

TED^x USagradoCorazón

October 18th, 2013. San Juan, Puerto Rico

Title: Prototype Habitable Exoplanets

Subtitle: Many Habitable Worlds to Choose From

Presenter: Abel Méndez, PHL @ UPR Arecibo

Running Time: 18 minutes

Number of Slides: 19

Language: English

Version: October 16, 2013 [Final Version 2]

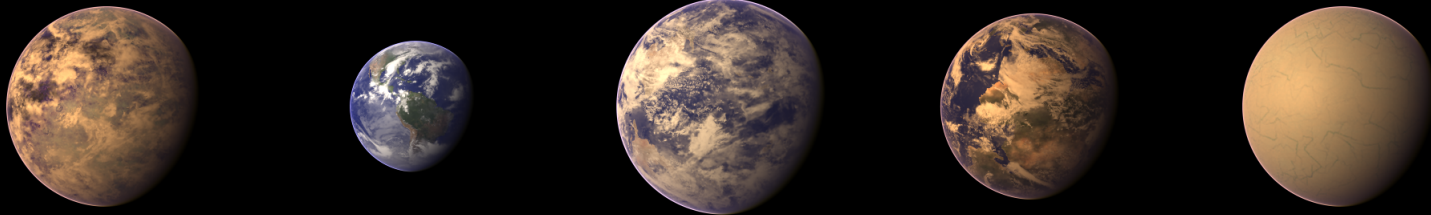
Main Idea: There are many types of habitable worlds, some probably even better than Earth.

Open Question: What characteristics does a better planet for life than Earth have?

Short Abstract: About 1,000 planets around other stars are known to exist with many more waiting for confirmation. One of the main objectives of astronomers is to find one just like Earth, but why are we looking for an Earth-like planet when we can look for planets better for life than Earth?

PROTOTYPE HABITABLE EXOPLANETS

Many Habitable Worlds to Choose From



Abel Méndez
Planetary Habitability Laboratory
University of Puerto Rico at Arecibo



A close-up photograph of a bright red bromeliad flower in a dense, mossy rainforest. The flower is the central focus, with its vibrant red petals and yellow stamens. The surrounding environment is filled with lush green foliage, including large, wet leaves and various types of ferns. The background is slightly blurred, emphasizing the flower. The overall atmosphere is one of a healthy, thriving ecosystem.

