

Exoplanets And the Search for Habitable Worlds

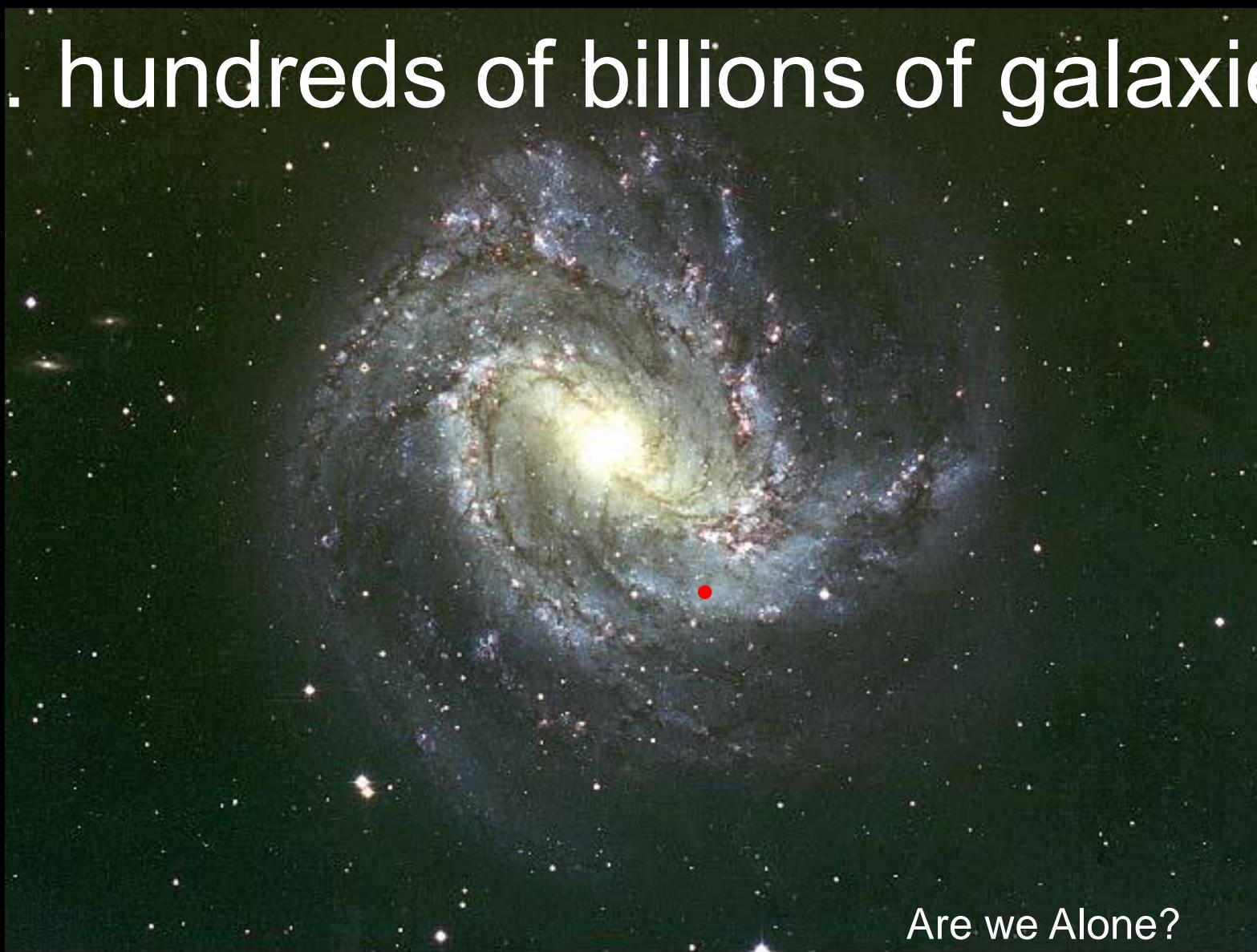
Sara Seager



Massachusetts
Institute of
