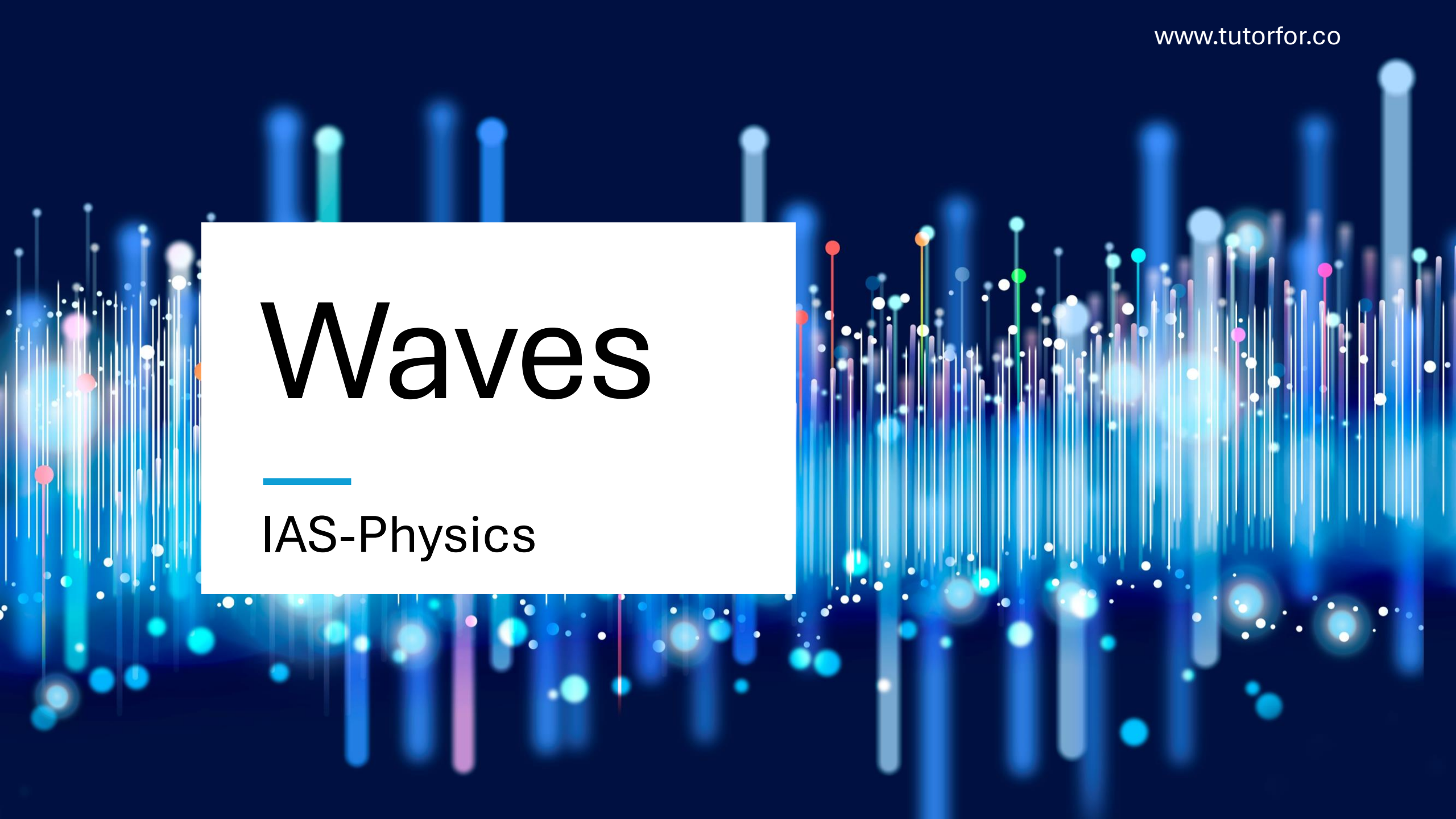


Waves

IAS-Physics

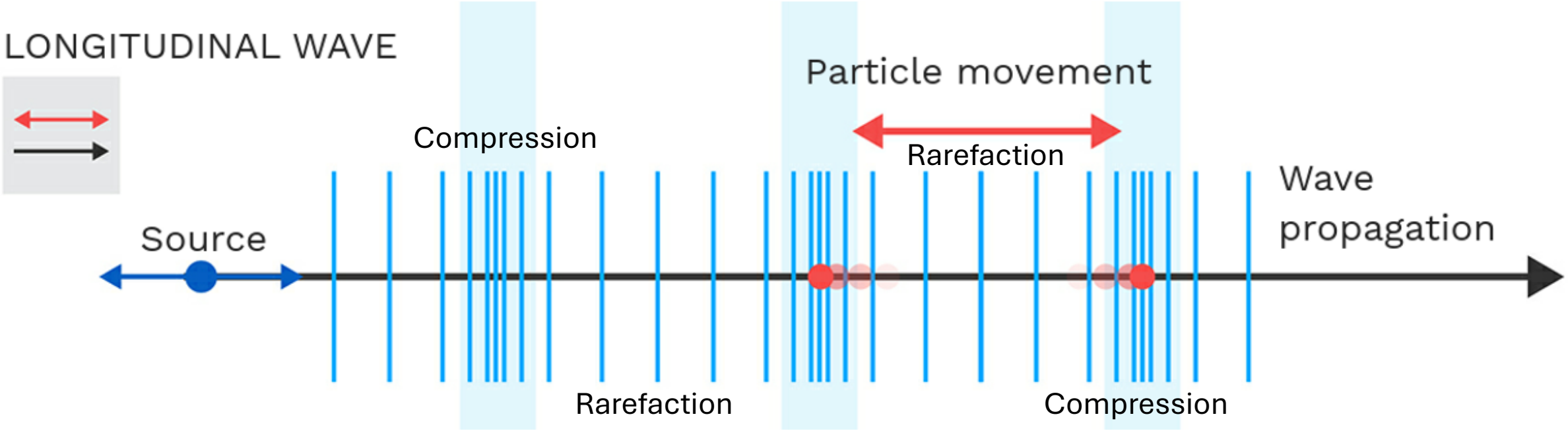
Types of waves

Based on particle vibrations, waves can be categorized into two groups.

- Transverse waves – Ex: Light waves, P-waves (Seismic waves)
- Longitudinal waves- Sound waves , S-waves(Seismic waves)

Longitudinal waves

❑A longitudinal wave is a type of wave in which the particle vibrations are parallel to the direction of wave propagation.



