= Kepler @-@ 40b =

Kepler @-@ 40b , formerly known as KOI @-@ 428b , is a hot Jupiter discovered in orbit around the star Kepler @-@ 40 , which is about to become a red giant . The planet was first noted as a transit event by NASA 's Kepler spacecraft . The Kepler team made data collected by its satellite publicly available , including data on Kepler @-@ 40 ; French and Swiss astronomers used the equivalent to one night of measurements on the SOPHIE échelle spectrograph to collect all the data needed to show that a planet was producing the periodic dimming of Kepler @-@ 40 . The planet , Kepler @-@ 40b , is twice the mass of Jupiter and slightly larger than it in size , making it as dense as Neptune . The planet is also nearly thirteen times hotter than Jupiter and orbits five times closer to its star than Mercury is from the Sun .

= = Observational history = =

Kepler @-@ 40 was first observed by the Kepler spacecraft , a NASA satellite that searches for planets in transit (crossing in front of and dimming) their host stars , from May 13 , 2009 , to June 15 , 2009 in its first days of operation . The resulting light curve was made available to the public by the Kepler science team , revealing four transit events over 33 @.@ 5 days .

A team composed of astronomers from France and Switzerland used the SOPHIE échelle spectrograph at the Haute @-@ Provence Observatory in southern France to examine Kepler @-@ 40 . SOPHIE uses radial velocity measurements to examine stars for exoplanets . After background light was removed and alternative causes for radial velocity variations were disproved (for example , that Kepler @-@ 40 was actually a close binary star) , the team used SOPHIE to analyze the properties of the actual star . The astronomers observing the star found that it is nearing the main sequence turn @-@ off (the star fuses the last of its hydrogen and becomes a red giant) . The establishment of stellar parameters helped the astronomers extrapolate the exoplanet 's parameters and prove the existence of Kepler @-@ 40b . The discovered planet was the sixth transiting planet to have been discovered in orbit around stars with a radius of more than 1 @.@ 8 times that of the Sun , after planets including Kepler @-@ 5 and Kepler @-@ 7 .

The discovery of Kepler @-@ 40b demonstrated that smaller telescopes , such as SOPHIE , are effective when used as follow @-@ ups to space missions like Kepler . The team of astronomers spent what amounted roughly to one night on a 1.93d @-@ meter telescope and gathered all the data needed to establish Kepler @-@ 40b 's existence and parameters . Kepler @-@ 40b was published in the journal Astronomy and Astrophysics on January 4 , 2011 , after it was sent to the journal on September 15 , 2010 .

= = Host star = =

Kepler @-@ 40 is an F @-@ type star located in the Cygnus constellation . The star is 1 @.@ 48 times the mass of the Sun and 2 @.@ 13 times its radius . With an effective temperature of 6510 K , Kepler @-@ 40 is larger , more massive , more diffuse , and hotter than the Sun is . The metallicity of Kepler @-@ 40 , [Fe / H] = 0 @.@ 10 , means that it has 25 @.@ 9 % more iron than is measured in the Sun . Kepler @-@ 40 is nearing the main sequence turn @-@ off ; in other words , it is about to fuse the last of its hydrogen and become a red giant .

Kepler @-@ 40 hosts the sixth planetary system to be discovered in the orbit of a star with a mass of over 1 @.@ 8 solar masses . It lies 2700 parsecs (8806 @.@ 4 light years) away from Earth , making it more distant than any previously verified planet discovered by Kepler , and has an apparent magnitude of 14 @.@ 58 . Thus , it is invisible to the unaided eye .

= = Characteristics = =

Kepler @-@ 40b is a Hot Jupiter that is estimated to be 2 @.@ 2 times the mass of Jupiter (over 700 times the mass of Earth) , but 1 @.@ 17 times Jupiter 's radius (13 @.@ 12 times the radius

of Earth) . Thus , the planet has a density of 1 @.@ 68 grams per cubic centimeter , similar to that of Neptune (1 @.@ 638 g / cm3) . The planet 's equilibrium temperature is estimated to be 1620 K , thirteen times hotter than Jupiter 's equilibrium temperature .

Kepler @-@ 40b orbits its star every 6 @.@ 87 days at an average distance of 0 @.@ 081 AU . It also has an orbital inclination of 89 @.@ 7 ° , meaning that it can be seen nearly edge @-@ on with respect to Earth . In comparison , Mercury orbits the Sun every 87 @.@ 97 days at an average distance of 0 @.@ 387 AU ; therefore , Kepler @-@ 40b 's orbit is approximately thirteen times faster than that of Mercury 's and five times closer to its host star than Mercury is to the Sun .