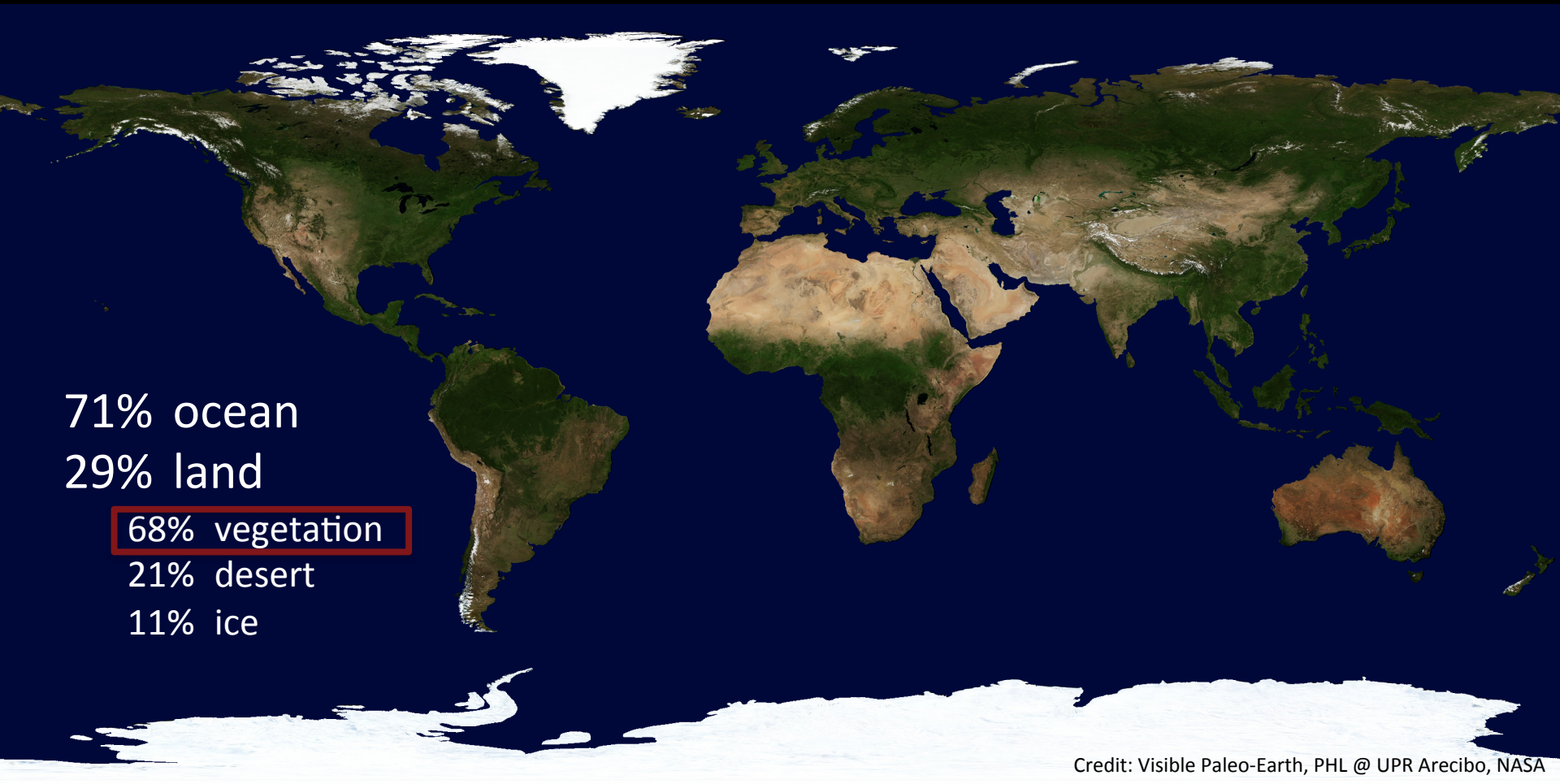
Do we live on a good planet for life?

Credit: Geoff Gallice (El Yunque Rain Forest, Puerto Rico)

Not everywhere is the same!



Habitable Surface of Earth Today



71% ocean

29% land

68% vegetation

21% desert

11% ice

A More Habitable Earth 105 Million Ago?

