

# Master Physique fondamentale et applications

## Quantum optics and quantum information

### Informations

Composante : Faculté des Sciences

### Responsables

Thomas DURT  
Brian STOUT

### Langue(s) d'enseignement

Anglais

### Contenu

The goal of our lessons is to familiarize the student with a quantum description of light; in particular it is aimed at introducing fundamentals in quantum optics and quantum information. Concepts such entanglement, vacuum fluctuations, second quantization and so on are indeed necessary in order to go beyond the classical Maxwell description. In our teachings, we aim at providing a survey of the progresses realized between Planck's derivation of the black body distribution in 1900, and quantum teleportation one century later, not forgetting precise predictions regarding spontaneous emission (Fermi golden rule-30's), the machinery of coherent states produced by a laser source (60's) and the so-called second quantum revolution initiated in the 90's. The tools that we introduce aim at giving to the student the ability to understand the most recent achievements in quantum information and quantum optics (entanglement, quantum cryptography, single photon sources, quantum tomography...).

#### Quantum information (11h)

qubits, entanglement, q communication, decoherence, quantum cryptography, biorthogonal Schmidt decomposition

#### Quantum optics - Part I (11h)

black body radiation, one mode quantization, coherent states, light-matter interaction, Fermi golden rule

#### Quantum Optics - Part II (6h)

Squeezed states, Quantum theory of beam-splitters, Quadrature operators, Homodyne detection, Hong-Ou-Mandel effect

### Compétences à acquérir

The students

- get familiar with a quantum description of light
- get acquainted with the most recent developments of quantum optics and quantum information
- are able to solve elementary exercises similar to those solved during the course and the tutorials sessions

### Modalités d'organisation

Two hours sessions of mixed courses and tutorials.

Evaluation: 1 written exam

### Bibliographie, lectures recommandées

Griffith: Introduction to Quantum Mechanics

### Pré-requis obligatoires

- Solid mathematical background, basic knowledge in physics
- Fundamentals in Atomic Physics/Quantum Mechanics

### VOLUME HORAIRE

- Volume total: 28 heures
- Cours magistraux: 28 heures

### Codes Apogée

- SPFCU42J [ELP]

### Pour plus d'informations

[Aller sur le site de l'offre de formation...](#)



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