Quantum field theory
Exercises 15.
2006-05-29

• **Exercise 15.1.**

Analogously to the $\pi^+ \to l^+ \nu_l$ decay calculate the width of the $K^+ \to e^+ \nu_e$ and $K^+ \to \mu^+ \nu_\mu$ decay width. Explain the different factors. Compare the ratio $\Gamma(K^+ \to \mu^+ \nu_\mu)/\Gamma(K^+ \to e^+ \nu_e)$ with the experimental data from the Particle Data Group.

• **Exercise 15.2.**

Calculate the decay rate for $K^0 \to \pi^- l^+ \nu_l$. To do this first express the separate matrix element into the electroweak and hadron part. The hadron part hes the form

$$\langle \pi^- | \bar{s} \gamma^\mu (1 - \gamma^5) u | K^0 \rangle = f_1(q^2) p^\mu + f_2(q^2) q^\mu \ ,$$

where $p^\mu = p_K^\mu + p_\pi^\mu$ and $q^\mu = p_K^\mu - p_\pi^\mu$. In the first approximation you may try to set $f_0 = 0$, $f_1 = 1$. Calculate the decay width in this approximation.