

WORLDS BEYOND OUR SOLAR SYSTEM: HOW TO FIND *EXOPLANETS*

Michael Cowley
PhD Student
Macquarie University

PDF VERSION

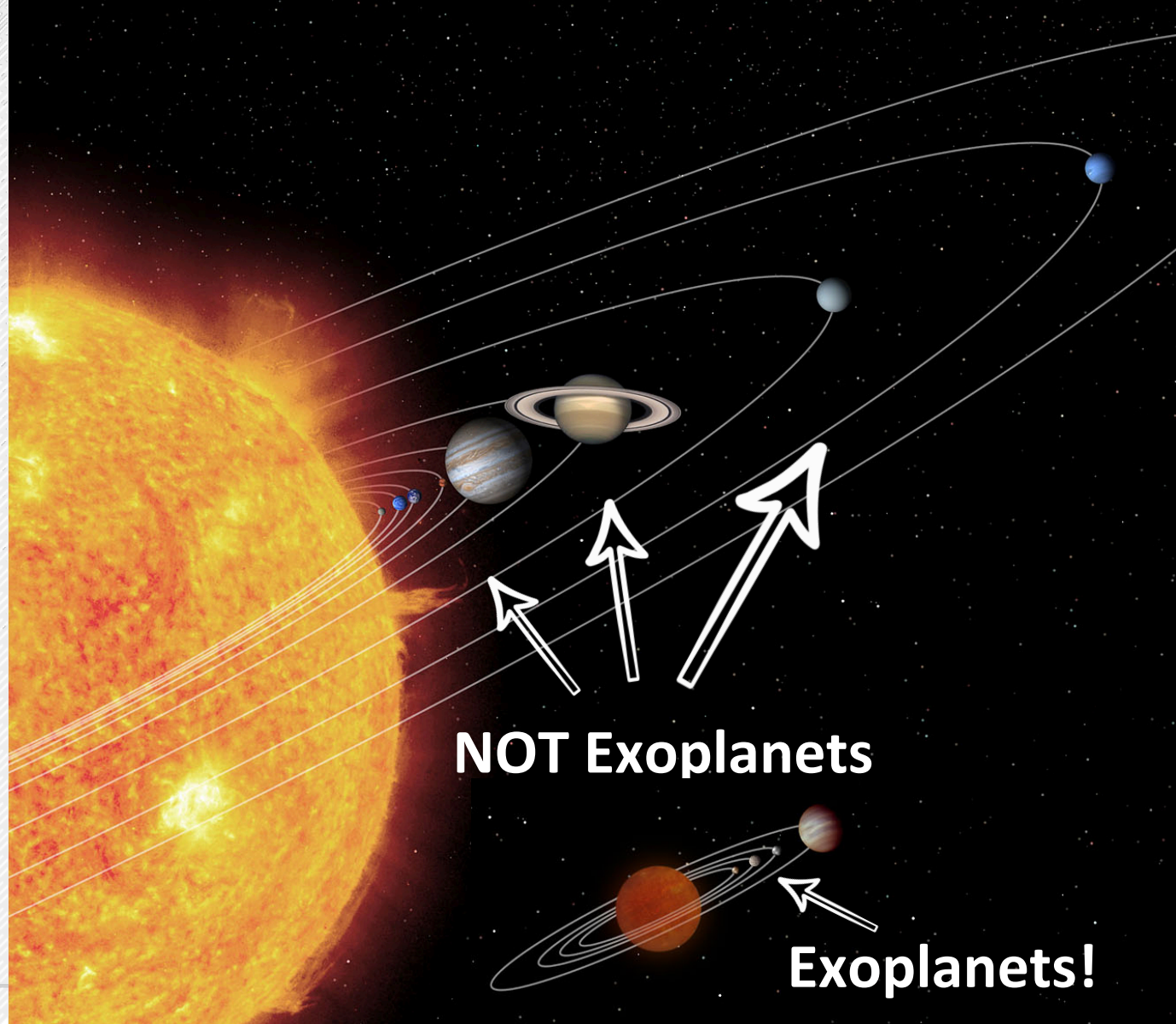
MACQUARIE
UNIVERSITY



WHAT ARE EXOPLANETS?

DETAILS

Exoplanets (also known as extrasolar planets) are planets that are found outside of our own Solar System.



HOW MANY?

