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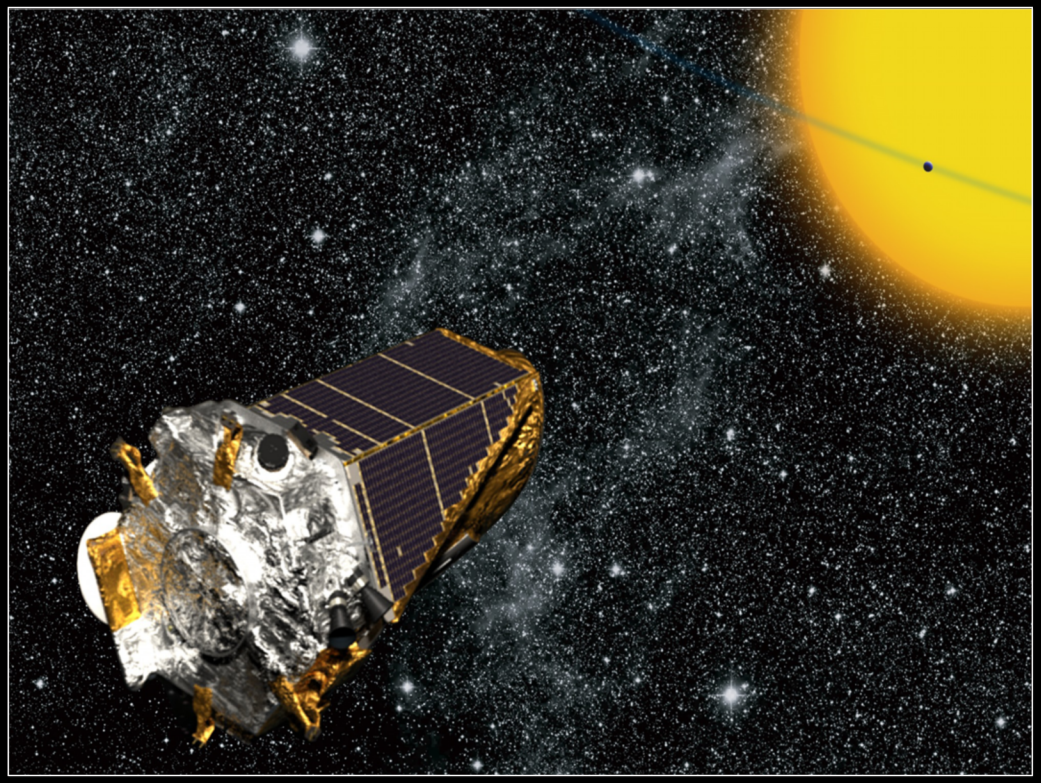
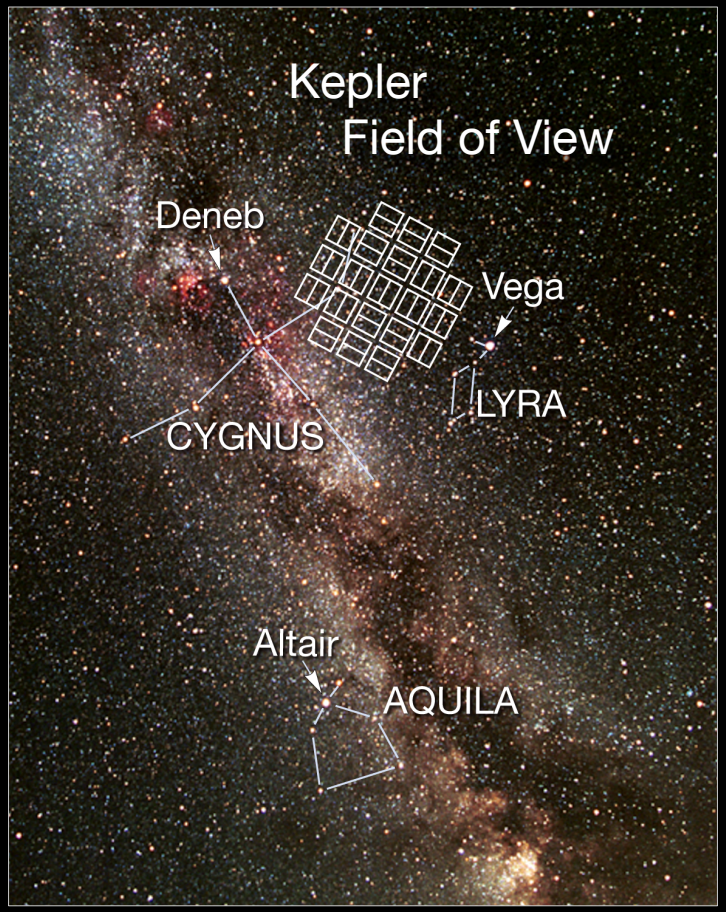
NASA's Kepler Mission:

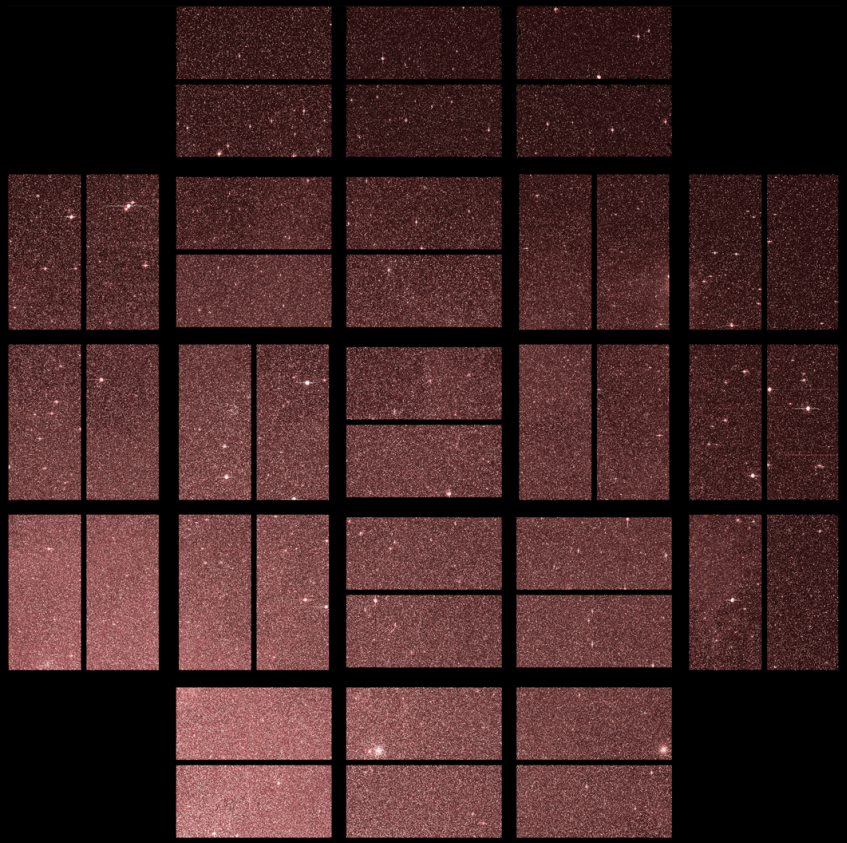
Searching for planets around other stars