76% ocean
24% land

97% vegetation

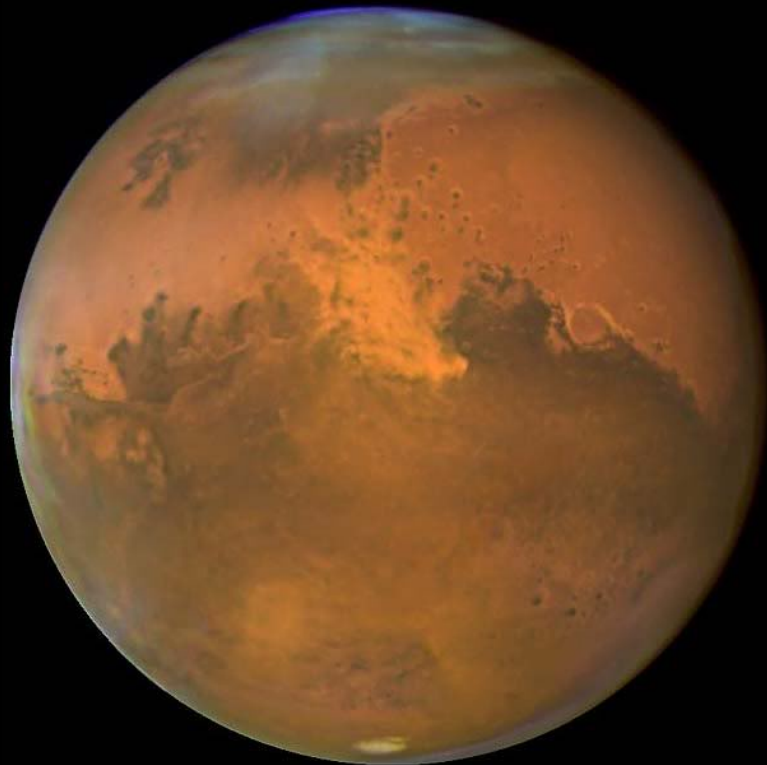
3% desert

0% ice

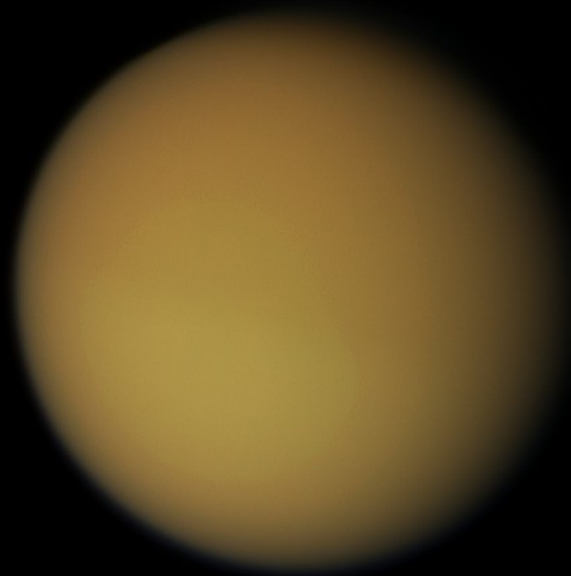
“Everything on this planet has evolved to kill humans.”

— *After Earth* (2013)

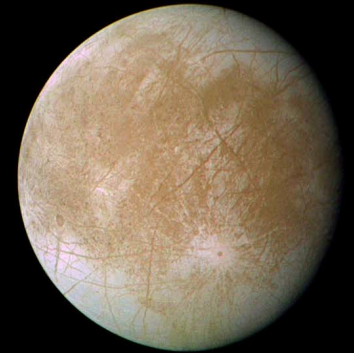
Potentially Habitable Objects in the Solar System



Mars



Titan



Europa



Enceladus

Where are other habitable exoplanets?



Jupiter-like



Mercury-Like



Earth 2



Venus-like



Earth+

[better than Earth]

