

## Gravitational Waves

### Science Grade-Level Expectations

This instructional task addresses content related to the following science grade-level expectation:

PS-M-C4 Identify and illustrate key characteristics of waves (e.g., wavelength, frequency, period, amplitude)  
(GLE 32)

### Contents

Teachers may choose to use or modify this task as part of an instructional lesson or as a formative or summative assessment.

	Objectives
Task	<ul style="list-style-type: none"><li>- Interpret wave models</li><li>- Compare waves using scientific vocabulary</li></ul>
<a href="#">Sample Exemplar Student Response</a>	

**Task:**

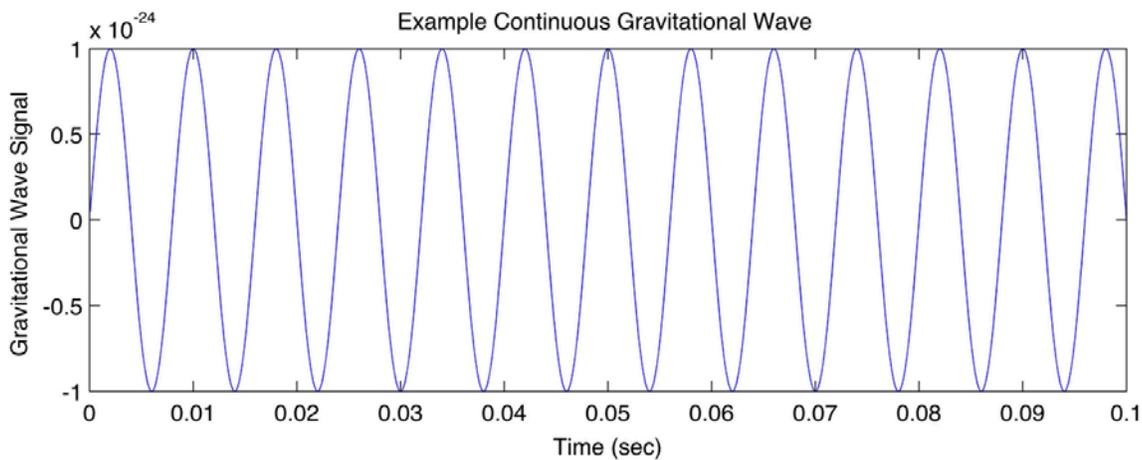
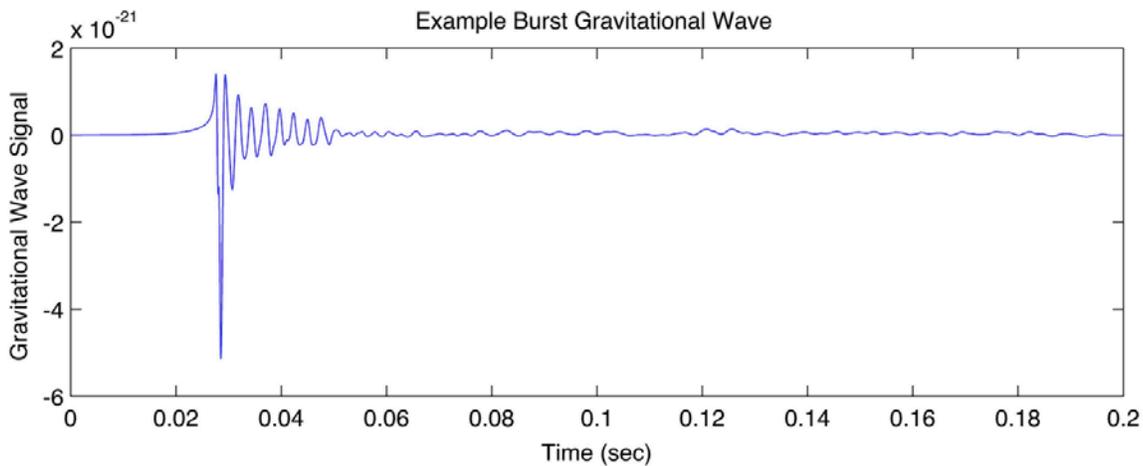
“Throughout history, humans have mainly relied on different forms of light to observe the universe. Today, we are on the edge of a new frontier in astronomy: gravitational wave astronomy. Gravitational waves carry information on the motions of objects in the universe.

Gravitational waves are created by moving masses, much as electromagnetic waves are created by moving charges. But because gravity is the weakest of the four fundamental forces (the others being the electromagnetic, weak nuclear, and strong nuclear), gravitational waves are exceedingly small.” (<http://www.ligo.org/science/overview.php>)

Gravitational waves have the same properties other types of waves such as sound waves, light waves, and electromagnetic waves. They can also be described using terms such as amplitude, frequency, wavelength, and period. The speed of gravitational waves can be calculated using the same formula as other waves.

LIGO Livingston is a state of the art research center in Livingston, Louisiana, built to detect gravitational waves. It is one of a handful of such facilities in the world.

Two graphs of gravitational waves are illustrated below.



With the properties of waves in mind, use scientific vocabulary to compare the two waves.

### **Sample Exemplar Student Response**

The burst wave is irregular and varies in wavelength, amplitude, and frequency. The burst wave demonstrates high amplitude for a short period of time and then the amplitude decreases and levels out. This brief high amplitude indicates greater energy/force during that time period. The periods in the burst wave are very short. There is also no regular frequency shown. Unlike the burst wave, the continuous wave is consistent in wavelength, frequency, and amplitude throughout the time period of measurement. The amplitude (amount of energy or force) does not vary. The period of the wave is approximately 0.01 second.