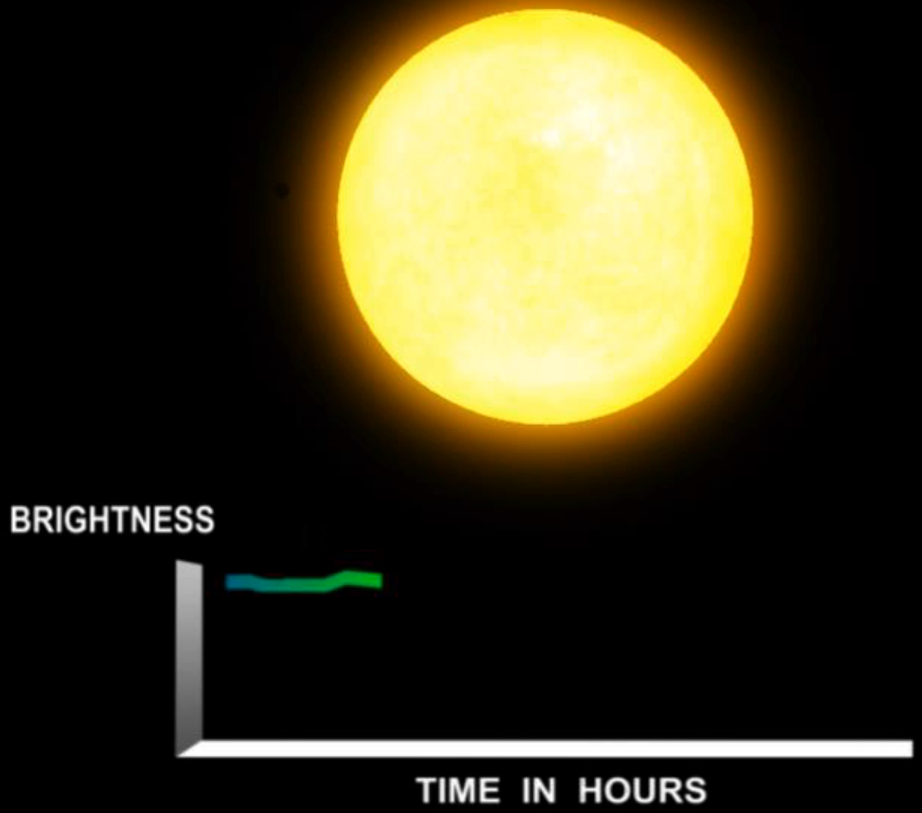
The Kepler Field of View

May 2009 – May 2013





Detecting Planets



Exoplanet Missions

JWST

WFIRST-AFTA

TESS

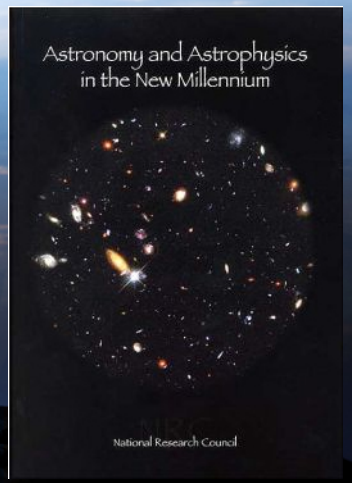
Kepler

New Worlds Telescope

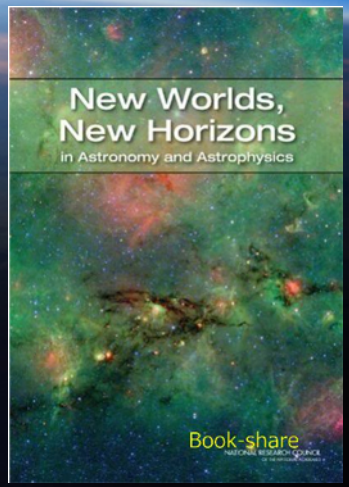
Spitzer

Hubble

Ground-based Observatories



2001 Decadal Survey



2010 Decadal Survey

Elisa Quintana
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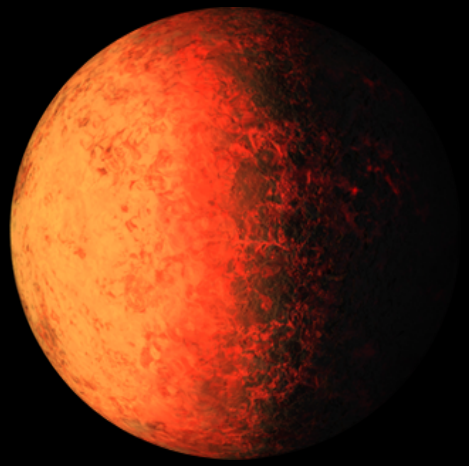
Searching for Habitable Worlds

The right size but hotter than Earth

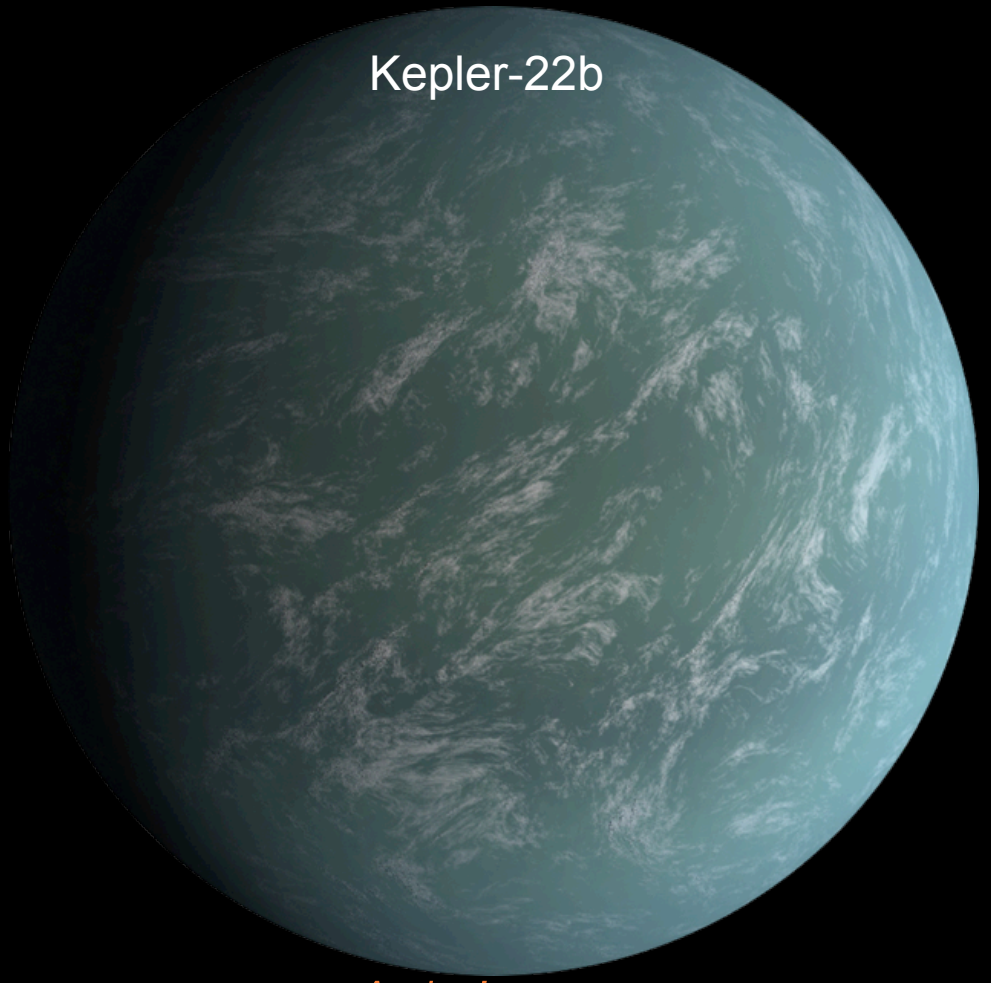
Kepler-20e



Artist's concept

Searching for Habitable Worlds

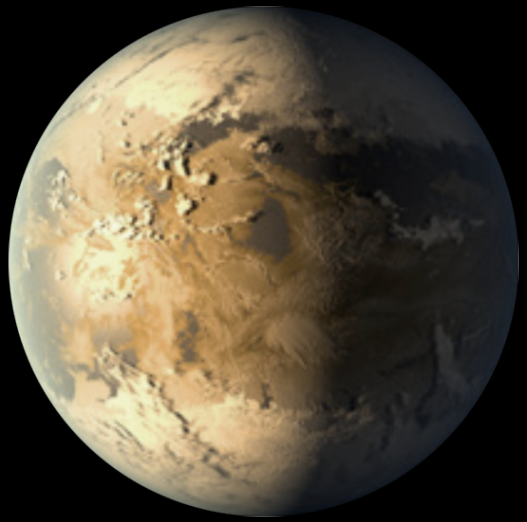
The right distance from its star but larger than Earth



Artist's concept

Searching for Habitable Worlds

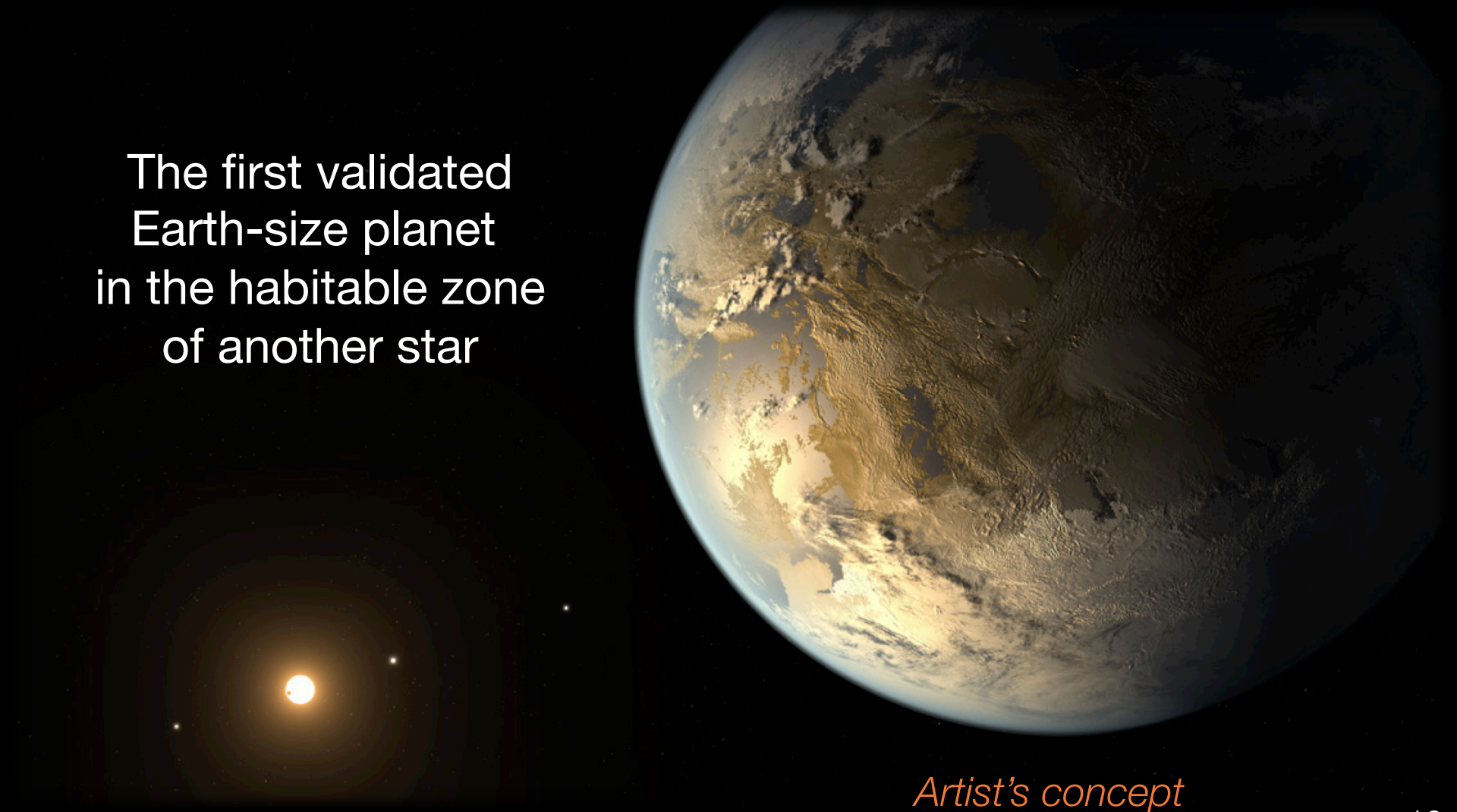
The right size and distance from the star!



