Searching for Exoplanets

Observing planets as they transit stars

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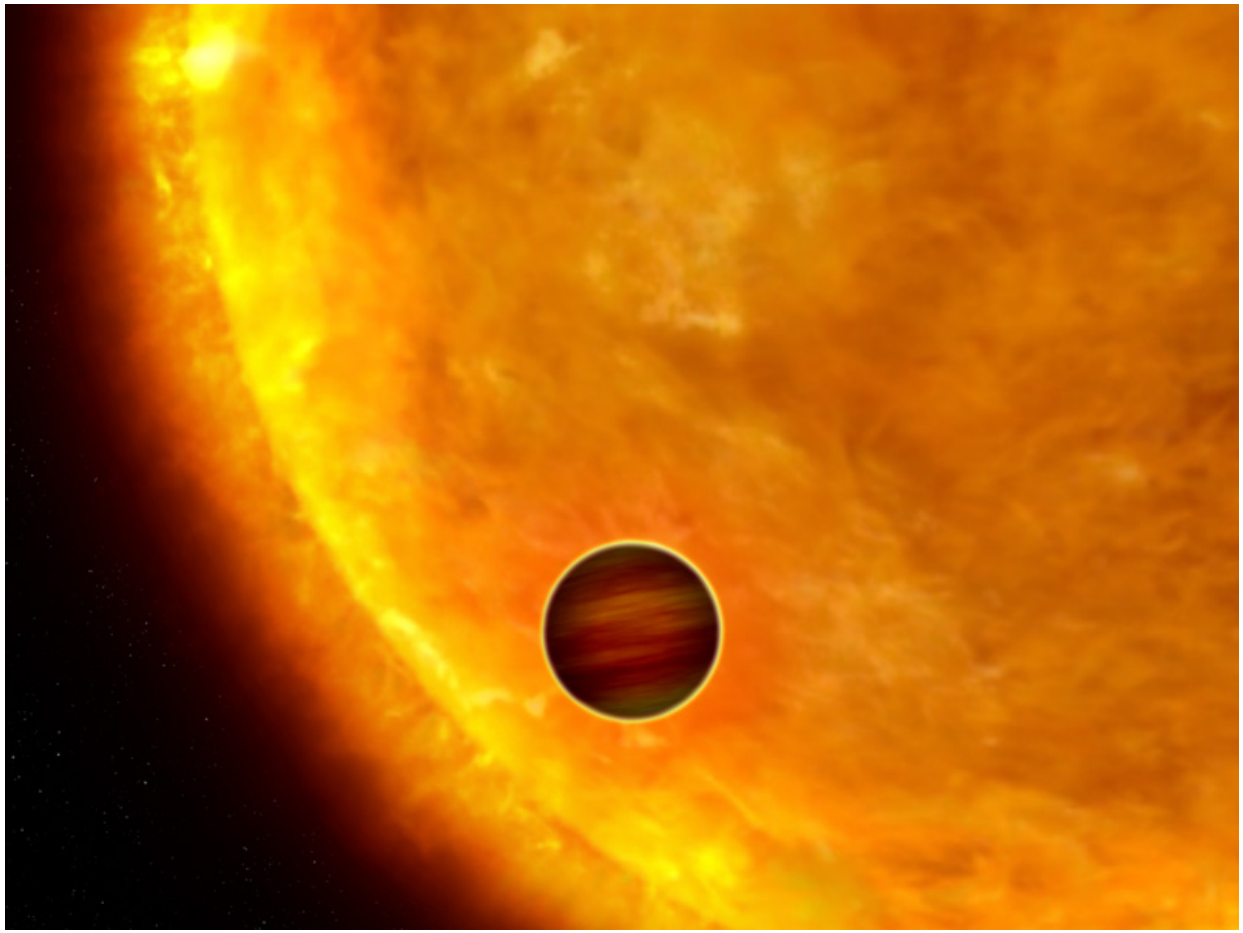
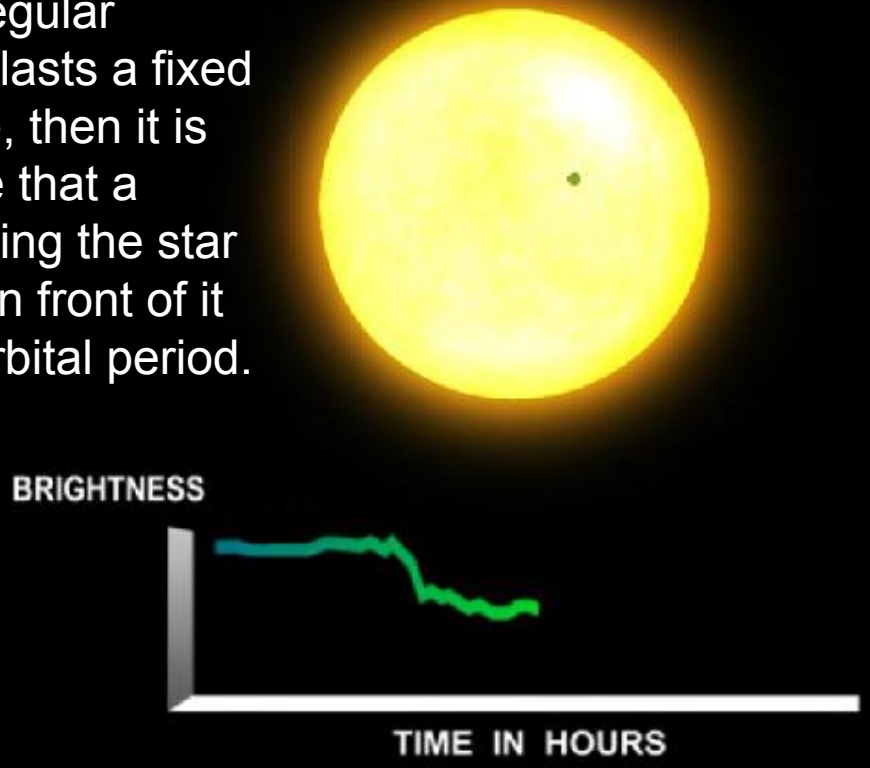
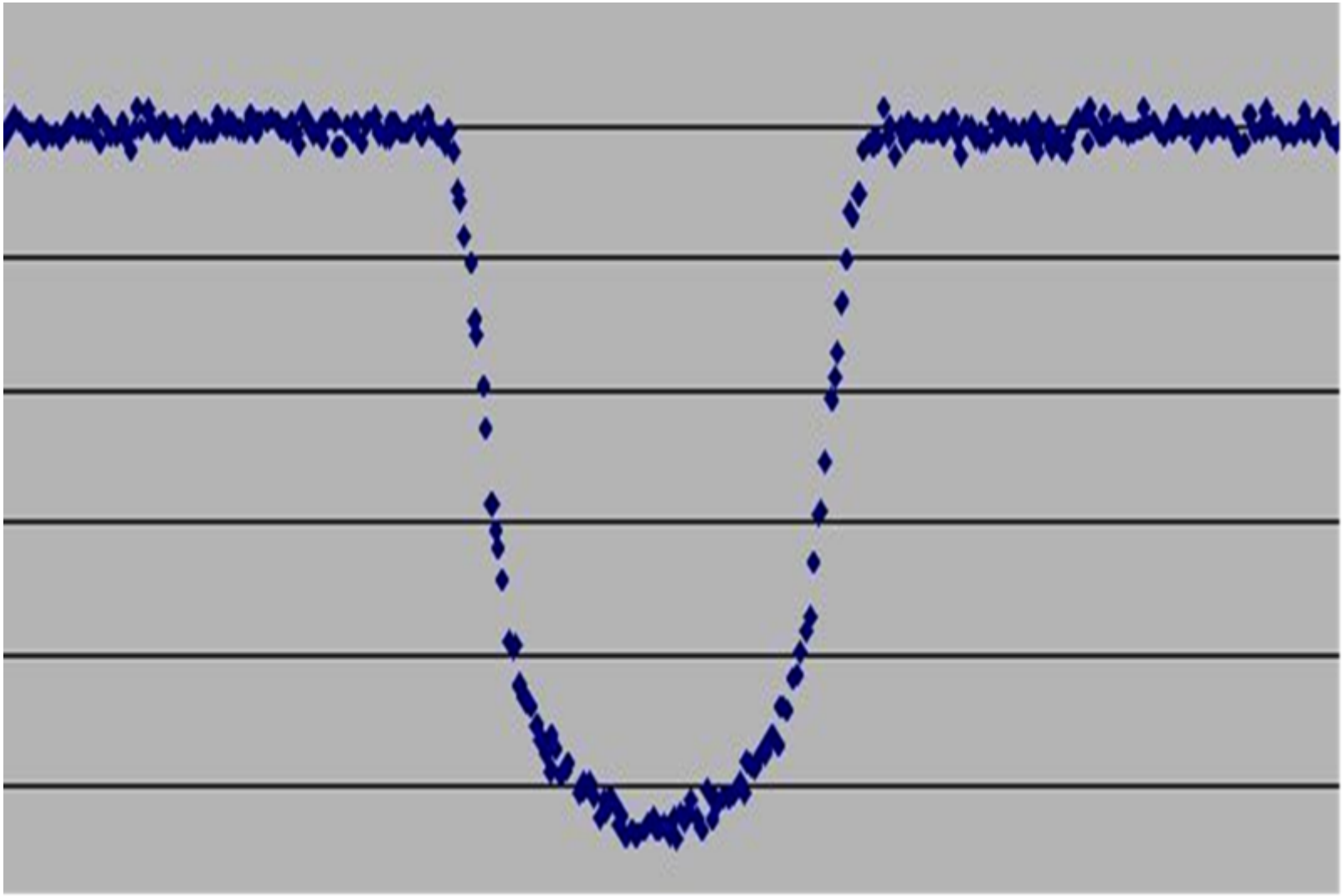
Astronomers are looking for planets that are transiting stars in our region of the Galaxy

