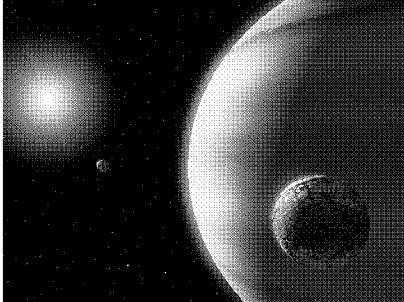


Tuesday, November 16
Properties of Exoplanets



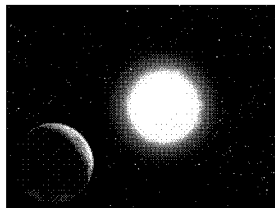
Quiz #4 will be on Friday.

Properties of Exoplanets
Key Concepts

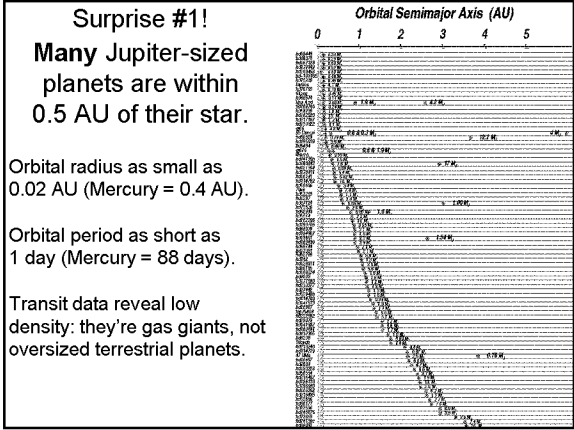
- 1) Hot Jupiters – gas giants close to their parent star – were a big surprise to astronomers.
- 2) Many exoplanets are on highly eccentric orbits, unlike the orbits of Solar System planets.
- 3) Planetary Migration explains how gas giants can be so close to their parent star.

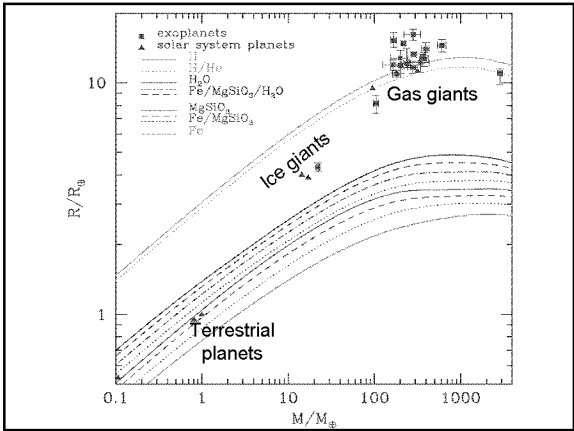
As of November 16, we've found 497 exoplanets around 419 stars.

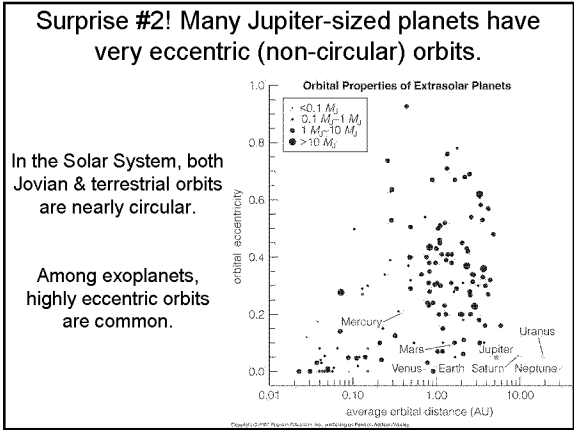
50 multiple-planet systems are known, some with 4 or 5 planets.



Most of the multiple-planet systems **don't** resemble our Solar System.



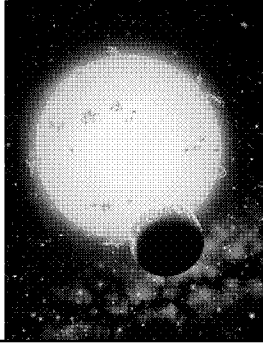


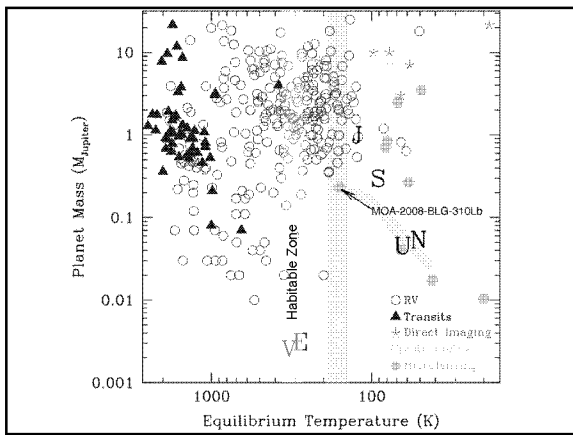


Few planetary systems found so far resemble our Solar System.

