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Nota di contenuto	Foreword; Contents; 14. Trapping of particles; 15. Two-body interactions at low temperatures; Acknowledgments; 1. General introduction; Purpose of this book; Organization of the book; Part 1 - Advances in spectroscopy; Part 2 - Perturbations of atomic levels by light; Part 3 - Multiphoton processes; Part 4 - Control of atomic motion. Cooling and trapping; Part 5 - Ultracold interactions and their control; Part 6 - Atomic interferometry. Entangled states; Part 7 - Quantum gases; Part 8 - A few frontiers of atomic physics; 2. General background; 2.1 Introduction 2.2 The two interacting systems: atom and field 2.2.1 External and internal atomic variables; 2.2.2 Classical versus quantum treatments of atomic variables; 2.2.3 Classical description of field variables; 2.2.4 Quantum description of field variables; 2.2.5 Atom-field interaction Hamiltonian in the long wavelength approximation; 2.2.6 Elementary interaction processes; 2.3 Basic conservation laws; 2.3.1 Conservation of the total linear momentum; (i) Case of free atoms; (ii) Case of atoms trapped in an external potential; 2.3.2 Conservation of the total angular momentum

(i) Selection rules for the internal angular momentum (ii) Selection rules for the external angular momentum; 2.4 Two-level atom interacting with a coherent monochromatic field. The Rabi oscillation; 2.4.1 A simple case: magnetic resonance of a spin $1/2$; 2.4.2 Extension to any two-level atomic system; 2.4.3 Perturbative limit; 2.4.4 Two physical pictures for Ramsey fringes; (i) Interference between two different paths; (ii) Interpretation in terms of linear superpositions of states; 2.5 Two-level atom interacting with a broadband field. Absorption and emission rates
 2.5.1 Absorption rate deduced from a semiclassical treatment of the field
 2.5.2 Physical discussion. Relaxation time and correlation time;
 2.5.3 Sketch of a quantum treatment of the absorption process; 2.5.4 Extension to spontaneous emission; 2.6 Two-level atom interacting with a coherent monochromatic field in the presence of damping; Light: a source of information on atoms; Introduction; 3. Optical methods; 3.1 Introduction; 3.2 Double resonance; 3.2.1 Principle of the method; 3.2.2 Predicted shape for the double resonance curve; 3.2.3 Experimental results
 3.2.4 Interpretation of the Majorana reversal
 3.3 Optical pumping [Kastler (1950)]; 3.3.1 Principle of the method for a $J_g = 1/2$ $J_e = 1/2$ transition; 3.3.2 Angular momentum balance; 3.3.3 Double role of light; 3.4 First experiments on optical pumping; 3.5 How can optical pumping polarize atomic nuclei?; 3.5.1 Using hyperfine coupling with polarized electronic spins; 3.5.2 First example: optical pumping experiments with mercury-199 atoms; 3.5.3 Second example: combining optical pumping with metastability exchange collisions for helium-3
 3.5.4 A new application: magnetic resonance imaging of the lung cavities

Sommario/riassunto

This book presents a comprehensive overview of the spectacular advances seen in atomic physics during the last 50 years. The authors explain how such progress was possible by highlighting connections between developments that occurred at different times. They discuss the new perspectives and the new research fields that look promising. The emphasis is placed, not on detailed calculations, but rather on physical ideas. Combining both theoretical and experimental considerations, the book will be of interest to a wide range of students, teachers and researchers in quantum and atomic physics.
