Gliese 876 b

Gliese 876 b is an exoplanet orbiting the red dwarf Gliese 876 . It completes one orbit in approximately 61 days . Discovered in June 1998 , Gliese 876 b was the first planet to be discovered orbiting a red dwarf .

Discovery

Gliese 876 b was discovered independently by two different teams , one led by Geoffrey Marcy (with data from Keck Observatory and Lick Observatory) and the other by Xavier Delfosse (at Geneva Observatory) . Like the majority of known extrasolar planets , it was discovered by detecting variations in its star 's radial velocity as a result of the planet 's gravity . This was done by making sensitive measurements of the Doppler shift of the spectral lines of Gliese 876 . It was the first discovered of four known planets in the Gliese 876 system .

Orbit and mass

Gliese 876 b is in a 1 : 2 : 4 Laplace resonance with the inner planet Gliese 876 c and the outer planet Gliese 876 e : in the time it takes planet e to complete one orbit , planet b completes two and planet c completes four . This is the second known example of a Laplace resonance , the first being Jupiter 's moons Io , Europa and Ganymede . As a result , the orbital elements of the planets change fairly rapidly as they dynamically interact with one another . The planet 's orbit has a low eccentricity , similar to the planets in the Solar System . The semimajor axis of the orbit is only 0 @.@ 208 AU , less than that of Mercury in the Solar System . However Gliese 876 is such a faint star that this puts it in the outer part of the habitable zone .
A limitation of the radial velocity method used to detect Gliese 876 b is that only a lower limit on the planet 's mass can be obtained . This lower limit is around 1 @.@ 93 times the mass of Jupiter . The true mass depends on the inclination of the orbit , which in general is unknown . However , because Gliese 876 is only 15 light years from Earth Benedict et al . (2002) were able to use one of the Fine Guidance Sensors on the Hubble Space Telescope to detect the astrometric wobble created by Gliese 876 b . This constituted the first unambiguous astrometric detection of an extrasolar planet . Their analysis suggested that the orbital inclination is 84 ° ± 6 ° (close to edge @-@ on) . In the case of Gliese 876 b , modelling the planet @-@ planet interactions from the Laplace resonance shows that the actual inclination of the orbit is 59 ° , resulting in a true mass of 2 @.@ 2756 times the mass of Jupiter .

Physical characteristics

Given the planet 's high mass , it is likely that Gliese 876 b is a gas giant with no solid surface . Since the planet has only been detected indirectly through its gravitational effects on the star , properties such as its radius , composition , and temperature are unknown . Assuming a composition similar to Jupiter and an environment close to chemical equilibrium , it is predicted that the atmosphere of Gliese 876 b is cloudless , though cooler regions of the planet may be able to form water clouds .
This planet , like c and e , has likely migrated inward .
Gliese 876 b currently lies beyond the outer edge of the habitable zone but because Gliese 876 is a slowly evolving main @-@ sequence red dwarf its habitable zone is very slowly moving outwards and will continue to do so for trillions of years . Therefore , Gliese 876 b will , in trillions of years time , lie inside Gliese 876 's habitable zone , as defined by the ability of an Earth @-@ mass planet to retain liquid water at its surface , and remain there for at least 4 @.@ 6 billion years . While the prospects for life on a gas giant are unknown , large moons may be able to support a habitable environment . Models of tidal interactions between a hypothetical moon , the planet and the star suggest that large moons should be able to survive in orbit around Gliese 876 b for the lifetime of

the system . On the other hand , it is unclear whether such moons could form in the first place . However , the large mass of the gas giant may make it more likely for larger moons to form .