Deen Dayal Upadhyay Gorakhpur University, Gorakhpur

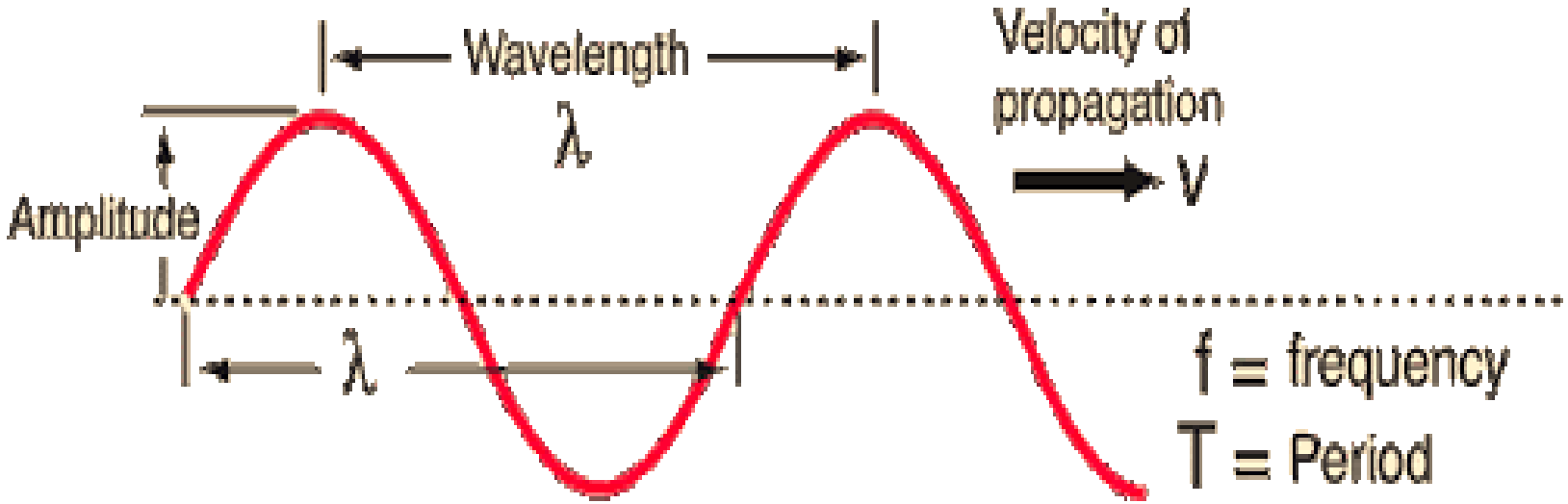
Department of Physics
Paper II: Oscillations and Waves

Presented by,
Dr. Sintu Kumar (Ph.D., IIT Delhi)
Assistant Professor
Department of Physics
DDU Gorakhpur University, Gorakhpur,
Uttar Pradesh-273009
Email: sintu.phy@ddugu.ac.in
sintukumar89@gmail.com

Velocities in Wave Motion

We have learned the wave motion, for individual oscillation which make up the medium do not progress through the medium with the waves. Their motion is simple harmonic, limited to oscillations, transverse or longitudinal, about their equilibrium positions. It is their phase relationships we observe as waves, not their progressive motion through the medium.

There are three type of velocities in wave motion which are quite different although they are associated mathematically.



Particle velocity:

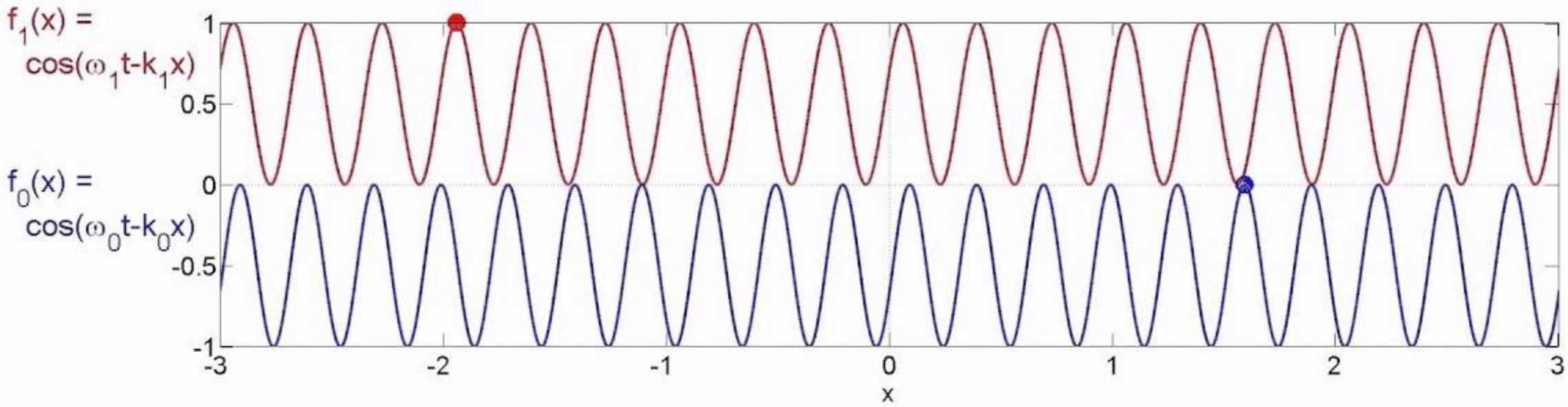
The particle velocity, which is the simple harmonic velocity of the wave about its equilibrium position.