DETAILS

Astronomers estimate that our galaxy, the Milky Way, is home to at least 100 billion planets.

Our Galaxy



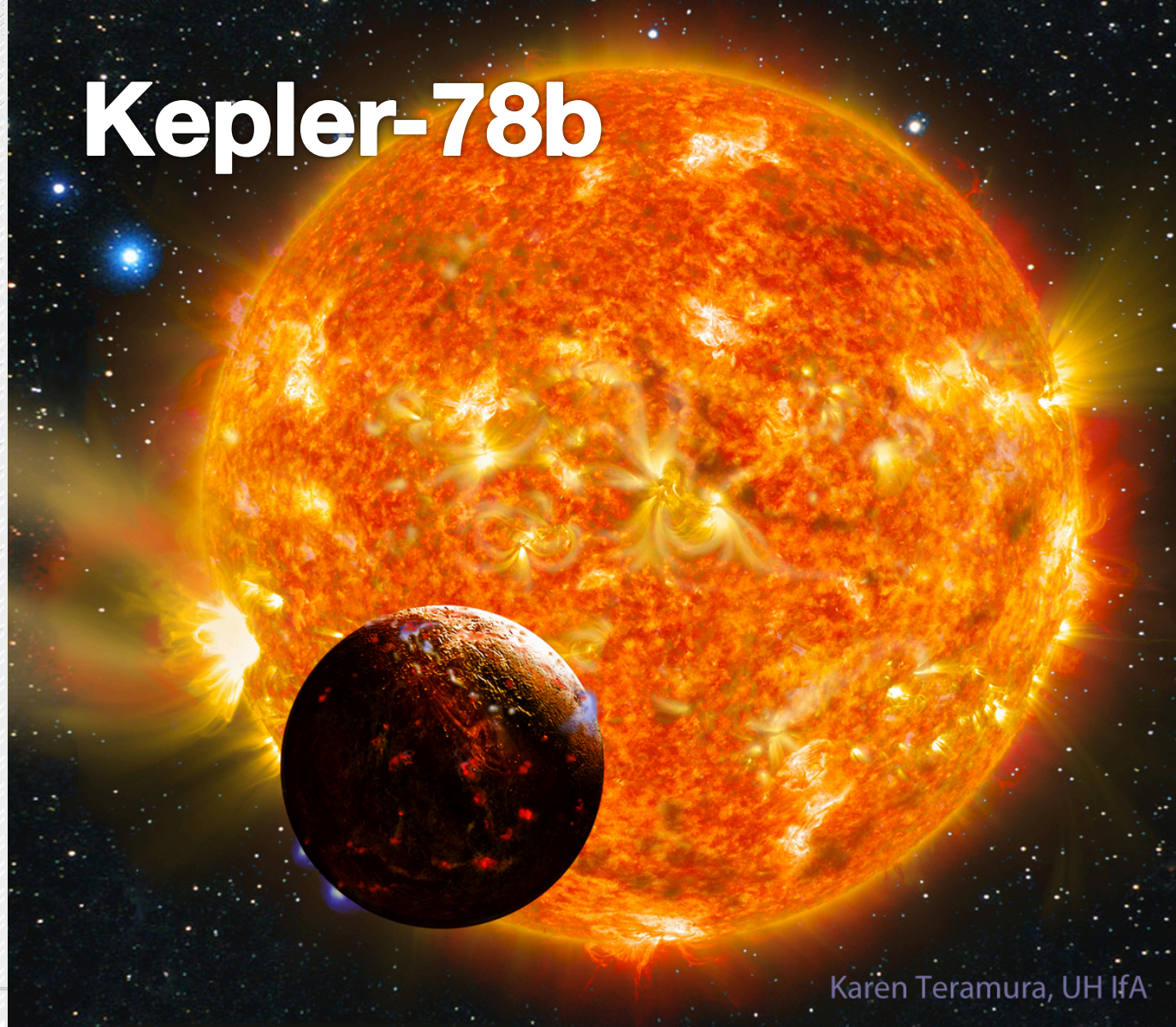
UNIQUE EXOPLANETS

DETAILS

Kepler-78b is similar in size and mass to Earth, but orbits around its parent star in an 8.5-hour orbit.

Imagine a planet where it could be your birthday, Christmas and New Year's Eve every day!

