

Particle Physics - Exercises

6. Two particle kinematics 20.1.11.

1. The highest energetic cosmic protons reach energies of more than 10^{20} eV. They interact with the nucleons in the Earth atmosphere and create huge cosmic showers. Which energy should a proton-proton collider have in order to reach the same energy in the centre of mass? [2]

2. Show that gamma conversions $\gamma \rightarrow e^+ e^-$ in free space violate the conservation of energy and momentum ! [3]

Which energy has to be transferred to a recoil nucleon to restore energy-momentum conservation? [3]

3. Consider the decay $\pi^0 \rightarrow \gamma\gamma$ in flight. One photon moves into and the other opposite to the direction of flight of the π^0 meson. For $E_{\pi^0} = 10 m_{\pi^0} = 1.35$ GeV calculate the energies of both photons in the lab system! [3]

4. What is the maximum momentum of a pion beam that allows its decay muons to be emitted backwards? [3]