



CH. 19 – EXOPLANETS: THE SEARCH FOR OTHER HABITABLE WORLDS

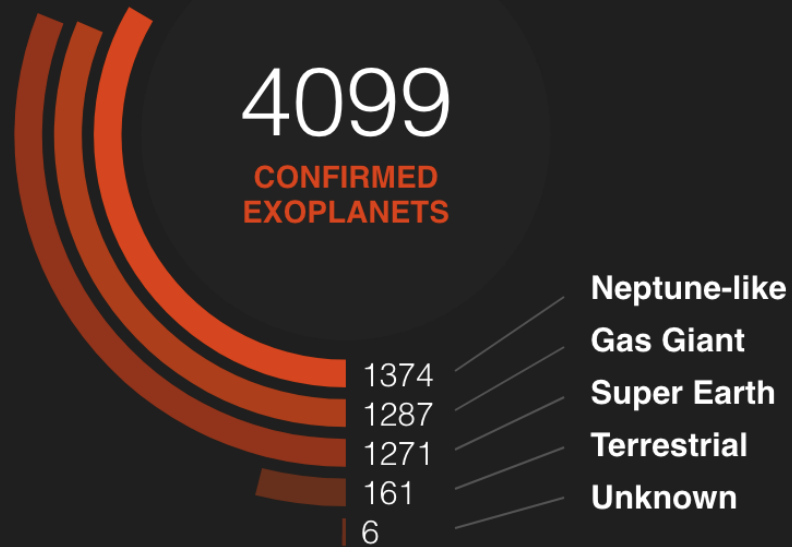
PIERCE'S ACTUAL FAVORITE THING IN ALL OF SCIENCE

I also like exoplanets
because they make for
pretty pictures like this one



Planet Types

Taken from
<https://exoplanets.nasa.gov/> on
Nov. 29



This chart tracks the current number of known planet discoveries beyond our solar system, sorted by type. Confirmed exoplanets have been validated by multiple observations. Kepler candidates have an 80-90% probability to be actual discoveries but have yet to be verified.

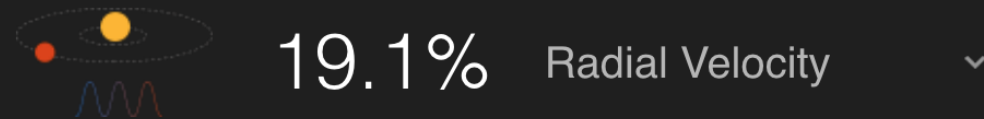
EXOPLANETS

- Worlds beyond our solar system, mainly come in 4 main varieties (typically characterized by mass and composition):
 - Earth-like (small, terrestrial)
 - Super-Earths (large, terrestrial)
 - Sub-Neptune ('gas-dwarfs', smaller than Neptune but too big to be terrestrial)
 - Hot Jupiters (Gas giants that orbit extremely close to their stars ~ days)

DETECTION

- Transit: Planet blocks some of star's light – lightcurve (**Hot Jupiters**)
- Radial Velocity – Gravitational tug of war between planet and star (**Hot Jupiters**)
- Microlensing – Light from one star bends around another (general relativity) and the presence of a planet can cause distortions to the light we observe
- Imaging – Really fancy telescopes and adaptive optics (**Large planets far from their star**)

By Method



0.46% Transit Timing Variations, 0.37% Eclipse Timing Variations, 0.17% Pulsar Timing, 0.15% Orbital Brightness Modulation, 0.05% Pulsation Timing Variations, 0.02% Disk Kinematics, 0.02% Astrometry

