Quantum Information

Module Code | PT4.8 | FHEQ Level | Level 7
---|---|---|---
Pre-requisites | Foundations of Quantum Mechanics | Co-requisites | None
Primary Department | Physics | |
Module Leader | Dr Florian Mintert | |
Additional Teaching Departments | None | |
Teaching Staff | Dr Florian Mintert + Course Associate | |
Programmes on which the Module is delivered | All UG Physics programmes (F300, F303, F309, F325, F390, F3W3, F3XC, F3XD) | Core/Elective: Elective

Learning Outcomes

On completing the Quantum Information course, students will:

**Dynamics of qubits**
- Construct the dynamics of a single or two qubits, as induced by a Hamiltonian.
- Understand the effect of a projective measurement on a single or two qubits.
- Understand the no-cloning theorem.

**Single qubits and the Bloch sphere**
- Represent the state of qubits and their dynamics on the Bloch sphere.
- Understand dissipative dynamics on the Bloch sphere.

**Decoherence and error correction**
- Understand qualitatively the concept of decoherence.
- Describe the dynamics of one or more qubits in terms of quantum channels.
- Construct error correction codes for given errors.

**Protocols**
- Understand the teleportation protocol with and without imperfections.
- Understand the Deutsch Jozsa algorithm.
- Understand the Grover algorithm.

**Entangled states**
- Understand the Bell theorem.
- Understand the concept of entangled states, both for pure and for mixed states.
- Determine if a state of two qubits is entangled or not.
- Construct quantum channels that change the entanglement of a state in a desired fashion, and understand when this is possible.

Description of Content

This course aims to introduce you to the fundamental principles and applications of quantum information and their realisation.

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