Technology



Hundreds of billions of stars ...
... hundreds of billions of galaxies

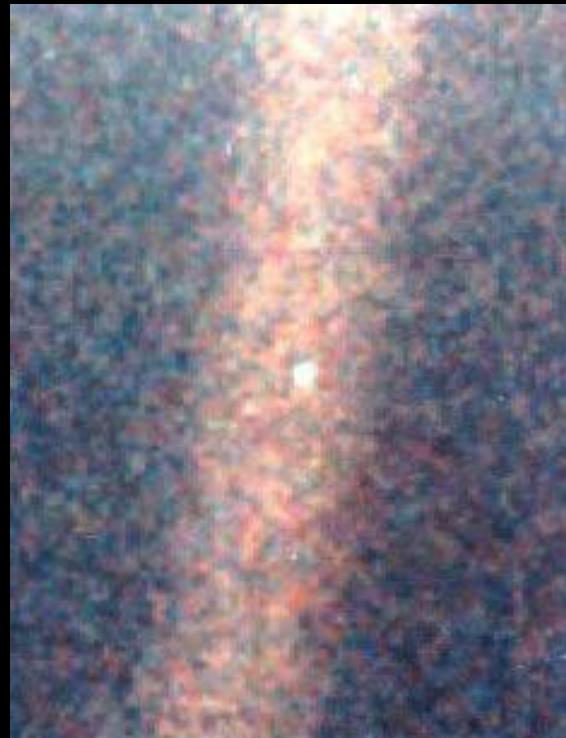


Are we Alone?

