

Exploring the Solar System IV – Exoplanets



Exploring the Solar System IV Exoplanets

Why Look For Exoplanets?

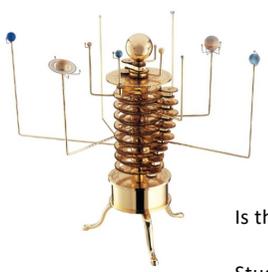
Finding Exoplanets

Looking For Life

What Next?

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Why Look For Exoplanets?



Is our solar system typical?

Are there other planets like the Earth?

Is there life elsewhere in the galaxy?

Studying other solar systems will help us understand our own

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Finding Exoplanets

Planets orbiting other stars can be found by various methods

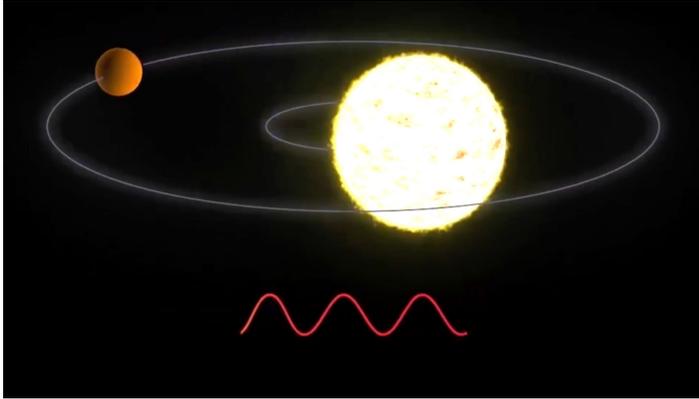
Discovery Method	Method Looks For ...
Radial Velocity	Wobble
Transits	Shadows
Direct Imaging	Dots in images
Microlensing	Bending of light
Astrometry	Motion of stars

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Method 1 – Radial Velocity

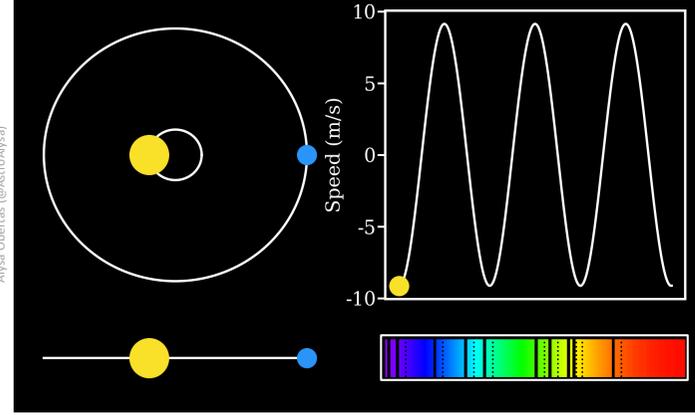
> 1000 planets found Looking for wobbles



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Changes to Spectrum



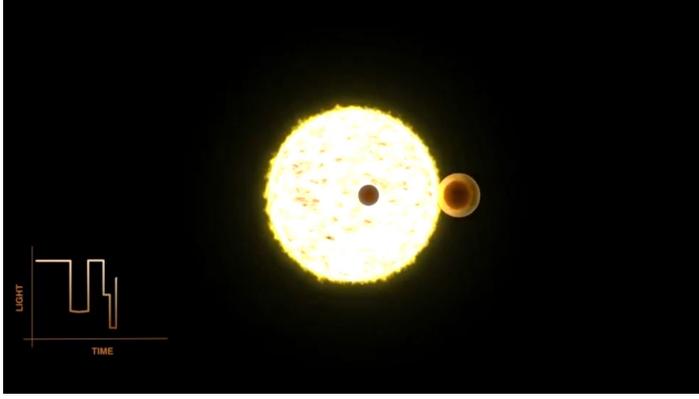
Alysa Obertas (@AstroAlysa)