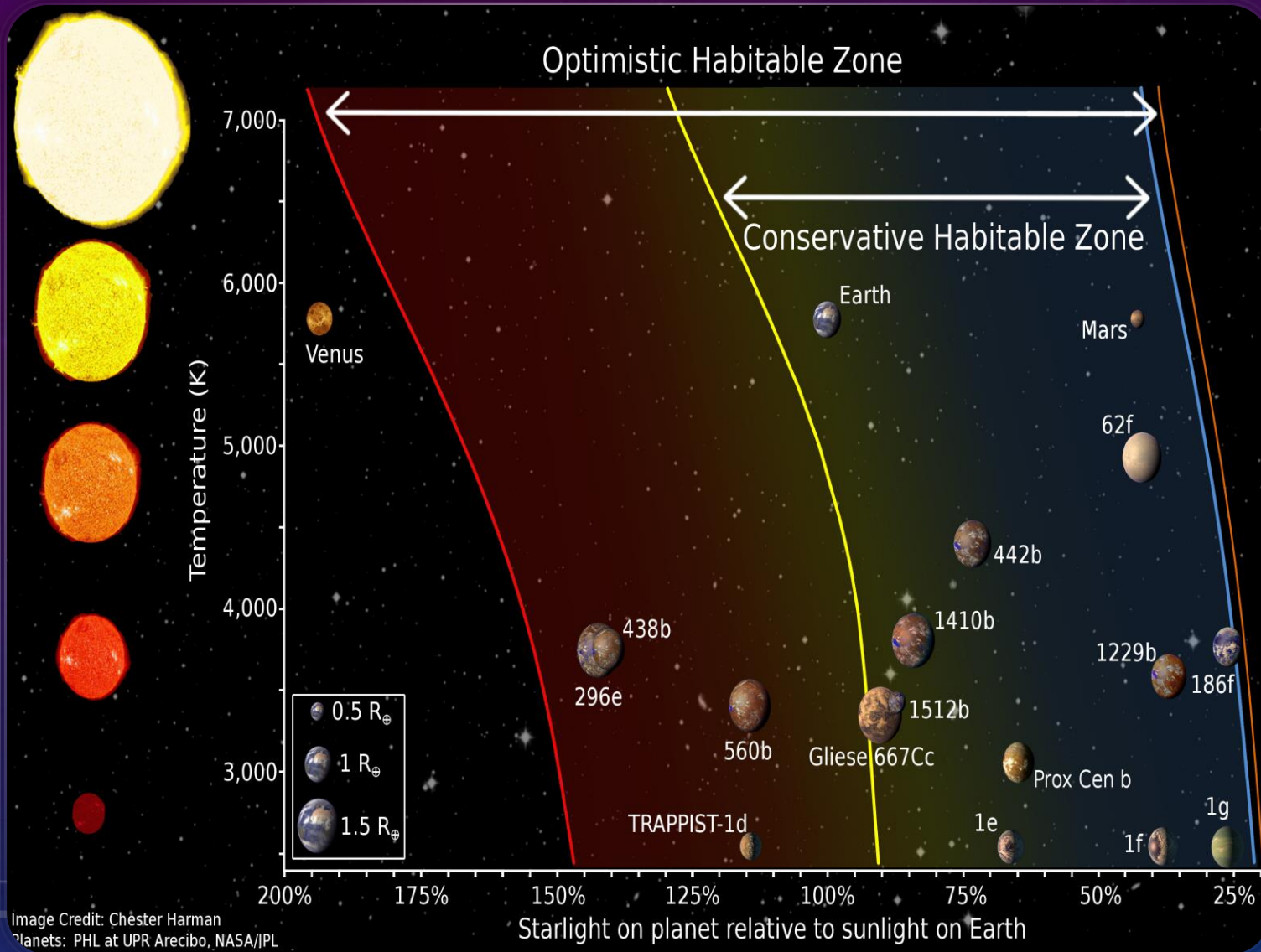


Image Credit: Chester Harman
Planets: PHL at UPR Arcibo, NASA/IPL

BUT ARE THEY HABITABLE?

- Presence of liquid water
 - Water vapor has been detected in some exoplanets' atmospheres
- The kind of star they orbit is very important
 - Sun-like? Red-dwarf?
- James Webb Space Telescope!
 - Look for certain gasses like methane
- Dr. Geronimo Villanueva – Planetary Spectrum Generator