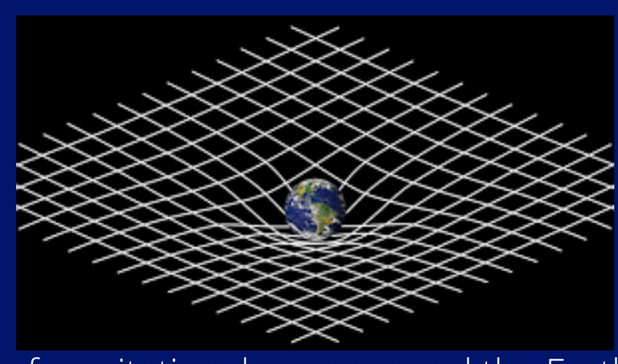
GRAVITATIONAL WAVES

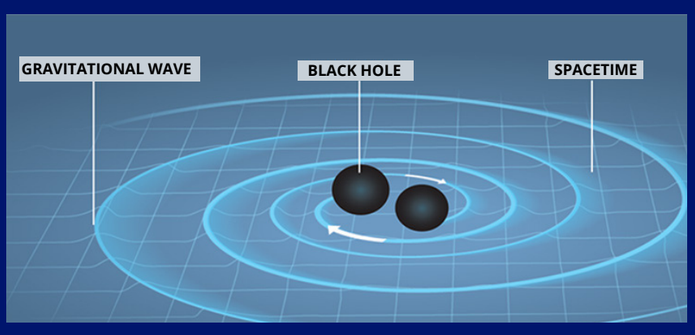
eTwinning: Once More Back 2 The Future

Characteristics

- Ripples or oscillations in space-time itself, unlike elettromagnetic radiation, which passes through space-time
- They travel at the speed of light
- Their strength weakens proportionally to the distance travelled from the source
- By the time the wavesreach Earth, they are weak abd difficult to detect



model of gravitational wave around the Earth



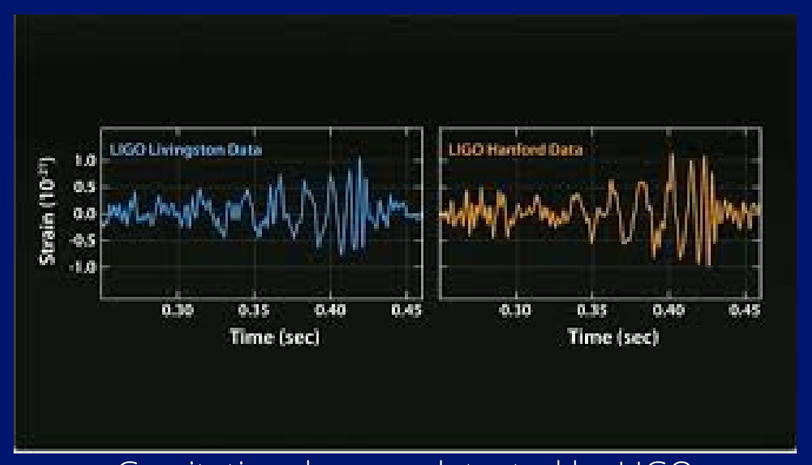
What else causes gravitational waves?

- Supernovae and stars' collapse into neutron stars
- Two bla holes colliding orbiting each other
- Neutron star orbiting a black hole
- Rotating neutron stars (continuous source of waves)
- Colliding galaxies

galaxy collision

How will we detect gravitational waves?

The Laser Interferometer Gravitational-Wave Observatory, also called LIGO, is a huge physics experiment that investigates direct gravity. LIGO consists of two identical detectors at the Livingston and Hanford Site in Richland. These detectors are used to feel the smallest vibrations on earth.



Gravitational waves detected by LIGO

What's LIGO in detail?

