## ADVANCED DYNAMICS — PHY 4241/5227 HOME AND CLASS WORK – SET 12

(April 18, 2011)

(38) Use  $F_{\gamma\delta} = \partial_{\gamma}A_{\delta} - \partial_{\delta}A_{\gamma}$  to show  $\partial_{\alpha} * F^{\alpha\beta} = 0$ , where

$${}^{*}F^{\alpha\beta} = \frac{1}{2} \epsilon^{\alpha\beta\gamma\delta} F_{\gamma\delta}$$

is the dual tensor. Here  $\epsilon^{\alpha\beta\gamma\delta}$  is the completely antisymmetric Levi-Cevita tensor: +1 for  $(\alpha, \beta, \gamma, \delta)$  an even permutation of (0, 1, 2, 3), -1 for  $(\alpha, \beta, \gamma, \delta)$  an odd permutation of (0, 1, 2, 3). Not assigned.

(39) Under a gauge transformation the vector potential transform according to

$$A^{\alpha} \to A'^{\alpha} = A^{\alpha} + \partial^{\alpha} \Lambda$$

Calculate the corresponding transformation of the electromagnetic field tensor

$$F^{\alpha\beta} \to F'^{\alpha\beta}$$
.

Due April 22 before class (4 points).