

## 量子科技實驗課程大綱

本實驗課程包刮兩主題：量子光學與固態自旋量子位元

課程內容：

### 1、 quantum optics

採用 Thorlabs 的 quantum optics educational kit

([https://www.thorlabs.com/newgrouppage9.cfm?objectgroup\\_id=15827](https://www.thorlabs.com/newgrouppage9.cfm?objectgroup_id=15827))

實驗項目：

HBT-Experiment with attenuated laser

Photon pair source

HBT-Experiment with one arm of the pair source

Grangier-Roger-Aspect experiment

GRA experiment with classica light

Malus' law for single photons

Single photon Michelson interferometer

Quantum eraser

### 2、 solid-state spin qubits in diamond

採用 Spin-flex Instruments 的 spinEDU educational kit

(<https://spin-flex.com/spinedu/>)

實驗項目：

Introduction lab

ODMR measurements

ODMR Rabi oscillations

Relaxation times

Dynamical decoupling

Single qubit operations and QST

Hyperfine spectroscopy

上課進度：

第一至第四週：講解

第五至十六週：實驗

實驗執行方式：每班人數 8 人，兩人一組，共 4 組。兩組先做 quantum optics，另兩組先做 spin qubits，六週後交換。

成績考核：實驗報告 80%，期末口頭報告 20%

AI 使用規則：有條件開放，請在報告中註明如何使用生成式 AI

## Quantum Technology Lab Course Outline

This lab course covers two topics: quantum optics and solid-state spin qubits

Course content:

### 1. Quantum optics

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Experiments:

HBT-Experiment with attenuated laser

Photon pair source

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### 2. Solid-state spin qubits in diamond

Using spinEDU educational kit from Spin-flex Instruments

(<https://spin-flex.com/spinedu/>)

Experiments:

Introduction lab

ODMR measurements

ODMR Rabi oscillations

Relaxation times

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Single qubit operations and QST

Hyperfine spectroscopy

Class schedule:

Weeks 1 to 4: Lectures

Weeks 5 to 16: Labs

Class enrollment is limited to 8 students. Two students work in pairs, for a total of 4 groups. Two groups carry out the quantum optics lab first, and the other two groups carried out the spin qubits lab first, and then switched after six weeks.

Evaluation: lab report 80%, final oral report 20%

Use of the AI: Conditionally open; please specify how generative AI is used in the report