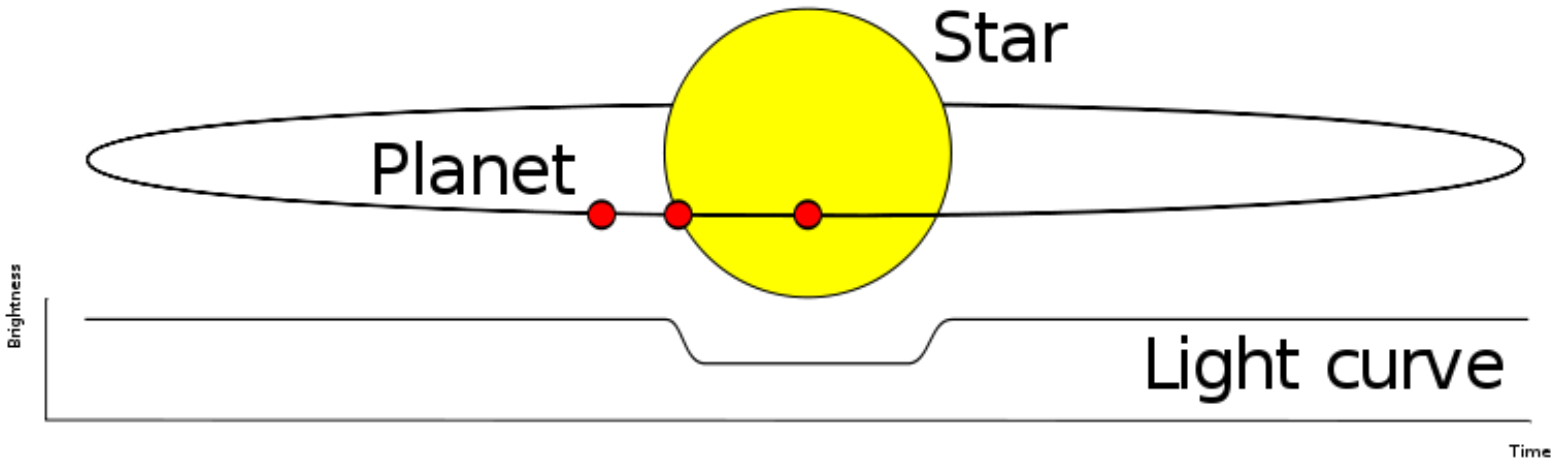


Transit Photometry

If such a dimming is detected at regular intervals and lasts a fixed length of time, then it is very probable that a planet is orbiting the star and passing in front of it once every orbital period.