Artist's concept

Announcing Kepler-186f

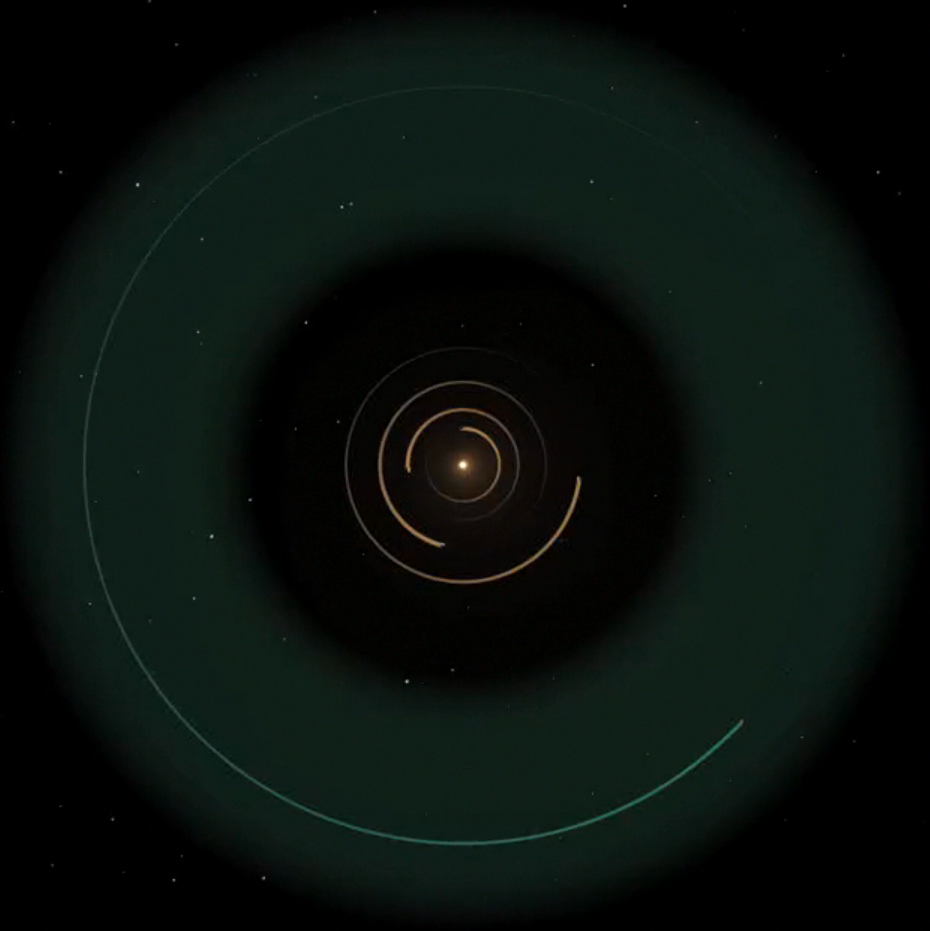
The first validated
Earth-size planet
in the habitable zone
of another star



Artist's concept

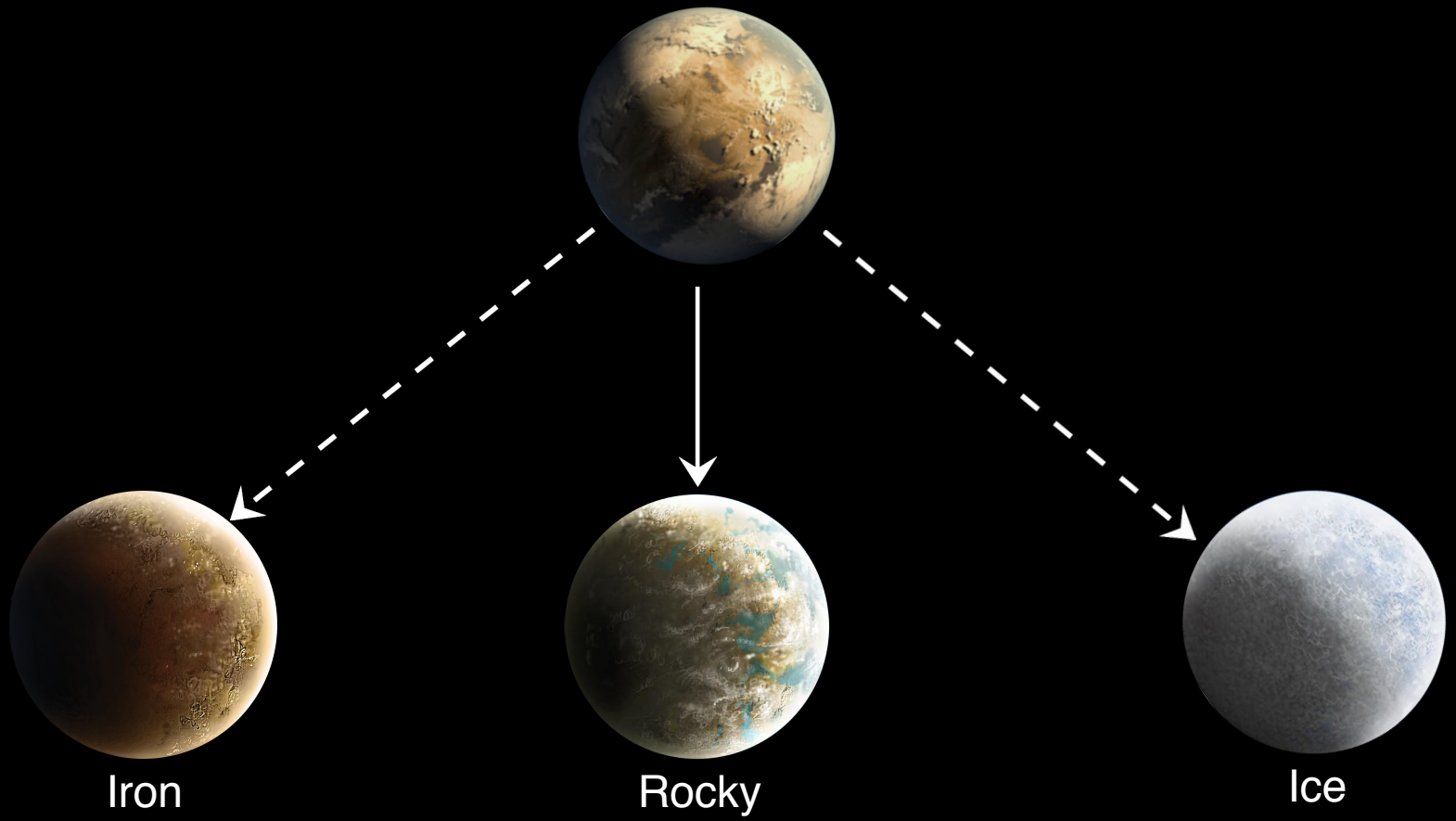
The Kepler-186 System

Artist's concept



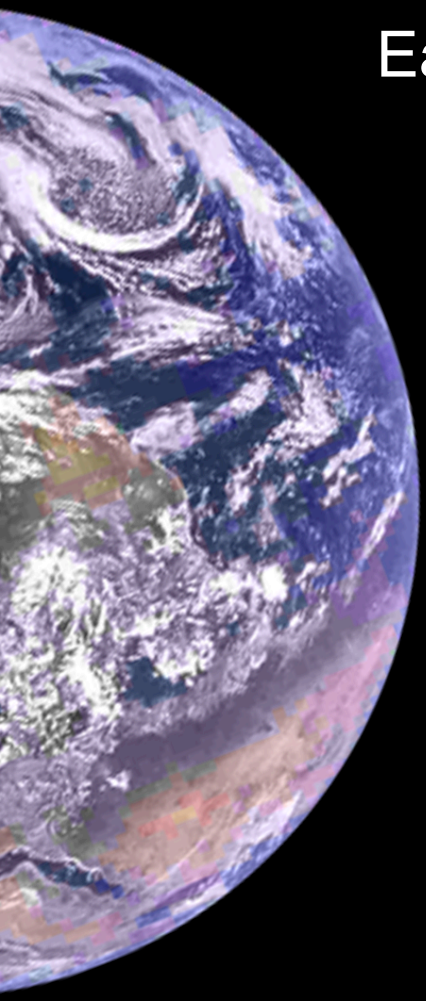
Composition of Kepler-186f

Artist's concept



SETI Institute

NASA

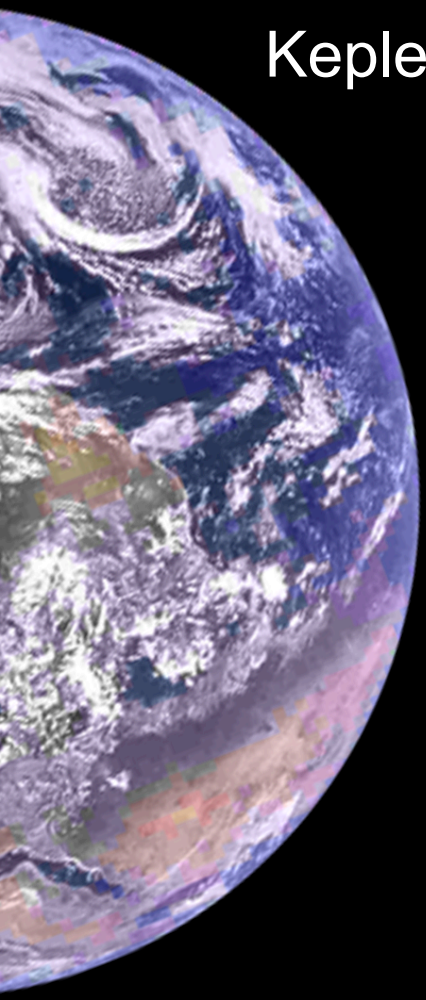


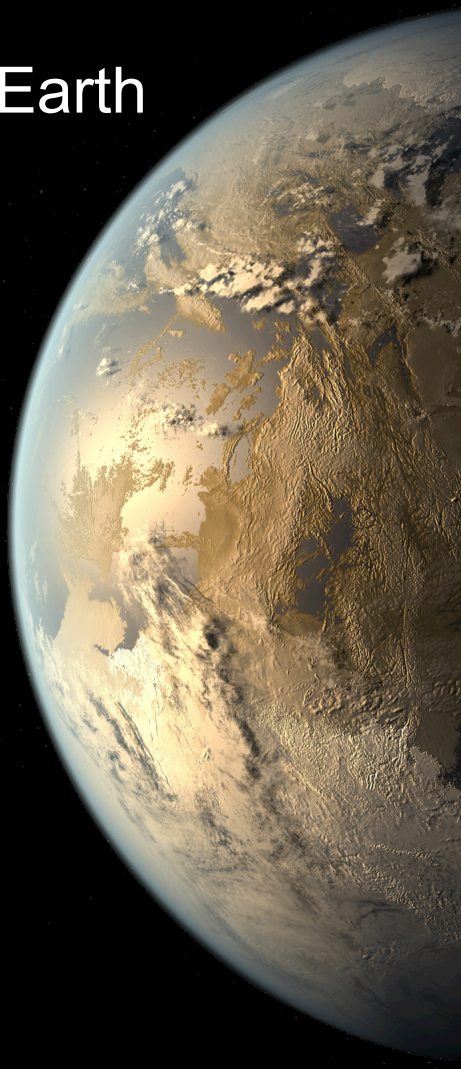
Earth, the one planet we know has life

SETI Institute

NASA

Kepler-186f – the planet closest in size to Earth in the habitable zone of another star

