

In the name of God

Department of Physics  
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MODERN COSMOLOGY

Exercise Set 1: Review on necessary parts

(Due Date: 1404/01/20)

1. Show that the Maxwell's equations through the Lorentz transformation are invariant.
2. Write the covariant form of maxwell's equations.
3. Suppose that a test charge particle moving through  $x$ -axis. Find electric field,  $\mathbf{E}$  and corresponding magnetic field,  $\mathbf{B}$ , from a rest observer with following conditions:  
**A** : Suppose it is moving with constant velocity  $v_x$ .  
**B** : Suppose it is moving with constant acceleration  $a_x$ .
4. Test the Homogeneity of our Universe. To this end, check in the relevant references and try to plot the matter density versus radius of a sphere including the matter for the range of  $r \sim 1m, 10m, 10^8m, 1Au, 1Pc, 1KPC, 1MPc, 100Mpc$
5. Solve Problem 4.14 (Chapter 4, an introduction to modern astrophysics, written by Bradley W. Carrol and Dale A, Ostlie, second edition)
6. Solve all exercises of chapter 1, Modern Cosmology Book written by S. Dodelson and F. Schmidt, 2021 edition.

Good luck, Movahed

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