Wave or phase velocity:

The wave or phase velocity, the velocity with which planes of equal phase, crests or troughs, progress through the medium.

Group velocity:

A number of waves of different frequencies, wavelengths and velocities may be superposed to form a group. Waves rarely occur as single monochromatic components; a white light pulse consists of an infinitely fine spectrum of frequencies and the motion of such a pulse would be described by its group velocity. Such a group would, of course, ‘disperse’ with time because the wave velocity of each component would be different in all media except free space. Only in free space would it remain as white light. Its importance is that it is the velocity with which the energy in the wave group is transmitted. For a monochromatic wave the group velocity and the wave velocity are identical. Here we shall concentrate on particle and wave velocities.



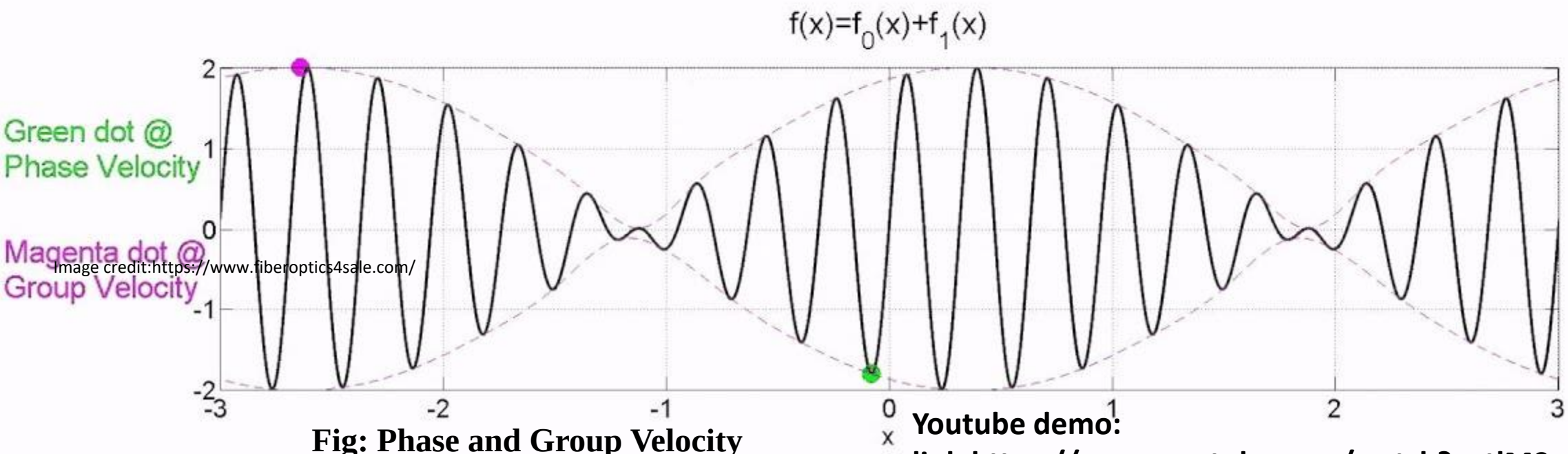


Image credit:https://www.fiberoptics4sale.com/

Fig: Phase and Group Velocity

Youtube demo: link:https://www.youtube.com/watch?v=tlM9vq-bepA

- We will study more about group and phase velocity and we will also derive the mathematic relation between group and phase velocity in our upcoming lectures. If you have any query fill free to email me at sintukumar89@gmail.com or meet me at Department of physics.

References:

- **IIT NPTEL Series**
- **MIT Open courseware**
- **The Physics Of Vibrations And Waves by H.P. Jain**