

Chapter 1: Basic concepts

Elastic scattering of elementary particles preserves their identities, and proceeds via exchange of neutral gauge bosons. Estimate the maximal range over which such exchange can take place, if the exchanged boson is:

a) photon, $m_\gamma = 0 \text{ GeV}/c^2$

b) Z boson, $m_Z = 91.19 \text{ GeV}/c^2$

c) hypothetical Higgs boson, estimated minimal mass $m_H > 114.3 \text{ GeV}/c^2$

–

Hint: $\hbar \equiv h/2\pi = 6.582 \times 10^{-22} \text{ MeVs}$ and $c = 2.998 \times 10^8 \text{ m/s}$

Chapter 2: Leptons, quarks and hadrons

Define which hadron quantum number combinations (Q,B,S,C, \tilde{B}) are allowed by the quark model, and suggest their quark constituents:

- a) (0,0,1,0,0)
- b) (2,1,0,1,0)
- c) (0,0,0,0,1)
- d) (-1,1,-2,0,-1)