



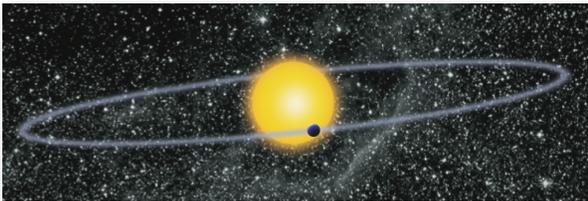
NASA Ames Research Center/W. Stenzel (OSC)/Artist's Concept

Kepler Mission: A Search for Habitable Planets

www.nasa.gov

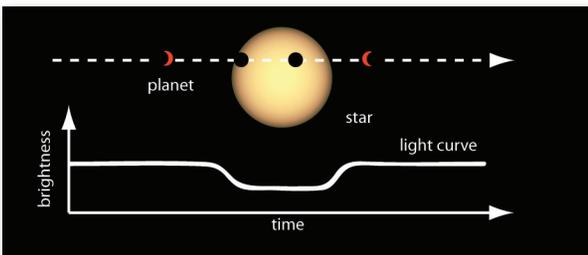
Are There Habitable Planets Beyond Our Solar System?

Is Earth unique in the universe? How many Earth-size planets exist? NASA's *Kepler* team seeks to answer these questions by using the "transit method" for detecting planets. Launched March 6, 2009, *Kepler* is searching for planets the size of Earth that orbit in the habitable zone of other stars. The habitable zone is the range of distance from a star where liquid water could exist on the surface of a planet, thus making life as we know it possible. For the first time in history, humans will know if there are Earth-size planets capable of supporting life beyond our solar system.



What Is The Transit Method?

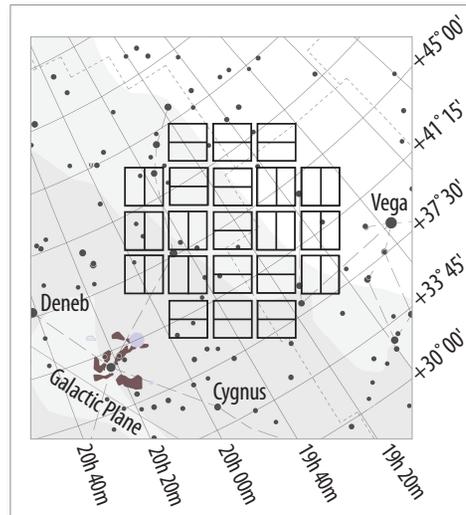
When a planet passes in front of a star as viewed from Earth, the event is called a "transit." On Earth, we can observe an occasional Venus or Mercury transit. These events are seen as a small black dot creeping across the Sun—Venus and Mercury block sunlight when they move between the Sun and us. *Kepler* finds a planet by looking for the tiny dip in brightness of a star when a planet transits in front of it. But the dips in brightness are so small, detecting them is like seeing the light dim when a gnat flies across a car's headlight as seen from many miles away.



Kepler's transit photometry measures the brightness variations of stars to detect Earth-size planets.

How Does *Kepler* Do It?

The *Kepler* spacecraft is a specialized telescope that performs like a very precise light meter; it is called a photometer. *Kepler* stares at one area of the sky in the constellation Cygnus, an area larger than a hand held at arm's length (see illustration below).



Kepler Field of View

Kepler stares continuously at this star field for years—virtually never blinking so as not to miss a transit—making brightness measurements of more than 100,000 stars every 30 minutes. By precisely measuring changes in each star's brightness and with some follow-up ground-based observations, the *Kepler* team will be able to determine the:

- types of stars that have planets
- sizes of planets
- duration of the planets' orbital periods
- distance planets are from their host stars
- characteristic temperatures of planets

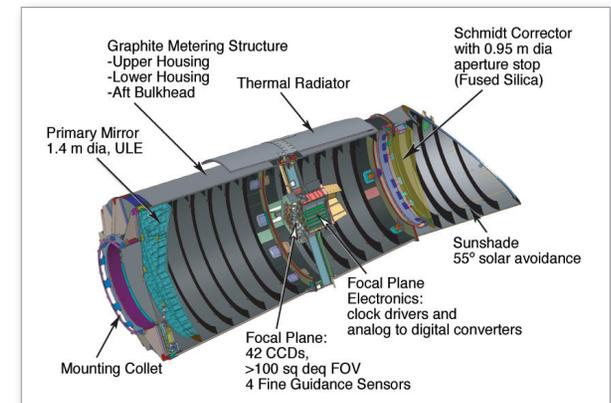
...and for giant planets like Jupiter

- the shapes of planetary orbits
- the masses and densities of planets.

From Pixels to Planets

The process of going from starlight focused onto individual pixels to discoveries is long and complex. Data for each star are recorded on the spacecraft and

radioed to the ground once per month. The raw data are processed to produce light curves for each star. The light curves are processed to search for sequences of transits. A team of scientists examines the light curves to decide which qualify as planetary candidates. Next an extensive series of ground-based follow-up observations are performed on the many hundreds of candidates. The objective is to eliminate false positive cases, while at the same time improve our knowledge of the parent stars. Extensive analysis and modeling are performed on the original *Kepler* data and the newly acquired ground-based data to determine the true nature of each planetary candidate. About one-half of the candidates are rejected. Of the candidates that remain, some meet all the discovery criteria and are published by the science team in peer-reviewed publications. The others may simply require more *Kepler* observational data, or may be left as undecided planetary candidates for future research.



Photometer Cross Section

Mission Length

Kepler launched on March 6, 2009. The mission is planned to last for three and one-half or more years to enable the detection of 3 to 4 transits for each planet in the habitable zone of a star.

Do You Want to Learn More?

On the *Kepler* web site, you will find news, computer animations, lessons, graphics, movies, detailed information about the *Kepler* team, and more. Please visit <http://kepler.nasa.gov>