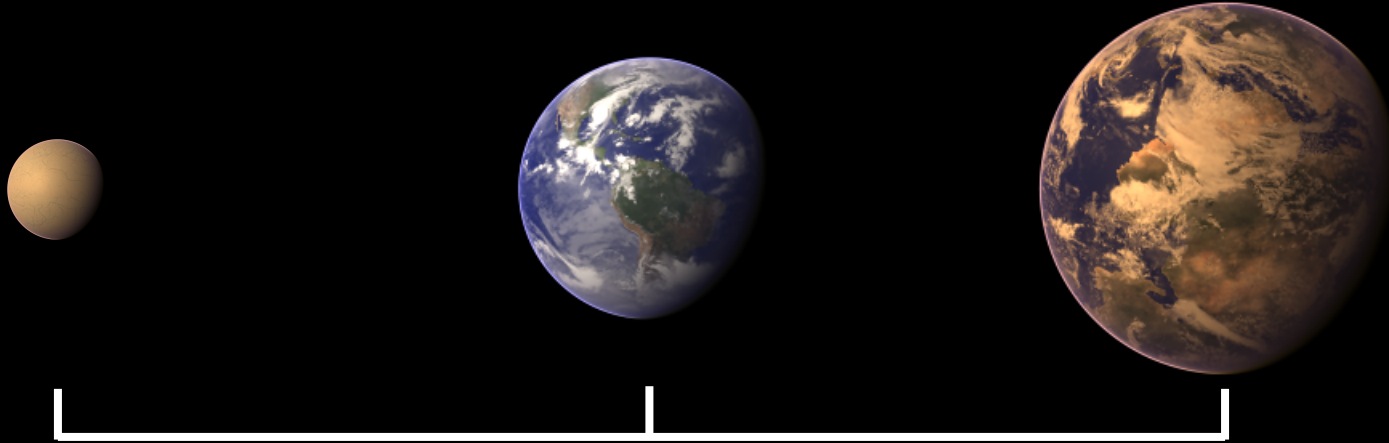


Neptune-like



Bob

Prototype Habitable Exoplanets



Earth-

[Barely habitable]