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Method 2 – Transits

> 4000 planets found Looking for shadows

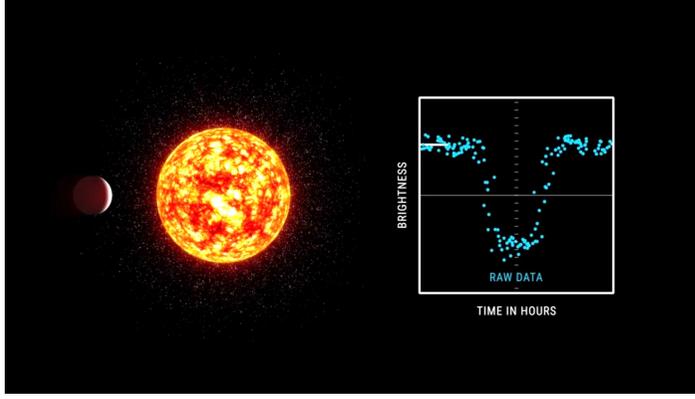


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Method 2 – Transits

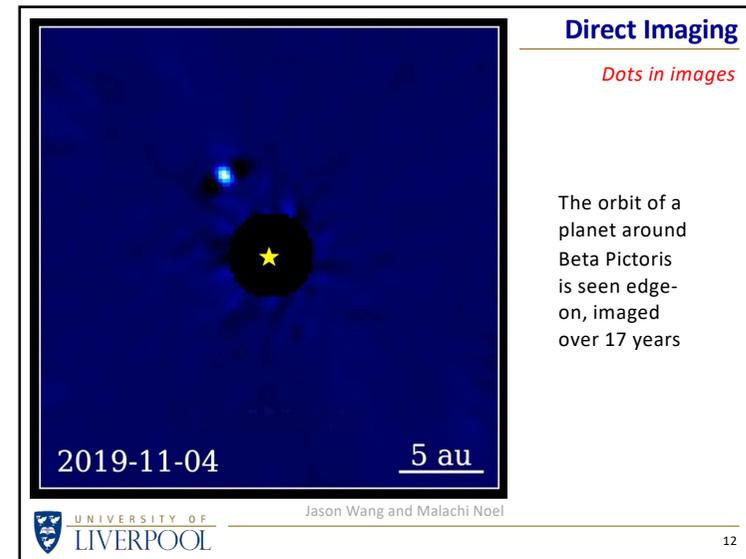
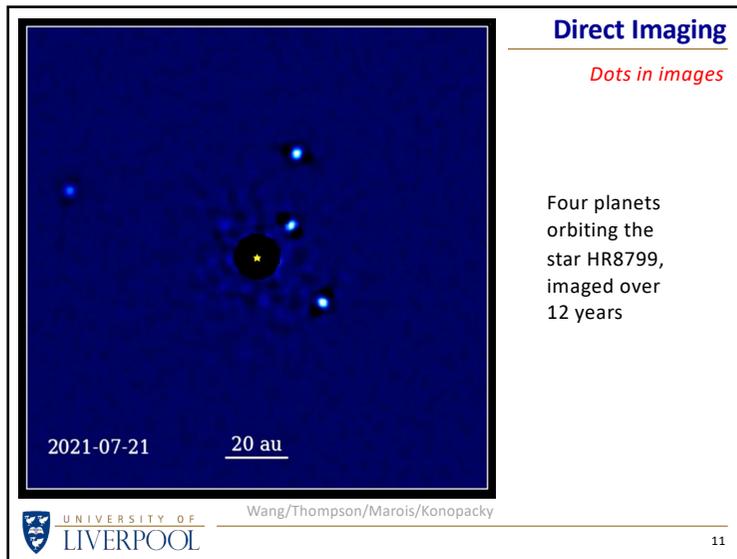
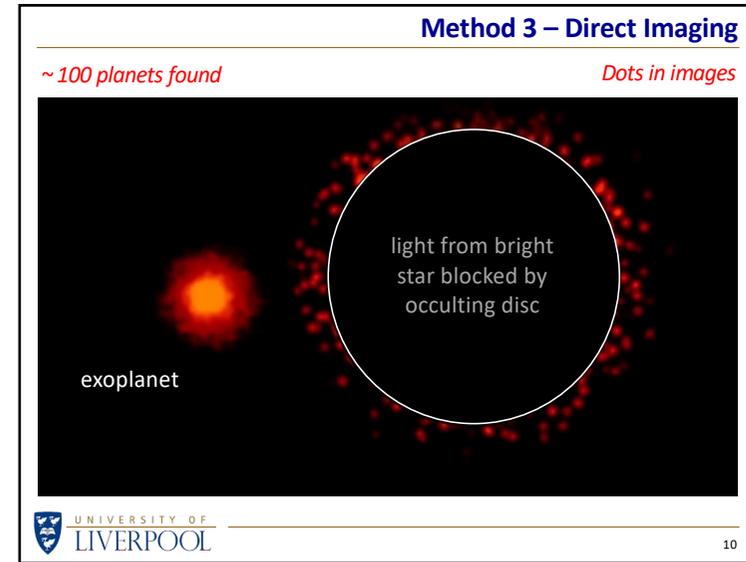
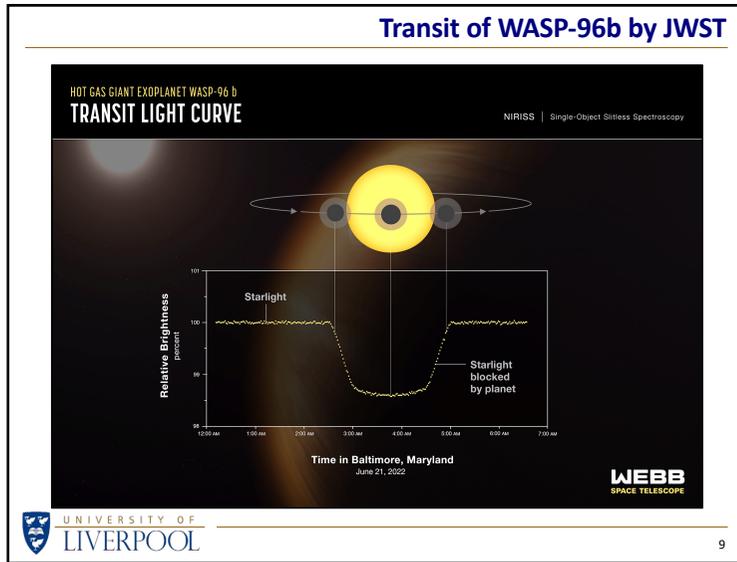
> 4000 planets found Looking for shadows



