GRAVITATIONAL WAVES: A NEW ERA OF ASTRONOMY BEGINS
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**WHAT ARE WAVES?**
A wave can be described as a disturbance that travels through a medium from one location to another, transporting energy from one location to another location. For example, the medium could be a rope, where the wave travels along the rope. Or the medium could be water, in which case you would have a water wave. Additionally, the medium could be air, in which case you would have a sound wave.

**WAVE INTERFERENCE**
A most important property of waves is called wave interference. This occurs when two waves come together, combine, and interfere with each other. Interference can occur constructively or destructively.

**INTERFERENCE OF LIGHT WAVES**
In the diagram below we show an example of the interference of light waves.

**INTERFERENCE OF SOUND WAVES**
When designing an auditorium for musical performances, one takes into account the fact that the wave from the stage will be interfered with from the same wave bouncing off the walls of the auditorium.

**BEATS**
Another example of sound wave interference is the concept of beats in music.

**NEWTON’S CONCEPT OF GRAVITY**

**EINSTEIN’S CONCEPT OF GRAVITY**

**WATER WAVES INTERFERENCE**

**SEEING GRAVITATIONAL WAVES**

**THE APPARATUS TO MEASURE WAVE INTERFERENCE**

**THE MICHELSON INTERFEROMETER**
The interferometer is a device invented by Michelson which allows study of the effects of interference. It takes a single beam of light and splits it into two perpendicular paths of variable length. The light then recombines and the interference effects are observed. The interference pattern for a Michelson interferometer is circular - that is, it produces concentric circles of light and dark "fringes." When one moves on the interferometer is moved, the path difference between the two split beams of light changes, and we observe an interference pattern. The beauty of this Michelson interferometer is that this instrument uses the wavelength of light itself as a measuring stick to measure distances. If the difference in travel lengths of the two rays is different by n times the wavelength, the fringe order is n. If the difference is less than the wavelength, they will combine constructively and cancel one another and produce a dark fringe. If the paths are exactly the same, or a difference of 1, 2, 3, ... wavelengths, they will combine destructively and appear as a bright fringe.

**The Laser Interferometer Gravitational-Wave Observatory**

LIGO is two Laboratory Sites separated by over 3000 km.
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