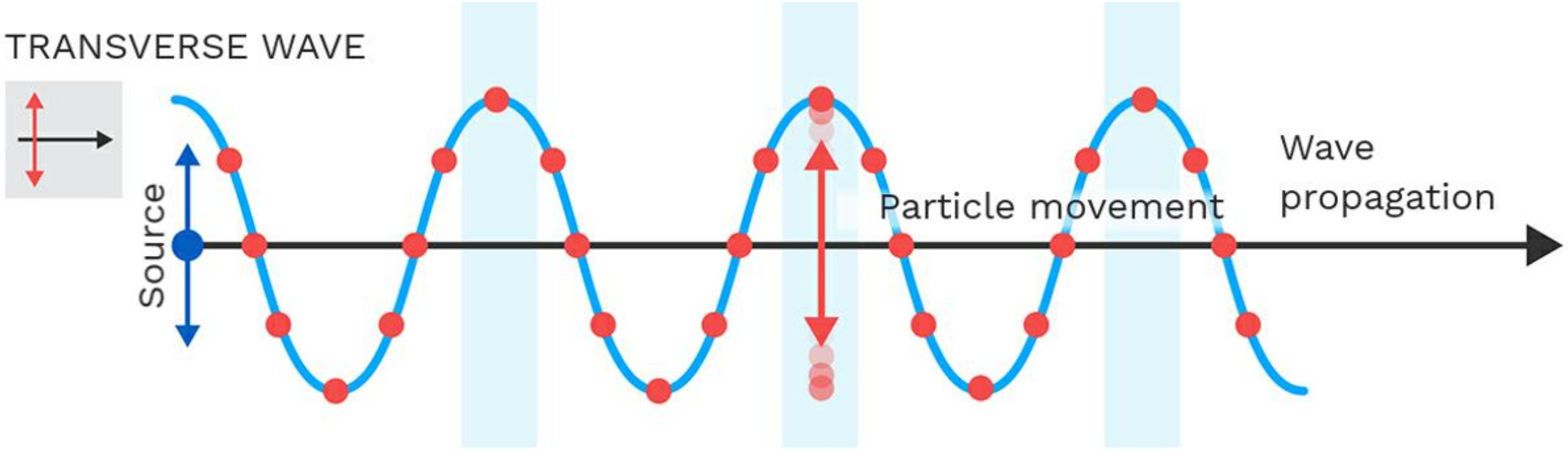
Compression & Rarefaction

Compression: High-pressure regions where particles are closer together than their equilibrium positions. This corresponds to the peak of the wave.

Rarefaction: Low-pressure regions where particles are farther apart than their equilibrium positions. This corresponds to the trough of the wave.

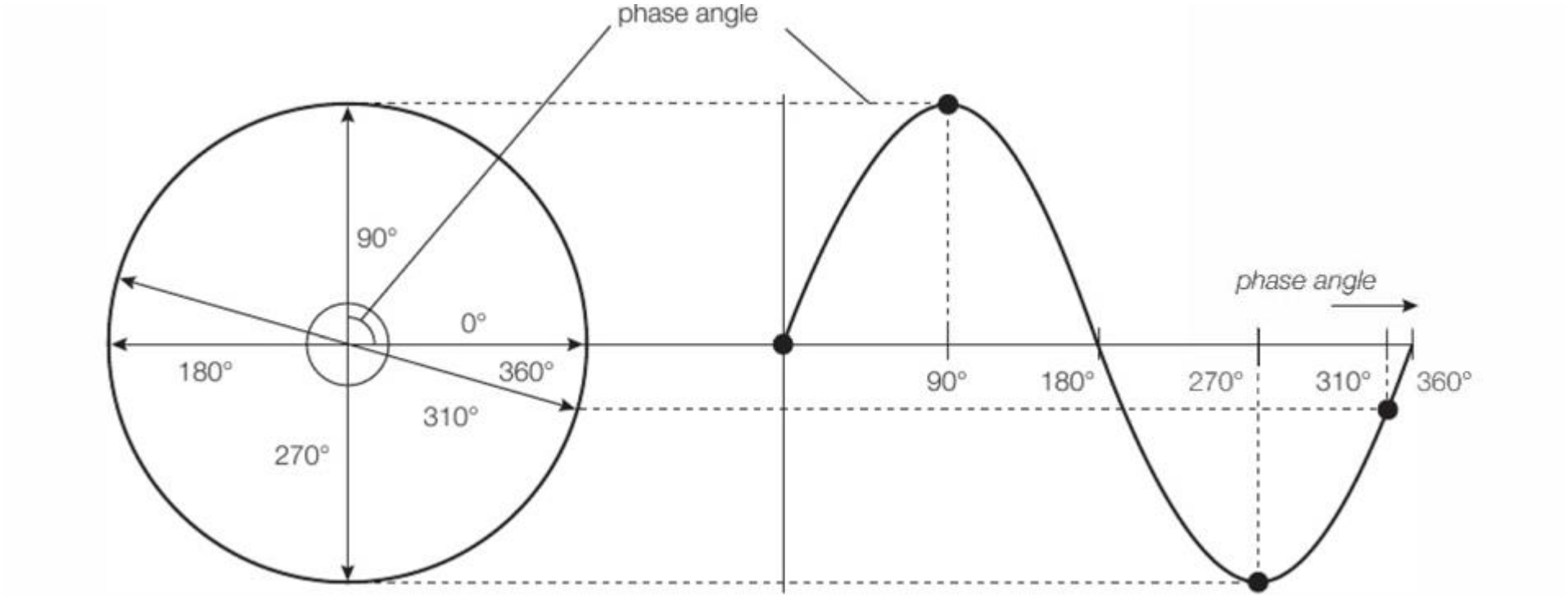
Transverse waves

- A transverse wave is a type of wave in which the particle vibrations are perpendicular to the direction of wave propagation.



