
Mathematical Quantum Mechanics

Homework Sheet 1

Exercise 1: In the physical literature some of the features of quantum theory are often considered to have non-important technical nature. In this exercise we would like to discuss their necessity.

1. Assume that the Born–Jordan commutation relation

$$[p, q] = -i\hbar \tag{1}$$

is satisfied by $n \times n$ matrices p and q ($n \in \mathbb{N}$) with reduced Planck constant \hbar . Conclude that the Planck constant must be zero, i.e., there is no quantum mechanics. Find a proof which does not use eigenvectors.

2. Assume that two observables p and q are defined everywhere on a Hilbert space \mathfrak{H} , satisfy the Born-Jordan commutation relation (1), and that one of them has an eigenvector. Show that there is no quantum mechanics in the above sense.

The solutions should be put to the box marked “Mathematical Quantum Mechanics” on the first floor **by 16:00 on Tuesday, October 22.**

**Every solution must be an original work of its single author!
Violations of this rule will be penalized!**