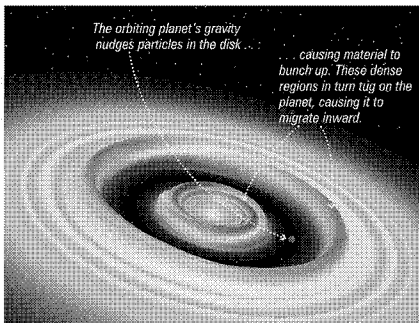
Large orbit eccentricities are hard to explain.

"Hot Jupiters" are hard to explain. Large planets should form farther from their star, where ices can freeze.





Planetary migration:
"hot Jupiters" formed far out, then migrated inward by interacting with the protoplanetary disk.



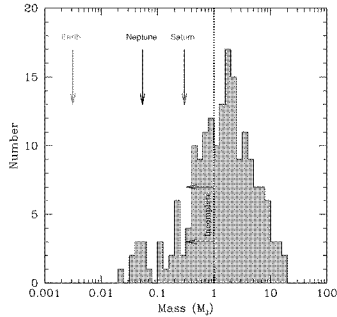
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Planet searches so far aren't sensitive enough to find Earth-sized planets.

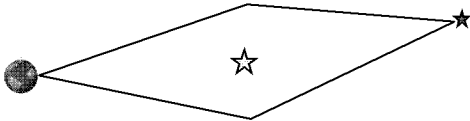
Doppler technique needs to be ten times more precise.

Transit technique is just now becoming sensitive enough.

Gravitational Lensing is a promising technique.

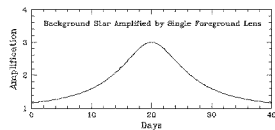


Gravitational lensing occurs when two stars line up with the Earth.



Light from the background star is amplified by the gravity of the foreground star (it's a relativity thing).

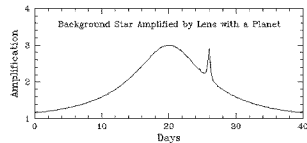
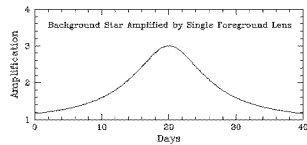
The background star is briefly brightened as it moves directly behind the foreground star.



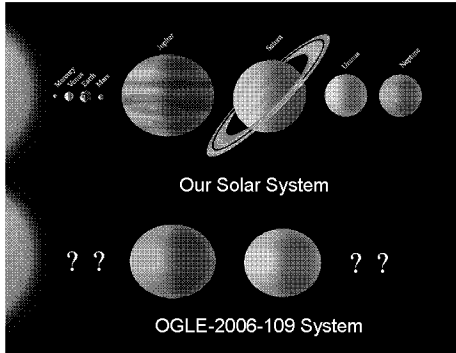
If there's a planet around the foreground star, it will also amplify the background star.

The result is a little extra "bump" of amplification.

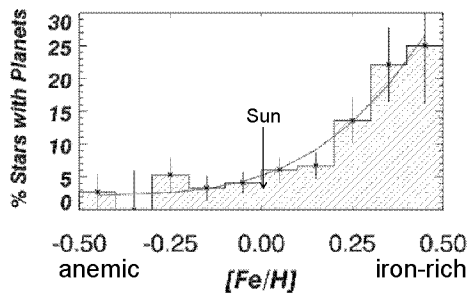
So far 11 planets have been found this way, mostly by Ohio State's Microlensing Follow Up Network (MicroFUN).



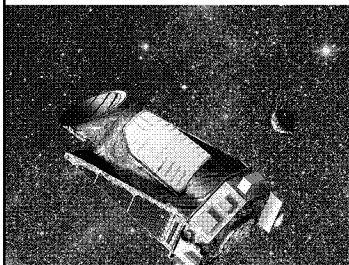
The OGLE-2006-109 system, found by gravitational lensing, is the first true Solar System analog discovered.



Planets tend to be found around stars that are rich in heavy elements.



The *Kepler* Mission, launched in 2008, is sensitive to transiting, habitable Earths around FGKM parent stars.



The hunt is on for Earth-like planets in Habitable Zones!
