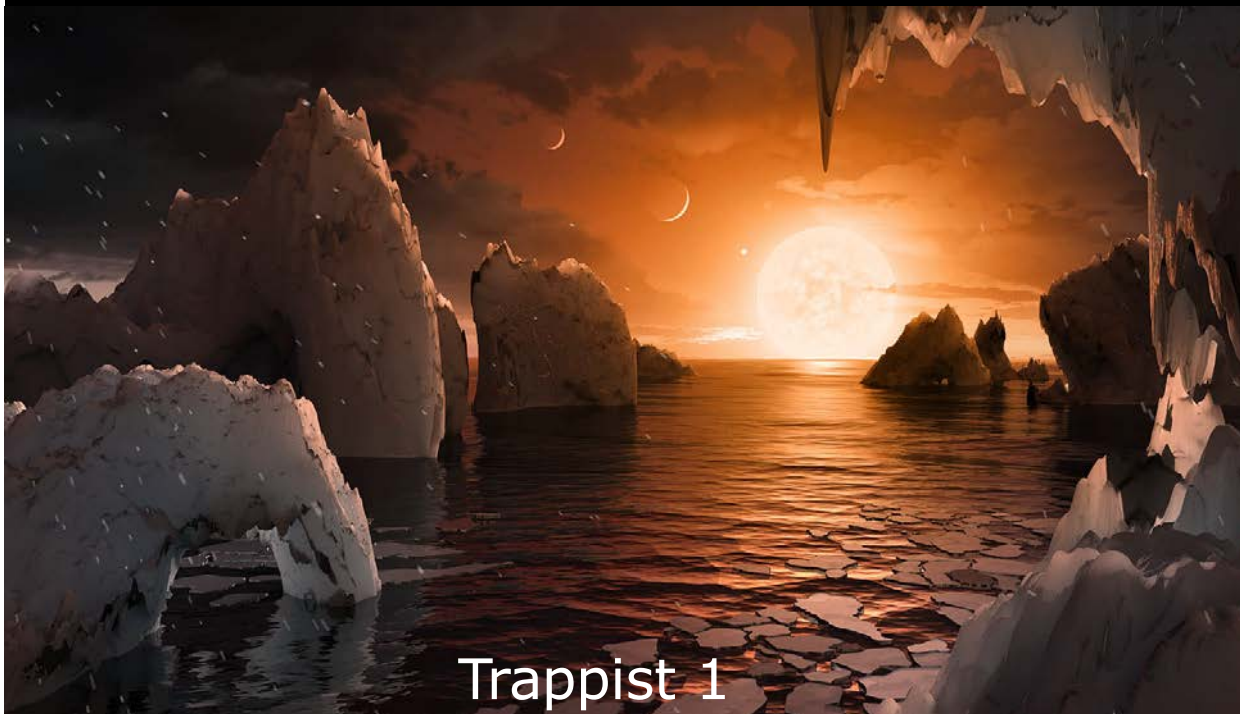
Planets e, f, & g in the habitable zone in the TRAPPIST-1 system

No prominent near-IR spectral features, ruling out cloud-free H<sub>2</sub>-dominated atmospheres for d, e & f  
High-altitude cloud & haze not expected in H<sub>2</sub>-rich atmospheres under these illumination conditions

**Conclusion: consistent with terrestrial & potentially habitable nature**



# Habitability of Exoplanets: Are we alone?



Trappist 1



Proxima b

Beware of strong X-ray radiation and inductive heating by very active star!

Discovering and studying a true Earth-like planet is still the "Holy Grail".

