

1. Jackson 6.14

Hint: The small parameter in this problem is the light crossing time compared with the frequency ($\omega a/c \ll 1$). Write down the Maxwell equations and solve them order by order in powers of this small parameter.

2. Consider a rectangular loop of wire as shown with $L \gg w$ incident on a magnetized half space, $\mathbf{B} = B_0 H(y) \hat{z}$, where H is the Heaviside function. The wire

has an initial velocity $\mathbf{v} = v_0 \hat{y}$ with $v_0 \ll c$, a mass per unit length λ and infinite conductivity. The wire making up the loop has a circular cross section with a radius $a \ll w$. Initially the wire does not carry any current. Neglect end effects in the following.

- Under the assumption that the plane of the wire is constrained to remain perpendicular to \hat{z} calculate the total current flowing around the wire as the loop enters the magnetic field. Express your answer in terms of the distance y the right side of the wire has penetrated the magnetic field. Be sure to indicate the direction of the current.
- Calculate the force per unit length acting on the wire and write down an equation of motion for the wire.
- Solve for the motion of the wire for all possible values of v_0 .

Hint: There are two possible final states. What is the current in the wire in these two final states?