Kepler-78b



Karen Teramura, UH IfA

UNIQUE EXOPLANETS

DETAILS

Due to the absence of reflective clouds, TrES-2b is darker than a piece of coal and only reflects about 1% of its light!

In addition to this, the planet is also tidally locked, which means one side always faces the star - perpetual daytime!

TrES-2b



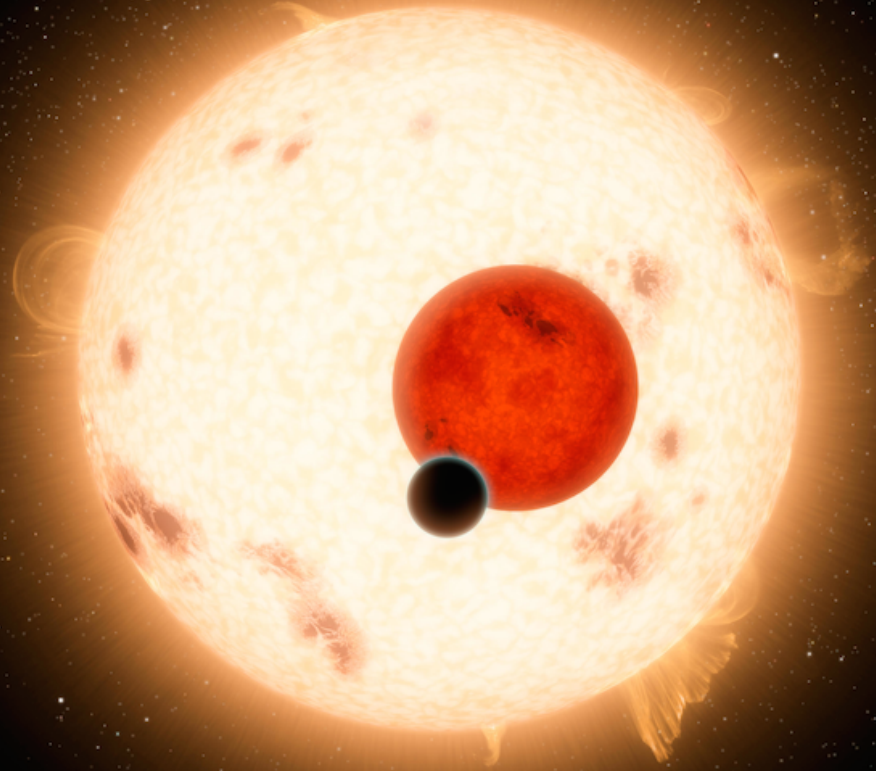
UNIQUE EXOPLANETS

DETAILS

A Saturn-sized planet that takes 221 days to orbit around binary stars.

If Kepler-16b was habitable and you could stand on its surface, you'd cast two shadows!