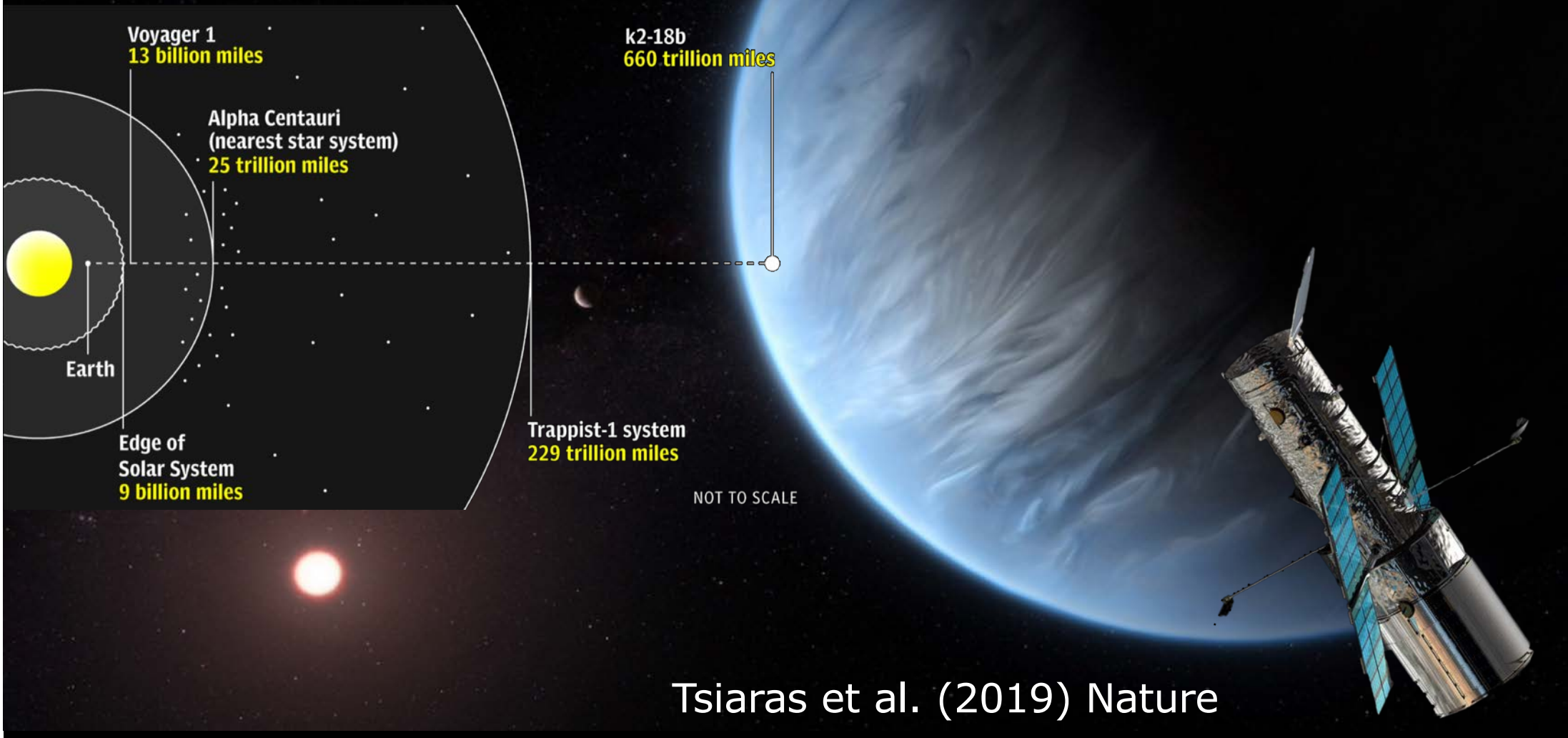
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