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Dusty Debris Disk

JAMES WEBB SPACE TELESCOPE
FOMALHAUT

inner disk
inner gap
intermediate belt
outer gap
outer ring
halo
great dust cloud

800u
MIRI Filters | F2300C | F2550W

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APOD 11 May 2023

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Method 4 – Microlensing

~ 200 planets found *Bending of light*

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Method 5 – Astrometry

~ 10 planets found *Motion of stars*

Gaia

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Mass–Size–Density

Radial velocity (wobble) → Mass
Transits (shadows) → Size
Spectroscopy → Atmos
Temperature →

Density

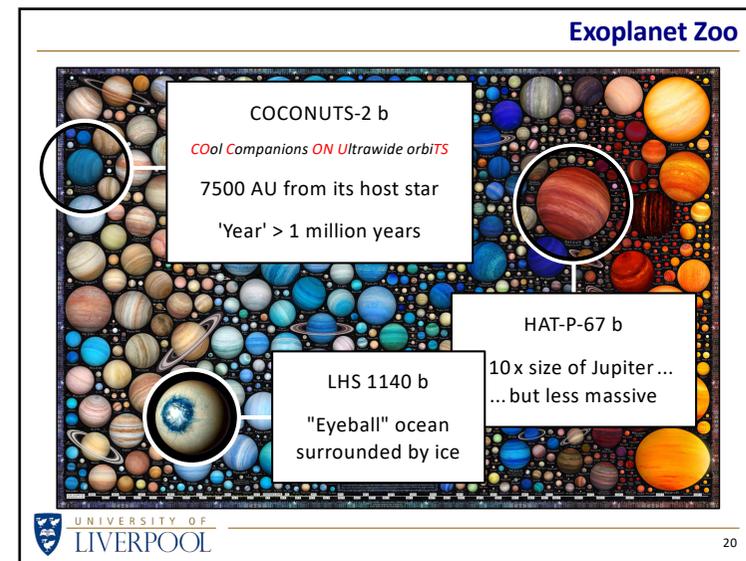
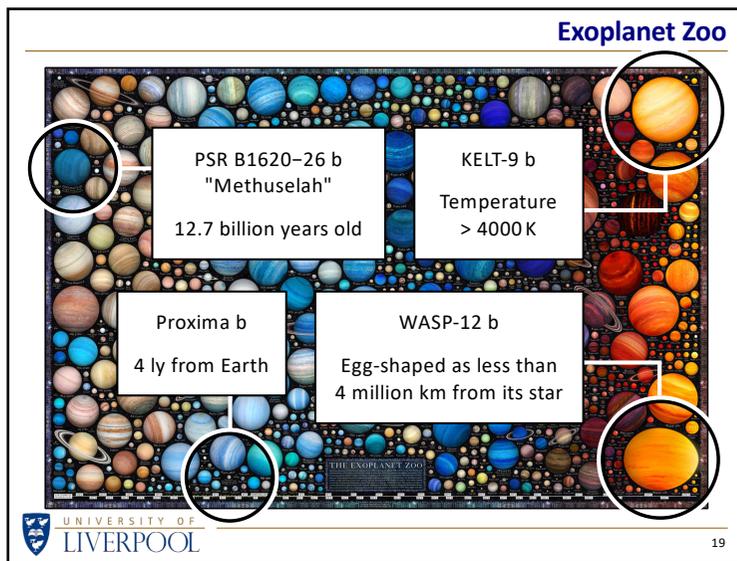
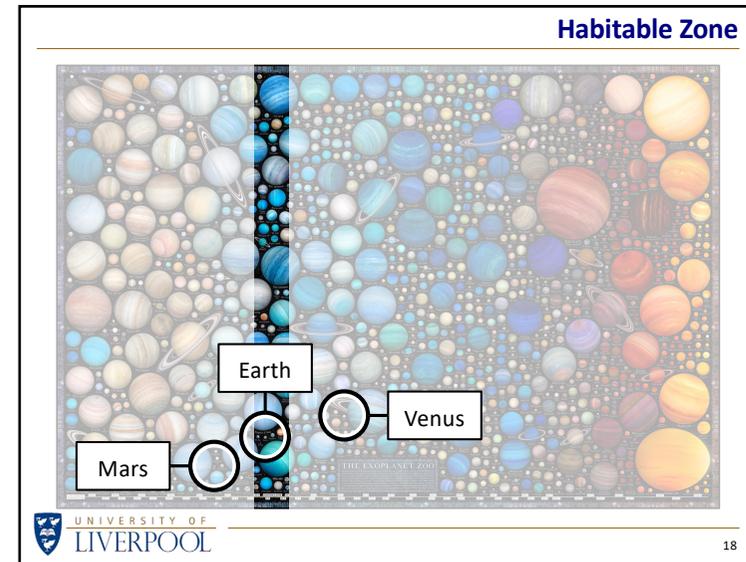
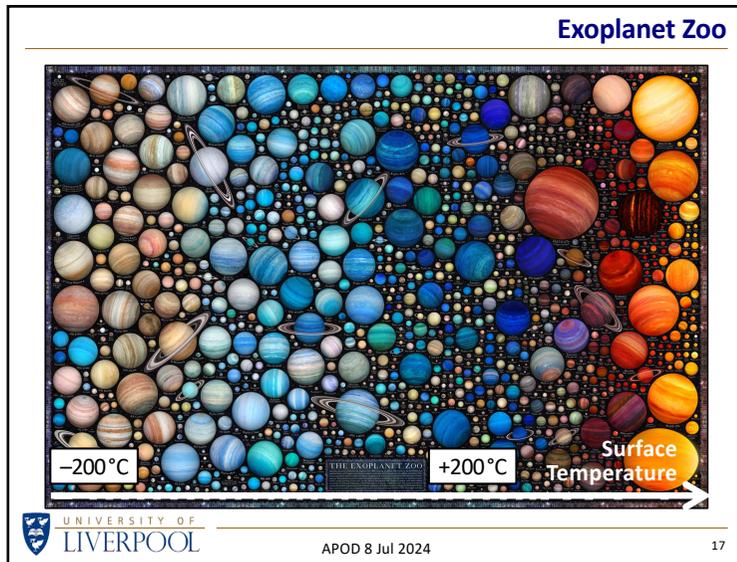
Type