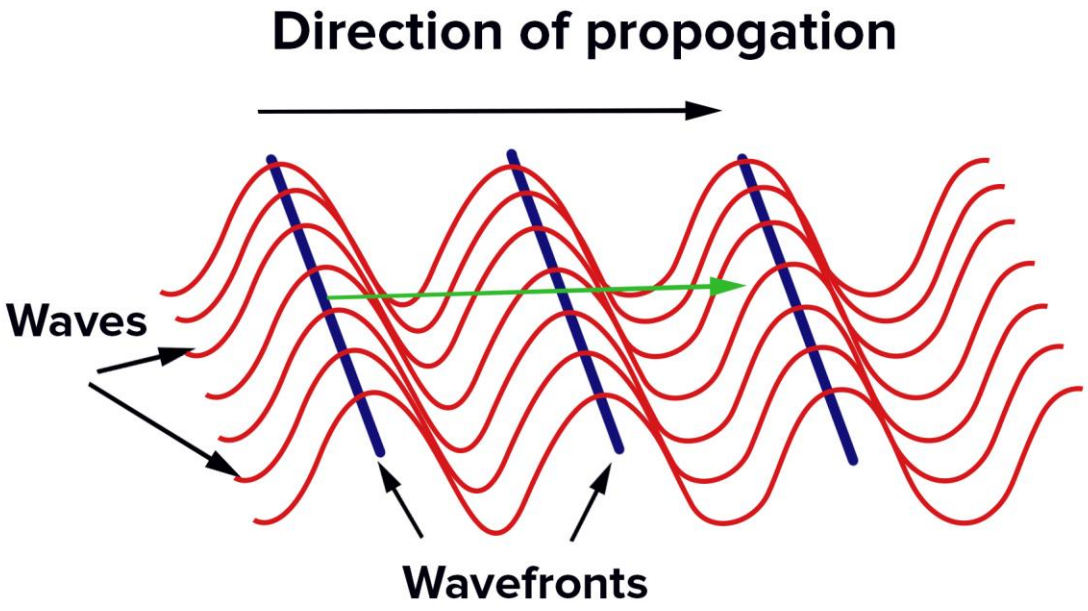
Phase

Phase describes where a specific point on a wave is within its cycle of oscillation. It is usually represented as an angle in radians or degrees.