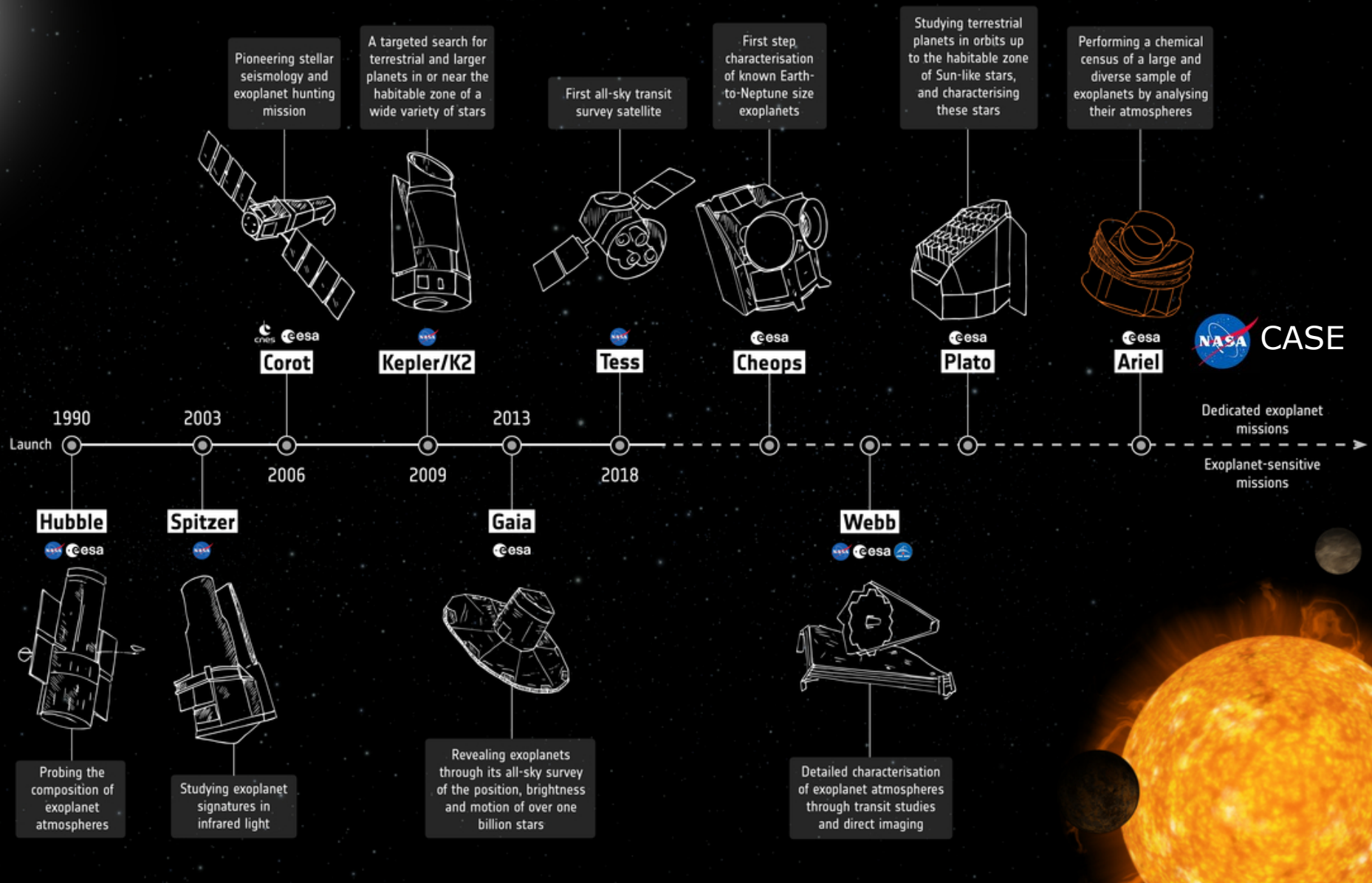
# Hubble detects Water in the atmosphere of k2-18b





