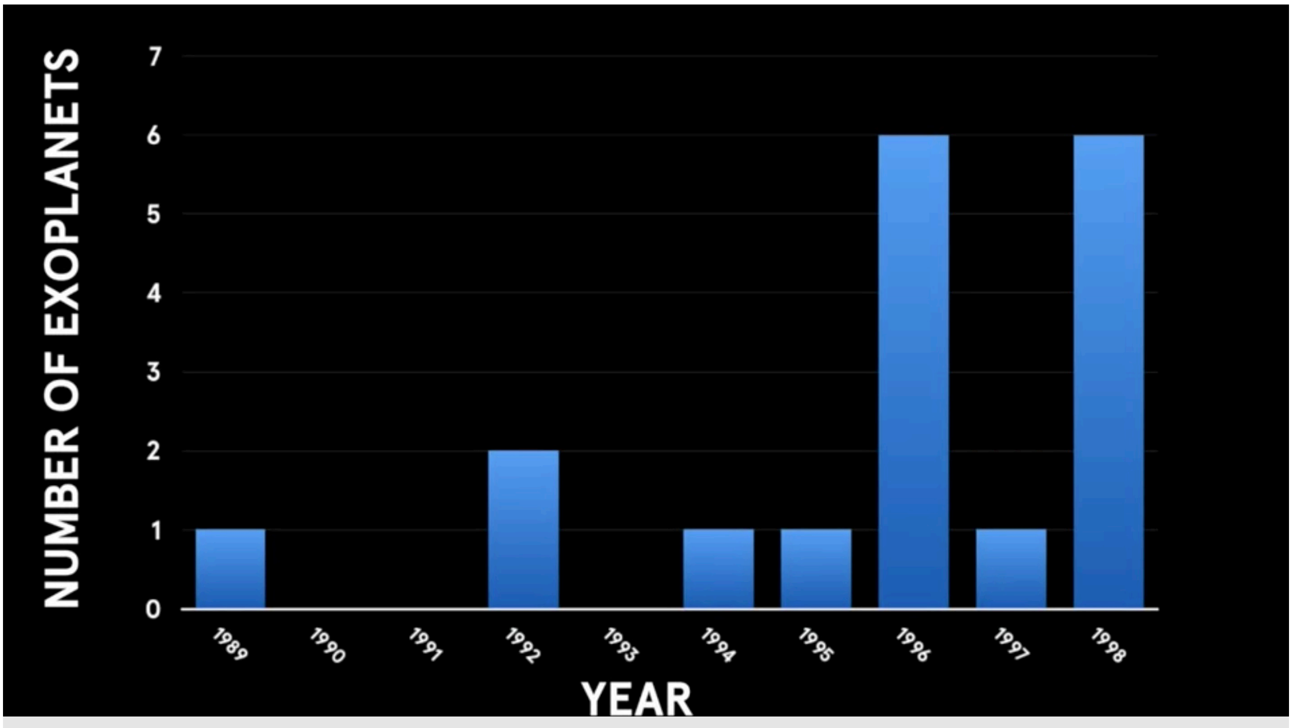
Exoplanet Discoveries.

