

BOOK REVIEW

Non-Linear Cooperative Effects in Open Quantum Systems: Entanglement and Second Order Coherence

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This monograph provides an in-depth and wide-ranging presentation of the modern approaches to open quantum systems, cooperative phenomena between the excited atoms and field in non-linear interaction with electromagnetic and vibration fields.

In the first part there are described models of two-quantum Interaction of non-equilibrium systems with thermal baths, and then there are presented methods of elimination of boson field operators in two-quantum interaction with a vacuum and squeezed bath, in non-linear interaction of small systems with a thermal bath, and the procedure of elimination of bi-boson atomic operators in the “good” and “bad” cavity limits.

The author next analyses the representation of photon correlation functions through atomic correlations and the induced phase transitions, based on Fokker-Planck equations and their steady state solutions. There is presented in detail the two-quantum super-radiance and its mutual interaction with single-photon super-fluorescence.

A special attention is paid to the quantum aspects of laser generation of light in non-linear interaction with a finite number of cavity modes and to cooperative two-quantum lasing. In the final chapter it is given a description of non-linear effects in cooperative second order phase transitions like super-radiance and superconductivity.

The monograph contains a series of new and interesting ideas and results that are detected or have an experimental confirmation, while other results provide a source of new and challenging questions which require further research. The common approach to non-linear cooperative phenomena between the photons, atoms and the cooper electrons in superconductivity demonstrates the necessity of development of such approaches in modern physics.

The book is highly recommended to graduate students in quantum optics, as well to researchers in the field of quantum optics and condensed matter physics, chemistry and biology, interested in cooperative phenomena.

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