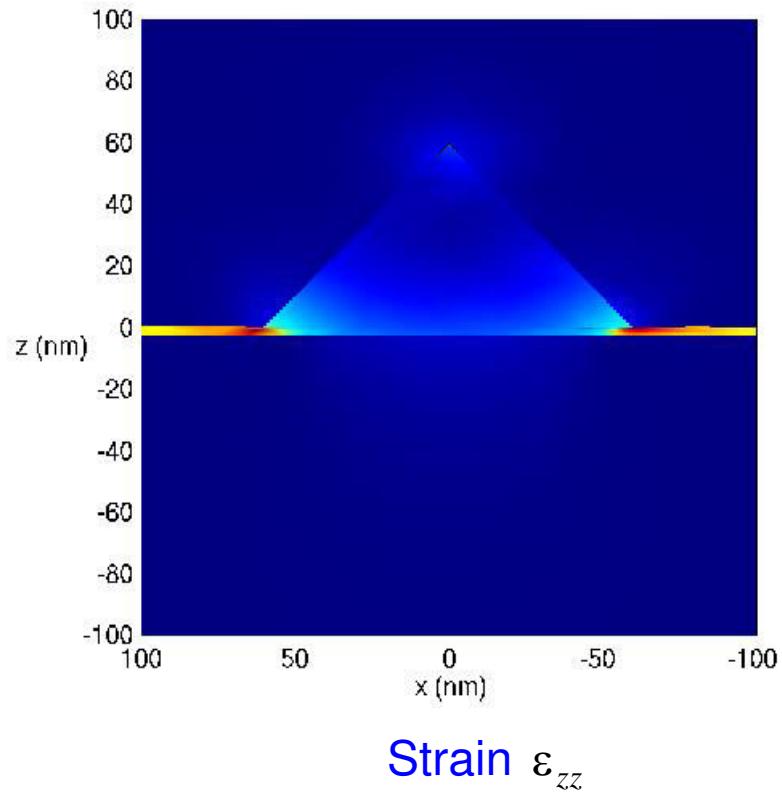


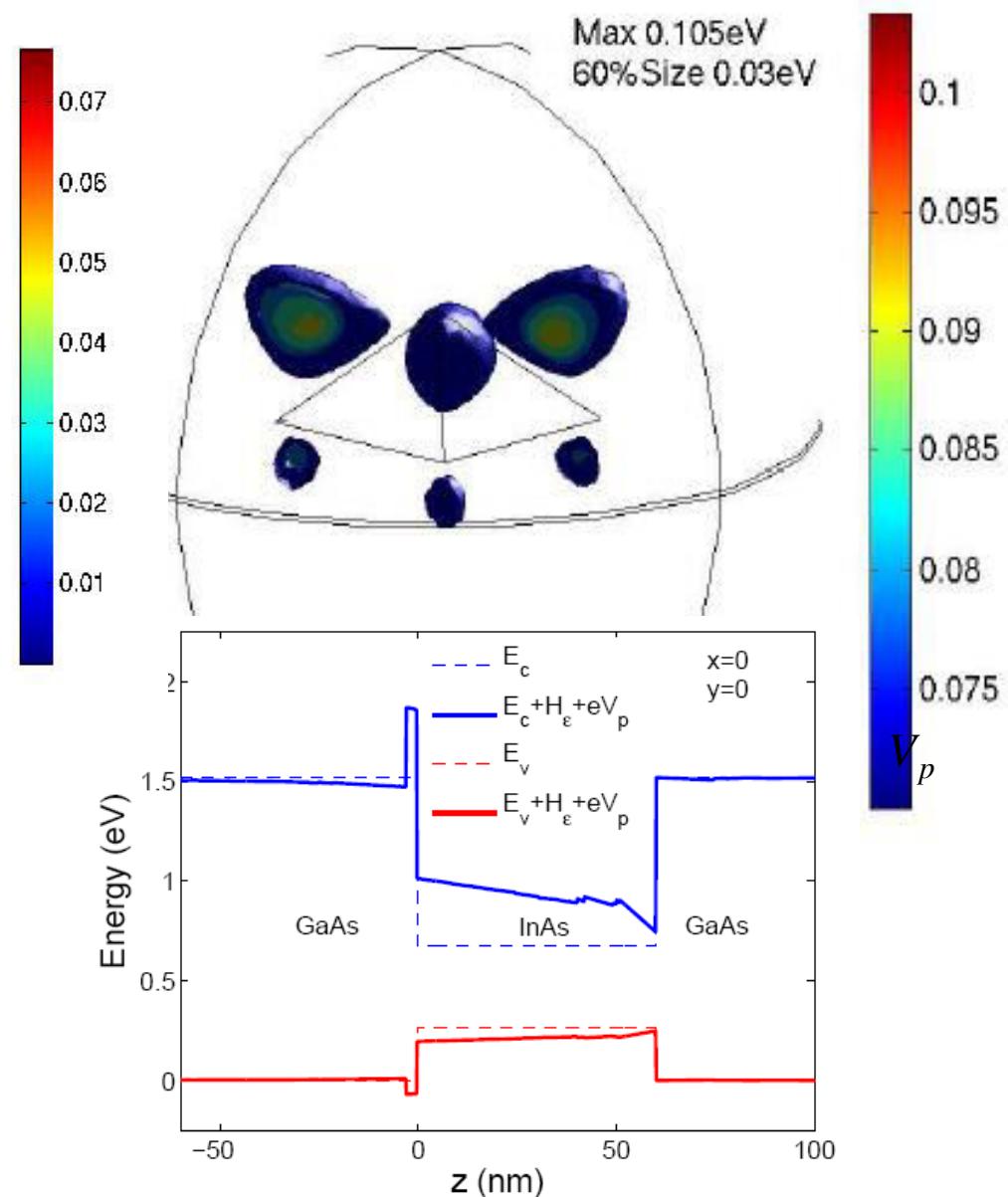
Strain Engineering of GaAs/InAs Pyramidal Quantum Dot



Ref.

Grundmann, Stier and Bimberg,
Phys. Rev. B 52(6), 11969 (1995)

Stier, Grundmann and Bimberg,
Phys. Rev. B 59(8), 5688 (1999)



Pyramidal Quantum Dot: Crystal Nonlinearity

Case I

$$\varepsilon_{xx} = \frac{\partial u_1}{\partial x} + \frac{1}{2} \left(\frac{\partial u_3}{\partial x} \right)^2, \quad \varepsilon_{yy} = \frac{\partial u_2}{\partial y} + \frac{1}{2} \left(\frac{\partial u_3}{\partial y} \right)^2$$

$$\varepsilon_{zz} = \frac{\partial u_3}{\partial z} + \frac{1}{2} \left(\frac{\partial u_3}{\partial z} \right)^2$$

Case II

$$\varepsilon_{xx} = \frac{\partial u_1}{\partial x} + \frac{1}{2} \left(\frac{\partial u_1}{\partial x} \right)^2 + \frac{1}{2} \left(\frac{\partial u_2}{\partial x} \right)^2$$

$$\varepsilon_{yy} = \frac{\partial u_2}{\partial y} + \frac{1}{2} \left(\frac{\partial u_1}{\partial y} \right)^2 + \frac{1}{2} \left(\frac{\partial u_2}{\partial y} \right)^2$$

