"Ladies and gentlemen, we have detected gravitational waves". An American cosmologist, or scientist who studies the Universe, made this announcement on February 11. He was speaking at a news conference in Washington DC, the U.S.’s capital city. The scientist explained that there was now a new window through which the cosmos, or Universe, could be studied. Some space researchers described the announcement as the 21st century’s most important discovery.

Amazingly, Albert Einstein (1879 – 1955) predicted gravitational waves 101 years ago. He was a German-born physicist. Einstein moved to the U.S. in 1933. He produced several famous theories. They said that the mass of a space object can warp, or bend, both space and time (or space-time). Einstein’s theories also suggest that time passes more slowly when gravity is very strong and that rays of light can bend.

Many of Einstein’s theories are now believed to be correct. One predicted that large space objects, such as big moving planets, create gravitational waves. These waves would be weak. However, huge explosions in space would generate much stronger gravitational waves. Some examples are supernovae, or exploding stars, and black holes crashing into each other. Black holes are space objects with very powerful gravitational fields. Nothing can get away from them. All material is sucked in and trapped. Even light and other types of radiation are unable to escape. As they emit no light, black holes cannot be seen. Recording stars circling around these space objects is the best way to find them.

No one knew if gravitational waves really existed. They are often described
as “ripples in space-time”. Picture a boat moving on a lake. The ripples it creates are like waves of gravity. Others talk about a part of space being shaken. If you shake a rope, the “shake” travels along it. This is like a gravitational wave. Yet gravitational waves go in all directions. They also travel at the speed of light. This is roughly 186,400 miles (300,000 kilometers) per second.

Gravitational waves squeeze and stretch space. They make the area between atoms expand and contract, or get smaller. If a gravitational wave passes through the Earth, everything (including you) gets slightly bigger and then smaller again. Yet the gravitational waves that reach our planet are tiny, or very weak. This is because they have traveled so far. Therefore the increase and decrease in size they cause is not noticed. However, if the Earth were much closer to an event that created the waves, everything (including you) would keep growing and shrinking in size until the waves passed.

The scientists who detected the gravitational waves work for an American project called LIGO. The name stands for Laser Interferometer Gravitational-Wave Observatory. There are two LIGO detectors. One is in Washington state and the other is in the state of Louisiana. The detectors, or observatories, are about 2,000 miles (3,220 kilometers) apart. Both are L-shaped. The legs of each L are 2.5 miles (four kilometers) in length. At the L’s corner, a laser beam is split in two. One half travels down each leg. There are mirrors at the end of the legs. These reflect the beams back to where they came from. Normally, the two beams arrive back at the corner at the same time.

However, if a gravitational wave passes through the legs, the beams would be slightly squeezed and stretched. If this happens, they do not arrive back at the corner at exactly the same time. The LIGO equipment is very sensitive. It can pick up differences in the laser beams that are a ten-thousandth of the width of a proton. Each atom has one or more protons in its nucleus, or central part.

The LIGO observatories were set up in 2002. Over the next eight years, they didn’t record a single gravitational wave. In 2010 a decision was made to upgrade the equipment. It took five years and cost $200 million. The two detectors were switched on again last September. Within days the Louisiana detector registered a very slight difference in its laser beams. Then, one-hundredth of a second later, the same thing happened at the Washington site. The scientists suspected that this was a gravitational wave. Yet a lot of work had to be done to make sure.

Five months later the scientists were able to confirm that they had recorded gravitational waves. So these waves of gravity do exist. The scientists believe that the recorded waves were created by two black holes crashing and merging into each other. From the waves’ measurements, the scientists worked out that this happened 1.3 billion light years away. Each black hole was about 30 times the mass of the Sun. The collision created an even larger black hole. The enormous explosion turned about three suns’ worth of mass into gravitational waves. These traveled, or rippled, through the cosmos at the speed of light.

Nobody really knows why the Universe came into existence. Most researchers think that the “Big Bang Theory” probably best explains how it began. In 1929, an American astronomer called Edwin Hubble (1889 – 1953) discovered that the Universe is getting bigger all the time. Working backwards, this means that it started as a single tiny point and then began to expand. If the Big Bang Theory is correct, the Universe is around 13.7 billion years old.