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Lecture "Quantum Optics" | Exercise Sheet #6 Problem 1 (part 1+2 easy, part 3 tricky) 1. Consider a two-level atom which is initially prepared in state  $|j\rangle$ , and which interacts resonantly (i.e., the detuning is zero,  $r = 0$ ) with a general single-mode light field  $i = P$   $n=0$   $c$   $n_j n_i$ , as described by the Jaynes-Cummings-model.

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Includes many exercises and historical sidelights. Approaches quantum optics from a perspective of fundamental physical principles rather than as a handbook of calculational techniques; Introductory material on quantum optics is brought up to date with recent examples and applications

[Eigenvalues of the Hamiltonian in quantum optics](#)

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Brooker on Modern Classical Optics [BRO03] covers most of the topics on classical optics that I want to address. The book of M. Fox on Quantum Optics [FOX06] covers most of the material on quantum optics. These books are a "must have" for the course and the exercises and an asset for later reference.

[An Introduction to Quantum Optics and Quantum Fluctuations ...](#)

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[Optical Coherence and Quantum Optics - Leonard Mandel ...](#)

Two possibilities  $+1/2$ ,  $-1/2$ . 2. State the number of possible electrons described by the following quantum numbers a.  $n = 3$ ,  $l = 0$  2. b.  $n = 3$ ,  $l = 1$  6. c.  $n = 3$ ,  $l = 2$ ,  $m_l = -1$  2. d.  $n = 5$ ,  $l = 0$ ,  $m_l = -2$ ,  $m_s = -1/2$  Not possible. 3. Give the  $n$  and  $l$  values for the following orbitals a.  $1s$   $n=1$   $l = 0$ . b.  $3s$   $n=3$   $l = 0$ .

Expected student activities . Weekly problem sheet solving, paper reading and presentation. Assessment methods . Oral examination. Resources Bibliography . For a review of the basics of quantum optics. Grynberg, Aspect and Fabre, Introduction to Quantum Optics; Core literature for the course. Haroche, Raimond, Exploring the quantum

This book presents a systematic treatment of a broad area of modern optical physics dealing with coherence and fluctuations of light. This field has largely developed since the first lasers became available in the 1960s. The first three chapters cover various mathematical techniques which are needed later. A systematic account is then presented of optical coherence theory within the framework ...

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Nonlinear and Quantum Optics Eliminate  $\hat{H}$  and  $\hat{D}$  using Eqs. (1.5) and (1.6). Use  $\epsilon_0 \mu_0 = 1/c^2$ . Take the curl of both sides of Eq.

(1.3) and substitute  $\nabla \times \hat{B}$  from Eq. (1.4). Use the identity  $\nabla \times \nabla \times \hat{E} = \nabla^2 (\nabla \cdot \hat{E}) - (\nabla \cdot \nabla) \hat{E}$  (1.10) Apply Eq.

Quantum Optics gives a comprehensive coverage of developments in quantum optics over the past years. In the early chapters the formalism of quantum optics is elucidated and the main techniques are introduced. These are applied in the later chapters to problems such as squeezed states of light, resonance fluorescence, laser theory, quantum theory of four-wave mixing, quantum non-demolition ...

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