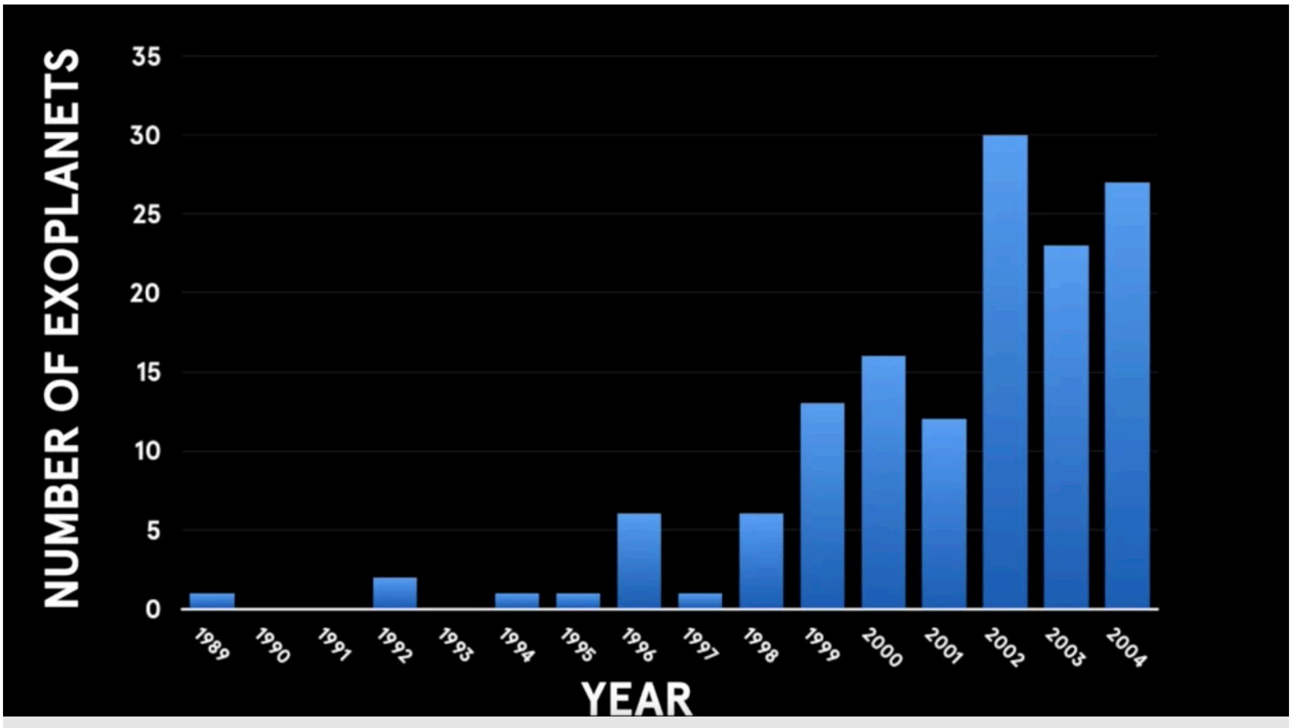
Although the science of exoplanets kicked of in the 1990's but the success of the space telescopes (x-ray and gamma ray detection) CoRoT and kepler.

In 90s the discovery rate was 1 or 2 of exoplanets a year
now with kepler it is about 100's of new planets a year are discovered