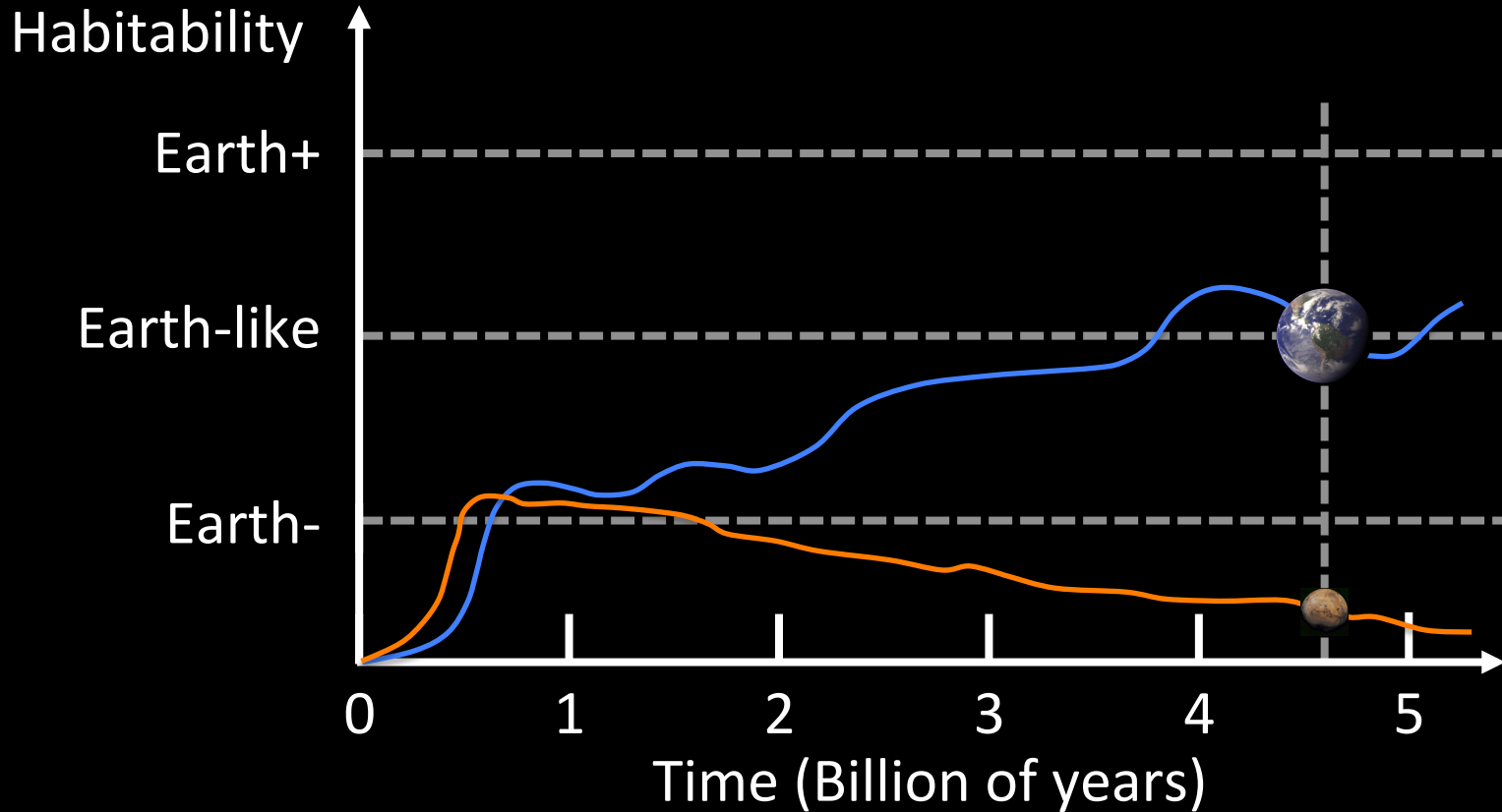
Earth-like

[As habitable as Earth]

Earth+

[More habitable than Earth]

Evolution of Habitable Exoplanets

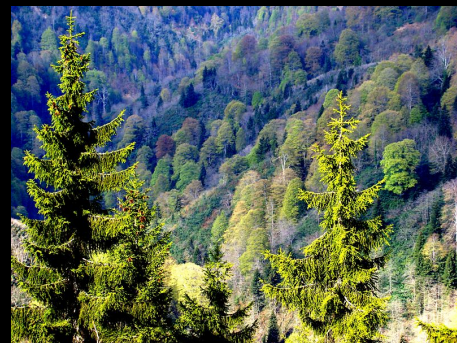


Main Goal: an Earth-like Exoplanet



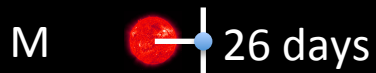
... and what about an Earth+?

What is an Earth-like Exoplanet?

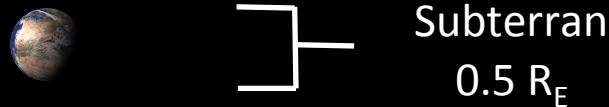
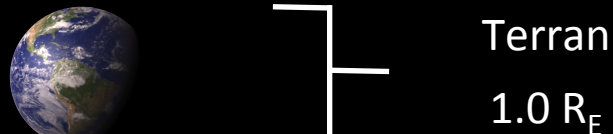


An Earth-like Exoplanet for Astronomers

Right Orbit



Right Size



The First Exoplanets, 21 years ago.



Number of Exoplanets Today

Confirmed

~1,000

Unconfirmed

>3,500



Types of Known Exoplanets

Terrestrial

Gas Giants

2
3

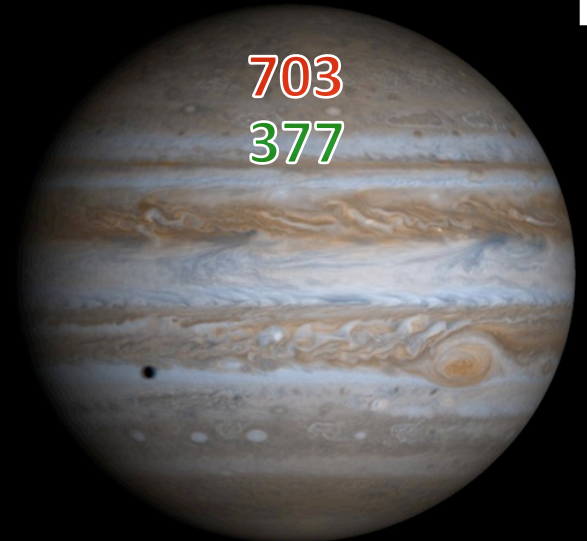
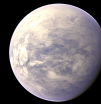
7
112