Star
Planet
Brightness
Light curve
Time

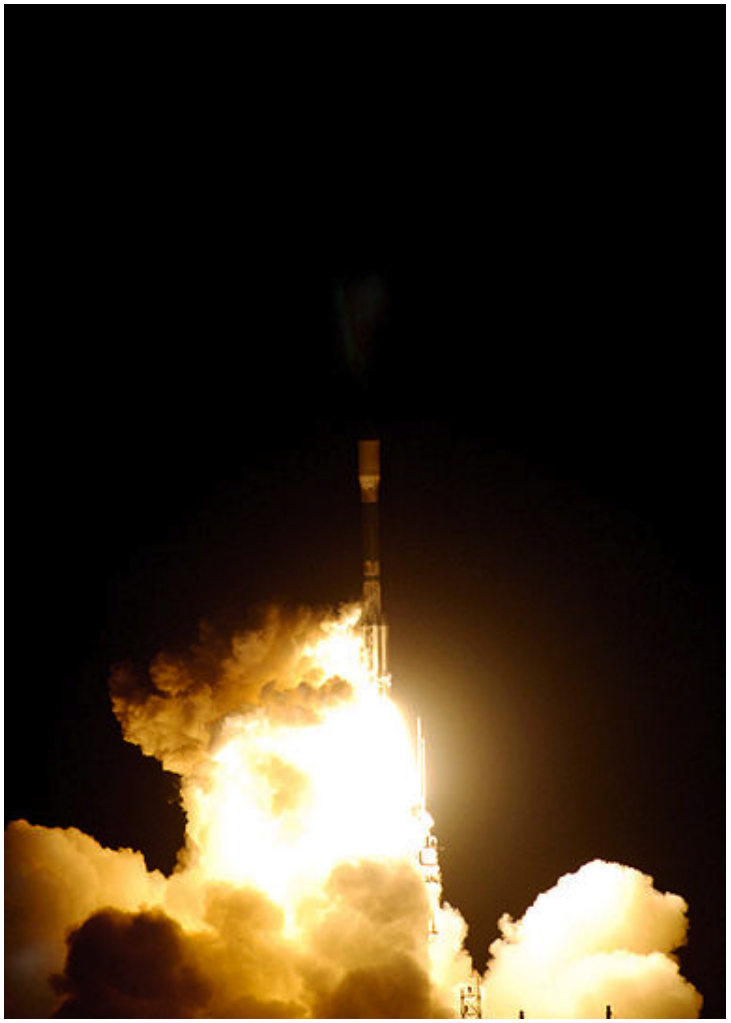
Advantages of Using Transit Method

- One of the most sensitive methods of detecting small planets and those orbiting close to their stars.
- While other methods can determine planetary mass, this method yields the planetary radius.
- Combined with detection methods that yield mass (e.g. radial method), astronomers can estimate planet's density.
- By examining light curves of different wavelengths of light, an absorption spectrum can be constructed which will determine composition of the planet's atmosphere.

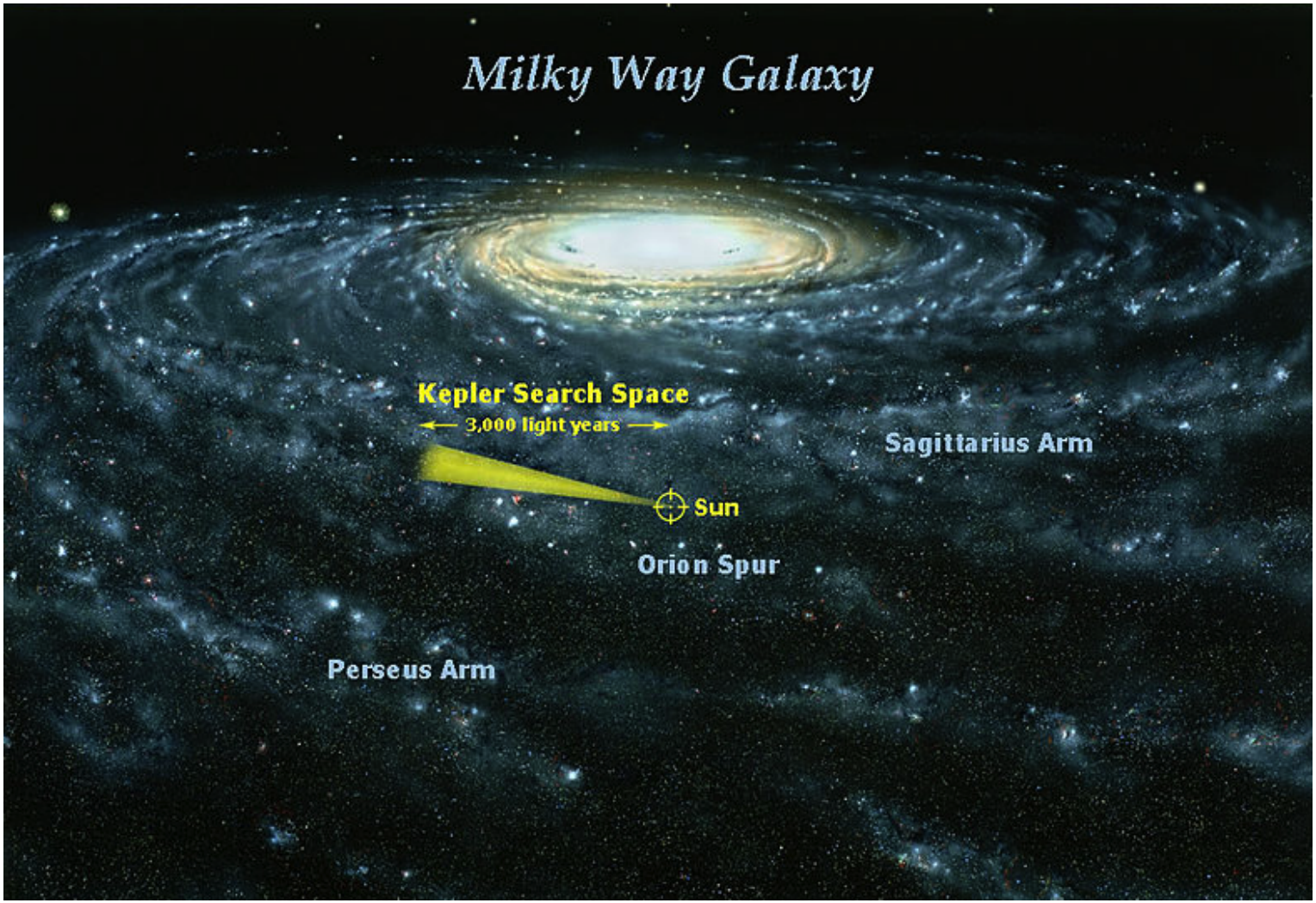
Disadvantages of Using Transit Method

- Planetary transits are uncommonly observed because Earth's line of sight has to be perfect.
- Transits don't last long; observation instruments can miss one in progress.
- Astronomers need to observe a series of transits for the same planet to confirm that changes in brightness aren't caused by other phenomena.
- High rate of "false positives"; binary star systems produce similar light curves.