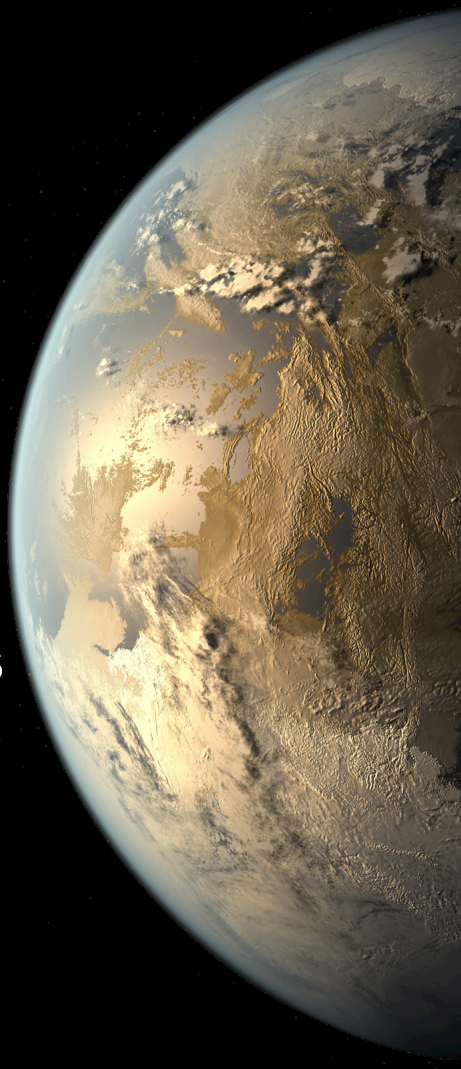




Artist's concept

Summary

- Kepler-186f is the first validated Earth-size planet in the habitable zone of another star
  - Right size – only 10% larger than Earth
  - Right distance from its star – 130-day orbit
- This discovery confirms that Earth-size planets exist in the habitable zone of other stars!



Artist's concept

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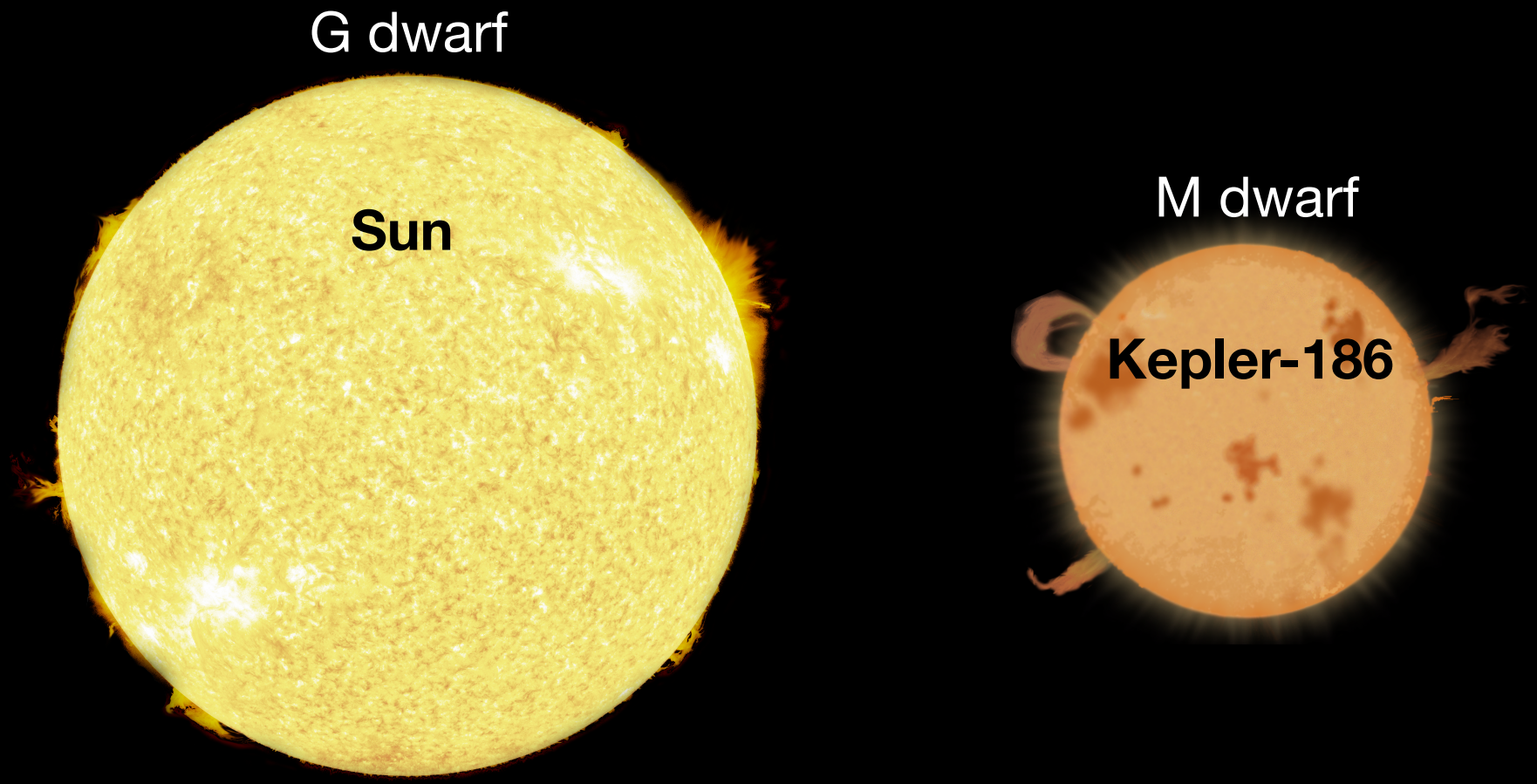
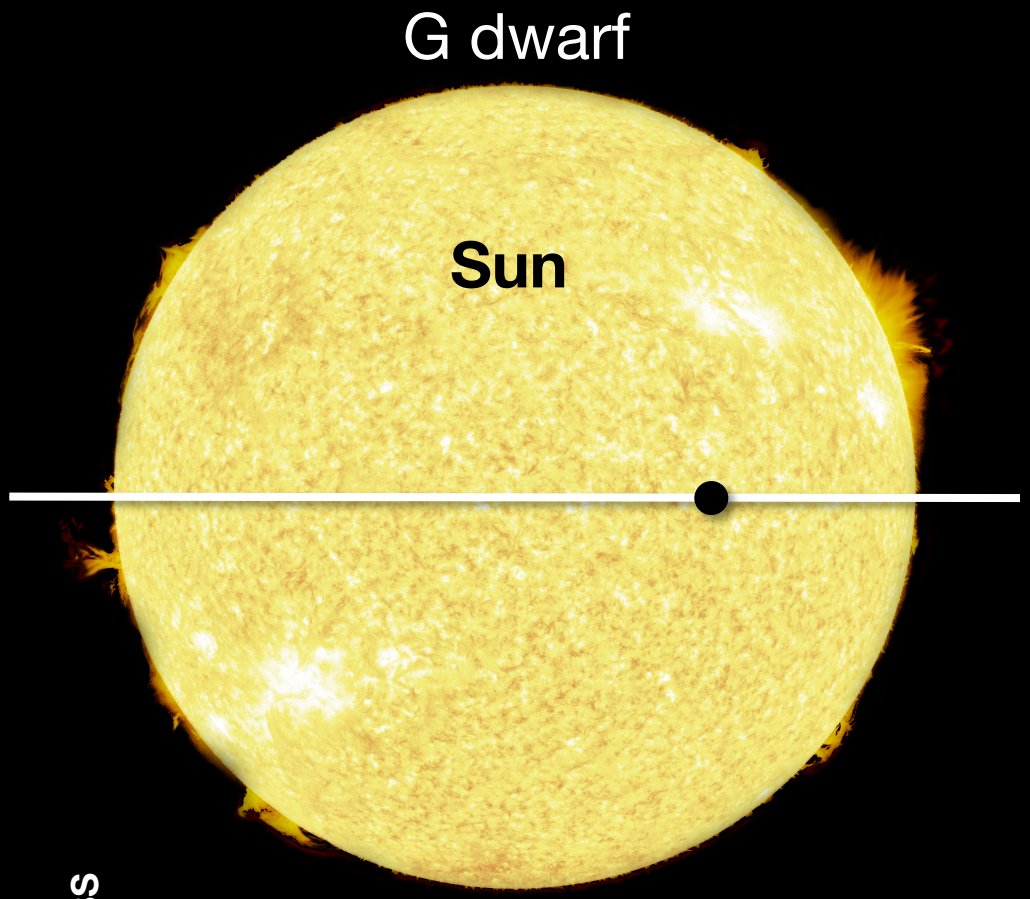
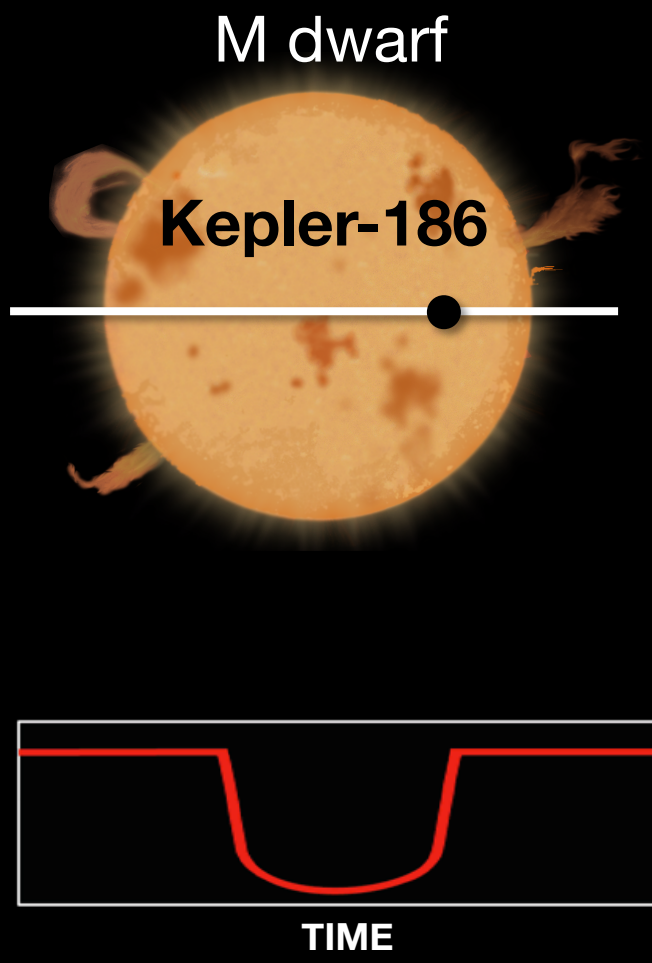
M Dwarfs are Smaller, Cooler, Dimmer

