

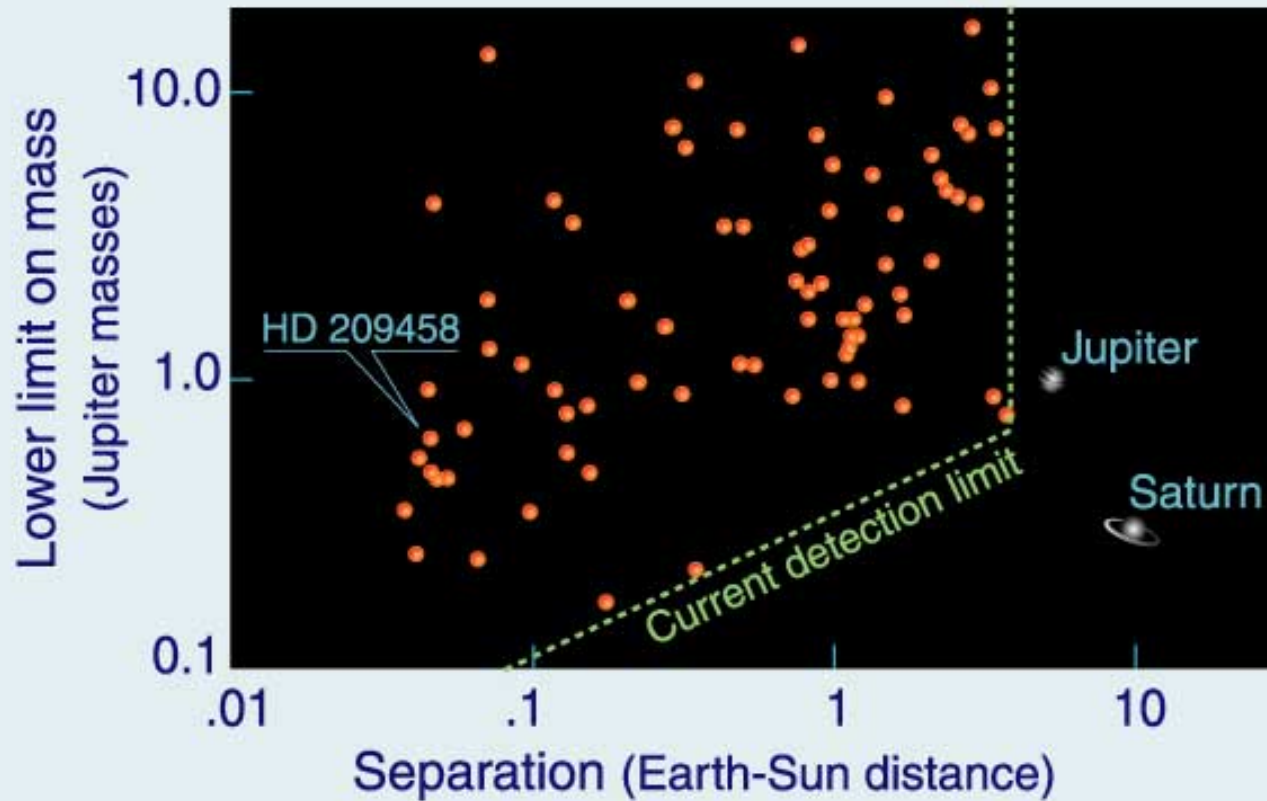
Astronomy 101
Monday, Wednesday, Friday
10:10 – 11:00 am