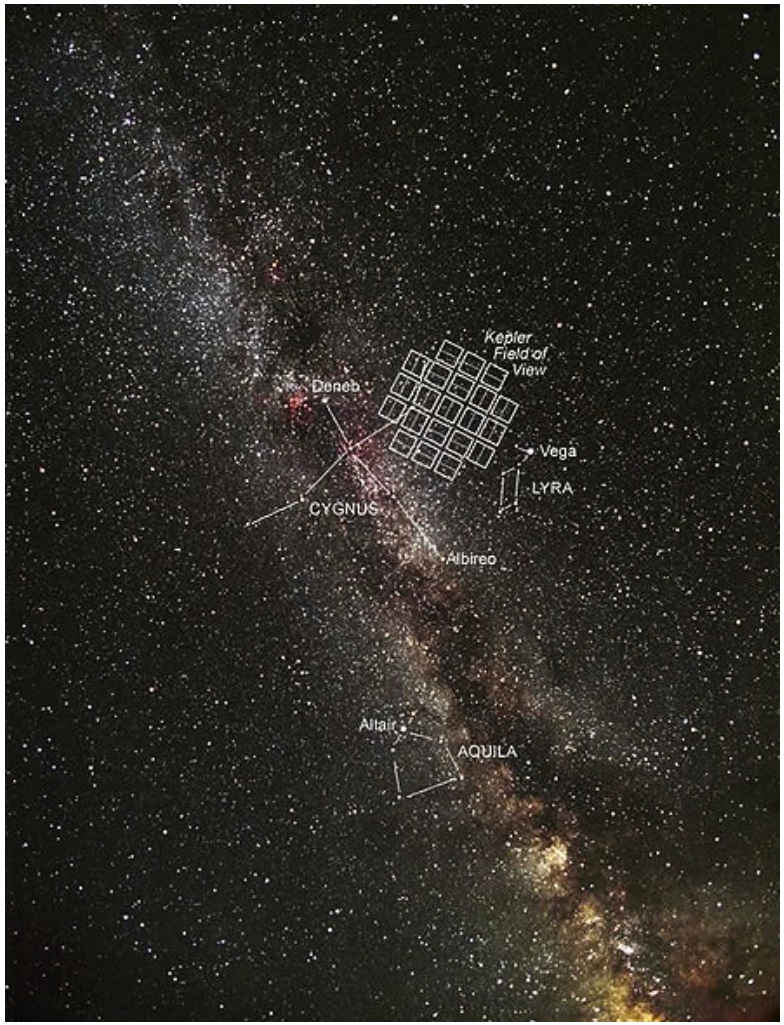
Kepler Telescope
Launched on
March 6, 2009

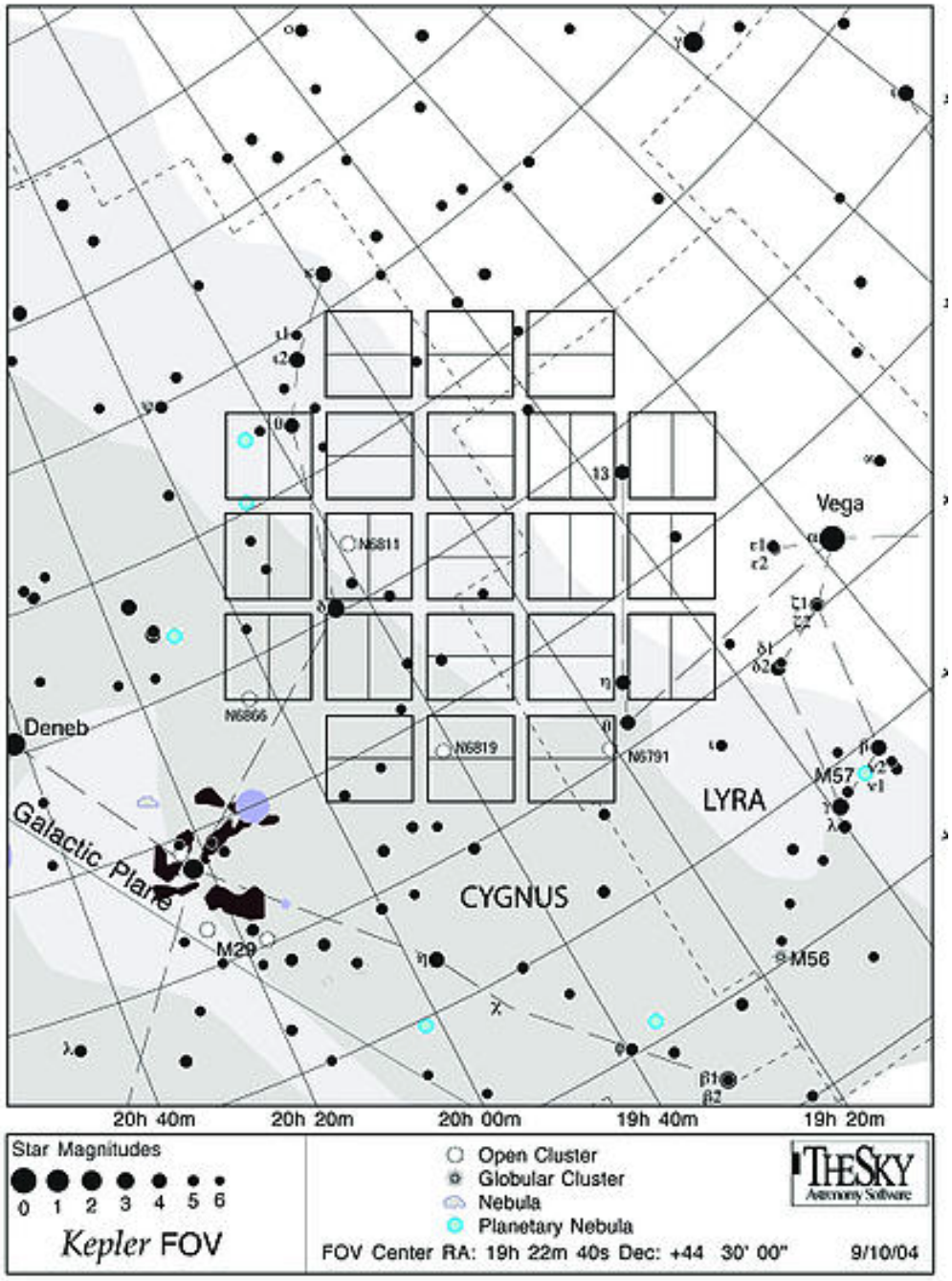



EXIT


Milky Way Galaxy
Kepler Search Space
3,000 light years
Sagittarius Arm
Sun
Orion Spur
Perseus Arm