13
497

130
1793

134
806

703
377



Mercurian
Mercury-Size

Subterran
Mars-Size

Terran
Earth-Size

Superterran
SuperEarth-Size

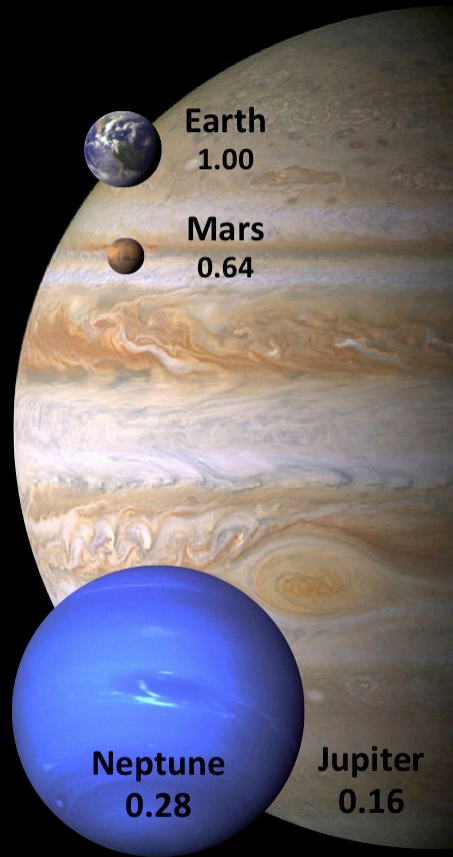
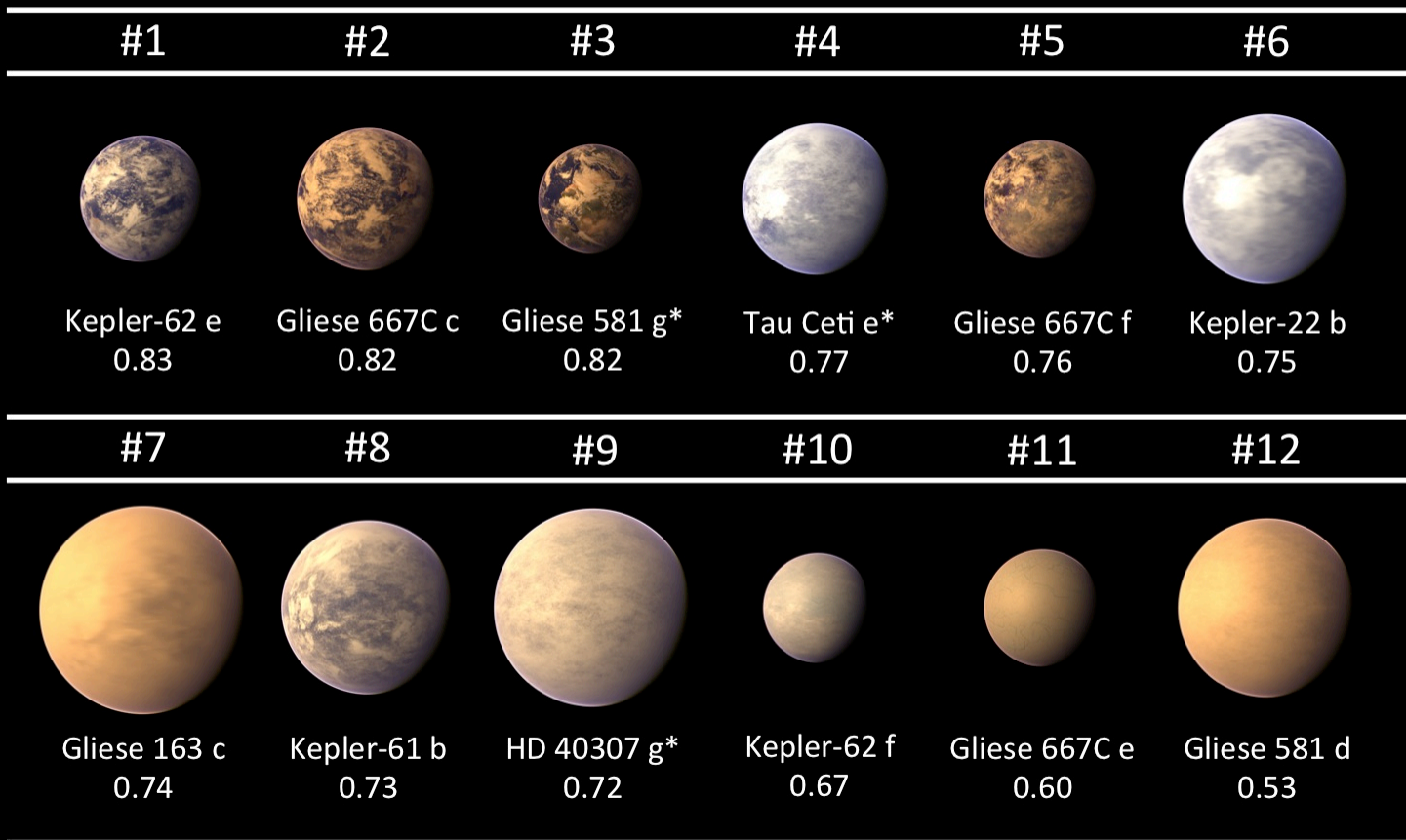
Neptunian
Neptune-Size