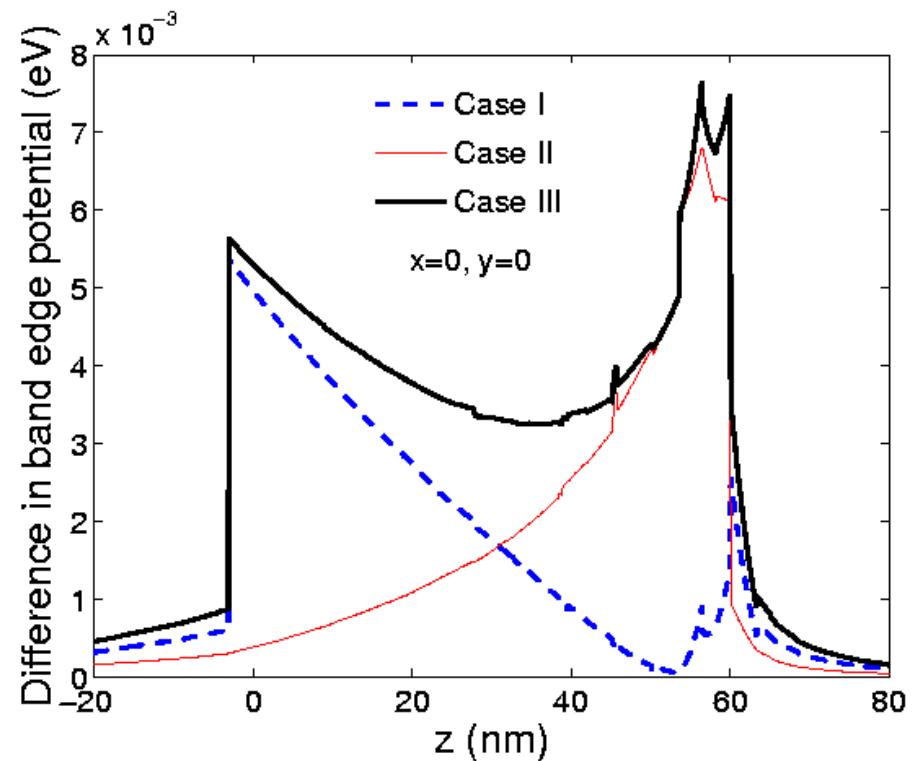
$$\varepsilon_{zz} = \frac{\partial u_3}{\partial z} + \frac{1}{2} \left(\frac{\partial u_1}{\partial z} \right)^2 + \frac{1}{2} \left(\frac{\partial u_2}{\partial z} \right)^2$$

Case III

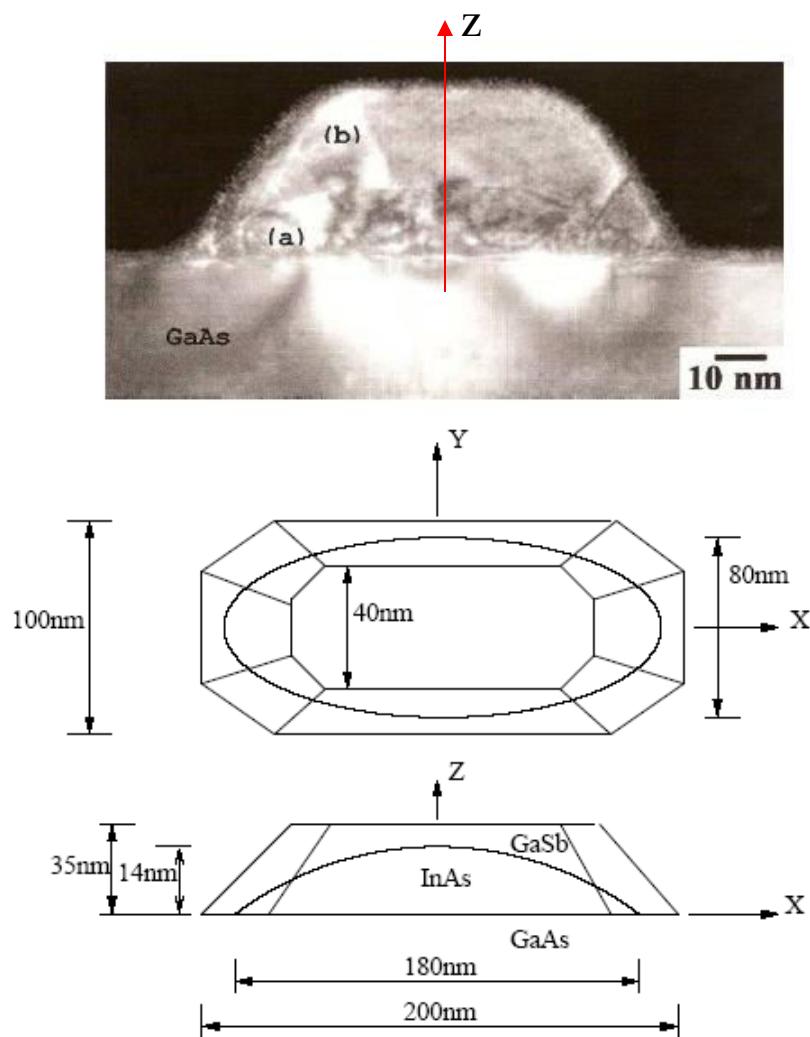
$$\boldsymbol{\varepsilon} = \frac{1}{2} (\mathbf{F}^T \mathbf{F} - \mathbf{I}), \quad F_{ij} = \delta_{ij} + u_{i,j}$$

