# PHYS 100C Q&A

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3:21 PM

* Q: We assume plane waves so that $\vec{E}$ & $\vec{B}$ are const for ALL $x, y$ (if $\vec{k} \parallel \hat{z}$). This is clearly UNPHYSICAL. What about spherical waves?

* A: Yes, it's UNPHYSICAL (if $x, y \to \infty$). But most waves can be approximated as plane waves (even spherical ones), as long as curvature of wavefront $R \gg \lambda$ (wavelength).

  Also, see prob. 9.33 in textbook.

* Q: Whenever we "guess" for a solution (e.g. to Maxwell's Eqs) how do we know it's unique?

* A: We don't. But! We have showed in Lect. #1 that waves $f(z,t) = g(z - vt)$ satisfy wave equation, and that <u>ANY</u> wave can be expressed as linear combination of sinusoidal functions

$$f(z,t) = \int_{-\infty}^{\infty} \tilde{A}(k) e^{i(kz - \omega t)}$$

(See Eq. 9.20 & Problem 9.4)

Therefore, our "guess" of harmonic wave $\sim e^{i(kz-\omega t)}$ is much more than a guess, it is instead a general solution describing ANY arbitrary function $f(z,t)$ that satisfies wave

$f(z,t)$ that satisfies wave equation.

* Q: In considering boundary conditions we always set boundary at $z=0$. How would this change if it's at $z_0 \neq 0$?

* A: In general expression $e^{i(\bar{k}\cdot\bar{r}-\omega t)}$ we would get additional term

$k_z \cdot z_0$ in the exponent

Since $k_z = \frac{\omega}{v} \cdot \sin\theta$, and $\theta_I = \theta_R$,

these parts are equal for I and R waves.

For T wave: $\frac{\omega \cdot \sin\theta_T \cdot z_0}{v_2} = \frac{\omega \sin\theta_I \cdot z_0}{v_1}$

since $\frac{\sin\theta_T}{\sin\theta_I} = \frac{n_1}{n_2} = \frac{v_2}{v_1}$ (Snell's Law)