

Simple kinematic calculations

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Example A – Inelastic Scattering

Electrons of energy 900 MeV scatter inelastically off protons. If an electron scattered through 30° has an energy of 234 MeV, what is the mass of the “excited proton” it creates?

Mass of electron = $0.5 \text{ MeV}/c^2$

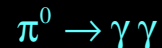
Mass of proton = $938.3 \text{ MeV}/c^2$

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Example B – Two-body Decay

a) Decay to massless particles

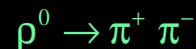
A π^0 (mass $135 \text{ MeV}/c^2$) at rest decays into 2 photons.



What are their energies and momenta?

b) Particles with mass

A ρ^0 meson (mass $770 \text{ MeV}/c^2$) at rest decays into 2 charged pions (mass $140 \text{ MeV}/c^2$).



What are their energies and momenta?

→ 4-vectors
[Go to Fermions and Bosons slides](#)

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Example C – Two-body Collision

What energy pions must strike a proton at rest in order to produce a Δ baryon (mass $1232 \text{ MeV}/c^2$)?

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