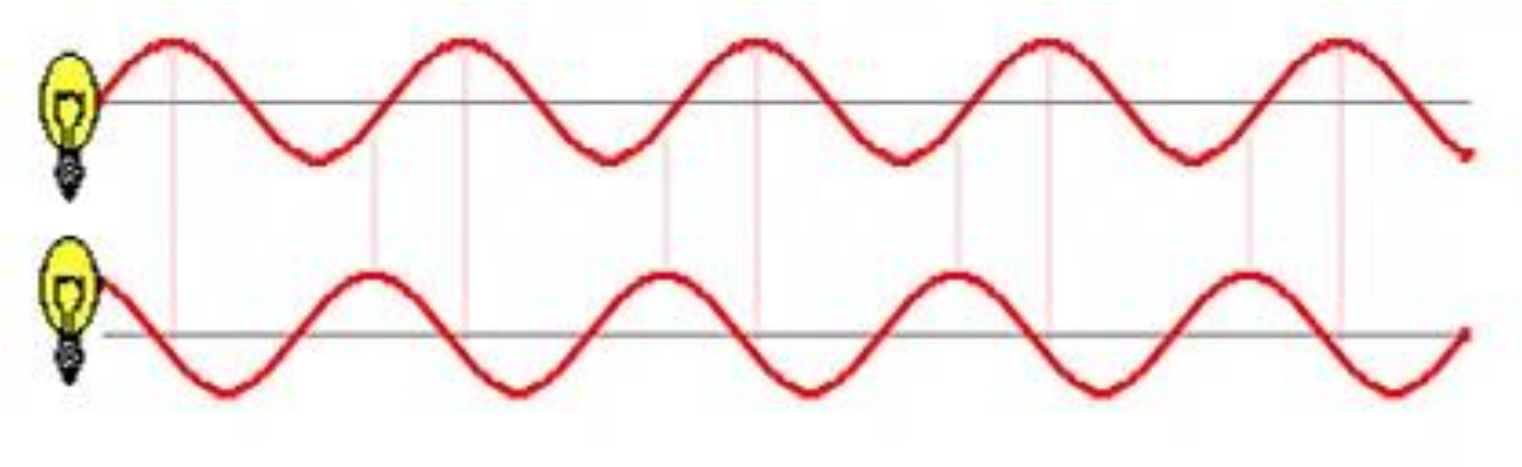
Wavefronts

A wavefront is an imaginary line that connects points on a wave where the oscillations are in phase, meaning they occur at the same point in their cycle at the same time



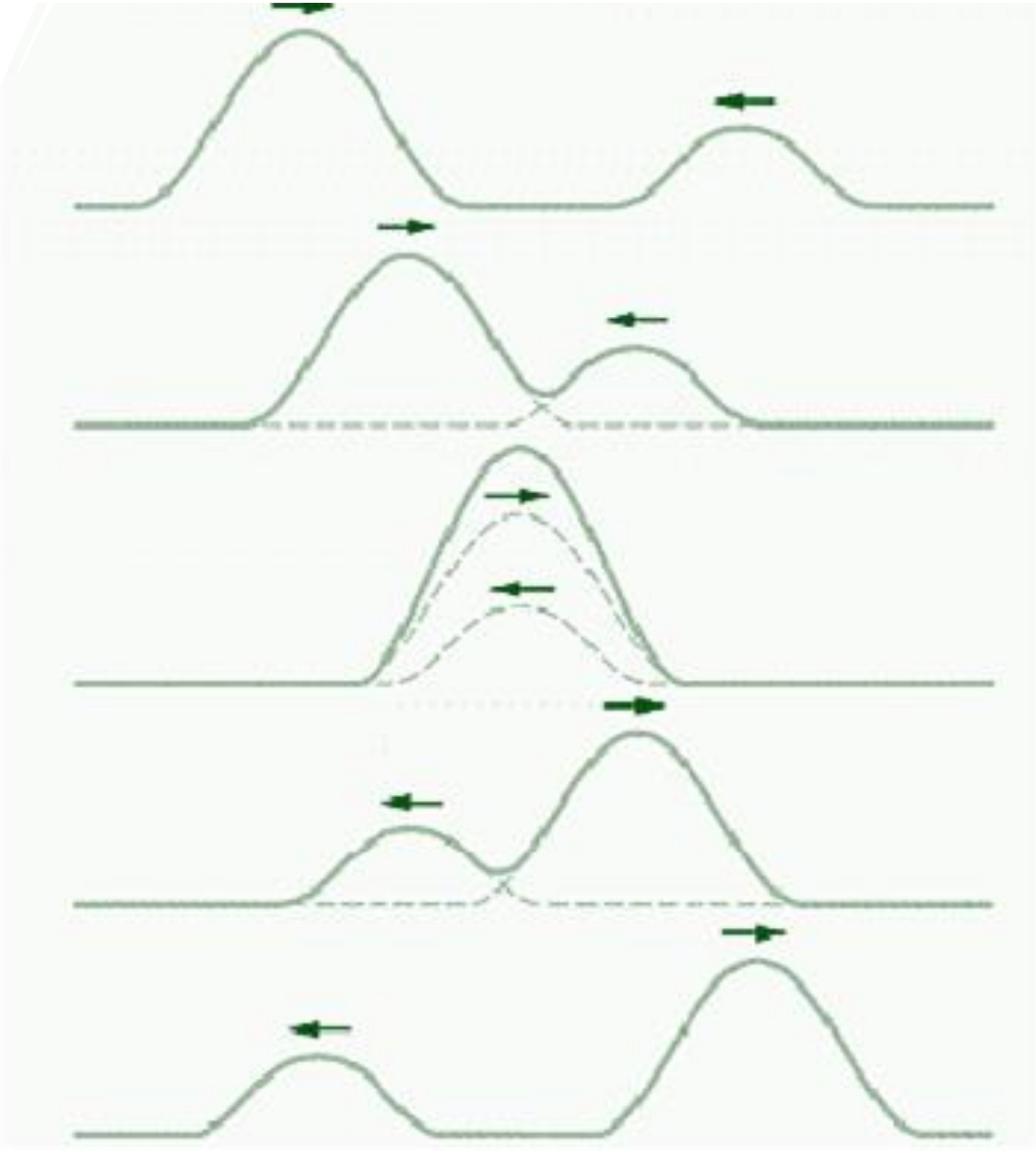
Coherent waves.