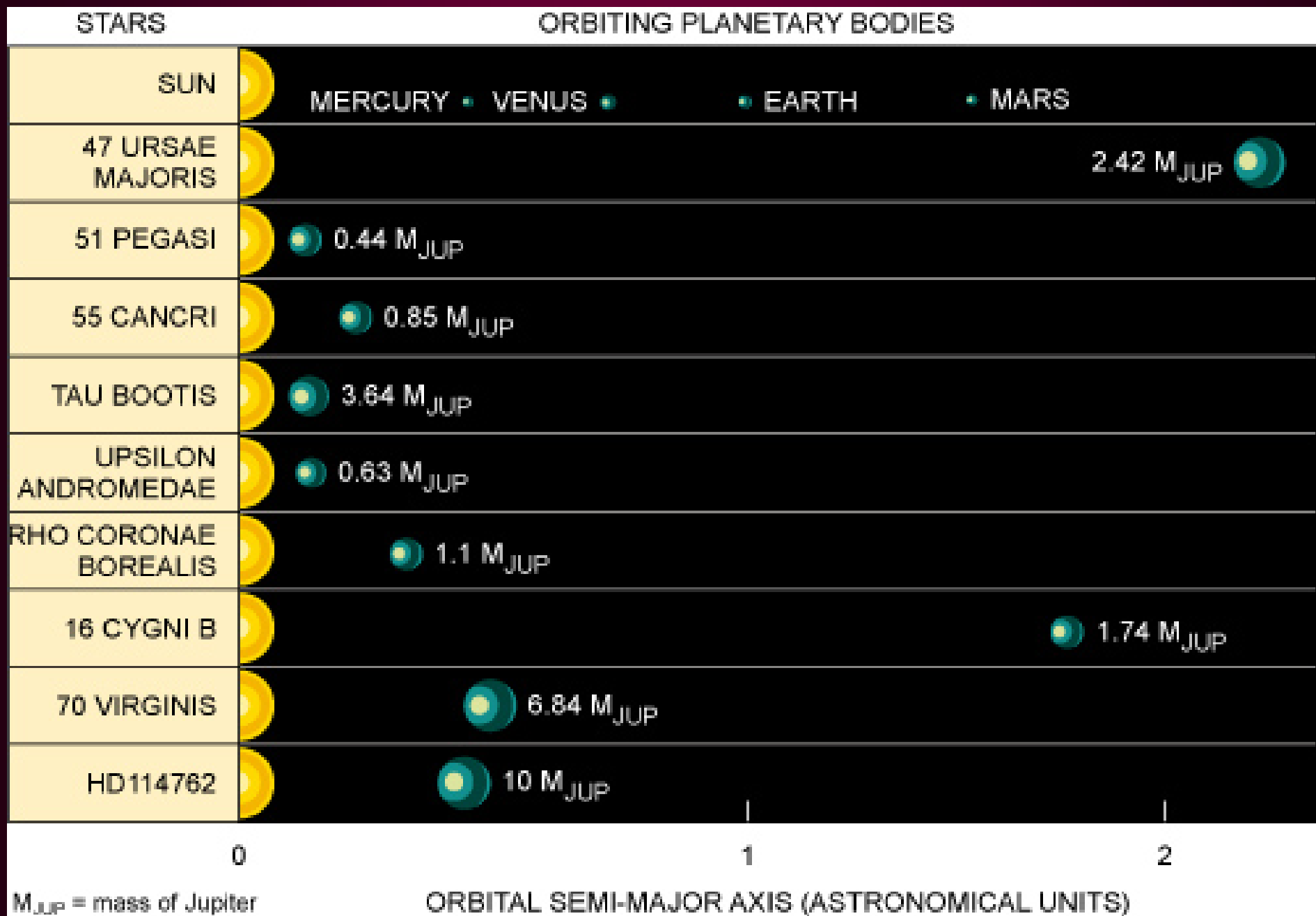
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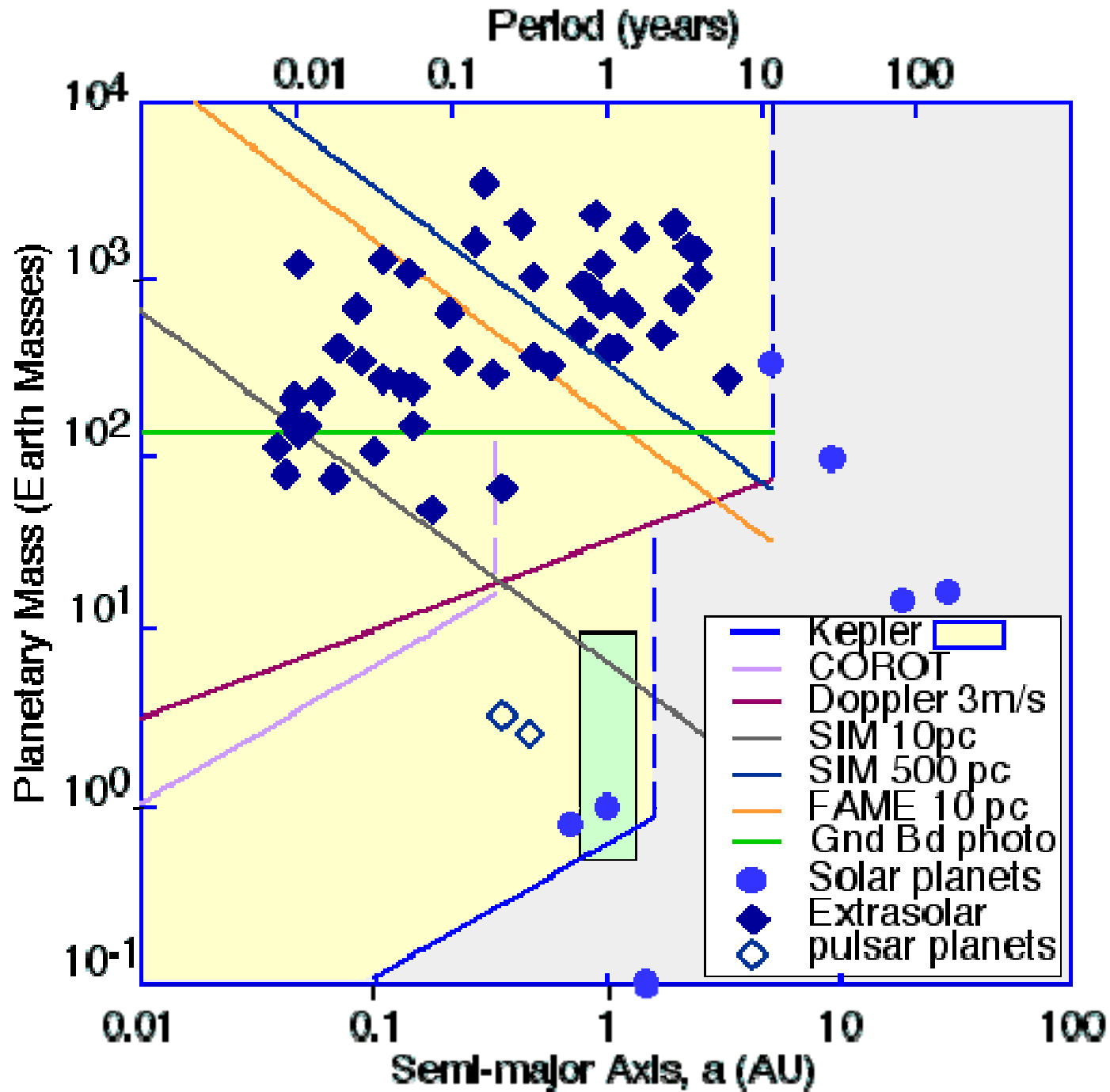
Schedule