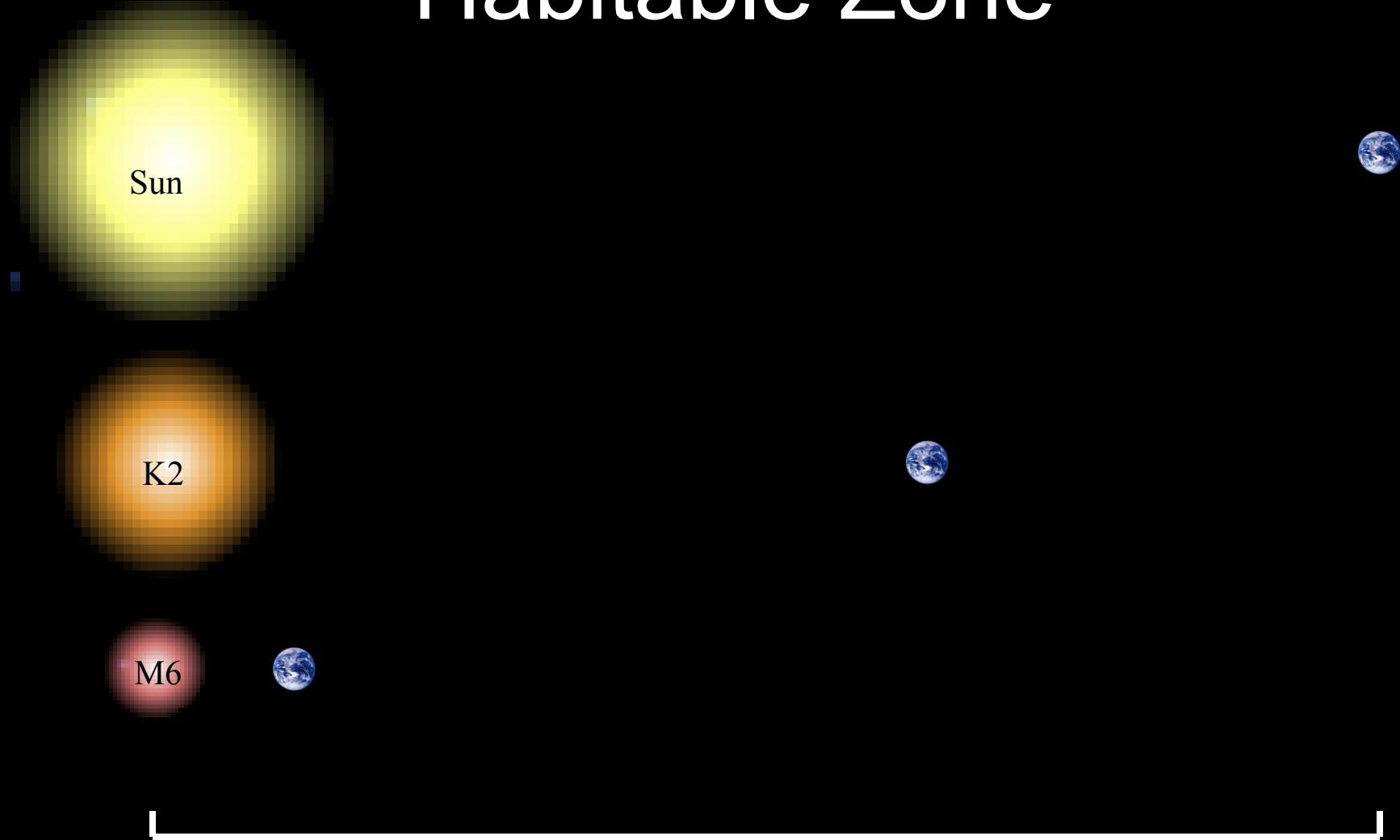
M83 © Anglo-Australian Observatory

Photo by David Malin

Earth: The Pale Blue Dot

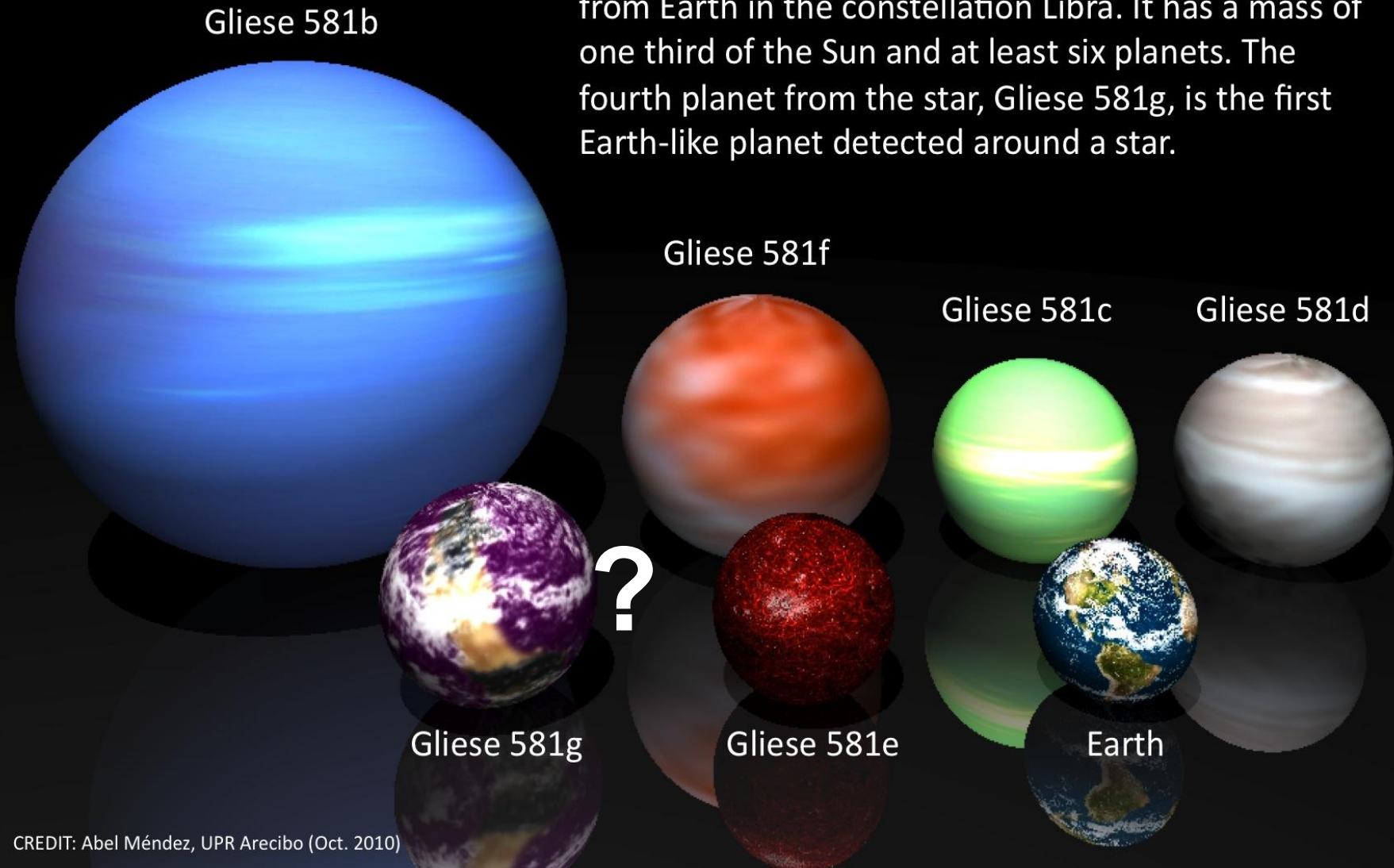


