

PHYS2023 Wave Physics

The essence of wave motion

We define a wave in microscopic context to be:

"A collective bulk disturbance in which what happens at any given position is a delayed response to the disturbance at adjacent points"

The progress of the "disturbance" from one point to the next is the propagation of the wave, from which we can define a phase velocity (speed of propagation).

The position within a medium is described by coordinates in 1, 2 or 3 dimensions. At each position, the wave is described by one or more other variables, such as fluid pressure; this second quantity is the disturbance. These disturbance variables are collectively referred to as wavefunctions. Each wavefunction depends on the position and the time.

For example, for a wave travelling on a string, we can take position in 1 dimension as x . The time is denoted as t and the disturbance can be taken to be the lateral displacement, denoted with ψ . This gives a wavefunction $\psi(x, t)$.

Another example could be the changing electromagnetic force felt by one fixed particle caused by another particle oscillating up and down. We take the disturbance to be the strength of the electric field (so we don't have to worry about a vector force).