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Introduction to Quantum Optics

Course code: FSC410137

Credit hours: 4

Duration: 18 weeks

DESCRIPTION: Quantum properties of light. Interaction between light and matter. Quantum open systems. Quantum Information.

COURSE CONTENT:

1. Quantization of the electromagnetic field: quantization of the field. Quantum states of light: Fock, coherent and squeezed states.

2. Quantum properties of light: Correlation Functions of the electromagnetic field. Theory of quantum distributions: functions P, Q and Wigner.

3. Interaction atom-field: semi-classical approach

4. Interaction atom-field: quantum theory. Rabi's Hamiltonian. Jaynes-Cummings model.

5. Open quantum systems: density operator. Time evolution master equation. Kraus and Choi's representation.

6. Modern topics in quantum optics: New physical systems in quantum optics. Quantum correlations

BIBLIOGRAPHY:

1. M. O. Scully and M. S. Zubairy, Quantum Optics, Cambridge University Press (1997).
2. D. F. Walls and G. J. Milburn, Quantum Optics, Springer, 2nd Ed. (2008).
3. H.-P. Breuer and F. Petruccione, The theory of open quantum systems, 1st Ed. (2002).
4. M. A. Nielsen and I. L. Chuang, Quantum Computation and Quantum Information, Cambridge University Press (2000).
5. J. Preskill, http://www.theory.caltech.edu/people/preskill/ph229/
6. Leonard Mandel, Emil Wolf, Optical Coherence and Quantum Optics, Cambridge University Press (1995).
7. Introduction to Quantum Optics: From the Semi-classical Approach to Quantized Light. Gilbert Grynberg, Alain Aspect, Claude Fabre, Cambridge University Press (2010).