The “Goldilocks Zone” or “Habitable Zone”



Gliese 581 Planetary System

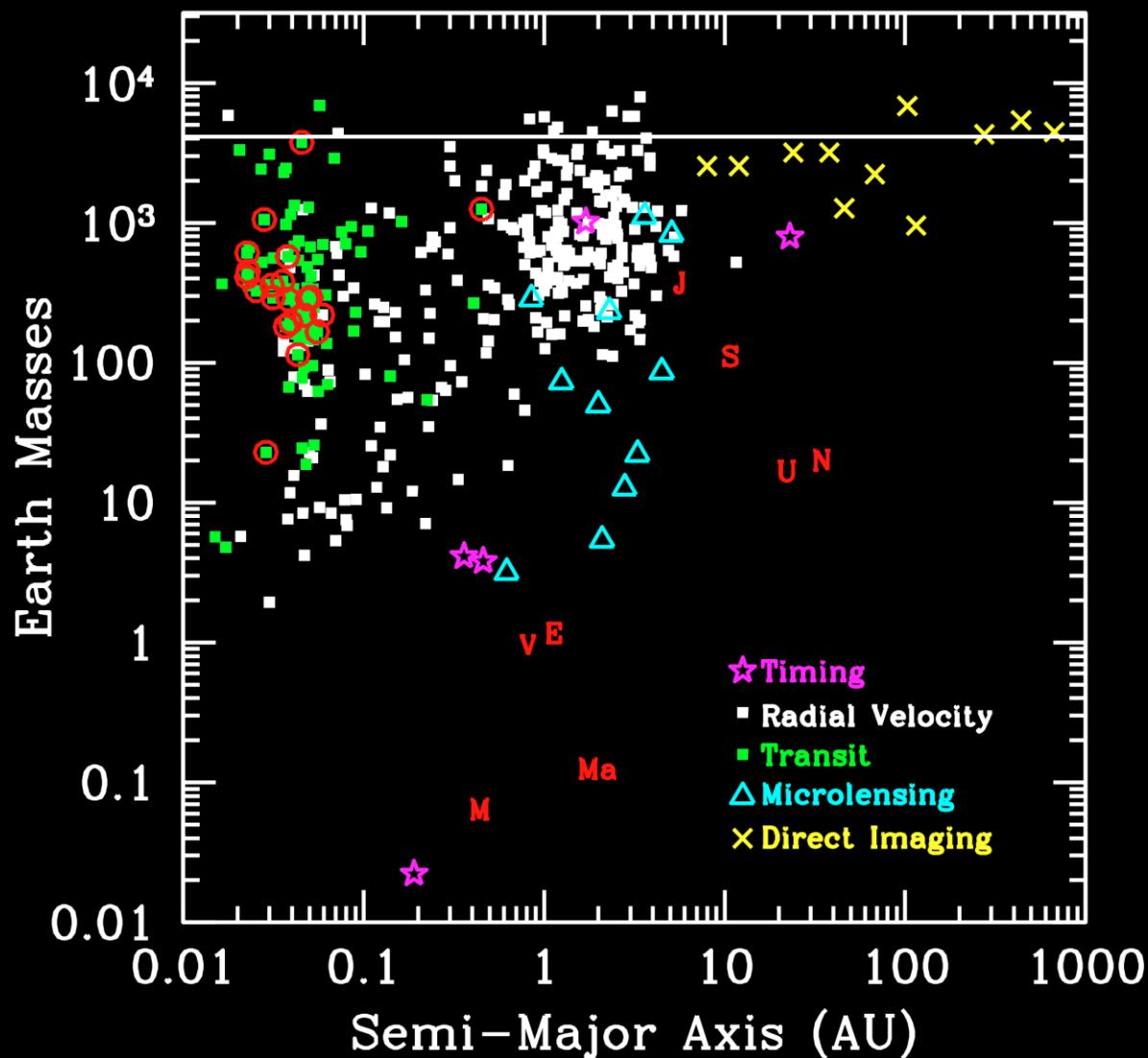
Gliese 581 is a red dwarf star located 20.3 light years from Earth in the constellation Libra. It has a mass of one third of the Sun and at least six planets. The fourth planet from the star, Gliese 581g, is the first Earth-like planet detected around a star.





