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Journal of Basrah Researches ((Sciences)) Vol. 37, No. 1. 15 February ((2011)) 8-26

Dynamical Delay Normalize of Master Equations Model of Semiconductor QD Lasers

ISSN 1817 - 2695

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((Received 27/10/2010, Accepted 19/12/2010))

Abstract

By re-expressing of the master equations model of quantum dots (QDs) laser theory by C. Gies et.al (2007), we have added a dynamical delay factor to the s-shall population's equations to take into account the retardation procedure. This addition has led to theoretical results nearly in isomorphism with experimental data . We present a theoretical simulation of characteristics and the turn-on dynamics of InGaAs/GaAs semiconductor QD laser output lasing with CW wavelength of 1.3μm at room-temperature including the photon-assisted polarization contribution.

Key words: Quantum dot, Dynamical delay, Luminescence.

1. Introduction

One can consider the first two confined shells which are denoted by *s* and *p* according to their in-plane symmetry. The *s*-shell is only spin degenerate, while the p-shell has additional angular- momentum two-fold degeneracy [1].The spectrum of the potential well introduces a splitting into sub bands with a spacing that depends on the strength of the axial confinement, although the term sub band is somewhat misleading for the QD case, as these possess only a discrete spectrum due to the additional in-plane confinement [2].

The discrete states are located energetically below a quasi – continuum of delocalized states, corresponding to the two-dimensional motion of carries in a *wetting layer* (WL). While, the localized states exist only below the quasi-continuum states of the WL[3-5]. In Fig.1 a schematic diagram of the energy levels of the coupled QD−WL system is shown. Further details of the QD model are discussed in Ref.[1]. Strictly speaking, the localized states and the WL states are solutions of the single-particle problem for one common confinement potential and must, therefore, form an orthogonal basis [6,7]. In this work, we focus on modulation of the laser theory model for semiconductor QDs in microcavities in Refs.[8,9], which express a site of master equations of semiconductor QDs lasers.