Quantum field theory
Exercises 5.
2005-11-28

• **Exercise 5.1.**

Find the center-of-mass energy for scattering of a high energy proton with energy E (and mass $M = 1$ GeV) on the CMB photon (average temperature $T = 2.7\mathrm{K}^\circ$). Compare the kinetic energy with the mass of π^0, $m_{\pi^0} = 135$ MeV.

• **Exercise 5.2.**

Check the formulas

$$\sigma^\mu \bar{\sigma}^\nu + \sigma^\nu \bar{\sigma}^\mu = 2g^{\mu\nu}\mathbb{1}$$
$$\bar{\sigma}^\mu \sigma^\nu + \bar{\sigma}^\nu \sigma^\mu = 2g^{\mu\nu}\mathbb{1}$$
$$\mathrm{tr}\,\sigma^\mu \bar{\sigma}^\nu = 2g^{\mu\nu}\ .$$