Jovian
Jupiter-Size

Potentially habitable depending on orbit and size.

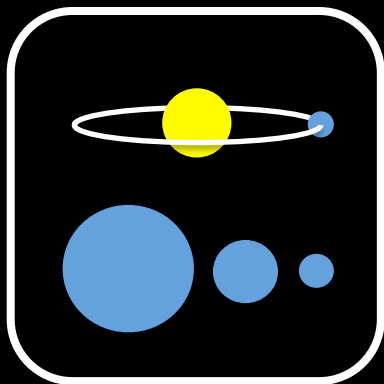
Current Potentially Habitable Exoplanets

Ranked in Order of Similarity to Earth



The Future of Habitable Exoplanet Discoveries

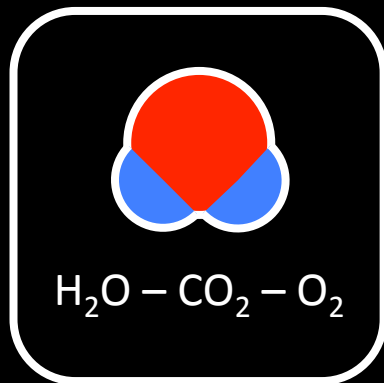
Today



Orbit & Size

[potentially habitable]

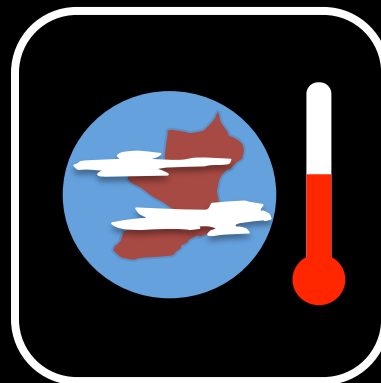
+ 10 Years



Atmosphere

[likely habitable]

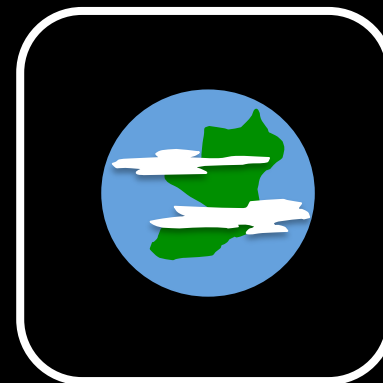
+ 20 Years



Surface

[habitable]


+ 30 Years



Life?

[inhabited]

Main “Tweetable” Ideas

- There are many types for habitable planets, some probably even better for life than Earth.
 - Earth+ planets are more habitable than Earth and easier to detect than Earth-like planets.
 - We might have already detected an Earth+ planet, but confirmation will take many years of additional observations.
- 



“Somewhere, something incredible
is waiting to be known”

— Carl Sagan (1934-1996)

An Earth+?

phl.upr.edu/projects/phe

