

Advanced quantum mechanics and quantum field theory, FS 2021

Blatt 10 = last “required” exercise sheet

Submission: 20.05.2021, 12:00H, on adam in the appropriate folder.

One file per submission please; the filename HAS TO contain your name, or the submission will not be corrected!

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- (1) **Hamiltonian and conserved charge for the Dirac field** (3 Punkte)
 - (a) Verify Eq. (38.11).
 - (b) Verify Eq. (38.15).

- (2) **Lancaster/Blundell problem 38.3** (3 Punkte)

- (3) **Lancaster/Blundell problem 38.4** (3 Punkte)

The spin sums mentioned in the formulation of the exercise are discussed in Example 36.7 on p. 332.

- (4) **Lorentz boosts** (1 Punkt)

Show that $u(p) = \eta(\not{p} + m)u(0)$ (where η is a normalization constant) fulfills the Dirac equation in momentum space. Hence we expect that $\eta(\not{p} + m)$ is related to the boost operator $\exp(i\mathbf{K} \cdot \boldsymbol{\phi})$ that we discussed in the lecture. Investigate this relationship.