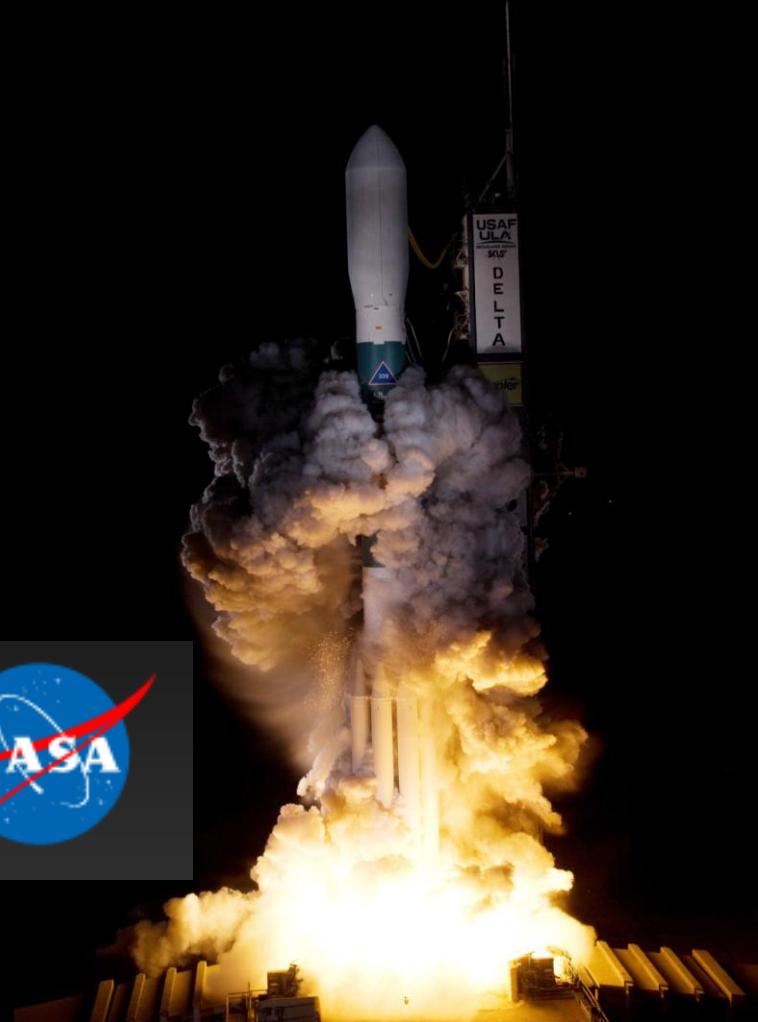
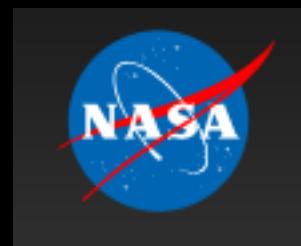
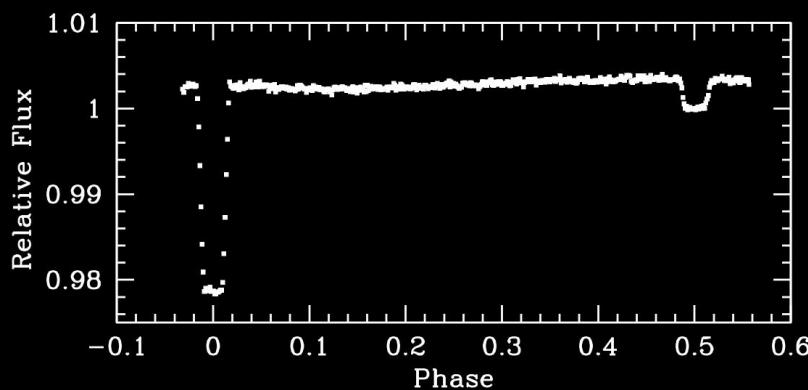
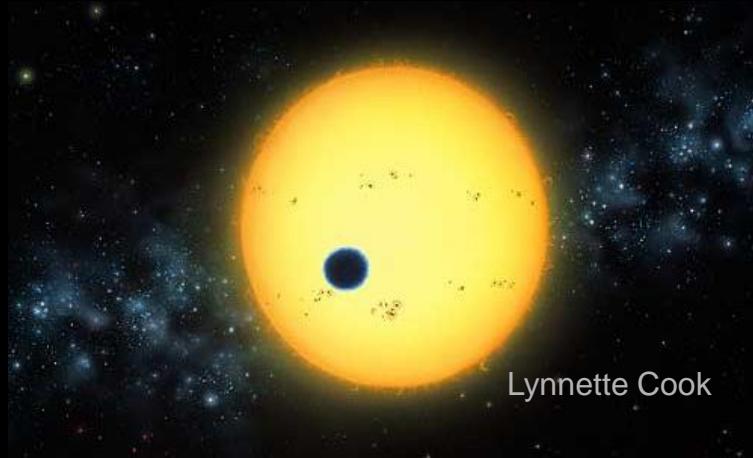
John E. Kauffman