https://exoplanets.nasa.gov/what-is-an-exoplanet/about-exoplanets/

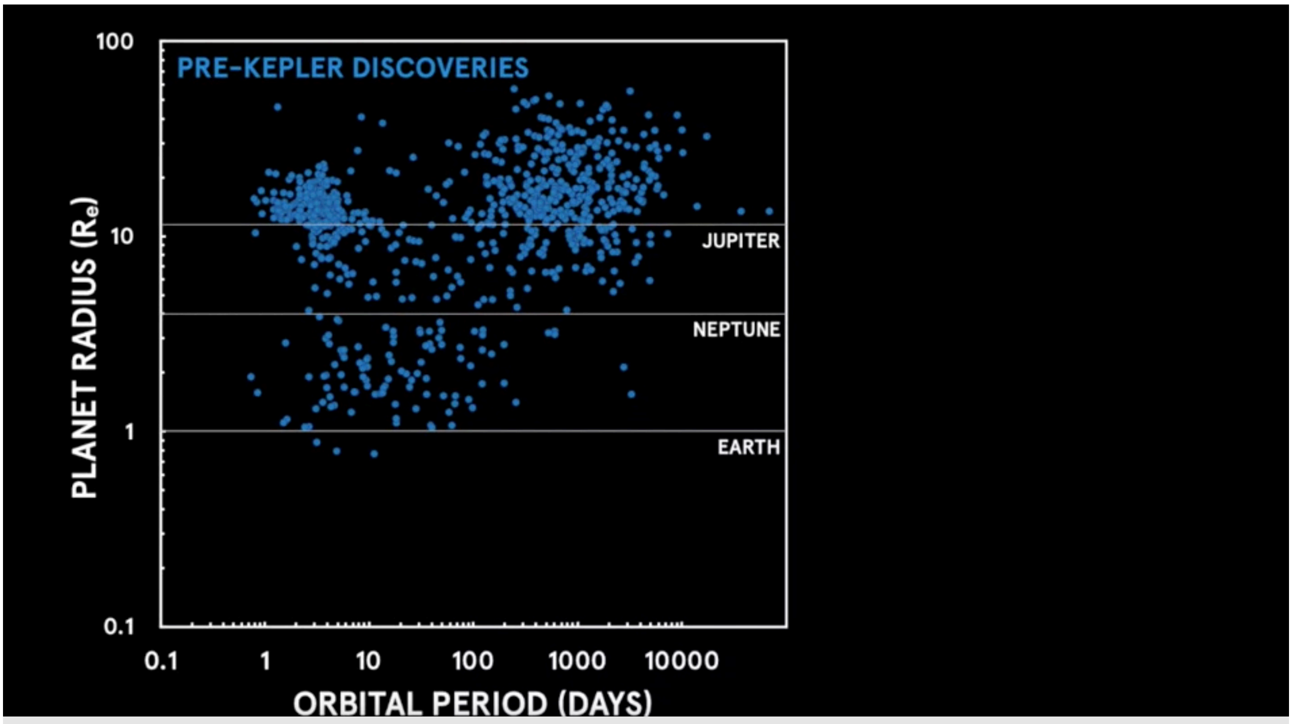


with kepler

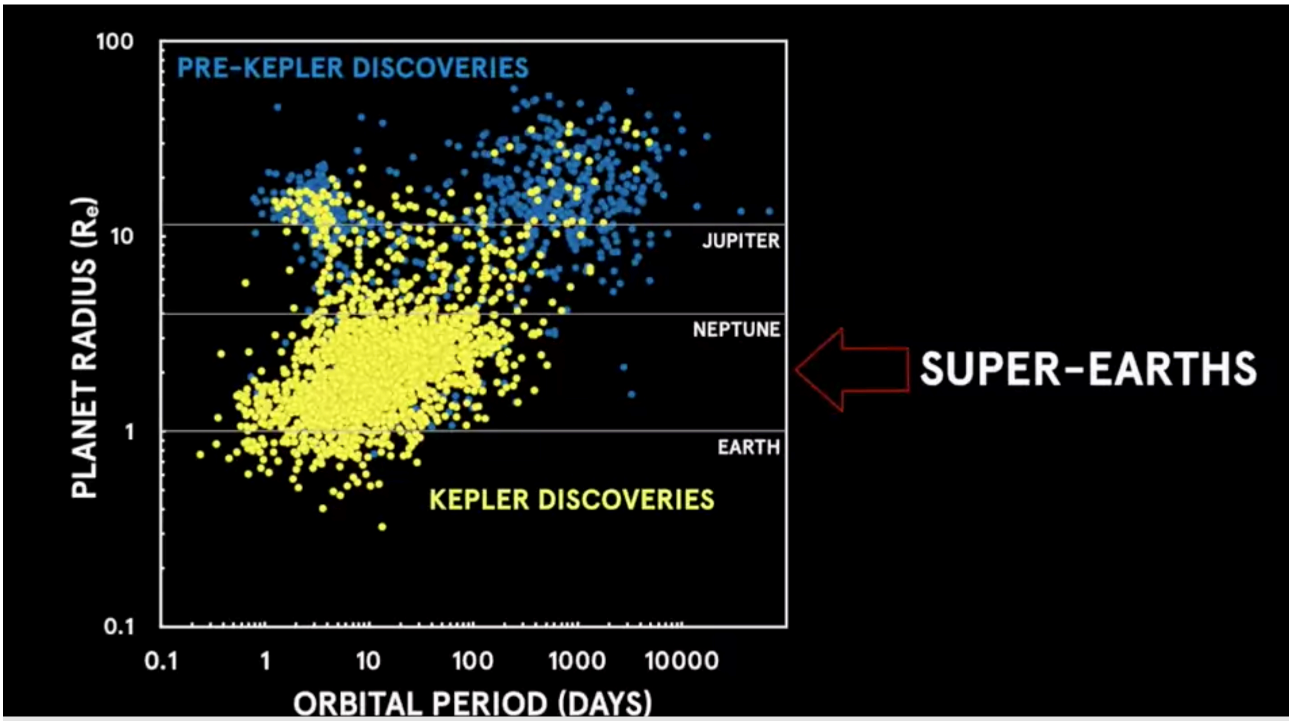


Kepler’s Discoveries haven’t only being prolific but transformative as well
they've also transformed what we know about exoplanets.
There are several methods use to detect planets.