Effect of finite strain

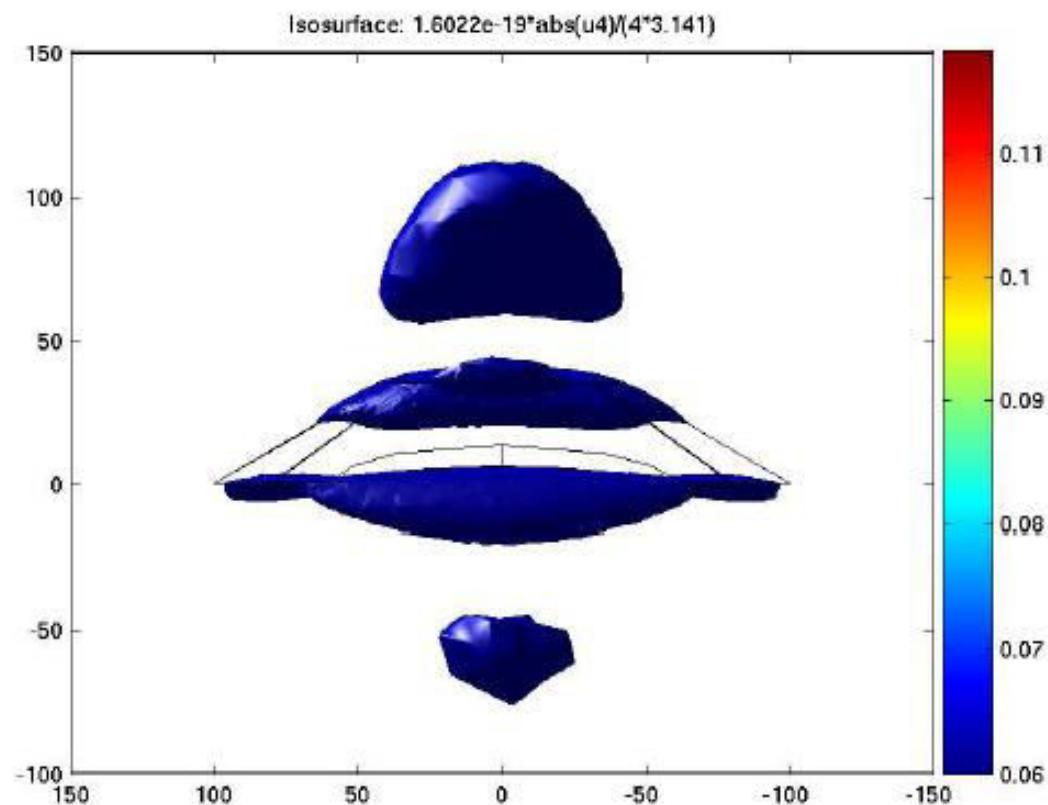
(shift in the band-edge potential with respect to
the unstrained band-edge potential)



GaAs/InAs/GaSb HeQuad Quantum Dot: Polarization



Piezoelectric potential (eV)



GaAs/InAs/GaSb HeQuad Quantum Dot: Quantum Confinement