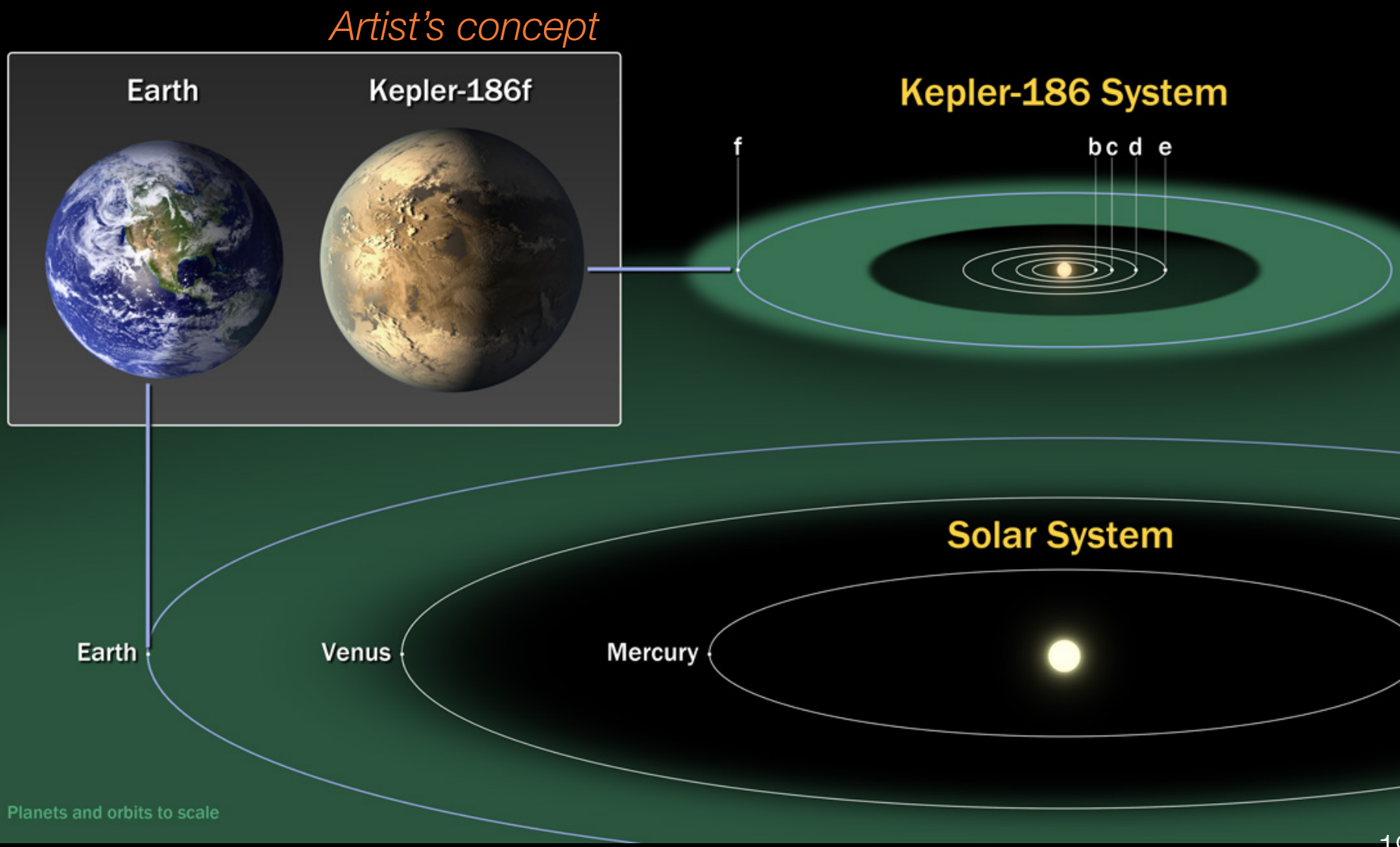


Detecting Planets around M dwarfs is Easier

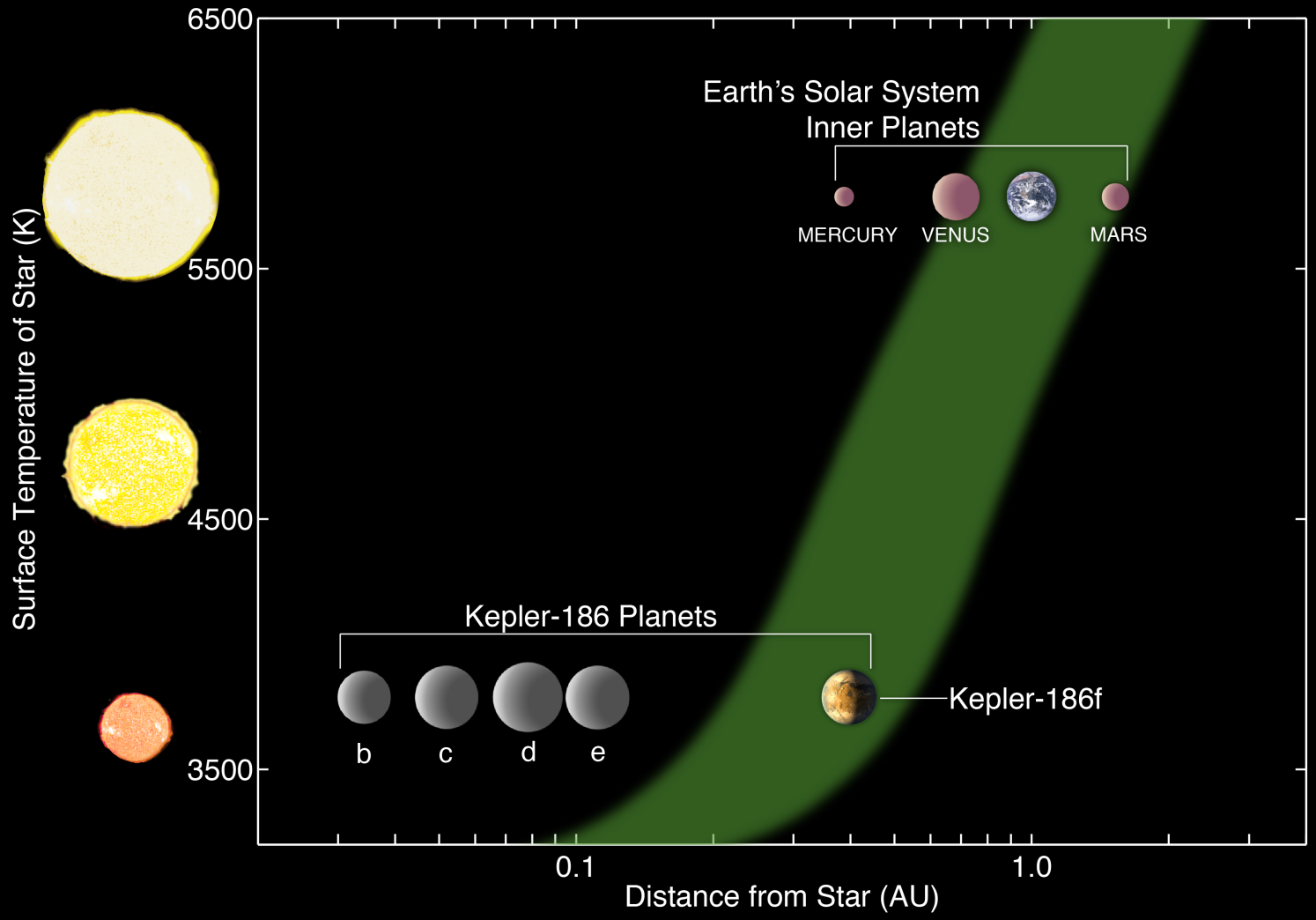




More Frequent Transits



System Comparisons



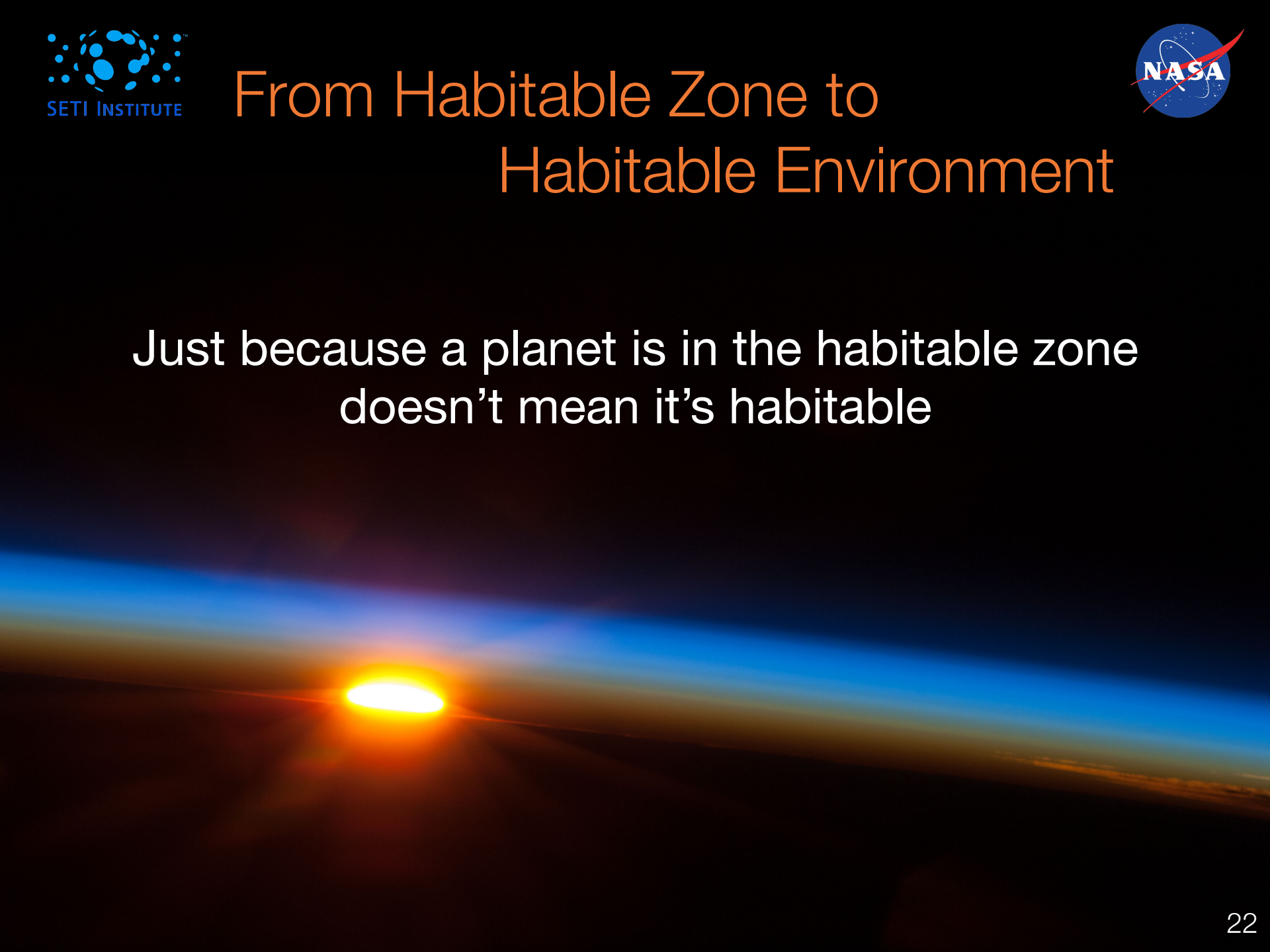
M Dwarfs:
Most Abundant and Nearest Stars

7 out of 10 stars in our galaxy are M dwarfs

The Sun's nearest neighbors are M dwarfs

From Habitable Zone to Habitable Environment

Just because a planet is in the habitable zone doesn't mean it's habitable



Summary

- Kepler-186f demonstrates that Earth-size planets exist in the habitable zone of other stars
