Theoretical Quantum Optics
Theoretische Quantenoptik

Lecture
Tuesday 8h00 c.t.
Thursday 8h00 c.t
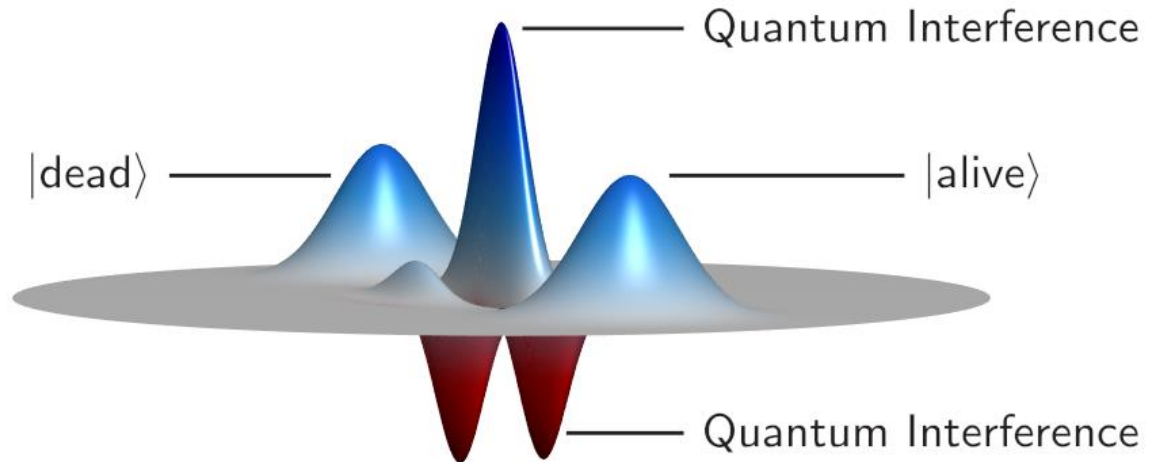Start: 17.10.2023
Venue: D8H33

Tutorials
Monday 12h00 c.t. in D8H33
Tuesday 10h00 c.t. in C5S06

Quantum Interference

|dead⟩ |alive⟩

Quantum Interference

Optical Schrödinger's Cat
© Wikipedia

Prof. Dr. Igor Lesanovsky
Institut für Theoretische Physik
igor.lesanovsky@uni-tuebingen.de

Lecture – Table of contents

Week (approx.)	Contents	Pages in script
1	**1. Quantisation of the electromagnetic field** Quantisation of a single mode Quantum fluctuations of a single mode	1 – 11
2	Quadrature operators of a single-mode field Multi-mode fields	12 – 21
3	Thermal fields Coherent states	22 – 31
4	**2. Quasi-probability distributions in phase space** Wigner-function (Coherent states)	32 – 42
5	Complex Fourier Transform in 2D Characteristic function Wigner-function (thermal states, Fock states) P – function	43 – 52
6	Q – representation Relationship between Wigner, P and Q functions Equation of motion for quasi-probabilities	53 – 66
7	Non-classicality of radiation fields Mandel parameter	67 – 76

Lecture – Table of contents

Literature

C. Gerry and P. Knight

Introductory Quantum Optics

Cambridge University Press

D. Braun

Quantum Optics Script
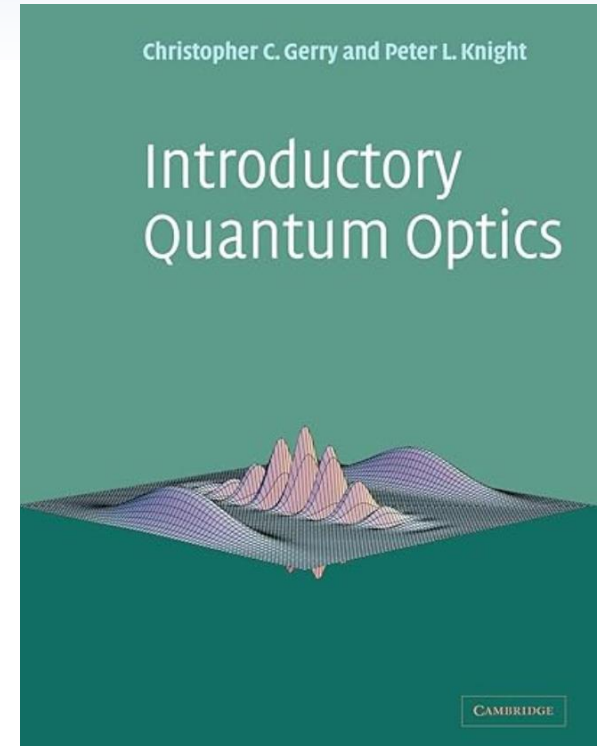
I. Lesanovsky

Theoretical Quantum Optics Script

(Download through Ilias)

Berthold-Georg Englert

Elements of Micromaser Physics

arXiv:quant-ph/0203052

…and any other
quantum optics book/script

Lecture plan

Date	
17.10.	Lecture 1
19.10.	Lecture 2
24.10.	Lecture 3
26.10.	Lecture 4
31.10.	Lecture 5
2.11.	Bad Honnef
7.11.	Lecture 6
9.11.	Lecture 7
14.11.	Lecture 8
16.11.	Lecture 9
21.11.	Lecture 10
23.11.	Lecture 11
28.11.	Lecture 12
30.11.	Lecture 13
5.12.	Lecture 14
7.12.	Dresden
12.12.	Lecture 15
14.12.	Lecture 16
19.12.	Lecture 17

Date	
21.12.	School holiday
26.12.	Christmas
28.12.	
2.1.	
4.1.	
9.1.	Lecture 18
11.1.	Lecture 19
16.1.	Lecture 20
18.1.	Munich
23.1.	Lecture 21
25.1.	Lecture 22
30.1.	Lecture 23
1.2.	Lecture 24
6.2.	Lecture 25
8.2.	Lecture 26

Tutorials

- **Venue**
  - Monday 12h00 – 14h00 c.t. D8H33
  - Tuesday 10h00 – 12h00 c.t. C5S06

- **Weekly problem sheet**
  - Hand out online on Thursday
  - Hand in before Thursday lecture

- **Pass criteria**
  - Meaningful attempt to solve of at least 70% of all questions
  - Presentation of solution at least three times during tutorials
  - Attendance of all but one tutorial