Waves with **same frequency** and **constant phase difference over time** are called coherent waves.



Superposition

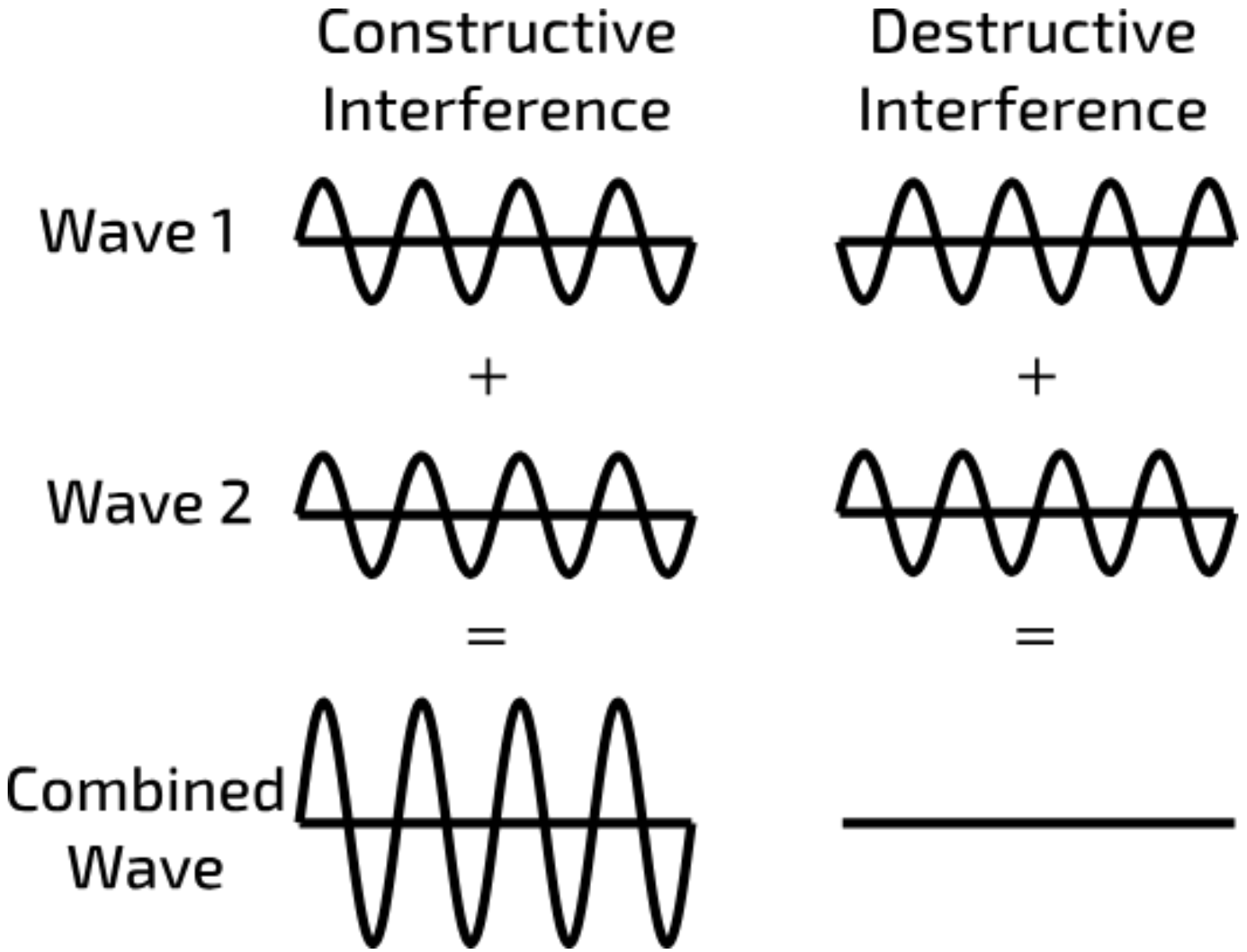
- When waves meet, each wave will be trying to cause a wave displacement according to its phase at that location. **The overall displacement will be the vector sum of the displacements** caused by the individual waves. This is called wave superposition.