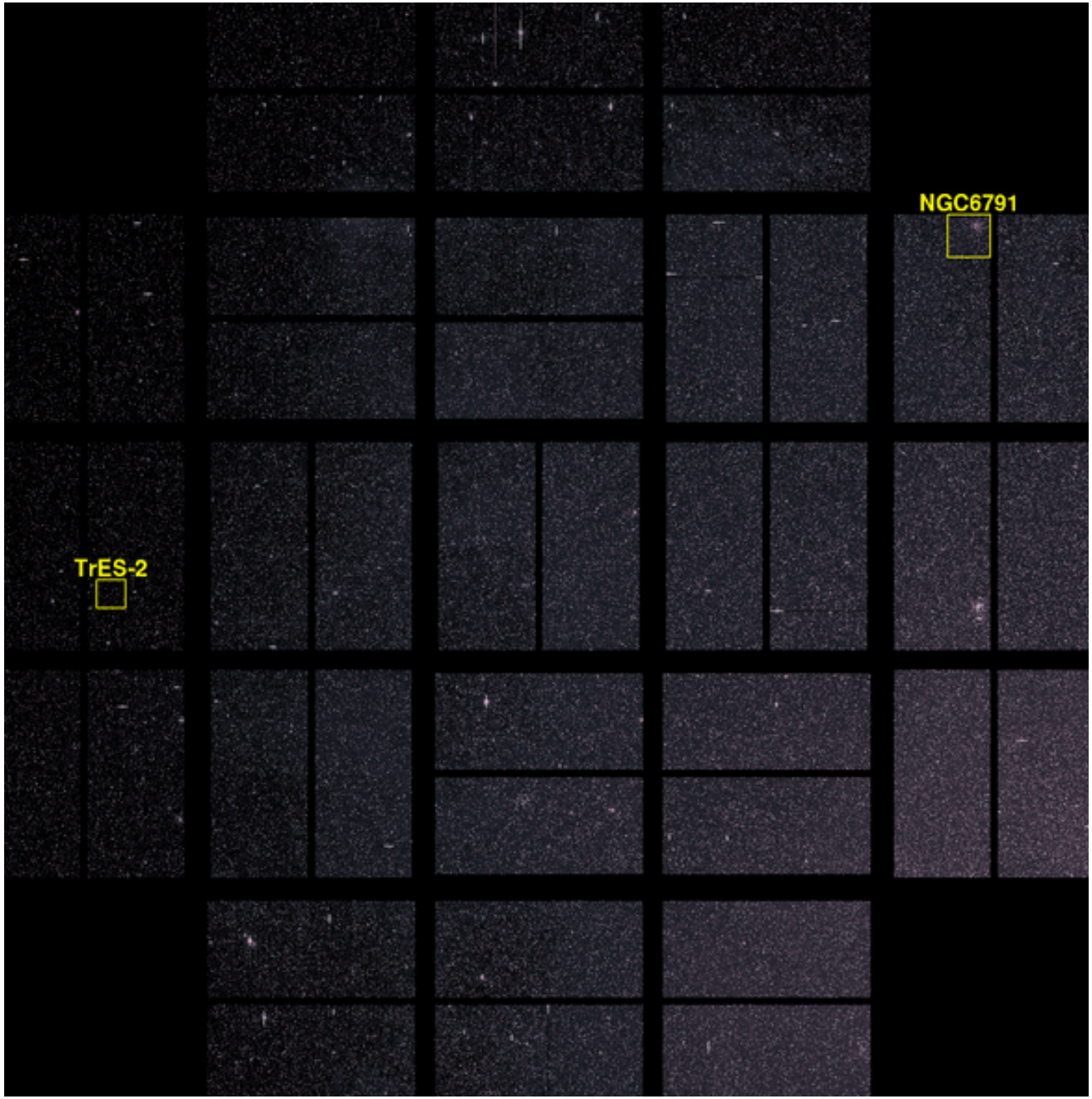
Kepler is examining the region of the Galaxy in the direction of Cygnus, the Swan…