Kepler-16b



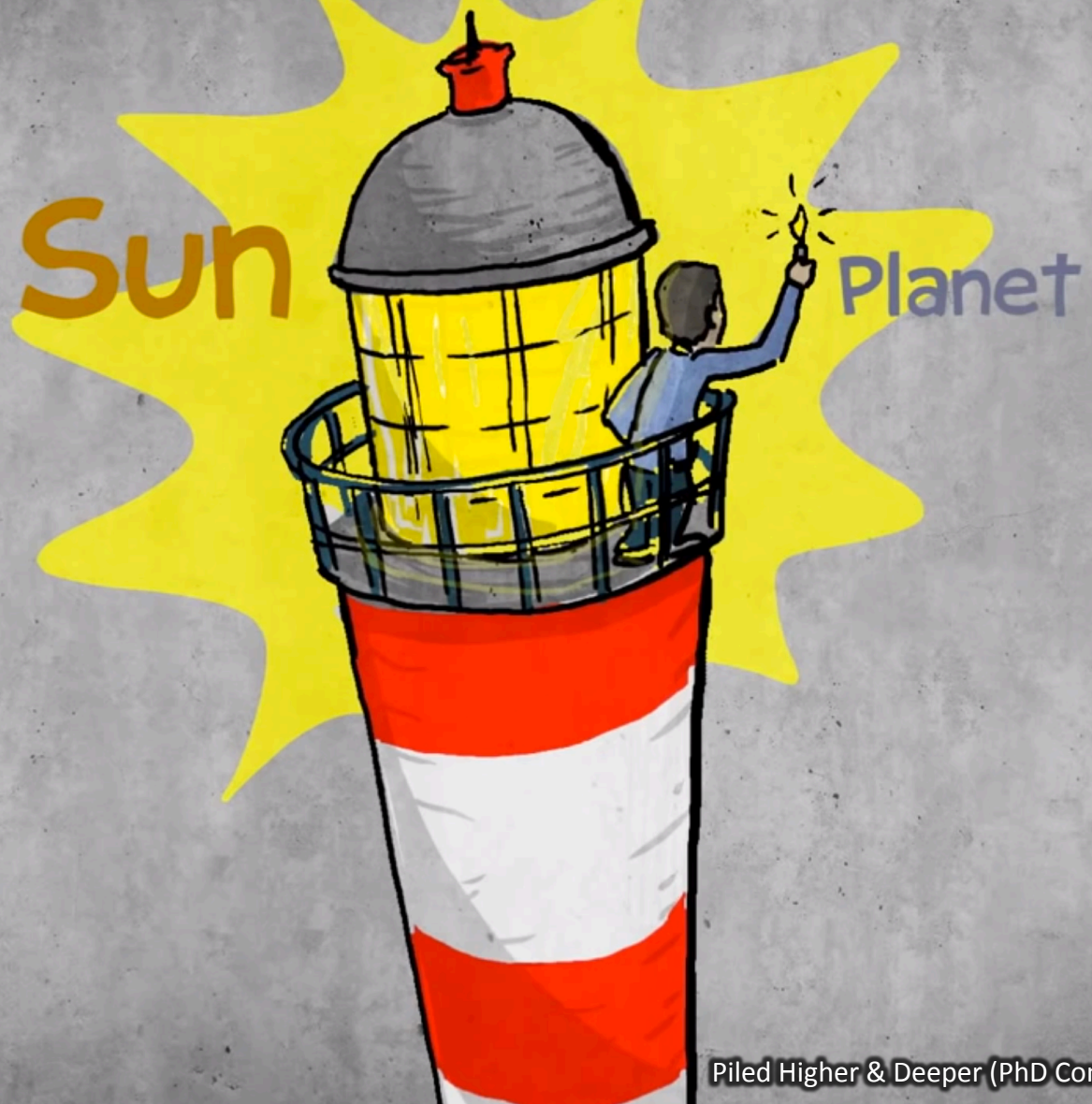
HOW ARE THEY FOUND?



HOW ARE THEY FOUND?

DETAILS

It is very difficult to detect exoplanets directly as they are extremely faint compared to stars, and what little light comes from them tends to be lost in the glare.



GROUND SEARCHES

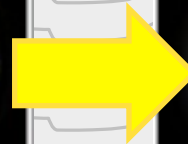
DETAILS

Ground-based telescopes have to contend with the obscuration and instability of our own atmosphere, limiting them primarily to the detection of larger planets.

