

Homework 7

Answers should be submitted, as both a tex file and a pdf file, to both me and the teaching assistants. You may use this file as a template.

Q7.1. Show that the eigenvalues α of a

(a) Hermitian operator satisfy

$$\alpha^* = \alpha \quad (\text{Q7.1.1})$$

(b) unitary operator satisfy

$$\alpha^* = \alpha^{-1} \quad (\text{Q7.1.2})$$

Q7.2. Show that the eigenspaces of a

(a) Hermitian operator

(b) unitary operator

are orthogonal.

Q7.3. The position and momentum operators have the commutation relation

$$[\hat{x}, \hat{p}] = i\hbar \quad (\text{Q7.3.1})$$

Show that they cannot have a common eigenvector. Interpret physically.