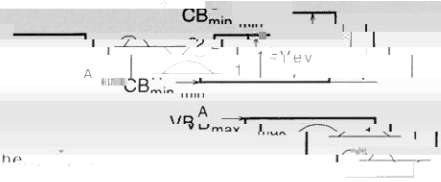




(a) Quantum Well (b) Quantum Dot

THEORETICAL APPROACHES TO

Quantum well can be rigorously described by the Schrödinger equation... periodic potentials in their interiors and the interface between them...



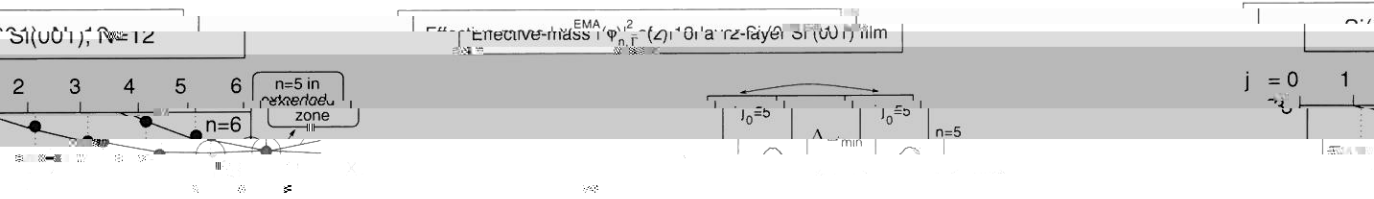
The electronic states of a quantum well are usually described by considering the electron and hole wavefunctions...

to the unit cell size has been dropped here, making the application of the EMA to large offset systems questionable. In doing so, one replaces the bulk band structure...



FIG. 1. Schematic depiction of quantum well and quantum dot energy band structures.

Energy continua, energy levels, and wave functions, indexed by quantum numbers, ψ_{EMA} are...



... minimum of the appropriate
 ... band index n depends
 ... in the z -direction
 ... states of bands $n=2, 3, 4$ are taken as the minima of the

... states of bands $n=2, 3, 4$ are taken as the minima of the
 ... appear also
 ... band order

where $u^R(r)$ and $u^L(r)$ are the radial wave functions in the right and left parts of the bubble, $\psi(r)$ is the wave function in the film, and $V(r)$ is the potential of the film constructed from the superposition of the potentials of the wells.

where $V(r)$ is the potential of the film constructed from the superposition of the potentials of the wells.



Thus, our calculations correspond

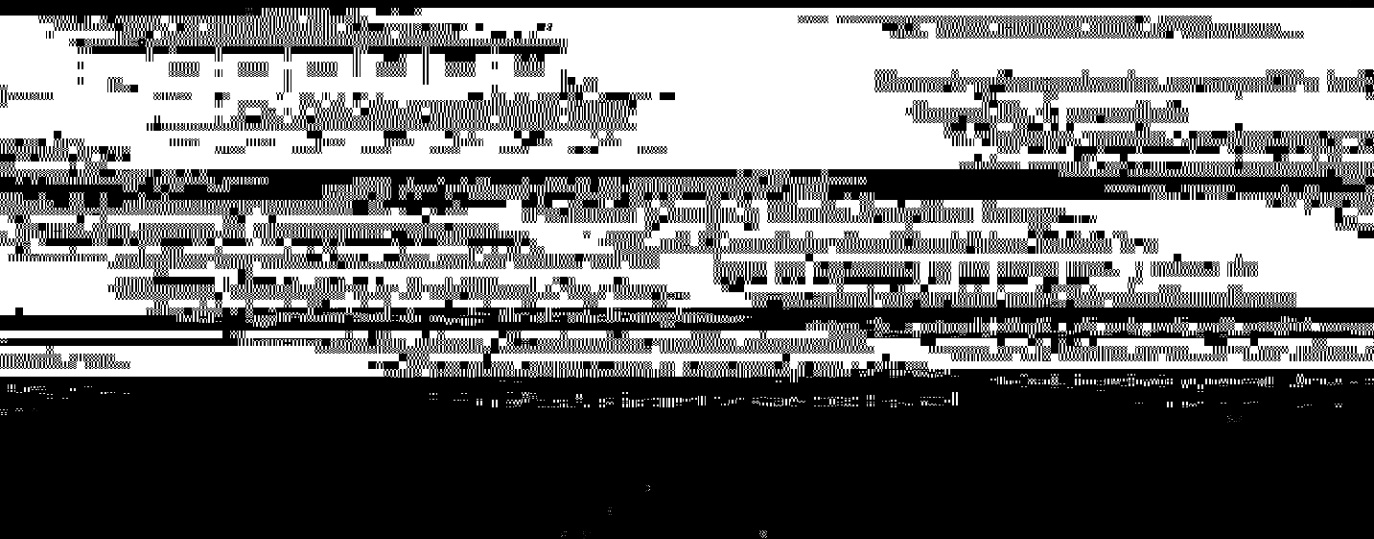
with the EMA wavefunctions of Fig. 3, but

