METADATA

Title: Quantum Optics

Other Titles: -

Language: Greek

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ISBN: 978-618-5726-65-2

Subject: NATURAL SCIENCES AND AGRICULTURAL SCIENCES

Keywords: Quantum optics / Photon / Electromagnetic (EM) field / Matter / Two-level, three level, four-level, multi-level system

Bibliographic Reference: Simserides, C. (2023). Quantum Optics [Undergraduate textbook]. Kallipos, Open Academic Editions. http://dx.doi.org/10.57713/kallipos-185

Abstract

The book is an introduction and overview, at the undergraduate level, to quantum optics. We analyze the quantum nature of light. We focus on the interaction processes between a photon and a two-level system. We explain what is continuous and what is discrete energy spectrum, as well as intermediate cases such as low-dimensional structures. The interaction of electromagnetic field with matter is tackled, in the first stage, semi-classically, where the electromagnetic field is treated classically and the matter quantum-mechanically. We explain in detail to which extent optical transitions between energy levels are allowed. Then, the interaction between electromagnetic field and matter is treated quantum-mechanically, i.e., the electromagnetic field consists of photons. We explain ladder operators and the differences between bosons and fermions, commutation and anticommutation. Then, we introduce the concept of density matrix and density operator. We explain the operating principles of LASERs. Finally, we develop several related topics. The book contains exercises, auxiliary mathematics and illustrative matlab programs.

The Project is funded by the National Development Programme 2021-2025 of the Ministry of Education and Religious Affairs and implemented by the Special Account for Research Funds of the National Technical University of Athens and the Hellenic Academic Libraries Link.