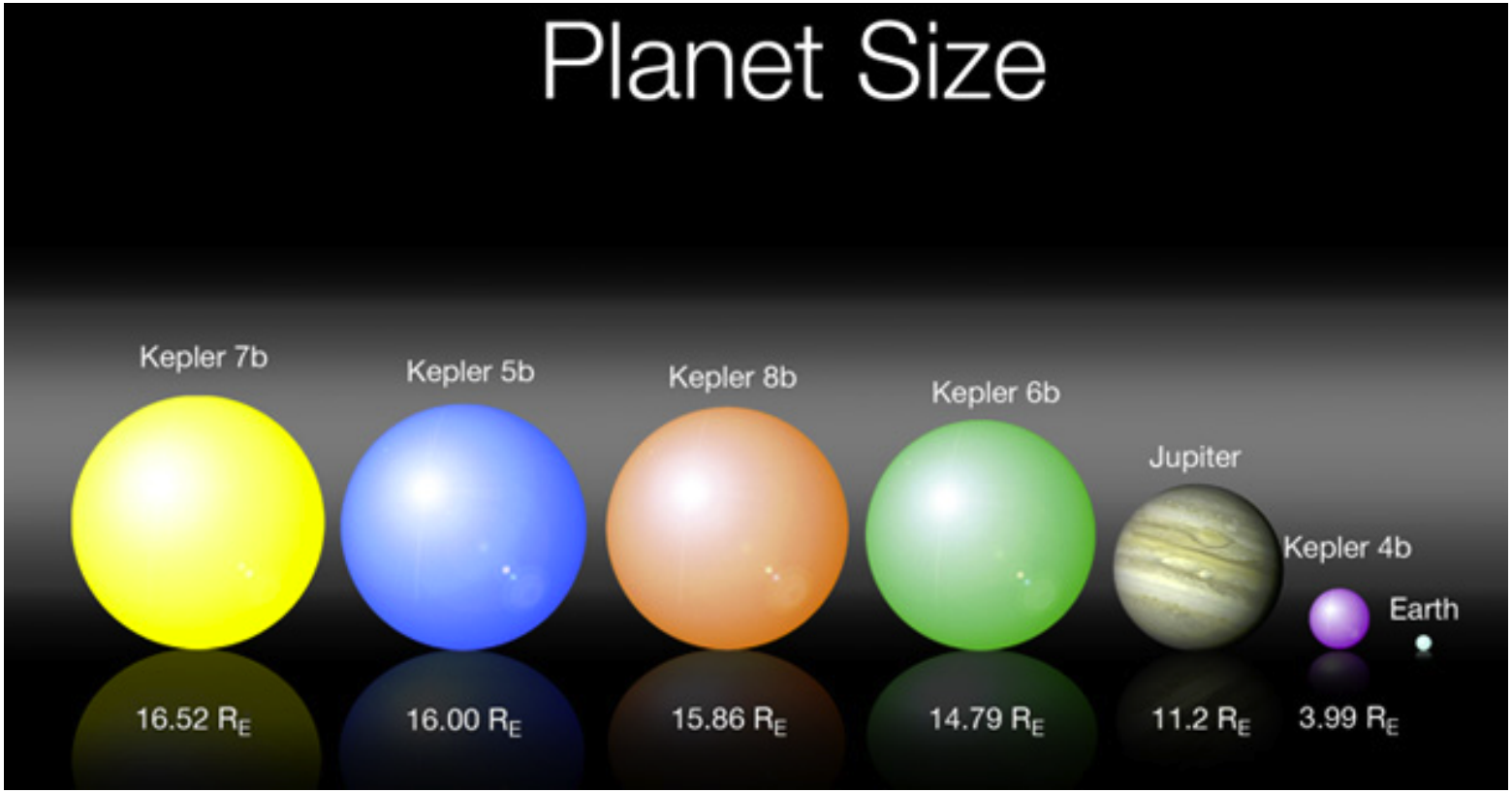

Vega
Deneb
LYRA
CYGNUS
Galactic Plane
M29
M56
M57
N6811
N6866
N6819
N6791
20h 40m
20h 20m
20h 00m
19h 40m
19h 20m
Star Magnitudes
0 1 2 3 4 5 6
Kepler FOV
Open Cluster
Globular Cluster
Nebula
Planetary Nebula
FOV Center RA: 19h 22m 40s Dec: +44 30' 00"
9/10/04
THESKY
Astronomy Software

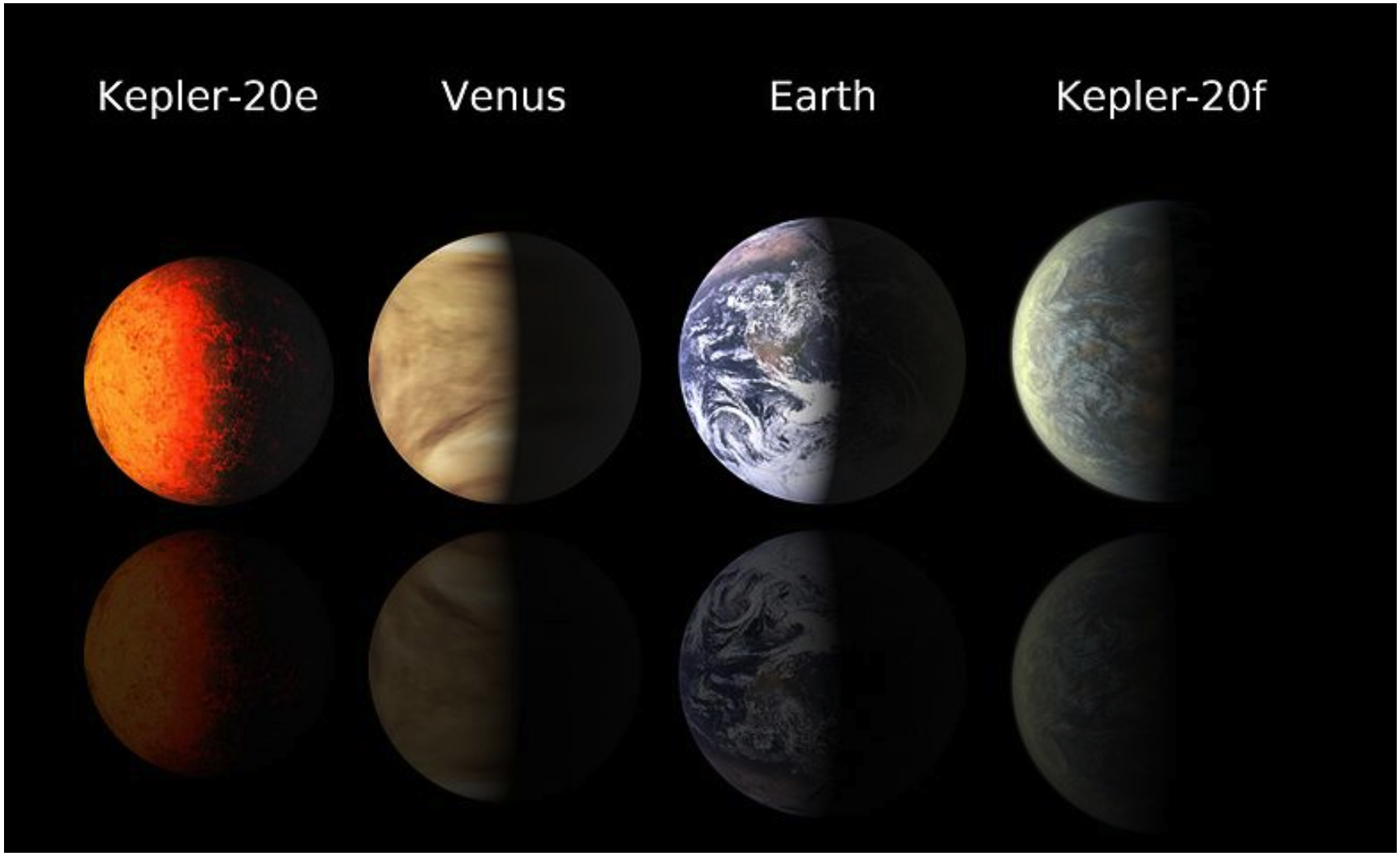
The Kepler Telescope has 100,000 stars available to measure.

