Exam quantum mechanics

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You can use the book. Be clear, what is not clear cannot be corrected. You can answer in Dutch, French or English. If you want a Dutch translation of the exam questions, feel free to ask. Good luck!

Addition of angular momenta [8 ptn]

Explain the idea behind the addition of agular momenta. Then use the combination of two spin 1/2 particles as an example.

Operator formalism [8ptn].

- Consider an operator A and B given by

$$A = \begin{pmatrix} 0 & \frac{5}{\sqrt{2}} & 0 \\ \frac{5}{\sqrt{2}} & 0 & \frac{5}{\sqrt{2}} \\ 0 & \frac{5}{\sqrt{2}} & 0 \end{pmatrix} \qquad B = \begin{pmatrix} 0 & -i\frac{6}{\sqrt{2}} & 0 \\ i\frac{6}{\sqrt{2}} & 0 & -i\frac{6}{\sqrt{2}} \\ 0 & i\frac{6}{\sqrt{2}} & 0 \end{pmatrix} \tag{1}$$

  An exact measurement is performed for observable A and the result was 5. Give the possible outcomes for an exact measurement of B and give the probability for each outcome [4pt]

- The Hamiltonian of the system is B. Consider that at $t = 0$ the state is in an eigenstate of A with value 5. Give the exact time-evolution of this state.[4]

Electromagnetism [4ptn]

Prove the gauge invariance of the Hamiltonian that describes the interaction of a free spinless wave with electromagnetic fields.