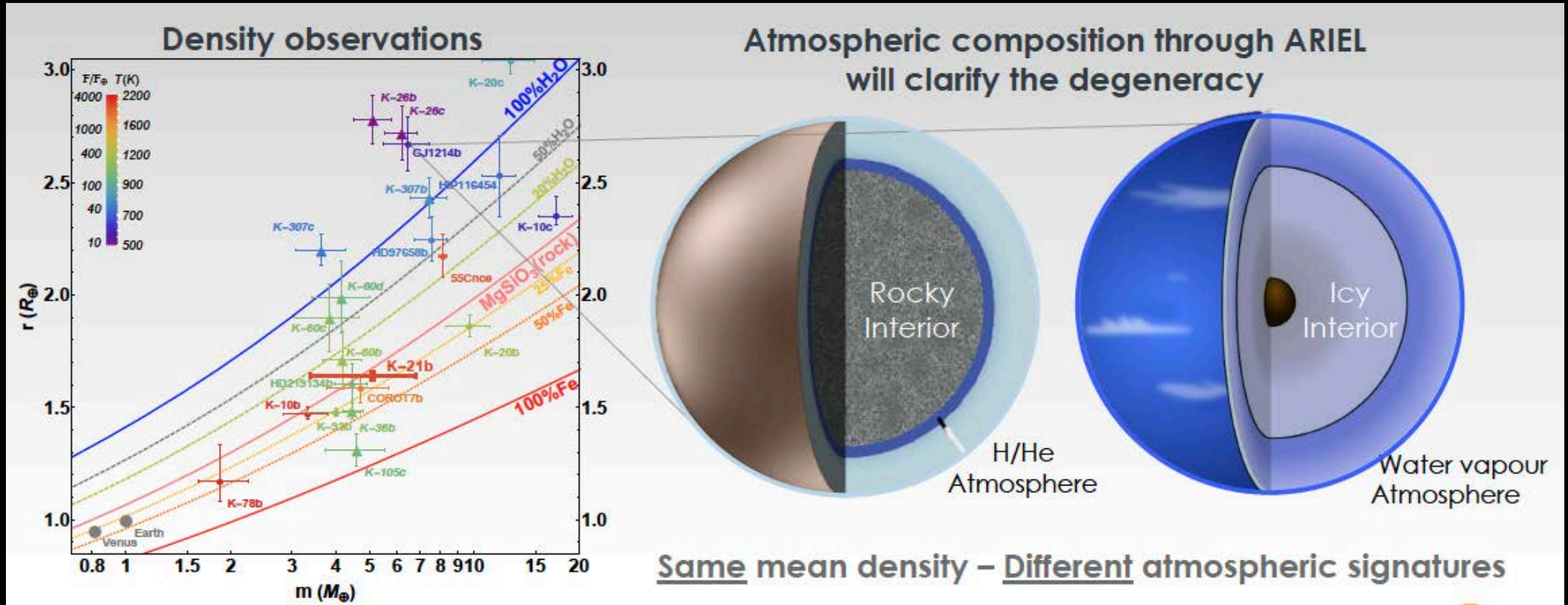
### Ground-based observatories

First discoveries of exoplanets in the 1990s opened up the field of exoplanet research. New innovations and discoveries continue to this day





# ARIEL Science Case



ARIEL will provide the spectroscopic Hertzsprung-Russell Diagram for Planets  