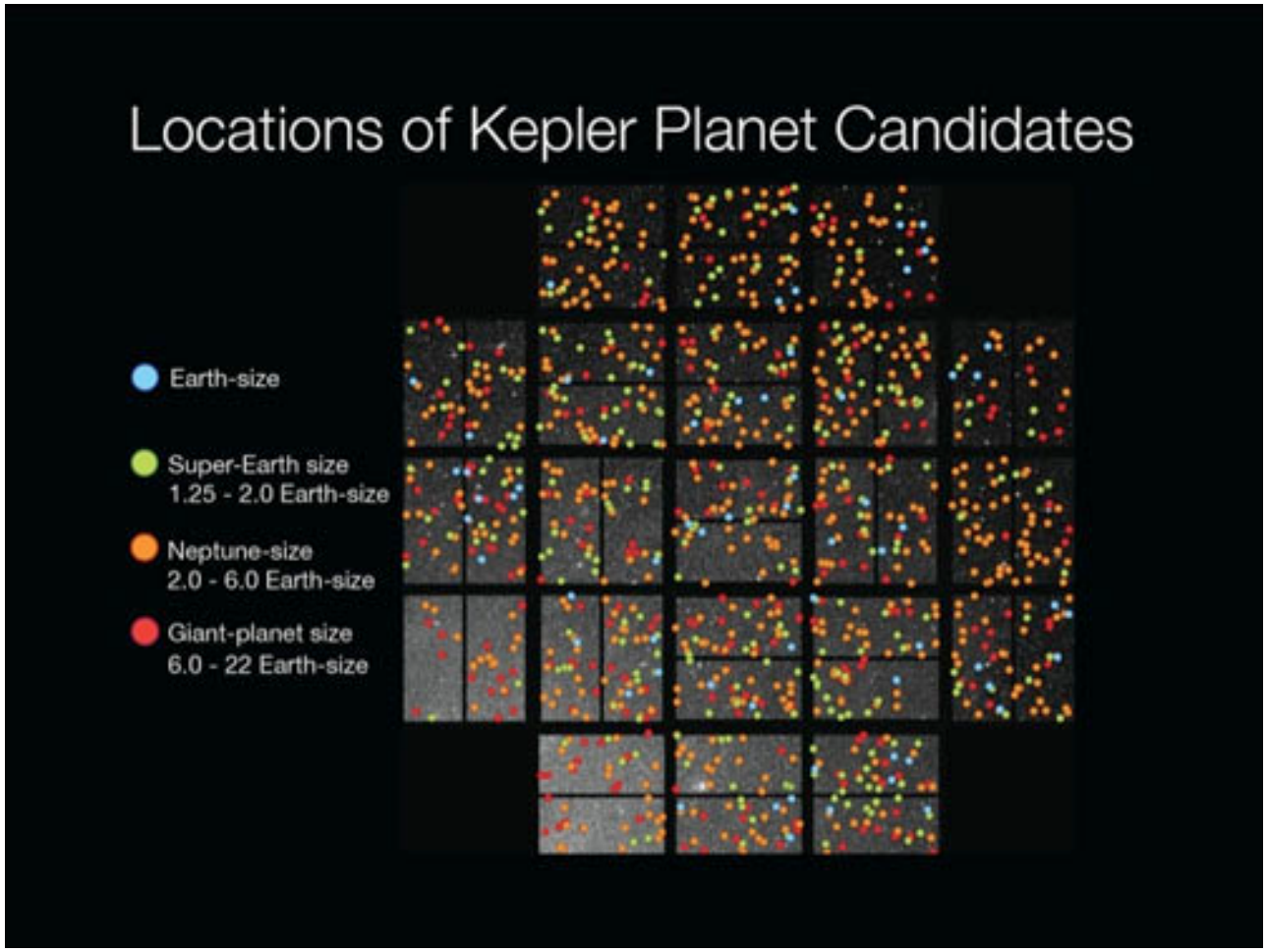
By February 2011, Kepler had already discovered 1235 planets

