Traveling Waves



The one-dimensional (1D) case

A traveling wave is the propagation of motion (disturbance) in a medium.



Reflection

Traveling Wave in Higher Dimensions

Plane waves in 3D



Example: sound waves

Watch animation: http://en.wikipedia.org/wiki/Plane_wave



Cylindrical wave (3D; top view)



Water surface wave (2D) (Circular wave)



Make a cylindrical wave from a plane wave



Electromagnetic Wave



Somehow start with a changing electric field *E*, say $E \propto \sin \omega t$

The changing electric field induces a magnetic field, $B \propto \frac{\partial E}{\partial t} \propto \cos \omega t$

If the induced magnetic field is changing with time, it will in turn induce an electric field

$$E \propto \frac{\partial B}{\partial t} \propto \sin \omega t$$

And so on and so on....

Just as the mechanical wave on a string.

Mathematical Expression of the Traveling Wave

A traveling wave is the propagation of motion (disturbance) in a medium.



Quiz: What kind of wave does y = f(x+vt)stand for?



More on sinusoidal wave: predictability, information, Lab 1, etc.

In some cases. the amplitude A decreases as the wave propagates. For many types of waves, the power density $\propto A^2$ For unit distance traveled. a fraction of power density is lost: certain

