LIGO and its mission

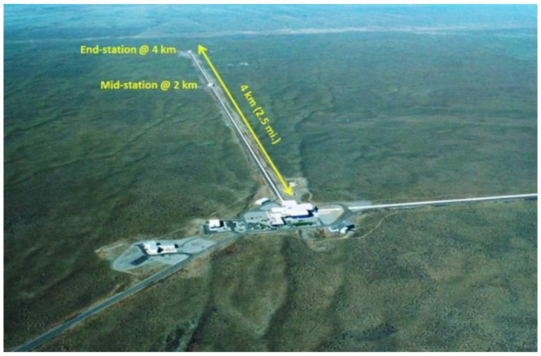
In the early 20th century, Albert Einstein's special and general theories of relativity caused an upheaval in the world of physics. Newton's theories were thought to have been infallibly proven through experiment, but it turned out that this was not the case at extreme speeds and masses.

Surprisingly, some of the implications of this theory were proven to be accurate and useful in the area of satellite communications and GPS technologies. However, many of the implications of these theories of relativity, such as black holes and the bending of light by massive gravitational fields created by such objects as galaxy clusters, generally happen thousands of lightyears away from us and therefore can only be detected with the help of extremely high-precision instruments.

It was exactly this problem that researchers who were trying to experimentally confirm the existence of gravitational waves, which Einstein's theory of general relativity predicted would emanate from massive objects with high acceleration such as colliding black holes and neutron stars. These very violent events would distort space-time itself, sending out gravitational ripples that travel at the speed of light. (Read more here: https://www.ligo.caltech.edu/page/what-are-gw)

Experimental data did indeed corroborate the possible emission of gravitational waves through indirect means; for example, the 1993 Nobel Prize in physics was given to Dr. Russell A. Hulse and Dr. Joseph H. Taylor Jr. "for the discovery of a new type of pulsar, a discovery that has opened up new possibilities for the study of gravitation" because they discovered that the rate of acceleration of orbiting neutron stars matched with the predictions from Einstein's theory of general relativity, provided that gravitational waves were being omitted, discharging energy with them. However, this was not a direct observation of gravitational waves.

LIGO set out to detect these waves directly. However, these ripples in space-time, just as ripples in water, became weaker and smaller over time, being reduced in amplitude by a factor of a trillion or more to the size of much less than an atom's nucleus.



Through the construction of extremely high-precision laser interferometers, whose arms are about 2.5 miles long (see below), the scientists of LIGO seeked to finally directly measure the effects of gravitational waves directly. Lasers would stretch across one end of each arm to the other and consequently measure the distance between the distance of the arms. When a gravitational wave passes through the interferometer, one would expect the arms to undulate in length, becoming shorter and longer than usual due to the ripples in space time. These fluctuations are so small, to the order of a thousandth the diameter of a proton. Therefore, LIGO devices needed years of calibration and design to be able to differentiate real gravitational waves from laser flickers caused by events such as traffic, earthquakes, and thunderstorms.

In 2015, LIGO finally detected laser flickers that are widely agreed to be from gravitational waves. Therefore, LIGO was widely seen as having succeeded in experimentally confirming Einstein's general relativity about a century after it was posited.

Example of each type of graphic (more specific examples)
Glossary/General information at bottom, up above samples of outputs
First thing that somebody sees at information page should be example
Guide to Understanding the Displays/Graphics (See glossary below for definitions)
Talk about gravitational waves, then talk about LIGO, VIRGO, Kv.
Display about