

# Transiting exoplanet with longest known year

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This artist's conception shows the Uranus-sized exoplanet Kepler-421b, which orbits an orange, type K star about 1,000 light-years from Earth. Kepler-421b is the transiting exoplanet with the longest known year, circling its star once every 704 days. It is located beyond the "snow line" -- the dividing line between rocky and gaseous planets -- and might have formed in place rather than migrating from a different orbit. Credit: David A. Aguilar (CfA)

Astronomers have discovered a transiting exoplanet with the longest known year. Kepler-421b circles its star once every 704 days. In comparison, Mars orbits our Sun once every 780 days. Most of the 1,800-plus exoplanets discovered to date are much closer to their stars and have much shorter orbital periods.

"Finding Kepler-421b was a stroke of luck," says lead author David Kipping of the Harvard-Smithsonian Center for Astrophysics (CfA). "The farther a planet is from its star, the less likely it is to transit the star from Earth's point of view. It has to line up just right."

Kepler-421b orbits an orange, type K star that is cooler and dimmer than our Sun. It circles the star at a distance of about 110 million miles. As a result, this Uranus-sized planet is chilled to a temperature of  $-135^{\circ}$  Fahrenheit.

As the name implies, Kepler-421b was discovered using data from NASA's Kepler spacecraft. Kepler was uniquely suited to make this discovery. The spacecraft stared at the same patch of sky for 4 years, watching for stars that dim as planets cross in front of them. No other existing or planned mission shows such long-term, dedicated focus. Despite its patience, Kepler only detected two transits of Kepler-421b due to that world's extremely long orbital period.

The planet's orbit places it beyond the "snow line" - the dividing line between rocky and gas planets. Outside of the snow line, water condenses into ice grains that stick together to build [gas giant](#) planets.

"The snow line is a crucial distance in [planet formation](#) theory. We think all gas giants must have formed beyond this distance," explains Kipping.

Since gas [giant planets](#) can be found extremely close to their [stars](#), in orbits lasting days or even hours, theorists believe that many exoplanets

migrate inward early in their history.

Kepler-421b shows that such migration isn't necessary. It could have formed right where we see it now.

"This is the first example of a potentially non-migrating gas giant in a transiting system that we've found," adds Kipping.

The host star, Kepler-421, is located about 1,000 light-years from Earth in the direction of the constellation Lyra.

This research has been accepted for publication in *The Astrophysical Journal* and is available online. Additional information can be found at [www.cfa.harvard.edu/~dkipping/kepler421.html](http://www.cfa.harvard.edu/~dkipping/kepler421.html)

Provided by Harvard-Smithsonian Center for Astrophysics

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