

# Accepted Manuscript

Quantum coherent nanodynamics by the interplay of localized photons, electron-hole pairs, and phonons

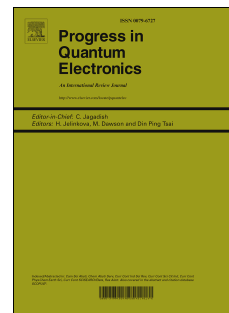
Kiyoshi Kobayashi, Akira Ishikawa

PII: S0079-6727(18)30021-1

DOI: [10.1016/j.pquantelec.2018.06.001](https://doi.org/10.1016/j.pquantelec.2018.06.001)

Reference: JPQE 217

To appear in: *Progress in Quantum Electronics*



Please cite this article as: K. Kobayashi, A. Ishikawa, Quantum coherent nanodynamics by the interplay of localized photons, electron-hole pairs, and phonons, *Progress in Quantum Electronics* (2018), doi: 10.1016/j.pquantelec.2018.06.001.

This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting proof before it is published in its final form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.

# Quantum coherent nanodynamics by the interplay of localized photons, electron-hole pairs, and phonons

Kiyoshi Kobayashi and Akira Ishikawa

*Department of Science for Advanced Materials, University of Yamanashi,  
4-3-11 Takeda, Kofu, Yamanashi 400-8511, Japan*

---

## Abstract

Intriguing intrinsic properties of light quanta and related topics are reviewed by emphasizing the self-consistency of light-matter interactions and open nano-systems dynamics. It is pointed out that there still remain fundamental and challenging issues related to quantization of a finite nano-system interacting with massive photon fields, as well as with a hierarchical or structured phonon fields. By using theoretical frameworks developed for an infinite system, some of quantum nature of a finite nano-system are revealed, and it is theoretically shown that dynamic phonon environments and the interplay of coherent and incoherent phonons play an important role in quantum coherent dynamics of electron-hole pairs interacting with massive photon fields.

*Keywords:* photon mass, dynamic phonon environment, open nano-system, non-Markovian, collective behavior, synchronization

---

## 1. Introduction

A lot of interesting aspects of light quanta have been explored for many years to gain valuable insights for scientific and engineering advancement, in particular, those for optical science, nano science and technology summarized  
5 in Fig. 1.

Gauge symmetry (Abelian  $U(1)$  symmetry) implies massless of a photon with

---

*Email address:* [kkoba@yamanashi.ac.jp](mailto:kkoba@yamanashi.ac.jp) (Kiyoshi Kobayashi and Akira Ishikawa )

Download English Version:

<https://daneshyari.com/en/article/7934868>

Download Persian Version:

<https://daneshyari.com/article/7934868>

[Daneshyari.com](https://daneshyari.com)