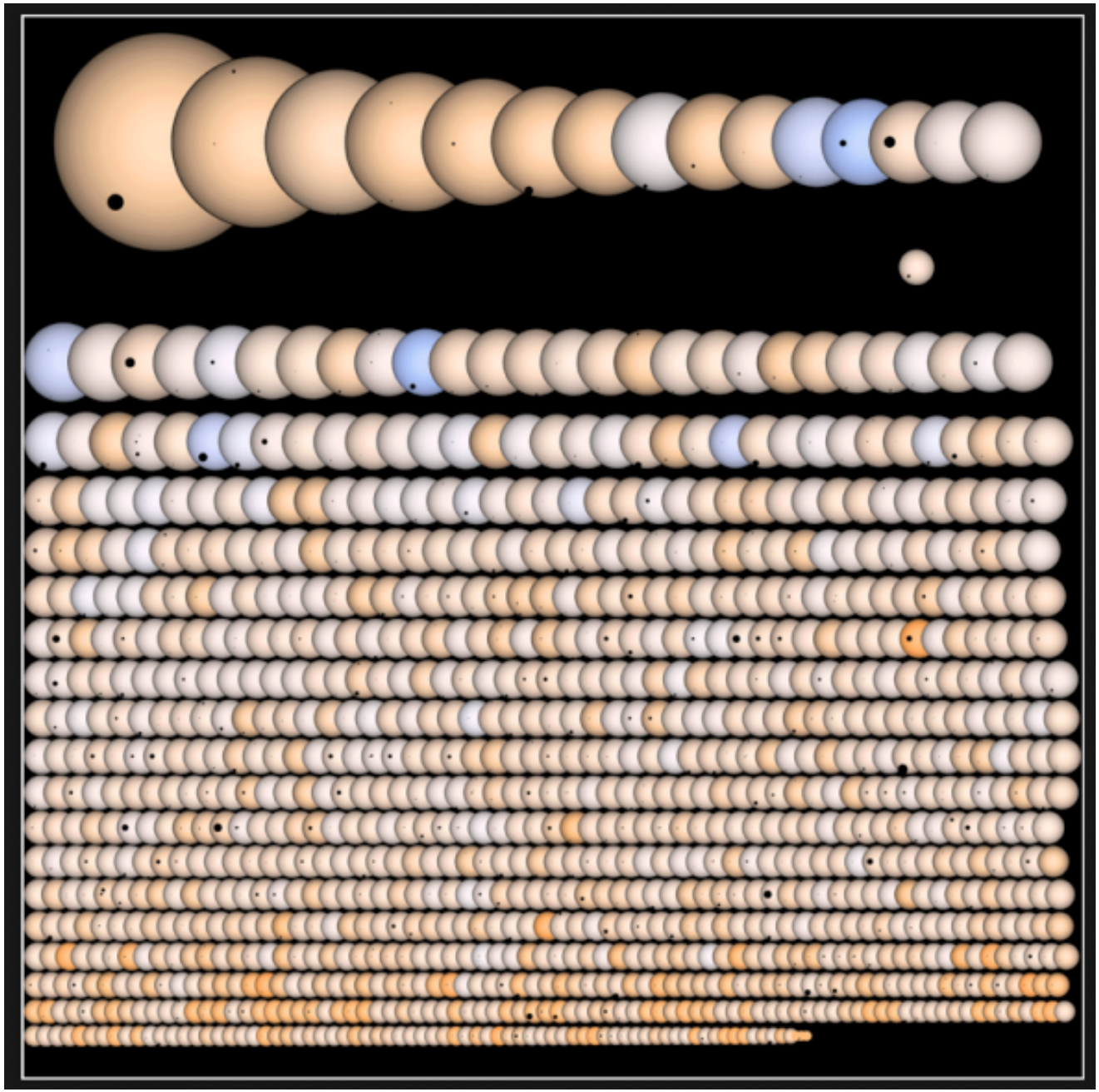


The first five planets Kepler discovered

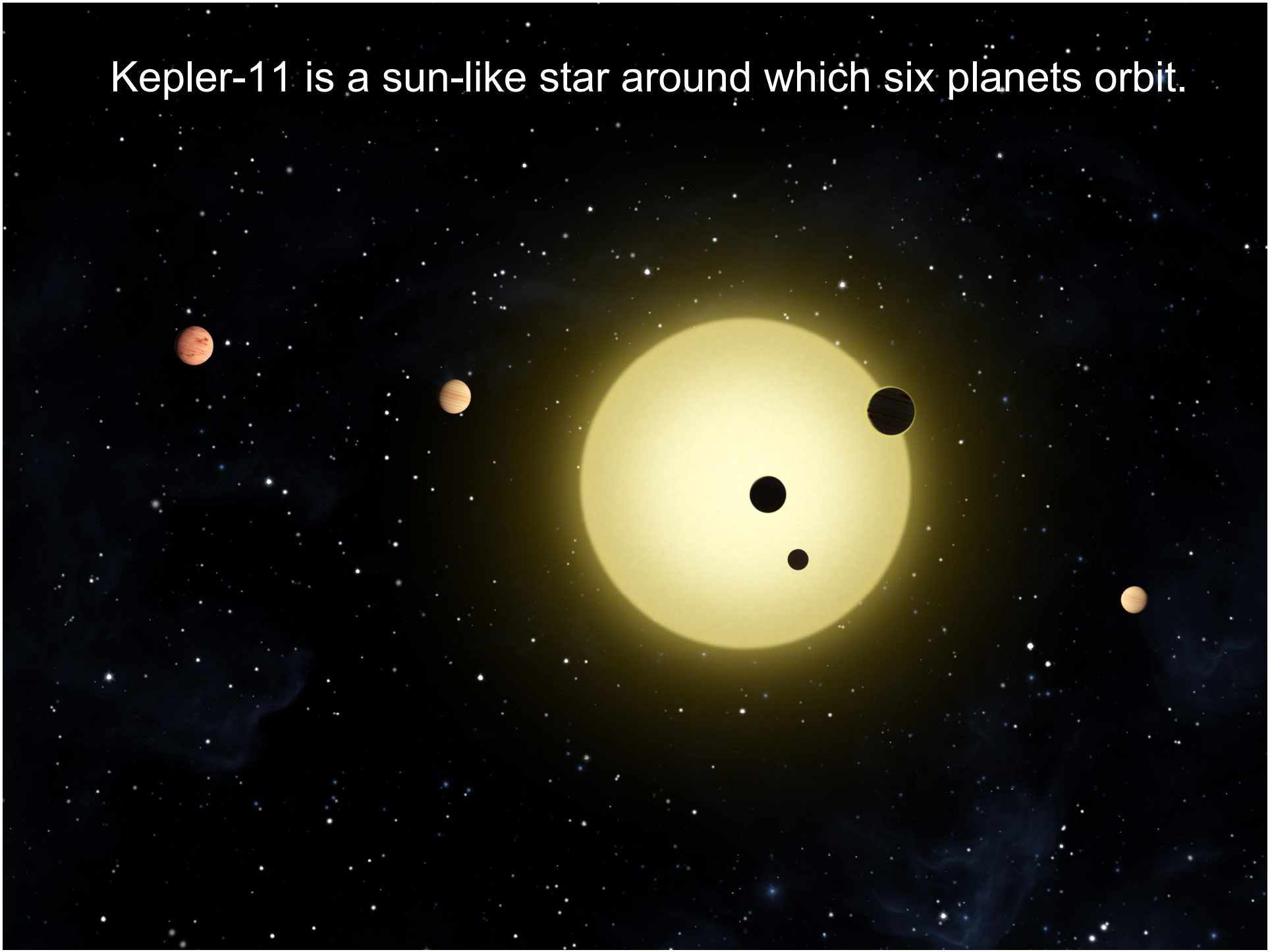



Kepler-20e
Venus
Earth
Kepler-20f


Locations of Kepler Planet Candidates
Earth-size
Super-Earth size
1.25 - 2.0 Earth-size
Neptune-size
2.0 - 6.0 Earth-size
Giant-planet size
6.0 - 22 Earth-size



If a planet has been detected by the transit method, then variations in the timing of the transit provide an extremely sensitive method capable of detecting additional planets in the system with sizes potentially as small as the Earth.


Kepler-11 is a sun-like star around which six planets orbit.