- LIGO is a collaboration between the California Istitute of Technology (Caltech) and the Massachusetts Institute of Technology (MIT)
- It is founded by the National Science Fauntation
- It will function as a national resource for both physics and astrophysics, and universities and institutions around the world will be envolved

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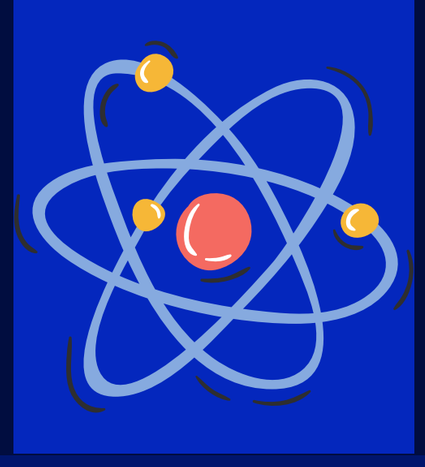
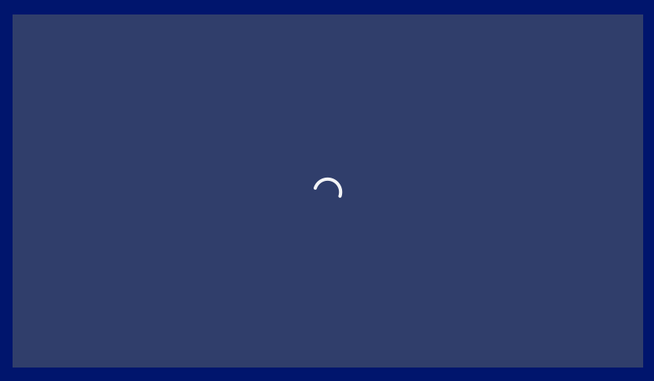


Goals of LIGO

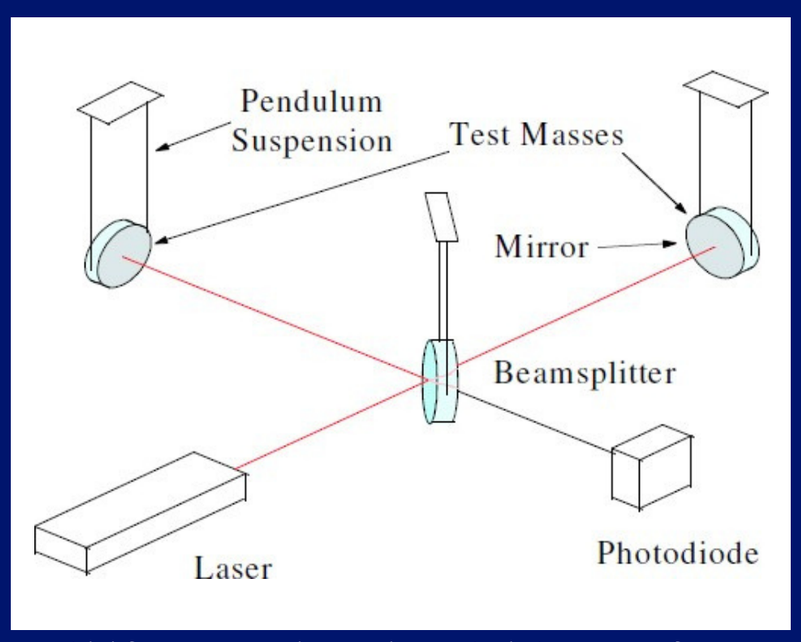
- Prove the existence of gravitational waves by direct measurements
- Confirm that gravitational waves cause disturbances of predicted amounts in the matter they pass through
- Learn more about black holes by proving their existences and study their behavior
- Gain other knowledge about the universe, including more informatione about supernovae and the Big Bang

OTHER DETECTORS

ALLEGRO (US)
AURIGA (Italy)
EXPLORER (Italy)
NIOBE (Australia)
MiniGRAIL (Denmark)
GRAVITON (Brazil)



Visualisation of a gravitational wave



Tidal forces carry the mathematical signature of gravitational waves | MIT Technology Review

So what happens now?

- Gravitational waves originating in different sources will have different, unique interference patterns
- Where the source is known, scientist can match the source with the pattern
- Eventually, they will be able to build a catalogue of these patterns and know what the source of the waves are and the properties of the source

Why should we care about gravitational waves?

- Learning about gravitational waves will expand our knowledge of the universe
- They are thought to remain unchanged by passing trough material
- Could gain insight into why the universe is the way it is and what it's fate will be
- Can accurately determine cosmological distances
- Searching for existence of gravitational waves may uncover new phenomena
- Scientist can detect a black hole and how big and how fast is spinning

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