Interference

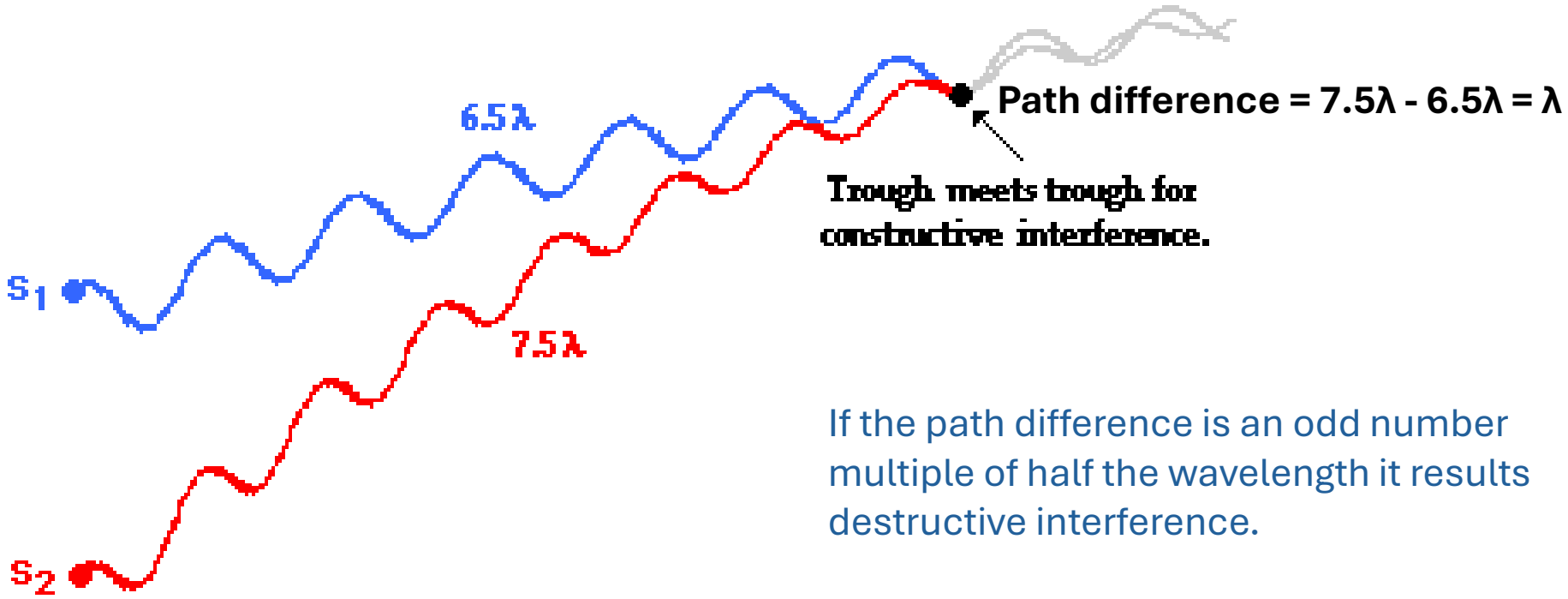
- If the two waves are in phase their effect will be to produce a larger-amplitude resultant wave. This is known as constructive interference.
  Phase difference = 2π rad or 0 rad
  Path difference =nλ
  where n= 0,1,2,3…

- If the two wave are exactly out of phase their effect will be to produce a zero- amplitude resultant wave.
  Phase difference = π rad
  Path difference =$\frac{(2n+1)}{2}$λ
  where n= 0,1,2,3…



Path difference.

Path difference is the difference in the lengths of the paths travelled by two waves or wavefronts from their sources to a given point where interference is being considered.



If the path difference is an odd number multiple of half the wavelength it results destructive interference.