

Exercise Sheet 5 – Particle Physics – Summer 2016

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hand in: Mo 20.06. (in the lecture)

5.1 Mesons masses (4 points)

Using the meson mass formula

$$m(q_1 q_2) = m_1 + m_2 + \frac{A}{m_1 m_2} \langle S_1 S_2 \rangle \quad (1)$$

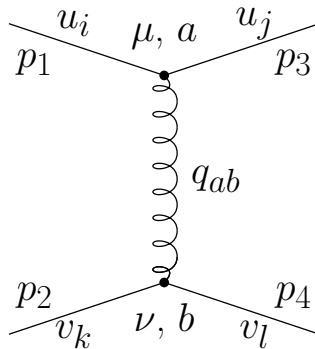
calculate the masses of pseudoscalar (π , K, η) and vector (ρ , K*, ω , ϕ) mesons.

Use following values for the parameters: $m_d = m_u = 0.307$ GeV, $m_s = 0.490$ GeV and $A = 0.06$ GeV³.

Compare to the measured masses.

5.2 Gluon exchange (4 points)

Write down the matrix element for gluon exchange between two quarks shown in the figure.



5.3 R_μ ratio (4 points)

Calculate the R_μ ratio at low, middle and high energy corresponding to production of the 3, 4 and 5 lightest quarks.

$$R_\mu = \frac{\sigma(e^+e^- \rightarrow \text{hadrons})}{\sigma(e^+e^- \rightarrow \mu^+\mu^-)} \quad (2)$$

At which energies (energy ranges) these ratios are valid?