- Kepler-186f orbits a cooler star – more like Earth's cousin than Earth's twin
- M dwarfs are compelling targets to search for other Earths:
  - Most abundant
  - Nearest neighbors
- Future missions will characterize the planets around M dwarfs

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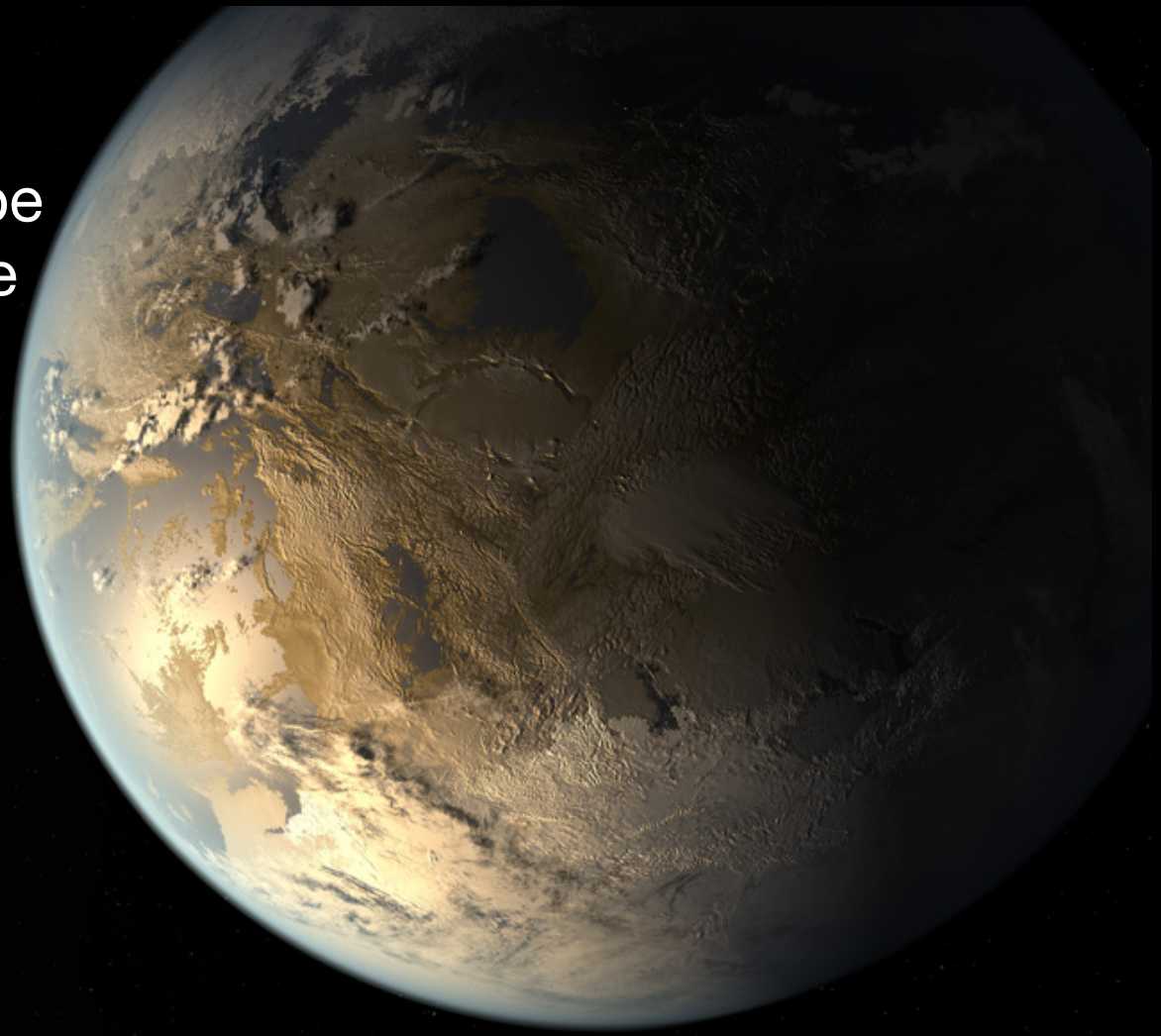
Searching for Habitable Worlds

M dwarf planets may be the most common type of habitable world



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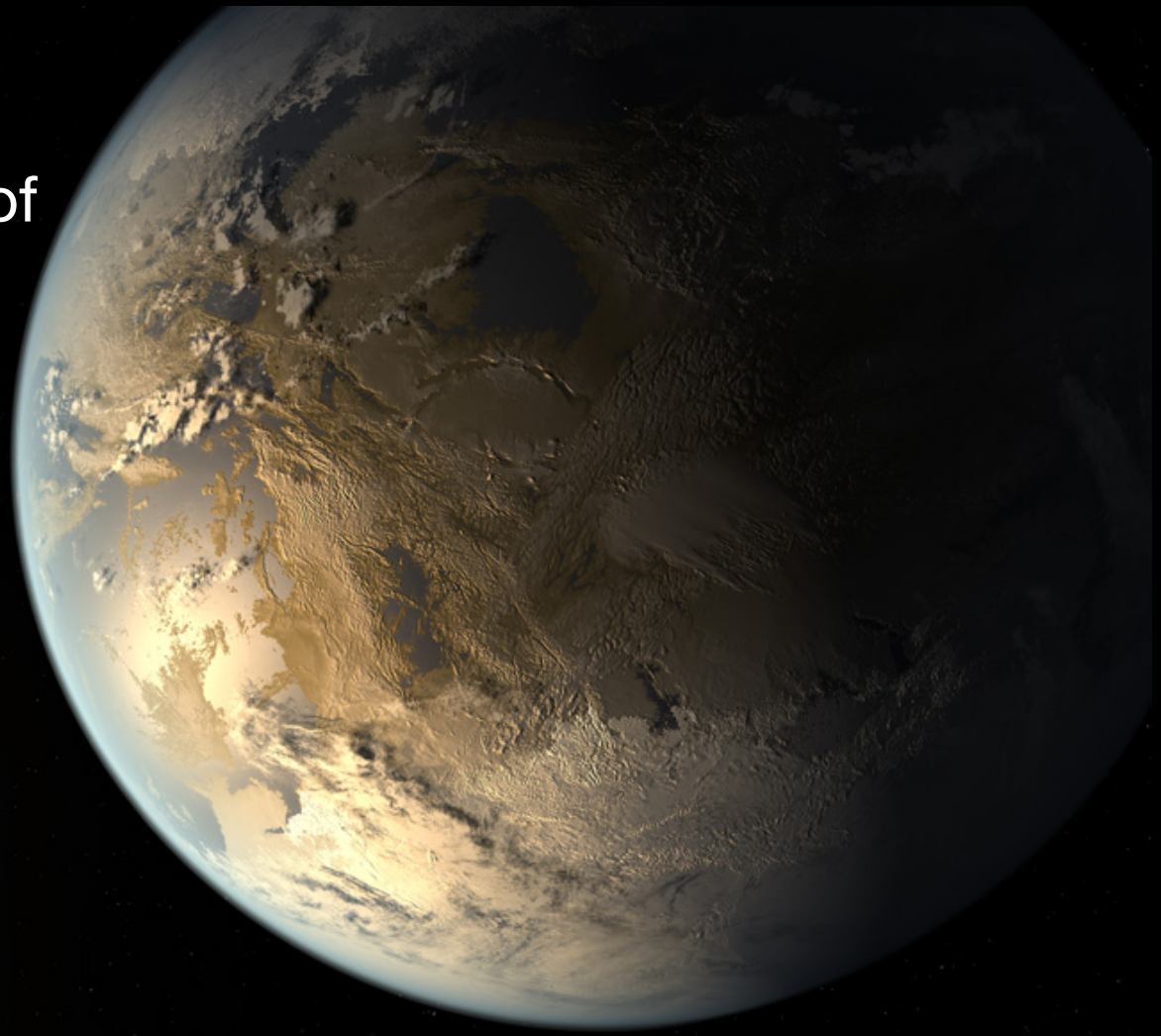
Searching for Habitable Worlds