Plane Waves From a Distant Object

Turbulent Layer in Atmosphere

Distorted Waves



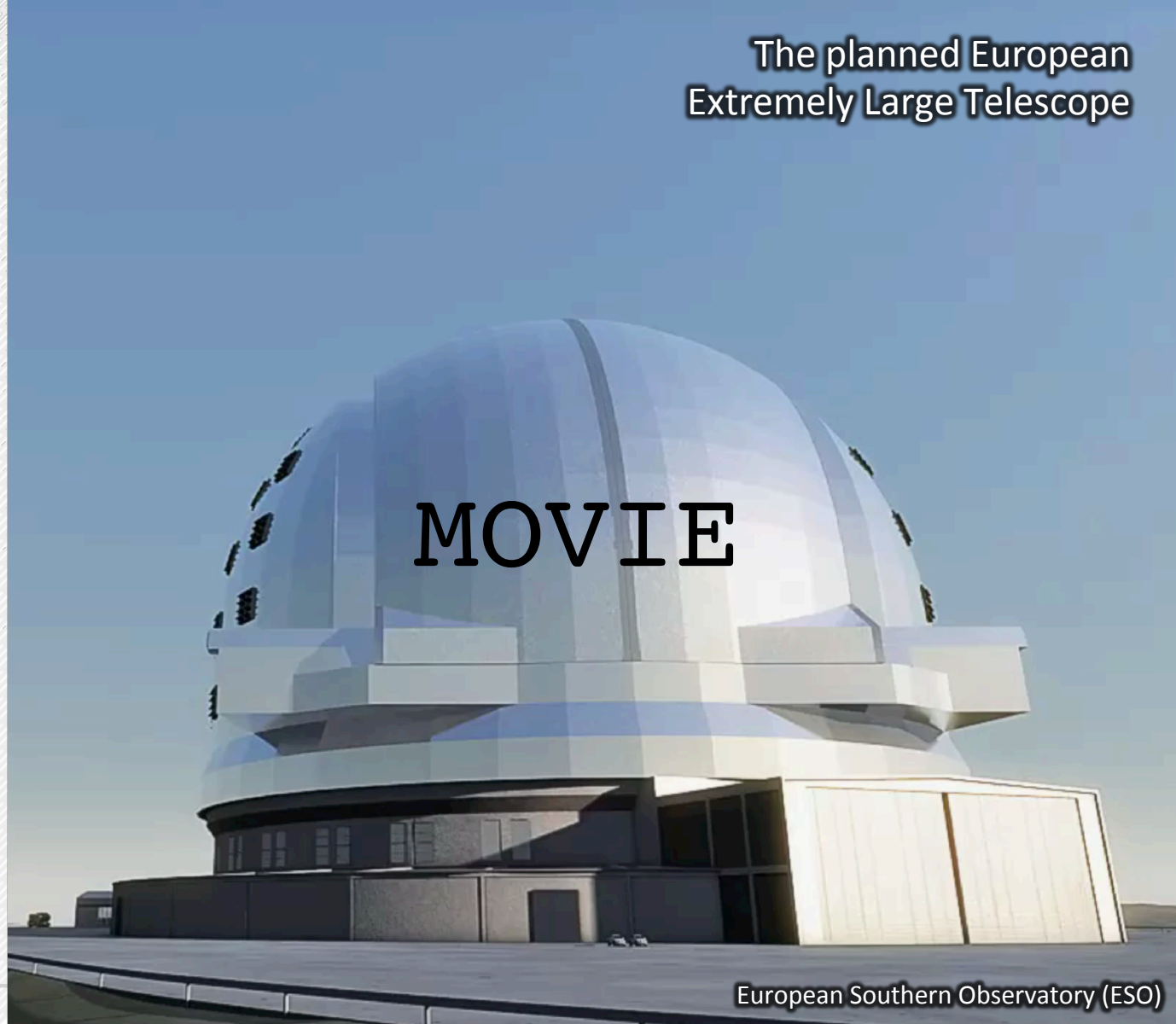
GROUND SEARCHES

DETAILS

Adaptive optics are being incorporated into existing and next generation telescopes as a means to improve the performance of optical systems by reducing the effects of atmospheric distortion.