Complementarity to JWST, PLATO and Ground-based ELTs.

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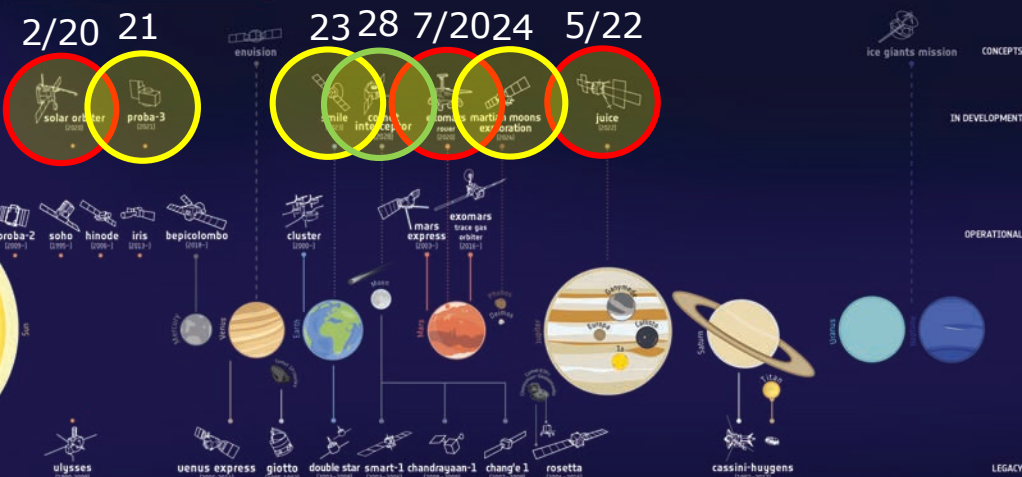
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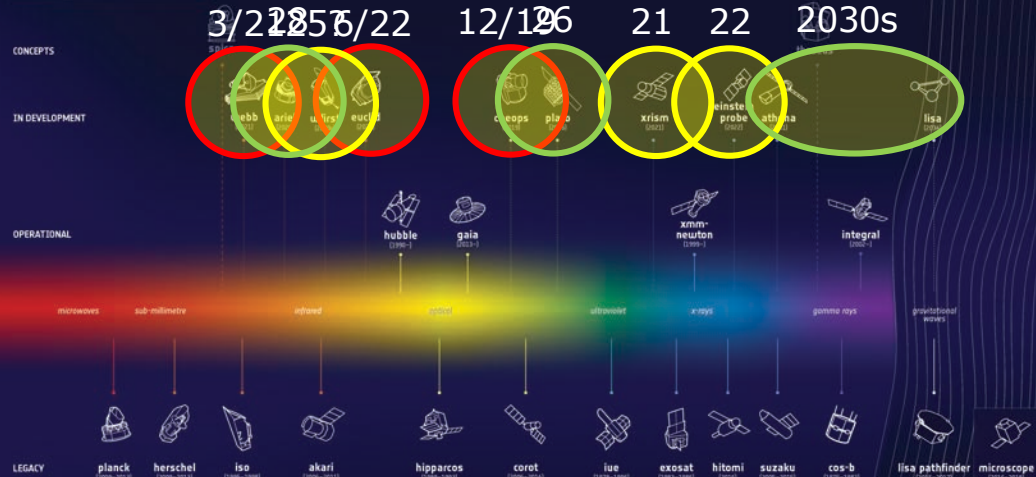
# ESA Solar System and Astrophysics Fleet