- Today (15th) – Is there Life out there?
- Tuesday (16th) - 6 pm – Review – Hasbrouck 134
- Wednesday (17th) – 4th Exam
 - Other room – Hasbrouck 109
- Wednesday (24th) – 1:30 pm- Optional Final and Makeup Test for Exam 2 or 3 or 4 – Hasbrouck 20

Discovery space for extrasolar planets







The only star we know that has
Earth-Like Planets is the Sun

Special Characteristics of the Sun

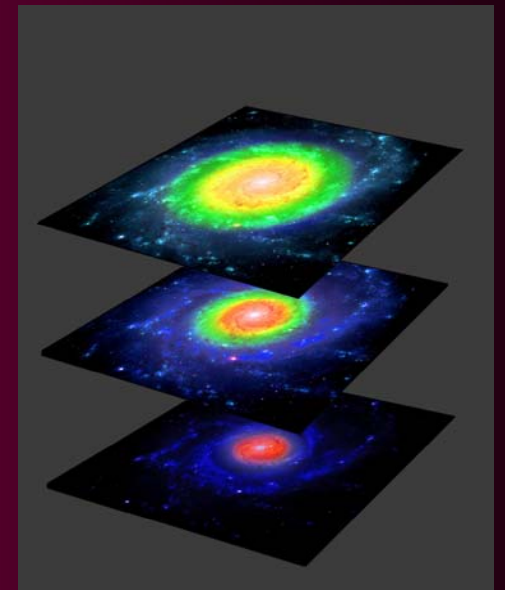
- It's a solitary star since most stars are binaries.
 - Stable planetary orbits like the Earth's are much more likely around single stars.
- It is massive enough that it is not too cool or dim, but not so massive it that it burns out before life has time to develop, evolve, and manufacture an oxygen atmosphere to create an Earth-type planet.
- Appears to have roughly 50 percent more "heavy" elements than other stars of its age and type, but only about a third of their variation in brightness,
 - elements heavier than hydrogen are essential to make rocky planets like Earth
 - large stellar flare-ups can harm planetary life with hard radiation.

Galactic Habitable Zone

- It is the area in the galaxy whose boundaries are set by its calm and safe environment, and access to the chemical materials necessary for building terrestrial planets similar to the Earth.