Gas << 1
Water = 1
Rock ≈ 3
Metal ≈ 5

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Exoplanet Missions

Gaia (ESA 2013)

JWST (NASA-ESA-CSA 2021)

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Exoplanet Missions

Kepler (NASA 2009)

CHEOPS (ESA 2019)

PLATO (ESA 2026)

TESS (NASA 2018)

Roman (NASA 2027)

HWO (NASA 2040+)

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Star Shade Concept

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Looking For Life

Transit

Eclipse

Starlight

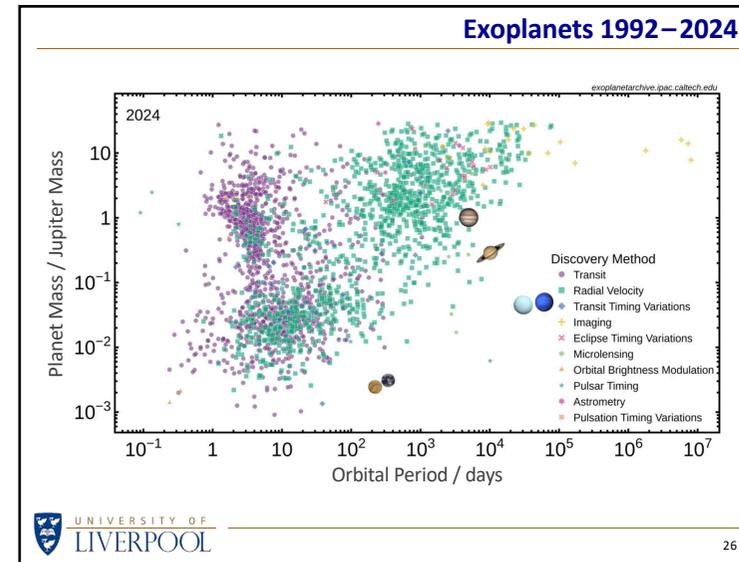
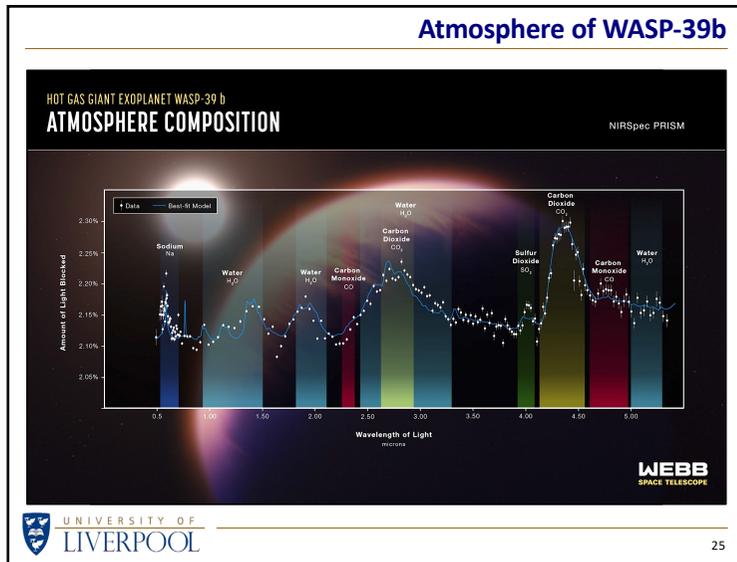
Size of planet

Brightness of planet

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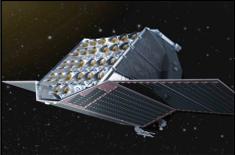
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Want To Know More?

NASA Discovery Dashboard:
science.nasa.gov/exoplanets/discoveries-dashboard

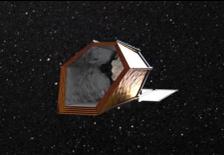
NASA Exoplanet Archive:
exoplanetarchive.ipac.caltech.edu



PLATO 2026
sci.esa.int/web/plato



Roman 2027
roman.gsfc.nasa.gov



HWO 2040+
habitableworldsobservatory.org

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EXOPLANETS

www.liverpool.ac.uk/~sdb/Talks

Dr Steve Barrett
Sunderland AS 22 Mar 2026