The planned European
Extremely Large Telescope

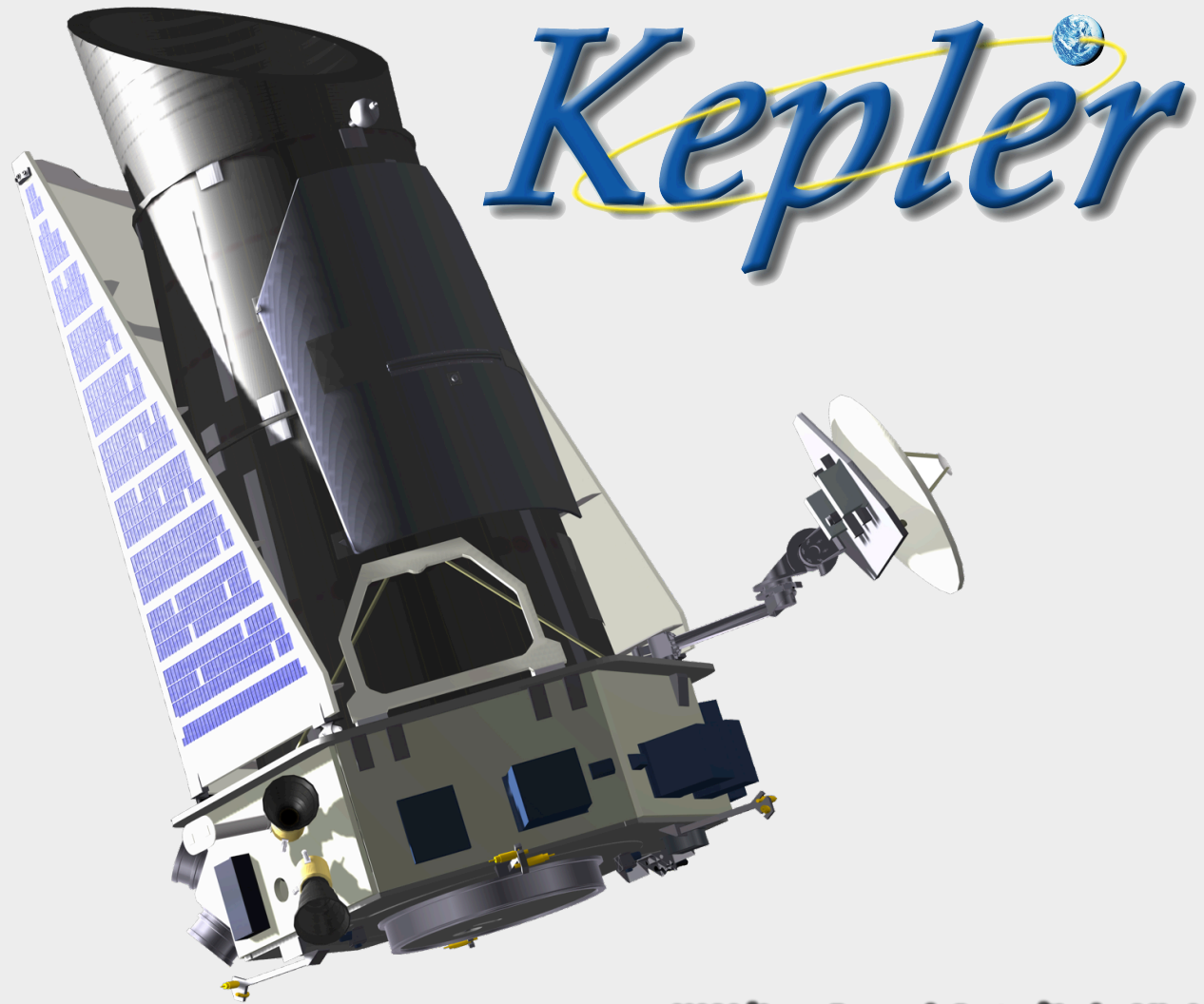
MOVIE



SPACE SEARCHES

DETAILS

By extending transit surveys to space, the limitations associated with Earth's atmosphere can be completely bypassed, allowing for uninterrupted, high resolution observations.



HOW ARE THEY FOUND?

