

Compito "relativistico" di Fisica - Classe 4 AST

"Dove c'e' grande volonta' non possono esserci grandi difficolta"
(Niccolo' Macchiavelli)

Problem n. 1 +

A muon at rest lives 10^{-6} sec and its mass is $100 \text{ MeV}/c^2$. How energetic must a muon be to reach the earth's surface if it is produced high in the atmosphere (say $\sim 10^4$ m up)?

Problem n. 2 +++++

An accelerator under study at SLAC (Stanford Linear Accelerator Center) has as output bunches of electrons and positrons which are made to collide head-on. The particles have 50 GeV in the laboratory. Each bunch contains 10^{10} particles, and may be taken to be a cylinder of uniform charge density with a radius of $1 \mu\text{m}$ and a length of 2 mm as measured in the laboratory.

- To an observer traveling with a bunch, what are the radius and length of its bunch and also the one of opposite sign ?
- How long will it take the two bunches to pass completely through each other as seen by an observer traveling with a bunch ?

Problem n. 3 +

Una certa particella "instabile" (di massa $m = 10^{-27}$ kg) viene accelerata fino ad una energia pari a $E = 10 \text{ GeV}$. Si determini il suo fattore di Lorentz γ e la sua velocit  v . Possiamo ritenere relativistica tale particella ? Quanto vale la sua "massa relativistica" ? E la sua energia cinetica ? E la sua quantit  di moto ? Nel laboratorio, quanto risulta la sua "vita media", se "da ferma" decadrebbe in un tempo $\tau = 10^{-6}$ s ? Alla sua velocit , quanto spazio riuscirebbe a percorrere prima di decadere ?