In the Early days of Exoplanet discovery



Big percentage of the discoveries very found to be larger than Jupiter and only 15% of them were less than Neptune



After kepler was deployed
it was observed that only 15% were larger than Jupiter and most of them were around the size of Neptune

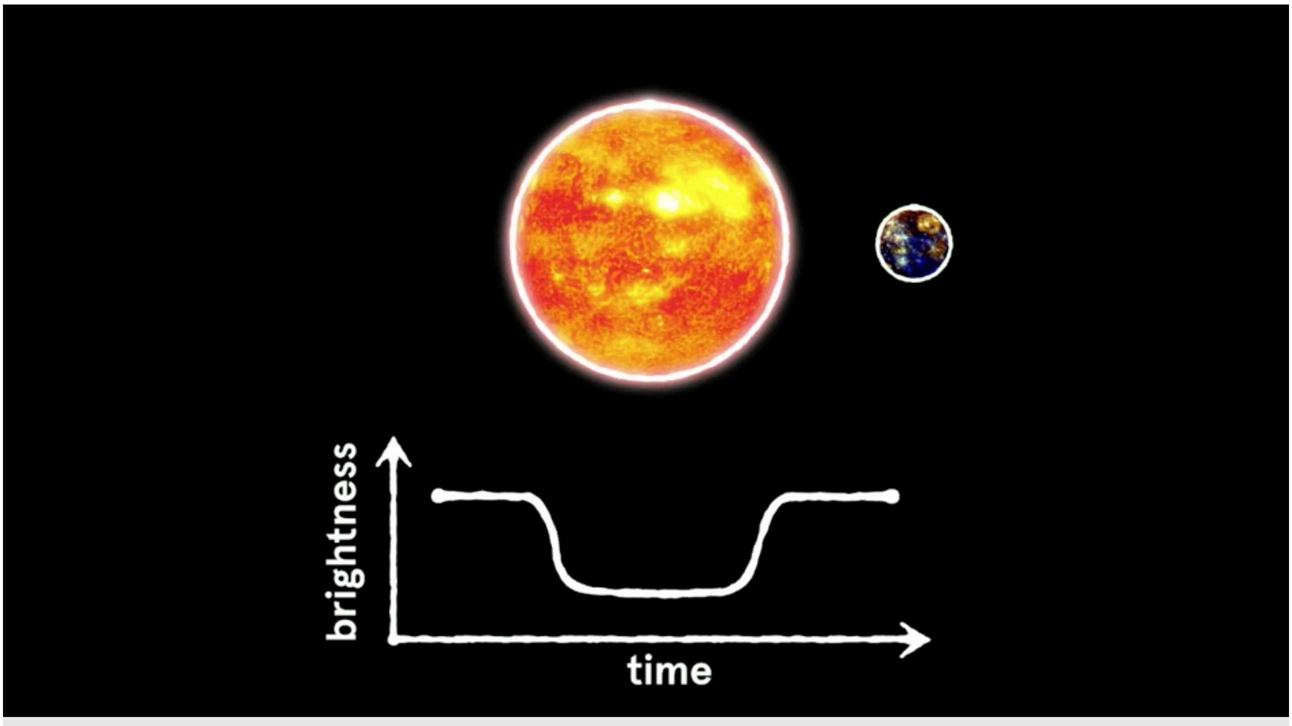
Exoplanets are the ones which we don't have direct analogues so we're not even sure what they look like.
They could be large rocky planets or
water worlds with a deep global ocean on the surface, we don't know.
A lot of theoretical works being carried out at the moment to predict
the composition of the huge tally of exoplanets that Kepler has produced.

One thing is for sure, the gas giants like Saturn and Jupiter are comparatively rare.