Known Planets 2010



Based on data compiled by J. Schneider

Kepler: How Common are Earths?



Goal: to find transiting Earth-size planets in the habitable zones



Search for other earths

© National Geographic
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Search for other earths

Direct imaging: 10^{-10}
Transiting Earth: 10^{-4}
Transiting super Earth
around a small star: 10^{-3}

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Terrestrial Planet Finder



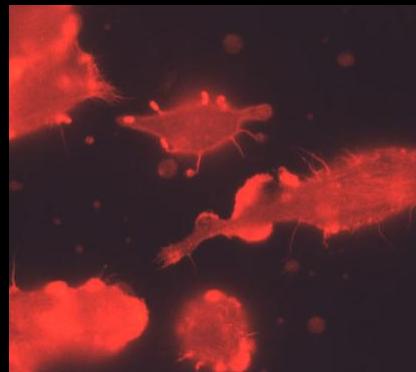
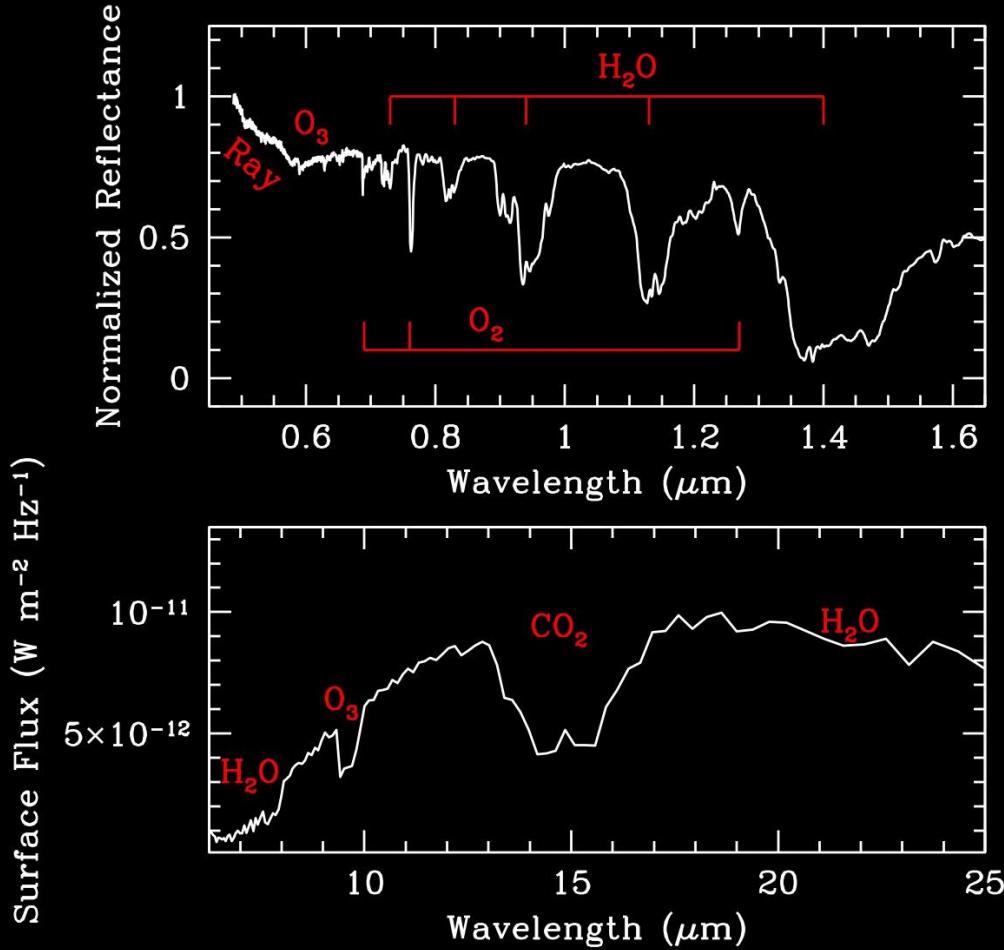
Goal: to find planets in the star's habitable zone and look for biosignatures.

Terrestrial Planet Finder



Northrup Grumman external occulter test bed

Biosignature Gases



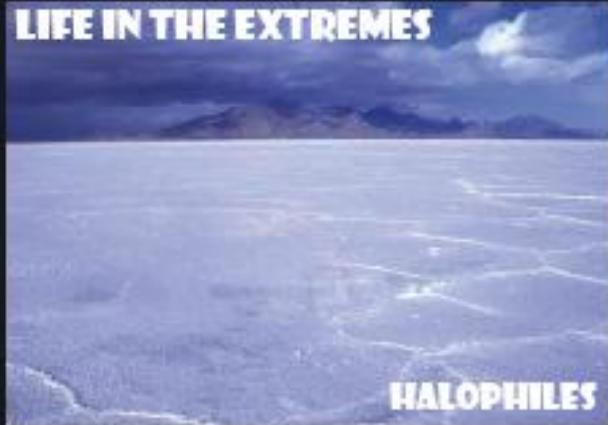
SETI



No alien civilization appears to be continuously broadcasting a powerful “beacon” signal from a planet circling any of the nearest 1,000 or so Sunlike stars, at least in the frequency bands searched to date.



