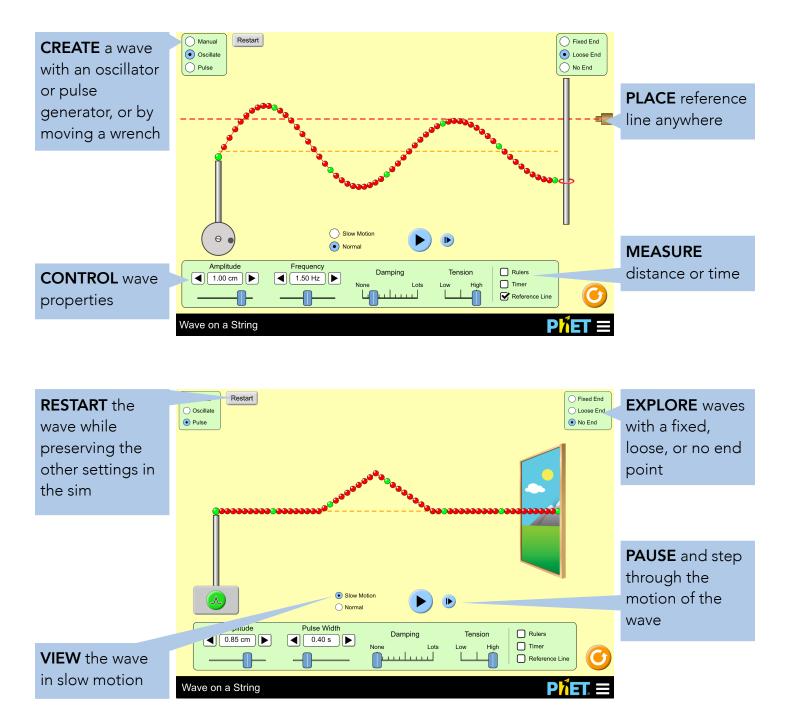The **Wave on a String** simulation allows students to create their own waves and explore wave concepts such as amplitude, frequency, damping, tension, speed, reflection, and interference.

CREATE a wave with an oscillator or pulse generator, or by moving a wrench

PLACE reference line anywhere

MEASURE distance or time

CONTROL wave properties

RESTART the wave while preserving the other settings in the sim

EXPLORE waves with a fixed, loose, or no end point

PAUSE and step through the motion of the wave

VIEW the wave in slow motion

Rouinfar, July 2016

Model Simplifications

• The waves are modeled as a rope on the ground being oscillated from side to side in the absence of gravitational effects and external friction.
• The rope is modeled as a string of particles, and can appear dissociated under extreme conditions, as the processing increments are not infinitesimally small.
• The tension in the string does not have any specific value in the model, as the appearance of tension is achieved by varying the time step used to animate the wave. The tension slider does not behave linearly – it operates on powers of two (High is 4x larger than Low). The functional relationship between the tension and wave speed can be qualitatively observed if tension is given arbitrary units in increasing powers of two (e.g. 2, 4, 8 or 64, 128, 256).

Insights into Student Use

• Some students struggle with damping, which is like internal resistance. Some students may want to understand more and could use Masses and Springs ("Damping" is called "Friction" in this sim) or Resonance sim (the Teacher Tips give a mathematical definition).
• This sim may be helpful for students as an introduction to more difficult concepts like sound, earthquakes, or light.

Suggestions for Use

Sample Challenge Prompts
• Predict the pattern of a reflected wave from a fixed or loose end.
• Develop a method to determine the speed of the wave.
• Design an experiment to find the relationship between a the wave speed, wavelength, and frequency.
• Measure the the wave speed and at different levels of tension to determine the relationship between speed and tension.
• Predict how two waves will interfere.
• What effect does damping have on a wave?

See all published activities for Wave on a String here.
For more tips on using PhET sims with your students, see Tips for Using PhET.