<http://astronomy.swin.edu.au/GHZ/>

green is habitable zone



It's place in the Galaxy

- One of Sol's unusual features is its orbit around the center of the galaxy, which is significantly less elliptical ("eccentric") than those of other stars similar in age and is barely inclined relative to the Galactic plane.
- This circularity in Sol's orbit prevents it from plunging into the inner Galaxy where life-threatening supernovae are more common.
- Moreover, the small inclination to the galactic plane avoids abrupt crossings of the plane that would stir up Sol's Oort Cloud and bombard the Earth with life-threatening comets.

HabCat

- Catalog of Nearby Habitable Systems made by Jill Tarter and Margaret Turnbull
- These Sun-like, habitable stars have just the right distance, constancy, and temperature to qualify in a forthcoming enlarged radio search.

What do else do you need?

- You need “metals” to make planets
 - Metals are elements heavier in mass than helium

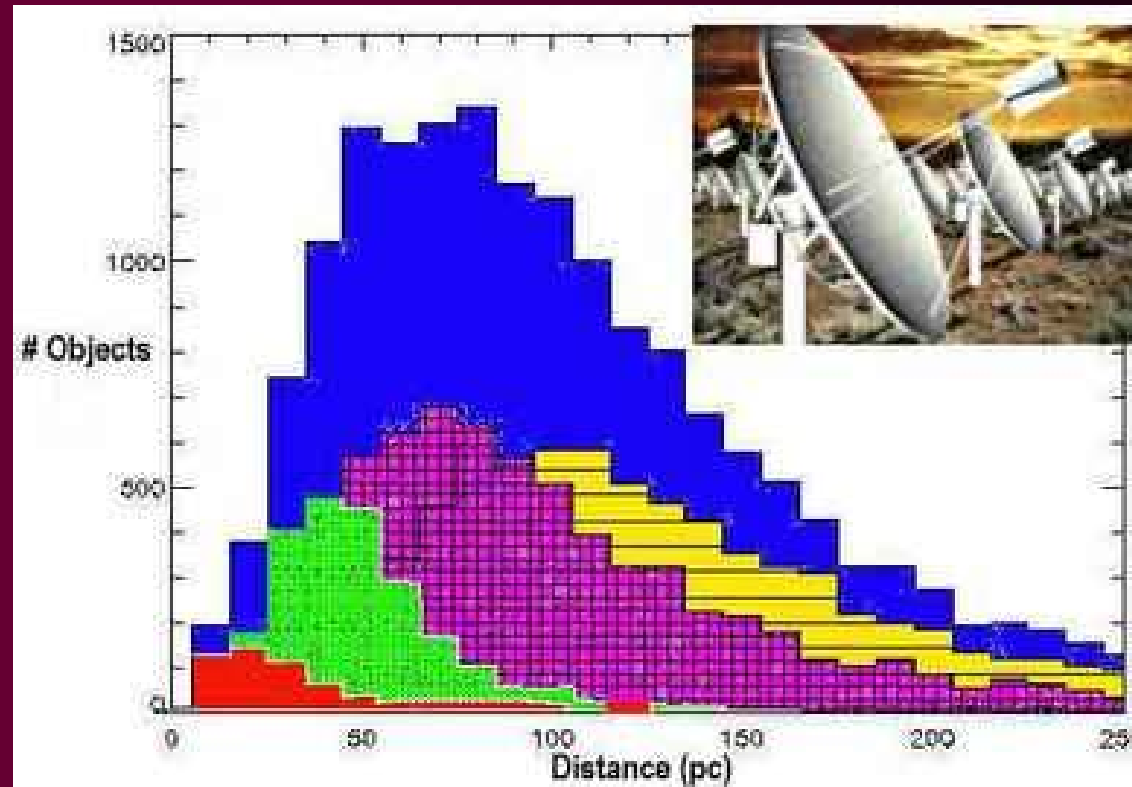
For simple life

- You need a planet with an atmosphere and some water

- Stars must remain nearly constant in brightness over billions of years for complex life to have time to develop.
 - On Earth, single cells may have developed after only 800 million years or so, but the fossil record indicates that it took another 3 to 4 billion years before multi-cellular life flourished.

- The number of HabCat stars, as a function of distance
- M-type stars (solid red histogram)
- K stars (dark-hatched green histogram)
- G stars (light-hatched violet histogram)
- F stars (horizontal-lined yellow histogram)
- all stars (open blue histogram).

<http://www.astrobio.net/news/article436.html>



Drake Equation

- http://www.activemind.com/Mysterious/Topics/SETI/drake_equation.html

Fermi's paradox

- http://en.wikipedia.org/wiki/Fermi_paradox

Movie

- <http://www.youtube.com/watch?v=V-NAvPzdjj0&search=made%20out%20of%20meat>

Any Questions?