

Massachusetts Institute of Technology

Department of Physics

Course: 8.701 – Introduction to Nuclear and Particle Physics

Term: Fall 2020

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Discussion Problems

from recitation on **October 1st, 2020**

Problem 1: Field strength tensor

Derive

$$\nabla \cdot \mathbf{E} = 4\pi\rho \quad (1)$$

and

$$\nabla \times \mathbf{B} - \frac{1}{c} \frac{\partial \mathbf{E}}{\partial t} = \frac{4\pi}{c} \mathbf{J} \quad (2)$$

from

$$\partial_\mu F^{\mu\nu} = \frac{4\pi}{c} J^\nu \quad (3)$$

Problem 2: Continuity equation

Show that the continuity equation

$$\partial_\mu J^\mu = 0, \quad (4)$$

which follows from the antisymmetry of $F^{\mu\nu}$, enforces conservation of charge.

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