

HW#12; Due Monday 5/15

1) Look at equation 12.117 (3rd Ed.)/ Eqn. 12.118 (4th edition). Take the very last equation (the last one of the 6 shown). Explicitly prove it is correct, knowing how tensors transform.

2) Problem 12.50 (3rd edition), 12.51 (4th edition).

3) An infinite slab in the x-y plane has a thickness "a". The slab has a uniform charge density  $\rho$  and also carries a (3)-current density  $J$  in the +x direction.

A) Find the fields outside the slab, then Lorentz transform the fields into the coordinate system where the slab is moving at a velocity  $v$  in the -x direction.

B) Now, instead transform the 4-current into this same frame, and calculate the fields outside the slab directly from the new 4-current. Your answer should be the same!

C) Check that the field-invariants are in fact invariant. (Calculated in the second problem, above; also used in the next problem.)

4) Problem 12.46 (3rd edition), 12.47 (4th edition).

5) A plane electromagnetic wave with frequency  $\omega$  is travelling in the x-direction, with a y-polarization. If the complex amplitude of the  $A^0$  component is "Z", find all other components of the 4-potential in terms of Z. (Hint: Consider both the Lorentz Gauge and how the E/B fields can be derived from the potential terms.)