

Written Examination Special Relativity MFN 1313
Academic Year 2012–20123: 25 June 2013, 2.30-4.30 PM

Please read the following INSTRUCTIONS

A. Answer at most TWO questions. You may answer in english or in italian. A pass is obtained for one complete answer.

B. You may not use notes or textbooks, but the course notes are available for consultation at the front desk.

1. In an inertial frame S two photons of frequencies ν_1 and ν_2 travel in the positive and negative x directions respectively.

a) Find the velocity of the CM (centre of mass) frame relative to S .

b) Calculate the photon frequencies in the CM frame

2. Show that the sequence of n consecutive parallel Lorentz boosts, each with velocity $u = c \tanh \theta$, is equivalent to a single Lorentz boost in the same direction with velocity $c \left(\frac{z^n - 1}{z^n + 1} \right)$, where $z = e^{2\theta}$.

3. Consider a process with a number of initial and a number (maybe different) of final particles. Show that if total energy is conserved for all observers, then so is total three-momentum, and vice-versa.