Summary
This lecture describes advanced developments applications of quantum optics. It emphasizes the connection with ongoing research, and with the fast growing field quantum technologies. The topics with cover some aspects of quantum information processing, quantum sensing and quantum simulation.

Content
1. Introduction

2. Quantum information

3. Quantum control

4. Collective and many-body effects

5. Mechanical effects of light

6. Quantum simulation

Keywords
Quantum technology, quantum computing, quantum simulation, quantum optics, laser cooling, quantum measurement, quantum electrodynamics, quantum devices

Learning Prerequisites

Required courses
Good understanding of basic quantum mechanics
Quantum Electrodynamics and quantum optics (Fall semester)
Statistical physics IV (Spring semester)

Recommended courses
Learning Outcomes
By the end of the course, the student must be able to:
• Master the calculational techniques

Teaching methods
Ex-cathædra, exercise classes. Mini-conference with student presentations

Expected student activities
Weekly problem sheet solving, paper reading and presentation

Assessment methods
Oral examination

Resources
Bibliography
• Grynberg, Aspect and Fabre, *Introduction to Quantum Optics*
• Cohen-Tannoudji, Dupont-Roc, Grynberg, *Atom-Photon Interactions*
• Gardiner, Zoller, *The Quantum World of Ultracold Atoms and Light Book II*
• Chuang, Nielsen, *Quantum Computation and Quantum Information*

Ressources en bibliothèque
• Grynberg, Aspect and Fabre, *Introduction to Quantum Optics*
• Cohen-Tannoudji, Dupont-Roc, Grynberg, *Atom-Photon Interactions*
• Gardiner, Zoller, *The Quantum World of Ultracold Atoms and Light Book II*
• Chuang, Nielsen, *Quantum Computation and Quantum Information*