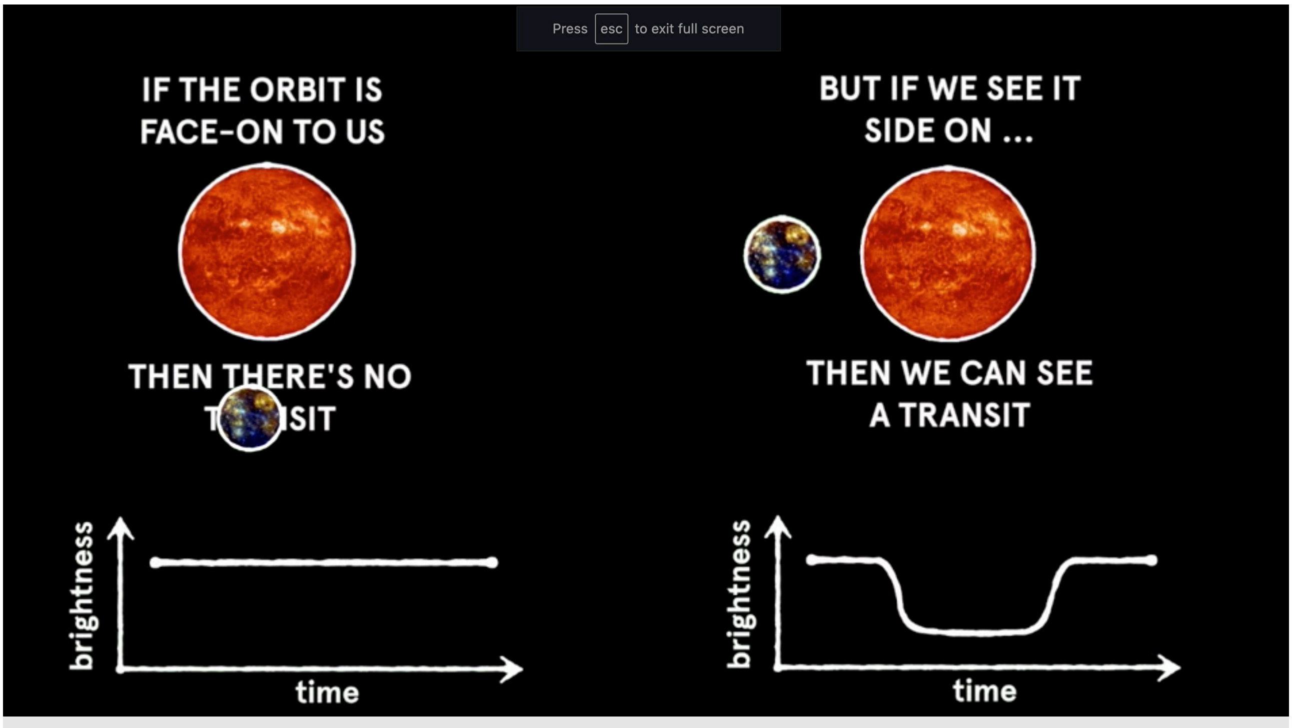
In retrospect, it's easy to see that the early discoveries were dominated by really
big Jupiter-sized planets, simply because big planets are easier to find.

But Kepler was built to spot the planets that are hard to find.
Specifically, it was designed to determine the number of Earth-like planets in the galaxy.
Its great sensitivity has lead to the discovery of some pretty exciting planetary systems such as Kepler 11, a six planet system.
And Kepler 186, with five planets, smaller than one and a half Earths.
One of these is particularly interesting,
Kepler 186F is the most Earth like planet we've found so far.

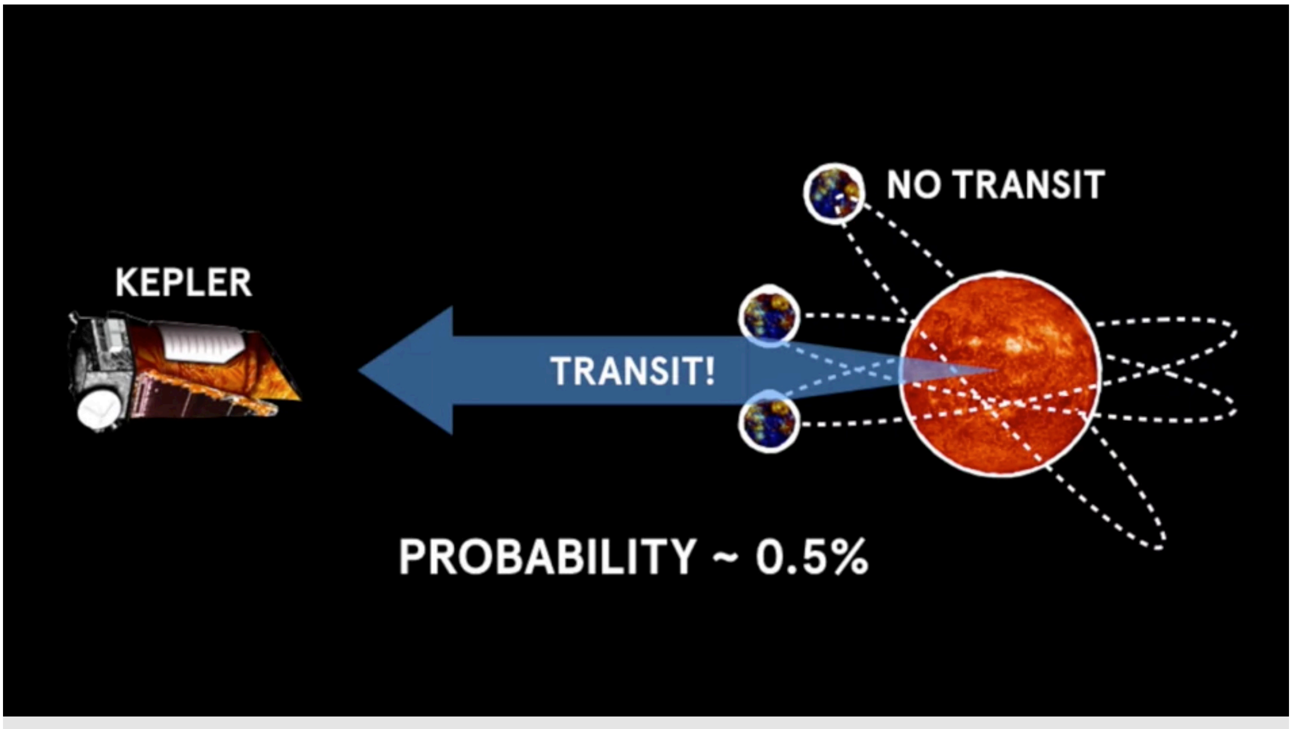
kepler looks for planets using the transit method, when a planet passes in front of the star the data in wave form detects a decrease in brightness.



