Quiz #10 (Wave Packet)

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Quantum Mechanics
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Prob. 1(2)

What is the relationship between angular frequency (ω) and wave number (k) for each of following waves? Determine its phase velocity and group velocity.

(a) A particle with mass M in free space.

(b) An electro-magnetic wave in a vacuum.

Prob. 2(1)

The phase velocity of light in some material around ω_o is given as $v_p(\omega) = v_0 \dfrac{\omega_0}{\omega_0 + a(\omega - \omega_0)}$, where v_o and a are constants. What is the group velocity of light in this material, $v_g(\omega)$, at ω=ω_o?

Prob.3(2)

Determine whether each of following statements is true or not. Explain.

(a) A Gaussian wave packet representing a particle located in a free space gets broadened as time increases.

(b) The magnitude of the group velocity for a particle with mass M in the ground state of an infinite barrier quantum well having width L is h/(2mL), where h is the Planck's constant.