But the environments of these Earth cousins may be very different



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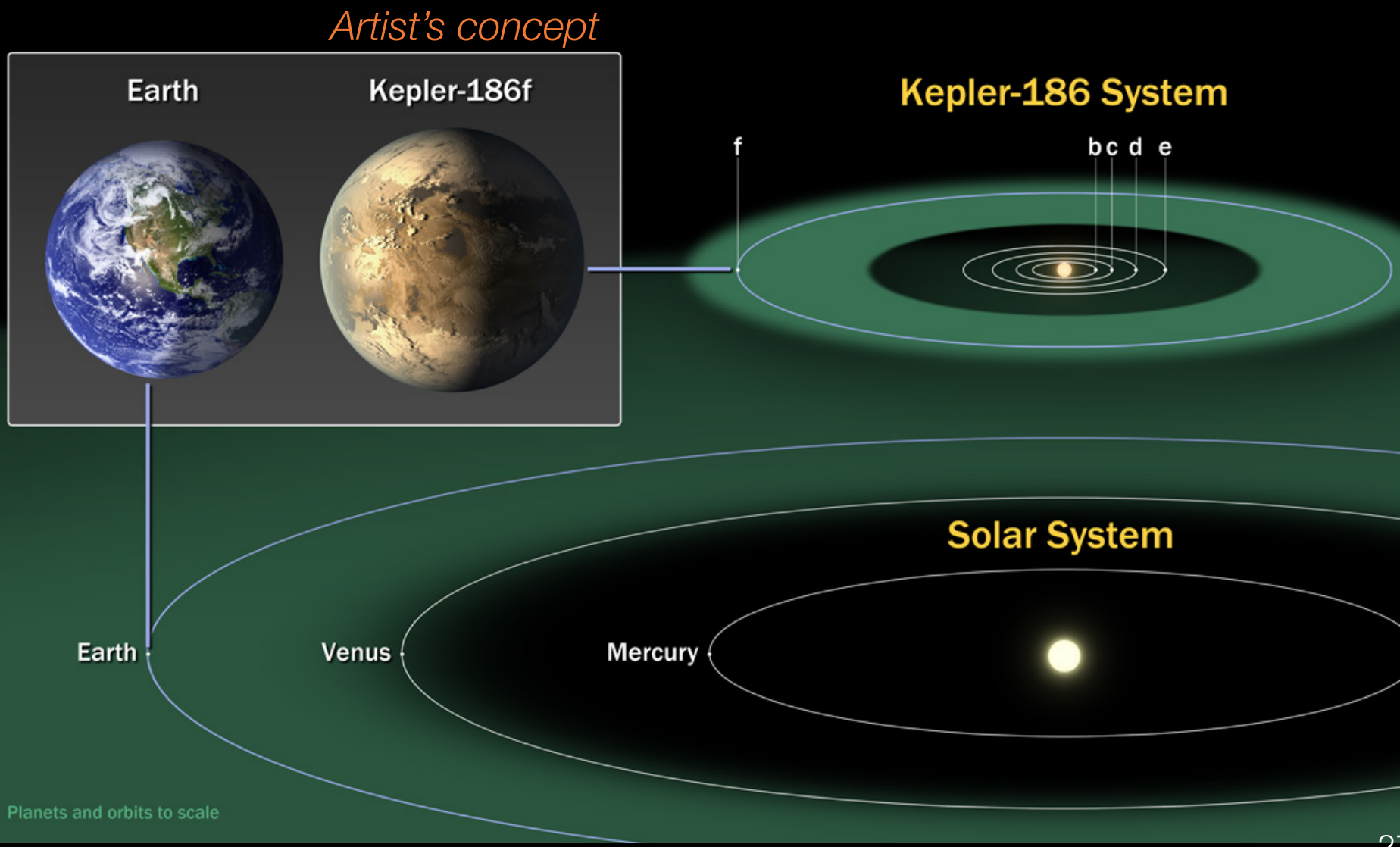
Close Encounters