however for this to perfectly happen the planets orbital plane should be aligned to the line of sight of kepler

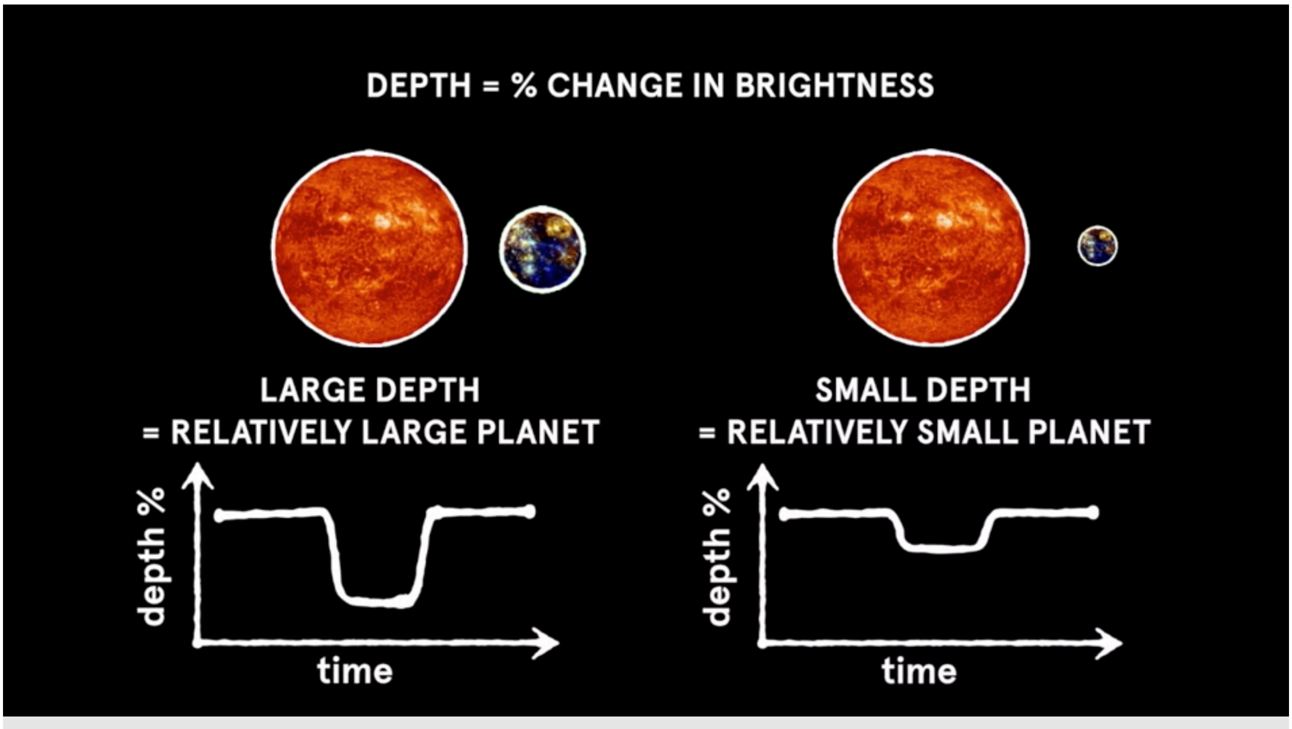


and assuming that the geometric probability of the axis is randomly distributed in space
then the geometric probability of a transit is 0.5