Doppler “Wobble” Method

Microlensing “Blip” Method

Transit “Wink” Method

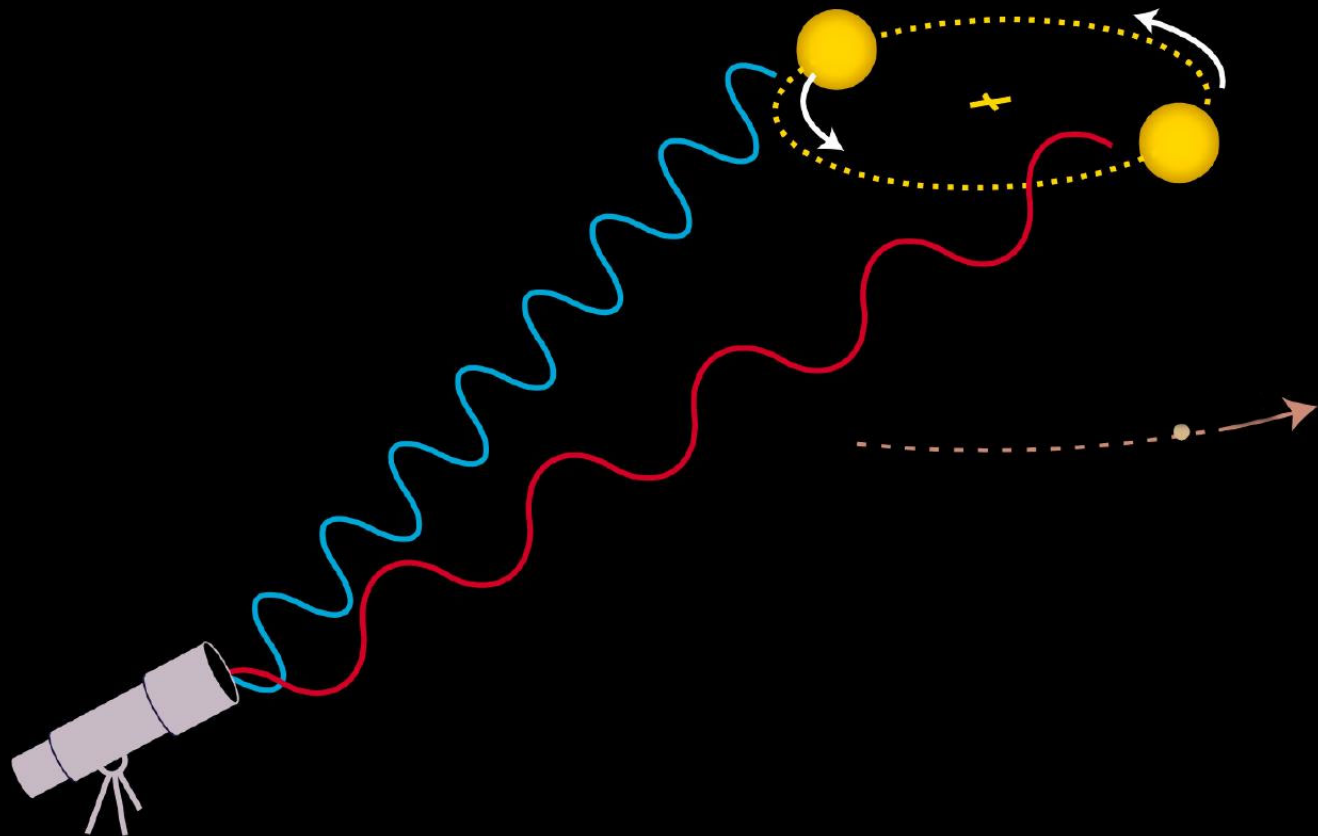
HOW ARE THEY FOUND?

DETAILS

This method relies on the fact a star does not remain stationary when orbited by a planet. It wobbles as it responds to the planet's gravitational tug.

If the star wobbles towards an observer, then its spectrum appears slightly shifted towards the blue; when it wobbles away, it will be shifted towards the red.

