A74, Dartmouth College
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A74 EXERCISES: Stokes parameters and moving charges (2 & 3)

1. Consider the Stoke's parameters for monochromatic plane waves (Eq 2.40; note that 2.47 is the more general forms for quasi-monochromatic plane waves). Note that the ωt part doesn't appear in these equations by definition (and I think also by virtue of reality: except in interferometry, we're always measuring a time average of a light wave, not recording a specific phase).

   (a) Just by considering the geometry and the verbal definitions given for the Stoke's parameters at the beginning of the lecture notes, what are the Stokes parameters for horizontally (along 0 degrees) polarized light and vertically (along 90 degrees) polarized light?

   (b) Consider the formulation of the electric field that uses β and χ. What must β and χ be for the E fields in the two scenarios above? (There are actually a combination of options). Then, use Eq 2.40 to determine the Stokes parameters, confirming your answer to part a).

   (c) Consider the formulation of the electric field that uses complex numbers (Eq. 2.35 + 2.36). For each of the two scenarios, what is the complex vector E field? (The answer is simple).

2. Consider the Lienard-Wiechart potentials, the potential fields for a moving charge (R&L Eq 3.7). Show that the scaling of the potentials with κ results in a beaming effect. Do this by considering **qualitatively** how κ changes when you consider the directions parallel, perpendicular, and anti-parallel to the velocity.

3. Show that the electric field (R&L Eq 3.9a) becomes Coulomb's law in the limit that $v << c$ and zero acceleration.