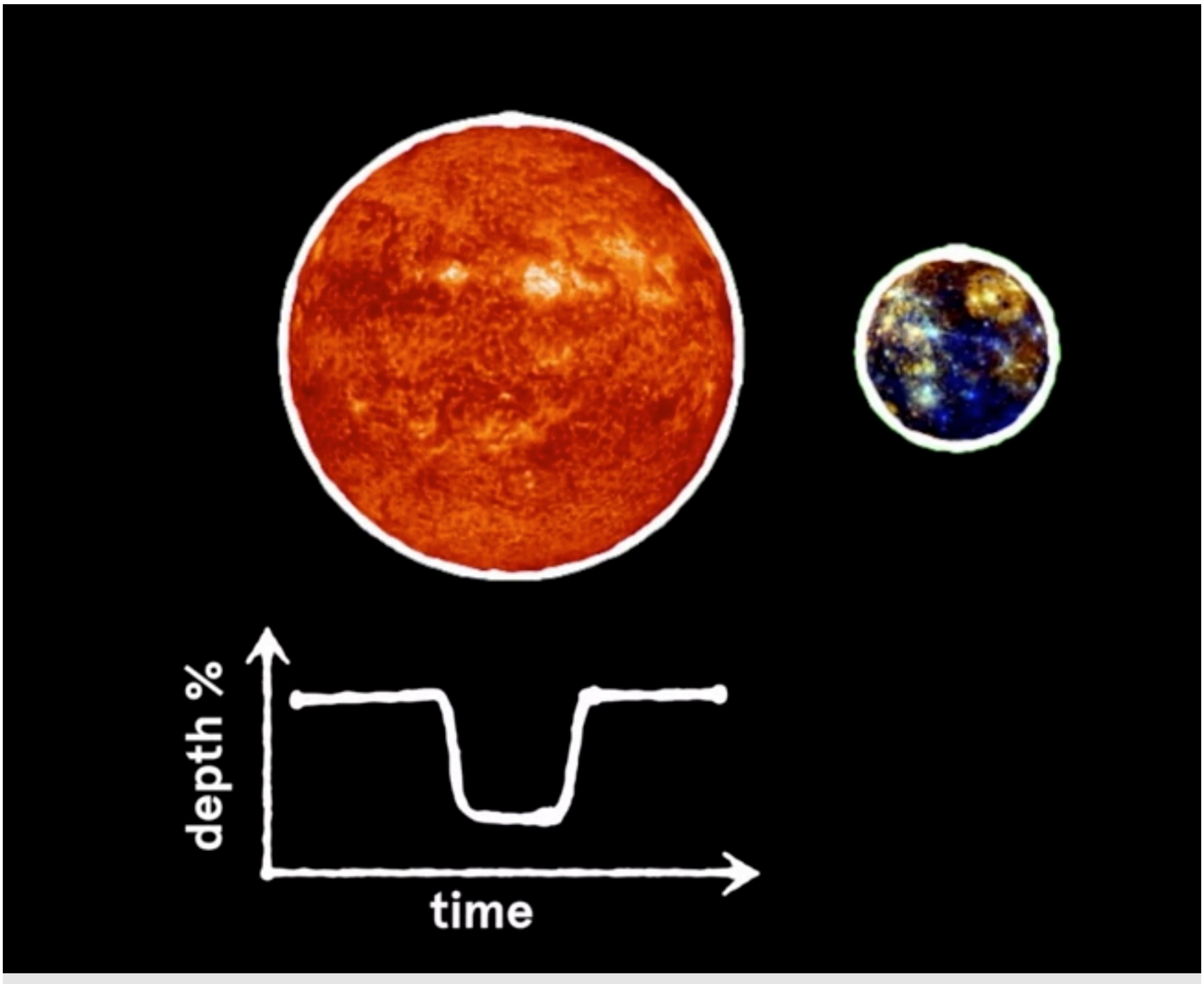


so to find planets you need to observe a lot of stars, half a million stars in kepler field of view around 150k are chosen for observation