## → SOLAR SYSTEM EXPLORERS



## → COSMIC OBSERVERS



→ Great excitement for the Science Program in the next decade !



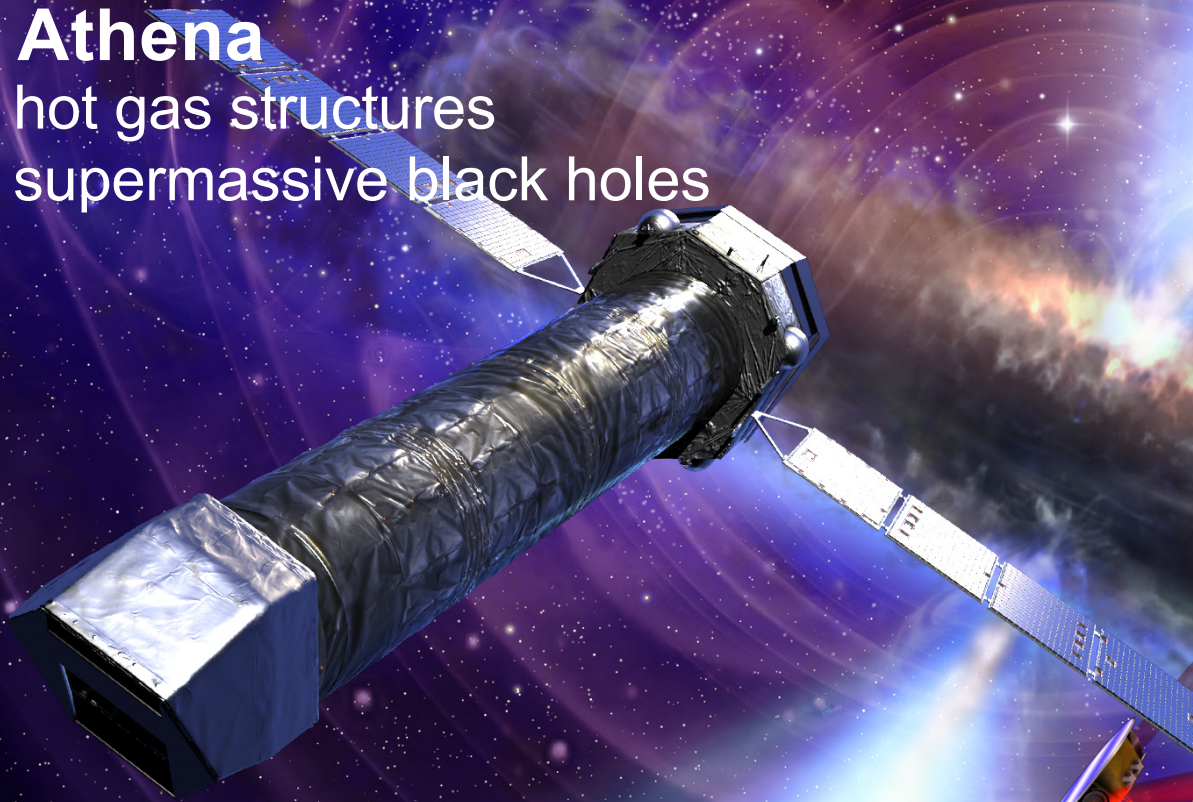


# “Bringing sound to the cosmic movies”



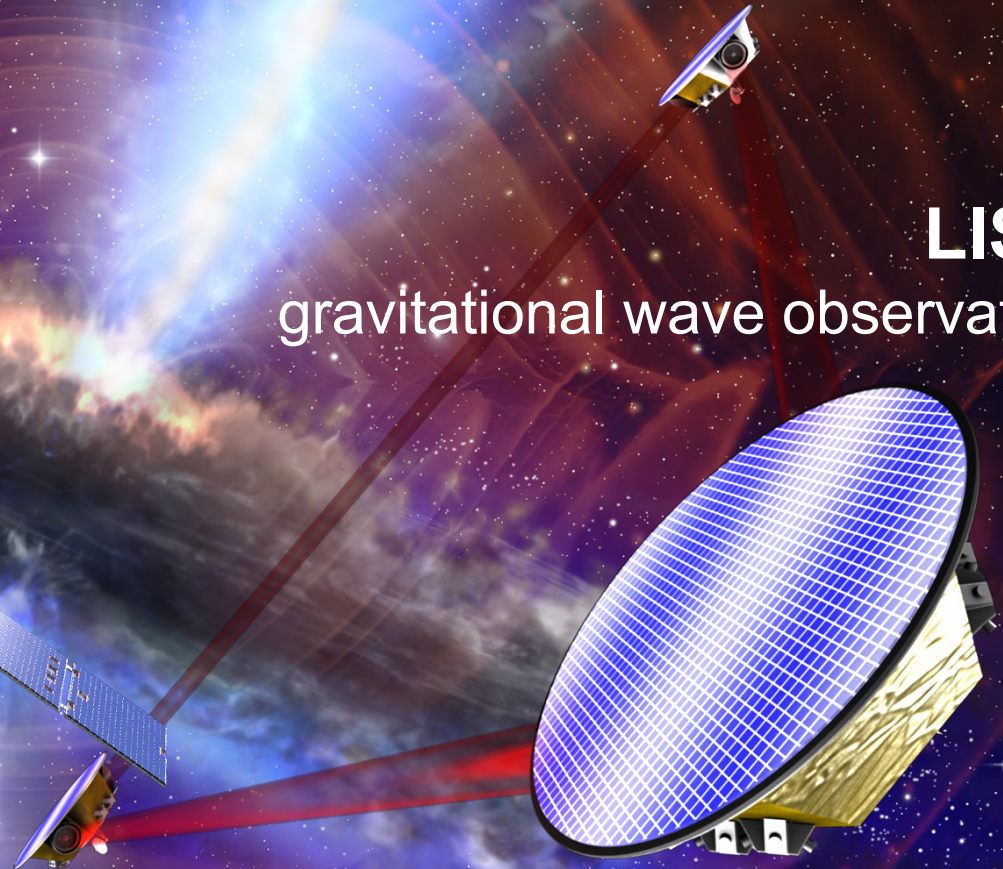
## Athena

hot gas structures  
supermassive black holes



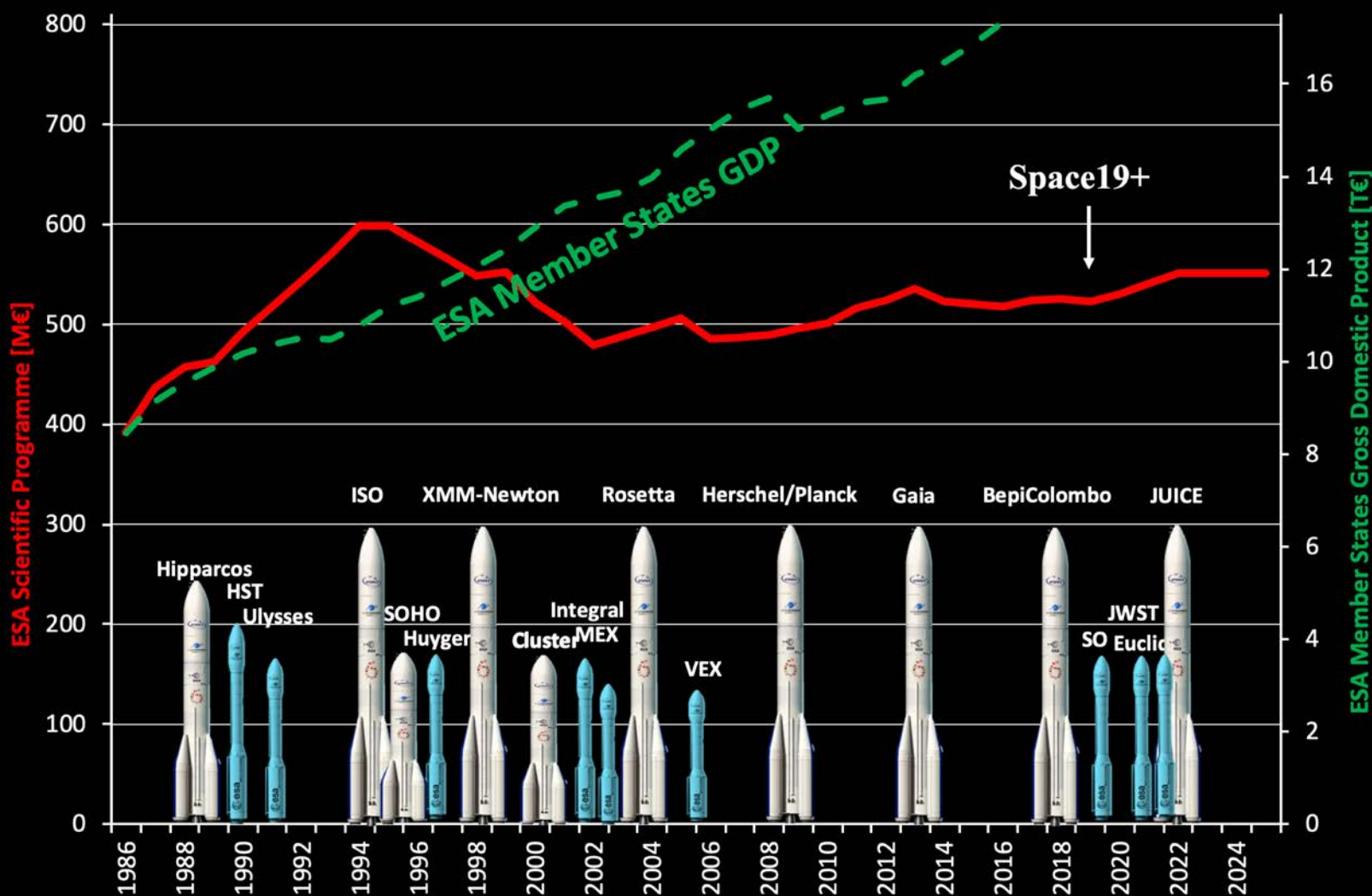
## LISA

gravitational wave observation

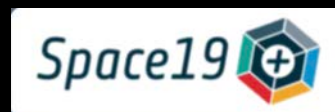


European Space Agency





We are very happy about the outcome of Space19+, with a 10% increase of the Science budget to secure European leadership in a number of key scientific areas.



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~100 Voyage 2050 White Papers  
200 Applications for Topical Teams  
10000 Community Engagement Survey Inputs



A composite image of Earth from space, showing the curvature of the planet and the glowing atmosphere. The Earth is partially illuminated by a bright light source, creating a lens flare effect. The image is overlaid with a faint grid of lines. The text "Thank you very much!" is written in a bold, yellow, sans-serif font in the upper right corner.

**Thank you  
very much!**