ADVANCED DYNAMICS — PHY 4241/5227

HOME AND CLASS WORK – SET 9

(March 29, 2010)

(26) Exercises with the rapidity variable.

1. Show $1/\sqrt{1-\beta^2} = \cosh(\zeta)$. Due in class (2 points).
2. Show $\cosh(\zeta_2)\cosh(\zeta_1) + \sinh(\zeta_2)\sinh(\zeta_1) = \cosh(\zeta_1 + \zeta_2)$. Due in class (2 points).
3. Velocities are given by $\beta_1 = \tanh(\zeta_1)$ and $\beta_2 = \tanh(\zeta_2)$. Use the addition theorem of rapidities to express the velocity given by $\beta = \tanh(\zeta_1 + \zeta_2)$ in terms of β_1 and β_2. Due in class (4 points).

(27) D mesons have a (mean) lifetime of $1051 \times 10^{-15}\,$s. Assume such a meson is created in a particle collission at Fermilab and moves at $0.995\,$c with respect to the Lab frame. Compute the (mean) distance travelled by such a D meson. Due April 4 before class (6 points).