= Gliese 581 d =

Gliese 581 d / ??li?z? / (often shortened to Gl 581 d or GJ 581 d) is a possible extrasolar planet orbiting the star Gliese 581 approximately 20 @.@ 4 light @-@ years away in the constellation of Libra . It is the third planet claimed in the system and (assuming a six @-@ planet model) the fifth in order from the star .

Though not confirmed to be a terrestrial planet and significantly more massive than Earth (at 6 @.@ 98 Earth masses) , the Super @-@ Earth is the first exoplanet of terrestrial mass proposed to orbit within the habitable zone of its parent star .

Assuming its existence , computer climate simulations have confirmed the possibility of the existence of surface water and these factors combine to a relatively high measure of planetary habitability .

= = Discovery = =

A team of astronomers led by Stéphane Udry of the Geneva Observatory used the HARPS instrument on the European Southern Observatory 3 @.@ 6 meter telescope in La Silla , Chile to discover the planet in 2007 . Udry 's team employed the radial velocity technique , in which the mass of a planet is determined based on the small perturbations it induces in its parent star ? s orbit via gravity .

= = = Formerly disputed = = =

In September 2012 , Roman Baluev filtered out the " red noise " from the Keck data and concluded that this planet 's existence is probable only to 2 @.@ 2 standard deviations .

That same year , however , a team from the USNO confirmed the existence of the planet with a much higher probability .

A study in 2014 concluded that Gliese 581 d is " an artifact of stellar activity which , when incompletely corrected , causes the false detection of planet g . " In 2015 , a study by Dr Guillem Anglada @-@ Escudé concluded that the planet could exist .

= = Orbital characteristics = =

Gliese 581 d orbits Gliese 581 at 0 @.@ 21847 AU , approximately a fifth of the distance that the Earth orbits the Sun , though its orbital eccentricity has not been confirmed . There are currently two models for its orbit , a circular one like Earth 's , and an eccentric one like Mercury 's . These are based on the four planet and six planet model for the Gliese 581 system , respectively . Under the four planet model Gliese 581 d would most probably be in a spin @-@ orbit resonance of 2 : 1 , rotating twice for each orbit of its parent star . Therefore , the day on Gliese 581 d should approximately be 67 Earth days long .

The orbital distance places it at the outer limits of the habitable zone , the distance at which it is believed possible for water to exist on the surface of a planetary body . At the time of its discovery , the planet 's orbit was originally thought to be farther out . However , in late April 2009 the original discovery team revised its original estimate of the planet 's orbital parameters , finding that it orbits closer to its star than originally determined with an orbital period of 66 @.@ 87 days . They concluded that the planet is within the habitable zone where liquid water could exist . Moreover , the data also suggested that the proposed exoplanet could have at least one or more large oceans .

= = Possible confirmation = =

The planet 's existence has been disputed due to inaccurate analysis from stellar activity , but later reanalysis of data suggests planet Gliese 581 d could really exist , despite stellar variability , exciting astronomers .

= = Physical characteristics = =

The motion of the parent star indicates a minimum mass for Gliese 581 d of 5 @.@ 6 Earth masses (earlier analyses gave higher values) . Dynamical simulations of the Gliese 581 system assuming that the orbits of the three planets are coplanar show that the system becomes unstable if the masses of the planets exceed 1 @.@ 6 ? 2 times the minimum values . Using earlier minimum mass values for Gliese 581 d , this implies an upper mass limit for Gliese 581 d of 13 @.@ 8 Earth masses . The composition of the planet , however , is not known .

= = = Climate and habitability = = =

As the planet is not known to transit from Earth and atmospheric conditions are not observable with current technology , no atmosphere for the planet has been confirmed to date . As such , all climate predictions for the planet are based on predicted orbits and computer modelling of theoretical atmospheric conditions .

Because Gliese 581 d was believed to orbit outside the habitable zone of its star it was originally thought to be too cold for liquid water to be present . With the 2009 revised orbit , climate simulations conducted by researchers in France in 2011 indicated possible temperatures suitable for surface water at sufficient atmospheric pressure According to Stéphane Udry , " It could be covered by a ' large and deep ocean ' ; it is the first serious ocean planet candidate . "

On average , the light that Gliese 581 d receives from its star has about 30 % of the intensity of light the Earth receives from the Sun . By comparison , sunlight on Mars has about 40 % of the intensity of that on Earth . That might seem to suggest that Gliese 581 d is too cold to support liquid water and hence is inhospitable to life . However , an atmospheric greenhouse effect can significantly raise planetary temperatures . For example , Earth 's own mean temperature would be about ? 18 ° C without any greenhouse gases , ranging from around 100 ° C on the day side to ? 150 ° C at night , much like that found on the Moon . If the atmosphere of Gliese 581 d produces a sufficiently large greenhouse effect , and the planet 's geophysics stabilize the CO2 levels (as Earth 's does via plate tectonics) , then the surface temperature might permit a liquid water cycle , conceivably allowing the planet to support life . Calculations by Barnes et al. suggest , however , that tidal heating is too low to keep plate tectonics active on the planet , unless radiogenic heating is somewhat higher than expected .

Gliese 581 d is probably too massive to be made only of rocky material . It may have originally formed on a more distant orbit as an icy planet that then migrated closer to its star . Its equilibrium temperature is 181 Kelvin .

= = Messages from Earth = =

In October 2008 , members of the networking website Bebo beamed A Message From Earth , a high @-@ power transmission at Gliese 581 , using the RT @-@ 70 radio telescope belonging to the National Space Agency of Ukraine . This transmission is due to arrive in the Gliese 581 system 's vicinity by the year 2029 ; the earliest possible arrival for a response , should there be one , would be in 2049 .

As part of the 2009 National Science Week celebrations in Australia , Cosmos magazine launched a website called Hello From Earth to collect messages for transmission to Gliese 581 d . The maximum length of the messages was 160 characters , and they were restricted to the English language . In total , 25 @,@ 880 messages were collected from 195 countries around the world . The messages were transmitted from the DSS @-@ 43 70 m radio telescope at the Canberra Deep Space Communication Complex at Tidbinbilla , Australia , on 28 August 2009 .

= = Gallery = =