PHY1106: Waves and Oscillators	Dr. Pete Vukusic

Lecture 16.

Lecture objectives.

- To be familiar with partial standing waves; how they form (e.g. from imperfect reflections R<1) and their mathematical representation.

- To understand how wavepackets can form; i.e. due to superpositions of waves of different ω and *k*.

- To appreciate that the packet (envelope) can travel at a different velocity to the wavelets (i.e. group velocity is not necessarily the same as the phase velocity).

- To know (and remember) the equations for group and phase velocities.

Post-lecture tasks.

- Define the terms phase velocity, group velocity and dispersion of waves.
- A wave on a guitar string obeys the dispersion relation: $\omega = ak^2+bk^3$. (a and b are constants). Write down expressions for the phase and group velocities of the wave.
- The dispersion relation for transverse waves on a 1D periodic structure is given by;

$$\omega = 2\left(\frac{T}{ma}\right)^{\frac{1}{2}} \sin\left(\frac{ka}{2}\right)$$

  Derive expressions for the phase and group velocities.
- In the dispersion relation $\omega = ck+dk^3$ for a wave on a piano string, where c and d are positive constants, calculate which is the larger value, the phase velocity or the group velocity.