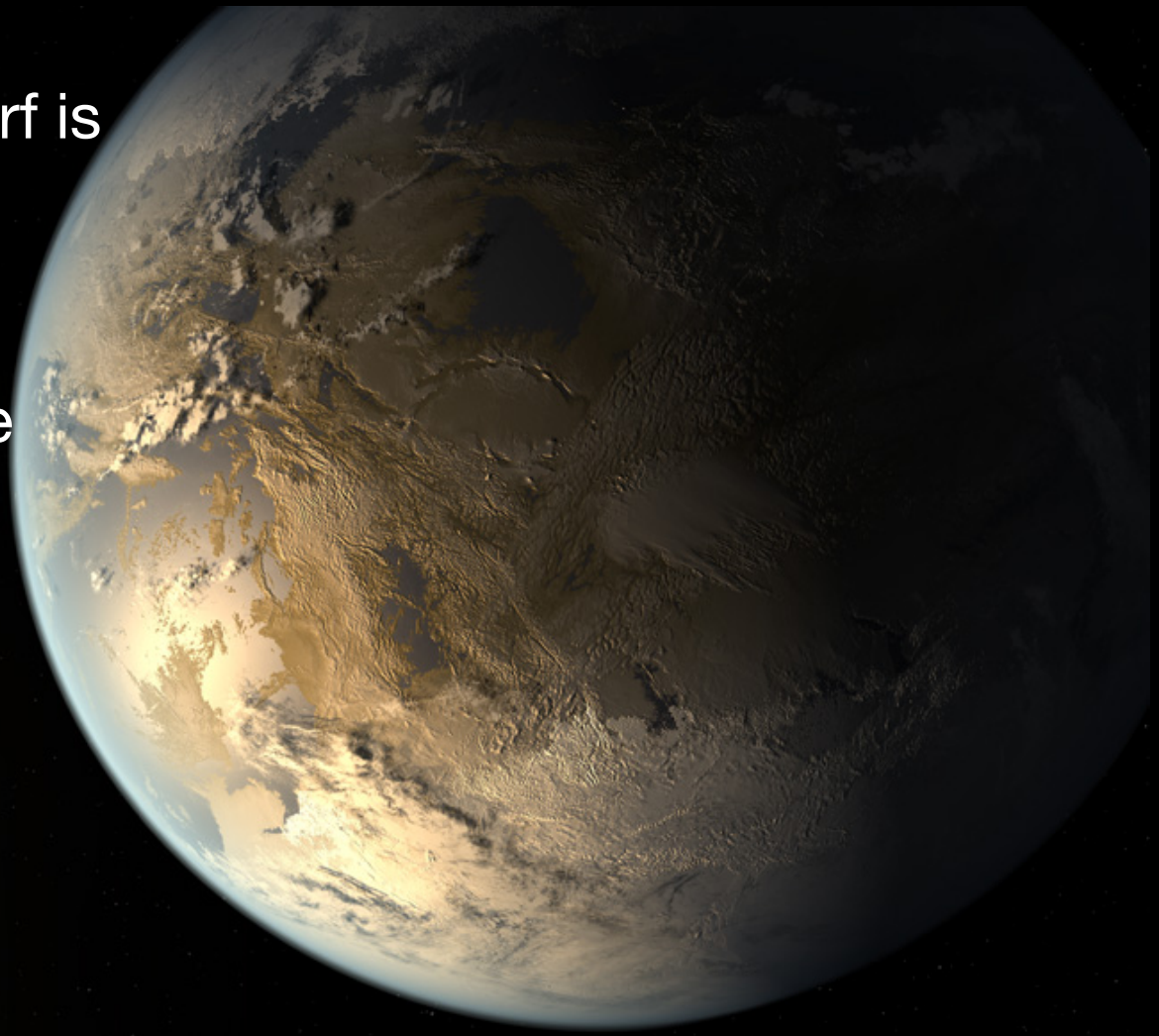
Factors Affecting Habitability

The star's gravity and radiation can both affect habitability

Seeing Red

Light from the M dwarf is redder than the light from our Sun

This changes how the planet interacts with its star's light



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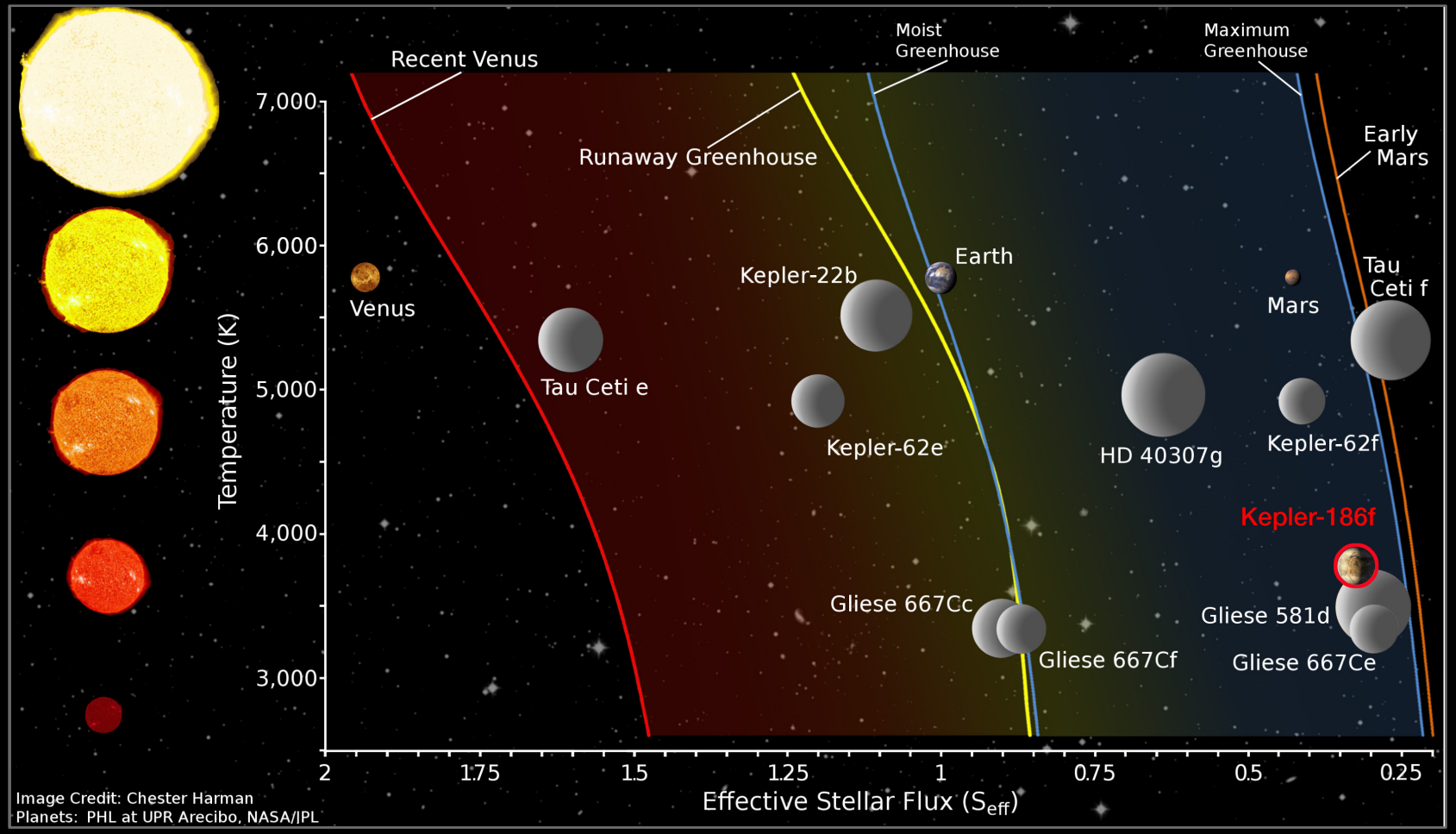
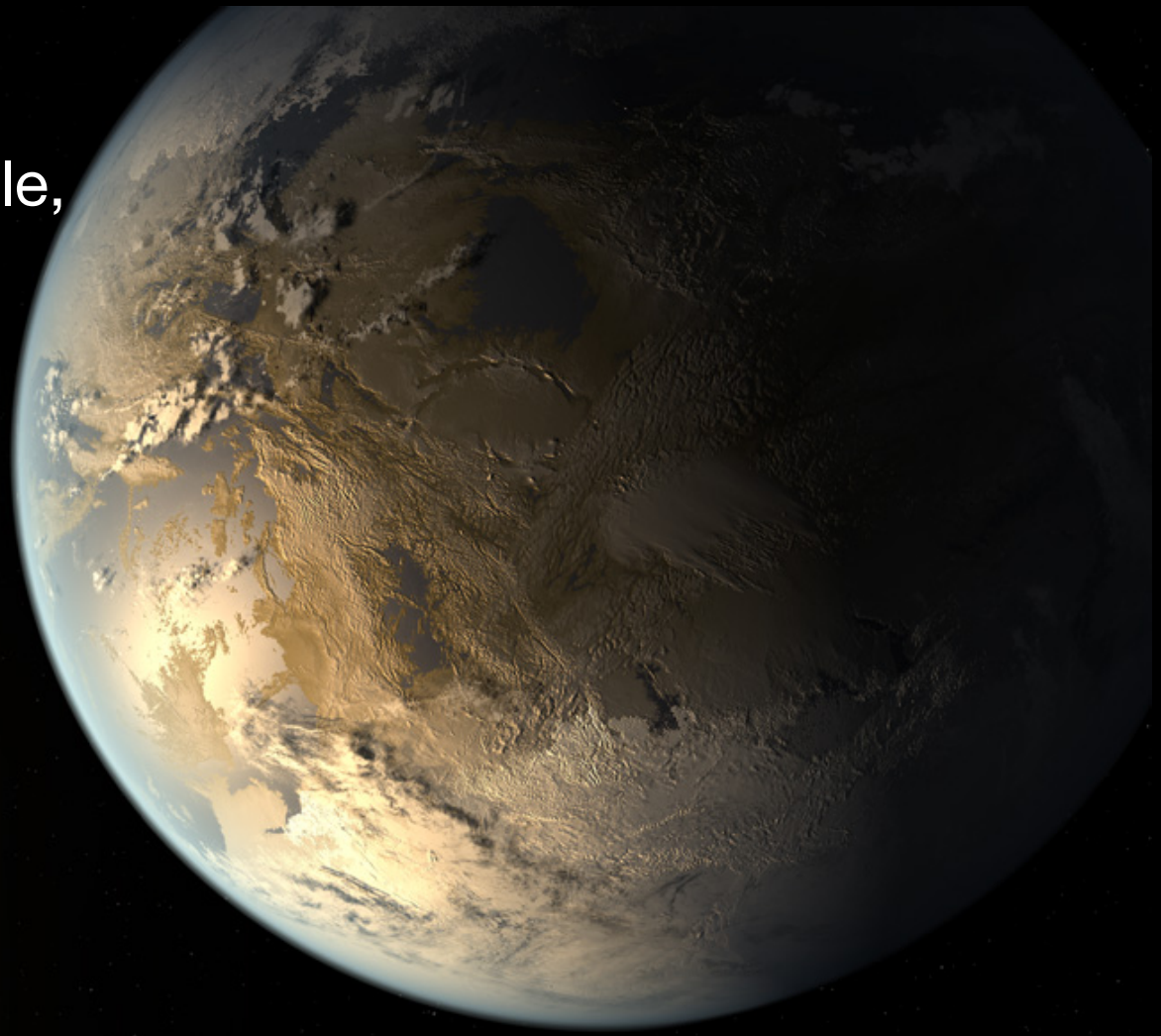
The Habitable Zone



Photosynthesis

If the planet is habitable, then photosynthesis may be possible



Artist's concept

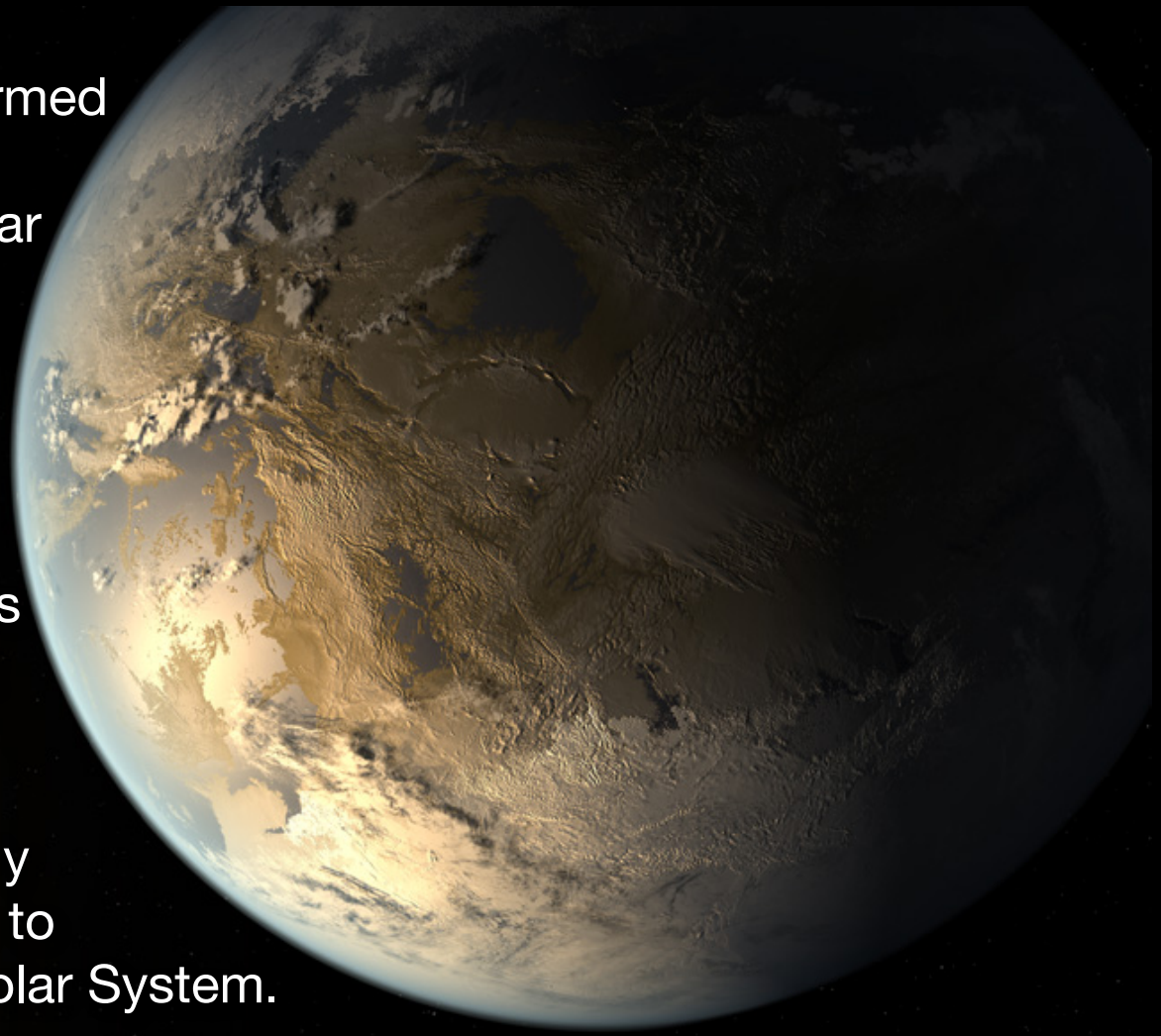
Summary

Kepler-186f is the first confirmed Earth-sized planet in the habitable zone of another star

M dwarf planets interact differently with their parent star

The majority of environments for life in the Universe might orbit M dwarfs

Planets like this one will likely provide our first opportunity to search for life beyond the Solar System.



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