

What to expect: Harmonic Motion and Mechanical Waves

Over the next two weeks you will learn about mechanical waves. You already learned about light waves, but now we want to dig a bit deeper into the nature of waves.

There are only two fundamental mechanisms for transporting energy and momentum: a streaming of particles and a flowing of waves. And even these two seemingly opposite conceptions are subtly intertwined - there are no waves without particles and no particles without waves.

In general a wave is a moving self-sustained disturbance of a medium, and that medium can be either a field (e.g. the gravitational field) or a substance (a solid or fluid). Here, the focus is on waves in a material media, and these are known as mechanical waves.

First we look at one single particle with a periodic motion. There are all sorts of vibrating systems: the balance wheel in a watch oscillates back and forth; puckering lips blowing a trumpet; a walker's swinging arms oscillate; so does a singing vocal cord. Vibratory periodic motion is referred to as harmonic motion.

If you have many particles in a harmonic motion, like the different pieces of string in a rope, you call this a wave. A wave can be traveling e.g. along a rope, or if the two ends of the rope are tied to a stand or the wall, the wave is called standing.

A mechanical wave which is driven by an external harmonic force and thus amplified further and further, is called a resonance.