How are planets born? http://www.abc.net.au/science/articles/2015/12/08/4366144.htm

**Scientists recently witnessed the birth a planet the size of Jupiter. Dr Karl explains how planets are born from the apparent emptiness of space.**

It's always fun when a new baby arrives — time for fizzy pop and chocolate! But what if the baby is heavier than the planet Jupiter? Well, even better — because it gives you a chance to test our ideas on the still mysterious process by which stars and planets are born from the apparent emptiness of space, inside a galaxy.

Our galaxy is the Milky Way. It has several hundred billion stars, and is about 100,000 light years across from one side to the other.

The emptiness of space between the stars is called the interstellar medium. It's very thin — down to 100 particles in each cubic metre. The particles are about 70 per cent hydrogen, with most of the rest being helium. But in addition, there are tiny, tiny traces of heavier elements. These came from stars — both during and at the ends of their lives, when they exploded and threw their star stuff into the interstellar medium.

But scattered about inside a galaxy are many giant molecular clouds — about 6,000 of them in our galaxy. They are more dense than the interstellar medium — say, around 100 million particles per cubic metre. They can be enormous — 100 light-years across, and six million times the mass of our Sun.

And inside these molecular clouds are even more dense regions called 'stellar nurseries' or 'star-forming regions'. As you can guess from the names, this is where stars are born.

The first stage of the process is that one region of this stellar nursery (for whatever reason) happens to be a little more dense than everything else around it. So it has more mass, and more gravity. It collapses to form an object that is not quite a star — a so-called protostar.

After a few million years, the protostar has evolved further into a baby star, surrounded by a rotating disc of gas and dust that did not get sucked into the baby star. And when I say "baby", I mean "newborn", not "small". A baby star can range between (say) a tenth of the mass of our Sun, to 30 times heavier.

There are still some problems with our understanding of the process. Luckily, we have been able to see different stages in the evolution from gas cloud to protostar to newborn star. Of course, it helps that there are lots of stars to see.

But the situation is different with trying to understand the second stage — that is, the formation of exoplanets, which are planets orbiting around other stars, not our own Sun.

The big question is — what is the exact process as, over a few million years, the rotating disc of gas and dust evolves into a bunch of exoplanets?

The trouble is that there are so few exoplanets. So far we have discovered only about 1900 exoplanets since the mid-1990s. All of them are fully formed.

But just recently, we proved that another exoplanet, Lick Calcium 15b, is a planet in the process of actually being born.

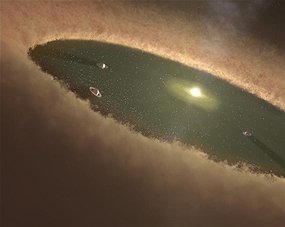
This planet, about 450 light-years away, is going around a newborn star called Lick Calcium 15, which is about only two million years old. This baby planet is a few times heavier than Jupiter, and it's about three times further from its star as Jupiter is from our Sun.

A team made up of astronomers from Stanford University, the University of Arizona and the University of Sydney made the discovery.

One of the scientists, [Professor Peter Tuthill, from the University of Sydney said:](http://www.abc.net.au/news/2015-11-19/planetary-formation-seen-for-the-first-time-by-astronomers/6951494) "... We see the star surrounded by a disk of material, we see a gap in the disk where the material's missing, we see the planets that are in the gap, and we see material falling onto the planets."

The newborn planet that is still growing, Lick Calcium 15b, has a powerful magnetic field. This magnetic field actually accelerates the infalling material that is landing on the growing planet. As a result, this material is hot - very hot. It's around 10,000 degrees C — roughly twice as hot as the surface of our Sun. But, being hot means that it emits lots of radiation, which our latest telescopes can detect.

With that kind of heat output, you would definitely want a baby shower …

[](http://www.abc.net.au/reslib/201511/r1499982_22140432.jpg)

Questions:

*“The trouble is that there are so few exoplanets. So far we have discovered only about 1900 exoplanets since the mid-1990s. All of them are fully formed.”*

Explain why so few exoplanets have been discovered?

What evidence for the Big Bang theory is provided in this article?

Explain the process of how a planet forms from a gas and dust not in the new star.

In Professor Peter Tuthill’s quote, explain how the gap formed gap.

Why do some regions of gas and dust not form planets?