while the direct approach provides the wavefunc-

tion (Fig. 4) of the EMA (Fig. 2) only near the band edge



energy states (see Fig. 4) is, as discussed next



As the case of $n=1$ band states

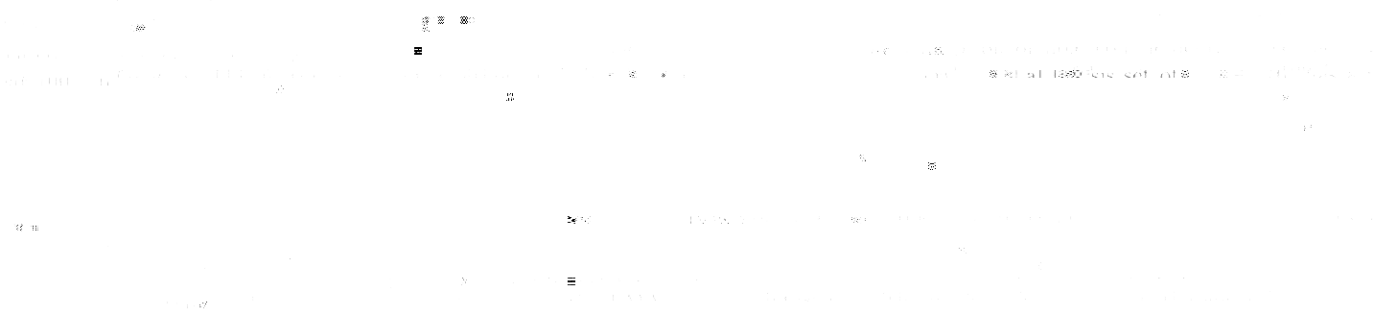
is-like $n=1$ band, or the $n=1$ band

with $n=1$ band bands derived from atomic $n=1$

states near V_1 and V_2 are also $n=1$ states

does not exist in Fig. 3, but exists in Fig. 4.

We suggest that the failure of the EMA near V_1 is



evolving from the $n=1$ band states near V_1 and V_2 are also $n=1$ states



where

$$\frac{E_{n,j}}{E_0} = \frac{E_{n,j}^{(N=8)}}{E_0} - \Delta E_{n,j} \quad (i) \quad \frac{E_{n,j}}{E_0} = \frac{E_{n,j}^{(N=12)}}{E_0} - \Delta E_{n,j} \quad (ii)$$

where $E_{n,j}^{(N=8)}$ and $E_{n,j}^{(N=12)}$ are the energy eigenvalues for $N=8$ and $N=12$ respectively, due to quantum confinement.

(iii) With the decrease of N from 14 to 1

the energy levels

are shifted towards

the bulk energy levels

and the energy levels

are shifted towards

the bulk energy levels

are shifted towards

are shifted towards

are shifted towards

are shifted towards

are shifted towards

are shifted towards

are shifted towards

are shifted towards

are shifted towards

are shifted towards

are shifted towards

are shifted towards

are shifted towards

are shifted towards

are shifted towards

are shifted towards

are shifted towards

are shifted towards

are shifted towards

are shifted towards

are shifted towards

are shifted towards

are shifted towards

are shifted towards

are shifted towards

are shifted towards

are shifted towards

are shifted towards

are shifted towards

are shifted towards

are shifted towards

are shifted towards

are shifted towards

are shifted towards

are shifted towards

are shifted towards

are shifted towards

are shifted towards

are shifted towards

are shifted towards

are shifted towards

are shifted towards

are shifted towards

are shifted towards

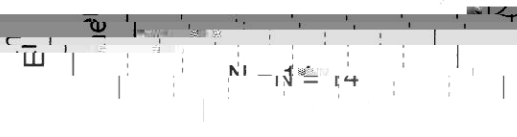
are shifted towards

are shifted towards

are shifted towards

are shifted towards

are shifted towards



response of the constant envelope function. The energy of this state is shifted to the bulk VBM level as N increases and n is the layer number. Hence for $n=1$ and $j=1$ the energy level is the lowest.

where

is

the energy of

the standing

wave function

is

the energy of

the standing

wave function

is

the energy of

the standing

wave function

is

the energy of

the standing

wave function

is

the energy of

the standing

wave function

is

the energy of

the standing

wave function

is

the energy of

the standing

wave function

is

the energy of

the standing

the number of peaks of a film state and its quantum index n is found. The evolution of energy levels with film layer thickness is examined, revealing the appearance of

REFERENCES

1. C. Bastard, *Wave Mechanics of Crystal Lattices*, Elsevier, Amsterdam, 1981.