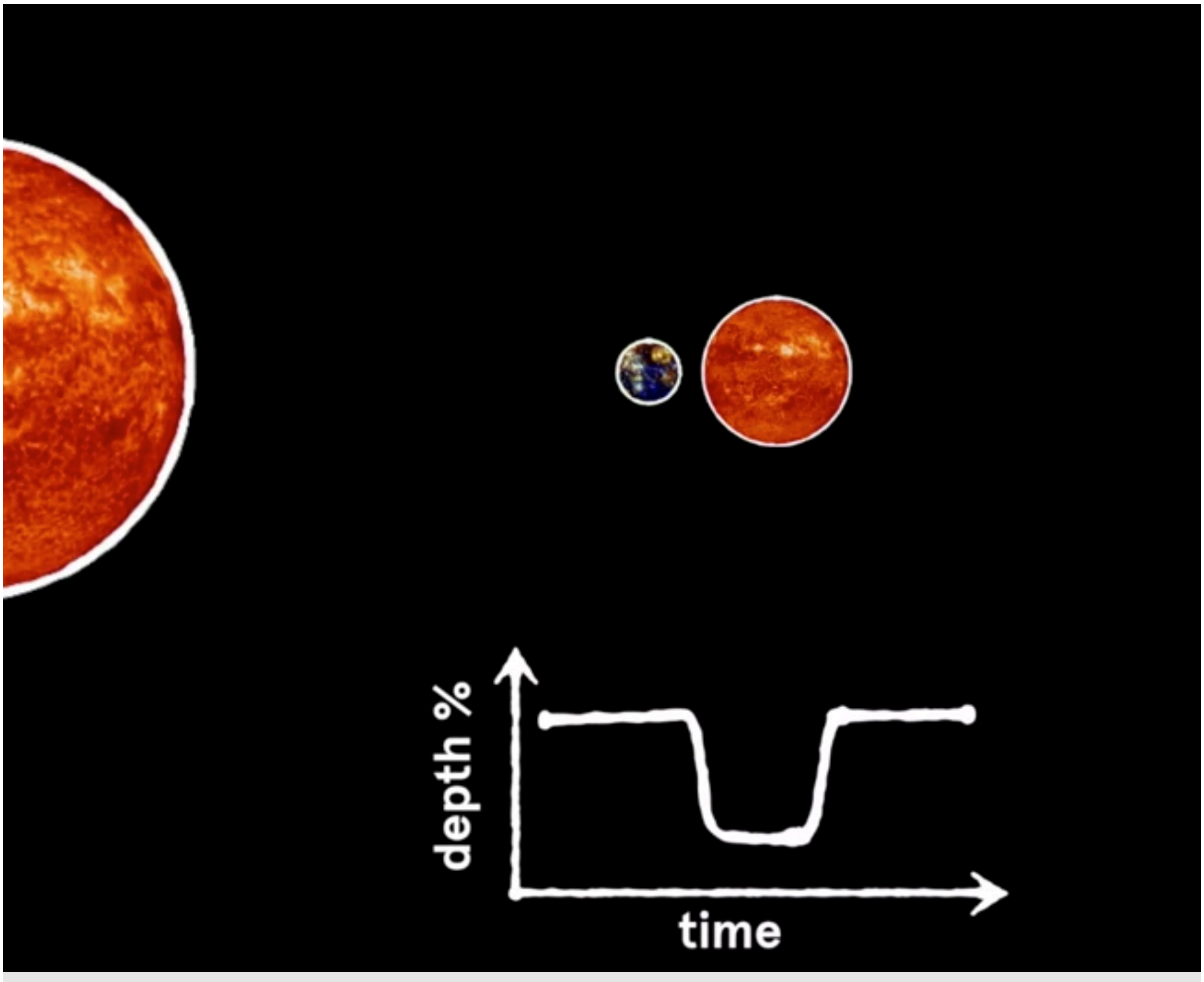
When an exoplanet is found, the transit itself is used to characterise a planet. In particular the transit depth tells you how large a planet is . but a problem, the sizes are relative



An observed transit could be signature of a big planet orbiting a big star



or
small planet orbiting a small star



So, To need to know about the planet size we require information about the star

To solve this Kepler has an input catalogue containing info of 100k of stars in the telescope field of view

One of the properties of Kepler’s catalogue is **"Stellar Radius"** Which is used to calculate the planetary radius for each detected Exoplanet.

T_{eff}	log(g)	log(Z)	$\log(R_*)$
86.	4.483	-2.540	-0.021
57.	4.303	-0.187	0.093
23.	4.334	-1.577	0.076
26.	4.441	-1.955	0.019
57.	4.404	-1.608	0.043
34.	4.539	-2.502	-0.057