If there is a time-dependent vector potential A, then we know that the E-field is no longer just -grad(V). In this situation, is the force on a charge q from such an E-field, F = qE, still conservative?

Yes , No, It depends

Feel free to elaborate on the previous question. In particular: if yes, how do you know? If not, what isn't being conserved? If it depends, what does it depend on (or can you think of different situations where it is /is not?)

In 11.1.2., Griffiths works out the Electric and Magnetic fields far away from a little oscillating dipole at the origin. (See Eq 11.18) The E field field is proportional to (1/r)*sin(theta)*cos(omega*(t- r/c)) and points in the theta-hat direction. Stare at that formula - how would you describe such a field? Select all that you think apply.

It looks like our old Electric dipole formula from Phys 3310, but with sinusoidal time dependence.

It looks like it falls off FASTER (with distance from the origin) than our old 3310 dipole formula

It looks like it falls of SLOWER (with distance from the origin) than our old 3310 dipole formula did.

It looks like a plane wave

It looks like a spherical wave, which becomes more and more like a plane wave far away from the origin

It looks like a spherical wave, which does NOT in any way become "plane-wave like" far away from the origin

It looks like it is strongest along the axis of oscillation

It looks like it is strongest in a plane perpendicular to the axis of oscillation.

Feel free to elaborate on the previous question. Any comments or descriptions you could add to "make sense" of that formula? (You might also look at the corresponding B-field in Griffiths if that helps!)

Griffiths draws a donut on page 448 (Fig 11.4). What is this drawing trying to demonstrate?! He doesn't label the figure, so take your own shot: how would you briefly and clearly explain to a reader what is being shown here?

(continued)

I want to go back to a question we asked some time ago, (which people didn't do so well on). This was also, in essence, on the midterm on Thursday!

In Griffiths 9.3.2, he drew E_I and E_R with arrows pointing up (as shown in Figure 9.13). He defines $\tilde{\mathbf{E}}_I(z,t) = \tilde{E}_{0_I} e^{i(k_1 z - \omega t)}\,\hat{\mathbf{x}},$ **and** $\tilde{\mathbf{E}}_R(z,t) = \tilde{E}_{0_R} e^{i(-k_1 z - \omega t)}\,\hat{\mathbf{x}},$ **. Griffiths then derives** $\tilde{E}_{0_R} = \left(\frac{1-\beta}{1+\beta}\right)\tilde{E}_{0_I},$ **(equation 9.82) with $\beta = v_1/v_2$ When using the boundary condition $E_1^{//} = E_2^{//}$, we need to first evaluate just the left side, that is, the parallel component of the *full* electric field in medium 1,** $\tilde{\mathbf{E}}_1^{//}$

Which one of the following two expressions for this is correct?

Watch out, the "1" subscript which appears on the left side of those equations looks kind of similar to the capital I "I" (for incident) subscript which appears on the right side... So to be clear: the left side of the equations below refers to subscript "1", it's the total (parallel component of) the E field in medium 1. The right sides below are a combination of "I" (incident) and "R" (reflected) terms. We simply want to know whether they add or subtract, when you combine them to find the total field...

For this question, assume we are in the special case ß>1

$$\tilde{\mathbf{E}}_1^{//} = \tilde{\mathbf{E}}_I^{//} + \tilde{\mathbf{E}}_R^{//}$$

$$\tilde{\mathbf{E}}_1^{//} = \tilde{\mathbf{E}}_I^{//} - \tilde{\mathbf{E}}_R^{//}$$

Given that we are assuming ß>1, when taking the x component of the above vector equation, *which of the following is correct?*

$$\tilde{E}_1 = \tilde{E}_{0I} + \tilde{E}_{0R}$$

$$\tilde{E}_1 = \tilde{E}_{0I} - \tilde{E}_{0R}$$