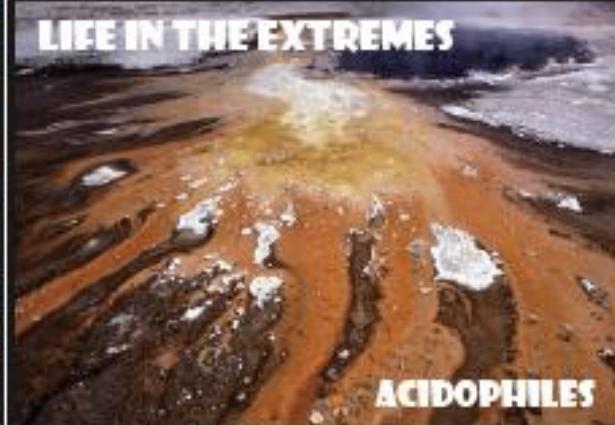
LIFE IN THE EXTREMES



HALOPHILES



PSYCHROPHILES



ACIDOPHILES

LIFE IN THE EXTREMES



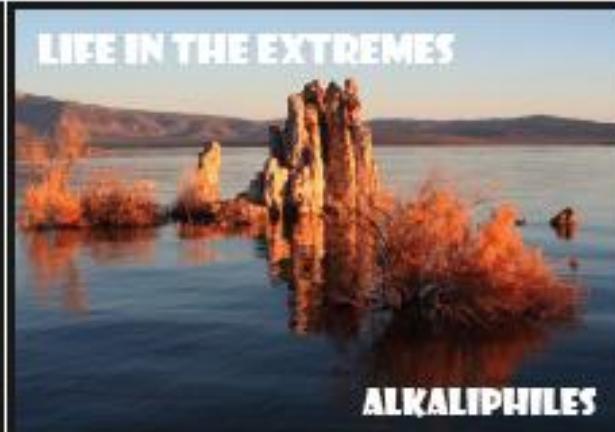
RADIORESISTANT MICROBES

LIFE IN THE EXTREMES



BAROPHILES

LIFE IN THE EXTREMES



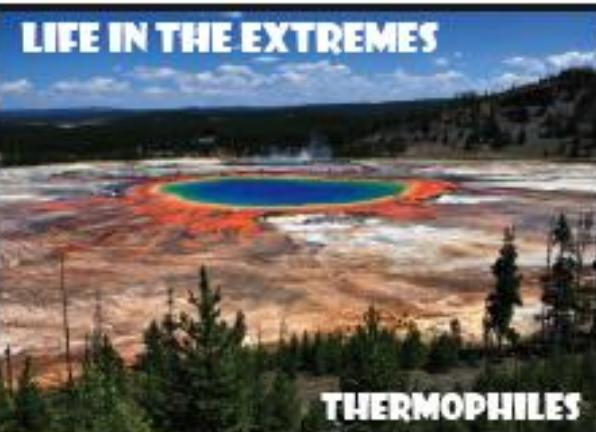
ALKALIPHILES

LIFE IN THE EXTREMES



XEROPHILES

LIFE IN THE EXTREMES



THERMOPHILES

LIFE IN THE EXTREMES



ENDOLITHS

SETI

- No alien civilization appears to be continuously broadcasting a powerful “beacon” signal from a planet circling any of the nearest 1,000 or so Sunlike stars, at least in the frequency bands we’ve searched.”