Doppler “Wobble” Method

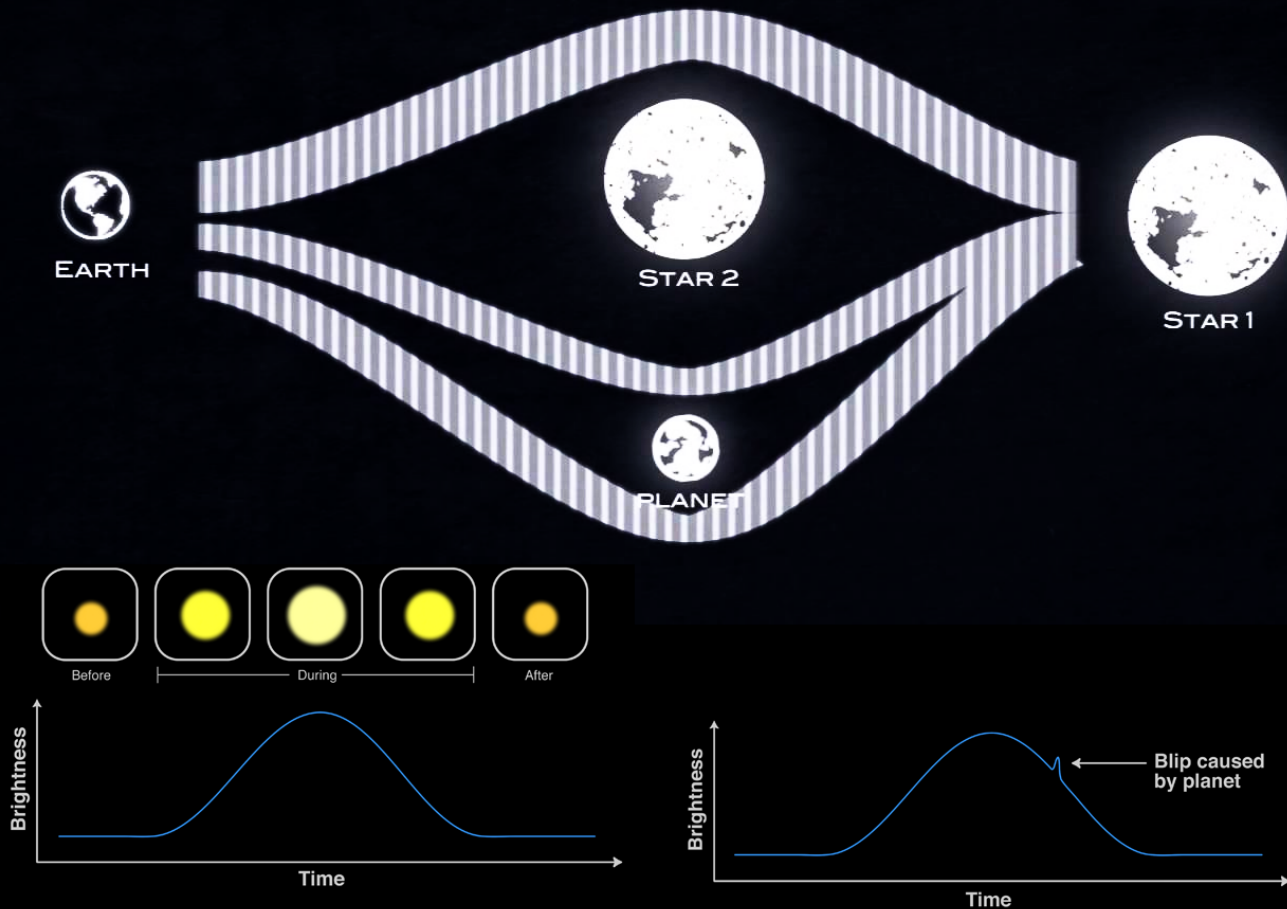


HOW ARE THEY FOUND?

DETAILS

This method relies on chance events where a dim star passes in front of a brighter one. When observed from Earth, the gravity from the dim star causes the light from the brighter star to bend and magnify. If a blip appears, that means a planet orbiting the dim star is increasing the effect of the magnification.

Microlensing “Blip” Method



HOW ARE THEY FOUND?

DETAILS

This method relies on a star-planet system that has their orbits aligned in such a way that, as seen from Earth, the planet travels between us and the star and temporarily blocks some of the light from the star once every orbit.

Transit “Wink” Method



MOVIE

WANT TO
KNOW MORE?

DETAILS

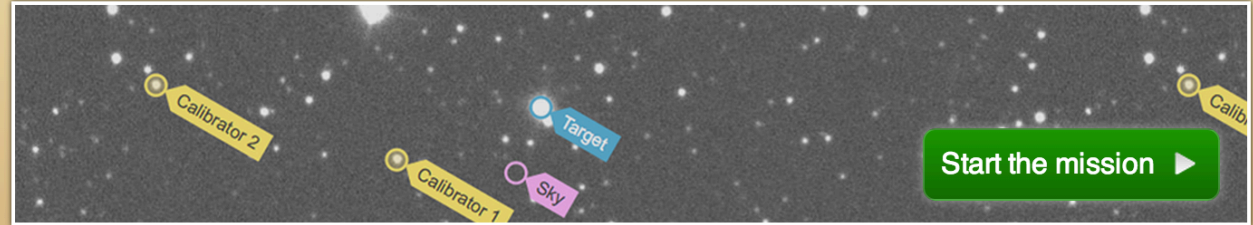
Head to Agent Exoplanet

***[www.lcogt.net/
agentexoplanet](http://www.lcogt.net/agentexoplanet)***

Home

Briefing

Planets



Mission Brief

Astronomers at Las Cumbres Observatory are investigating exoplanets - planets which orbit stars other than our Sun - and you can too.

Joining Agent Exoplanet you will study known exoplanets using images taken by LCOGT's telescopes. You'll measure the brightness of a star while a planet moves between it and our viewpoint.

You can examine as many images, from as many exoplanet transit events, as you like and contribute to understanding the properties of each exoplanet.

[Find out more...](#)

Briefing Video



[Comments & Suggestions](#) | Copyright © 2012 Las Cumbres Observatory Global Telescope Network. All rights reserved.

WHY SEARCH?



MOVIE