

Workbook



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Lorentz Transformations for Electromagnetic Fields

Lorentz Transformations for Electromagnetic Fields

Questions

- 1) An observer travels at a velocity of v in the x direction relative to the lab. The observer measures an electric field E_0 in the z direction and a magnetic field of zero. What electric and magnetic field will the observer in the lab measure?

- 2) An infinite plane has charge density σ . The plane travels at a constant velocity of $\vec{v} = v\hat{x}$ relative to the lab. Calculate the electric and magnetic fields, as well as the charge and current densities, in the lab's reference frame. Use both methods below.
First method:
 - a. Calculate the electric and magnetic fields in the plane's rest frame by using the plane's charge distribution.
 - b. Calculate the electric and magnetic fields in the lab's reference frame by using Lorentz transformations.
 - c. Calculate the charge and current densities in the lab's reference frame using the fields calculated in the previous step.Second method:
 - d. Calculate the charge and current densities in the lab's reference frame.
 - e. Calculate the electric and magnetic fields in the lab's reference frame using your answer from the previous step.

*For the solutions go see the videos