

# Effects of linear and nonlinear piezoelectricity on the electronic properties of InAs/GaAs quantum dots

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The effects of linear and nonlinear piezoelectricity on the electronic properties of InAs/GaAs quantum dots are investigated. The linear piezoelectricity is shown to lead to a shift in the energy levels of the quantum dots, while the nonlinear piezoelectricity leads to a change in the shape of the energy levels. The results show that the piezoelectricity can be used to tune the electronic properties of the quantum dots.

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$a = a - a_0$

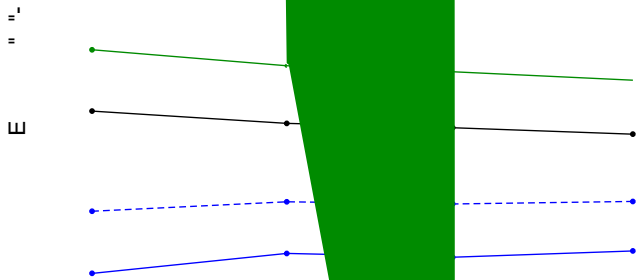
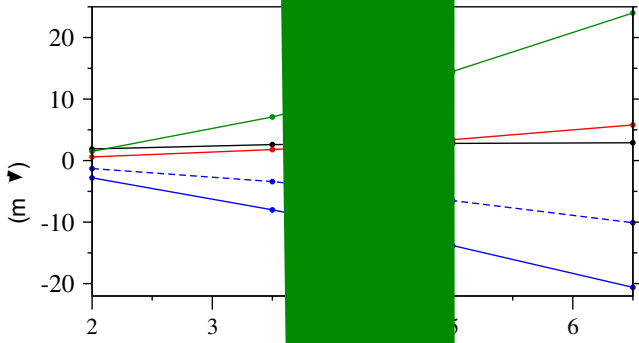
$a_0$

( )

(  $a/a$  2%)  $a/a$



$t_{10}$ ).  $t_{11}$   $t_{12}$   $t_{13}$   $t_{14}$   $t_{15}$   $t_{16}$   $t_{17}$   $t_{18}$   $t_{19}$   $t_{20}$   $t_{21}$   $t_{22}$   $t_{23}$   $t_{24}$   $t_{25}$   $t_{26}$   $t_{27}$   $t_{28}$   $t_{29}$   $t_{30}$   $t_{31}$   $t_{32}$   $t_{33}$   $t_{34}$   $t_{35}$   $t_{36}$   $t_{37}$   $t_{38}$   $t_{39}$   $t_{40}$   $t_{41}$   $t_{42}$   $t_{43}$   $t_{44}$   $t_{45}$   $t_{46}$   $t_{47}$   $t_{48}$   $t_{49}$   $t_{50}$   $t_{51}$   $t_{52}$   $t_{53}$   $t_{54}$   $t_{55}$   $t_{56}$   $t_{57}$   $t_{58}$   $t_{59}$   $t_{60}$   $t_{61}$   $t_{62}$   $t_{63}$   $t_{64}$   $t_{65}$   $t_{66}$   $t_{67}$   $t_{68}$   $t_{69}$   $t_{70}$   $t_{71}$   $t_{72}$   $t_{73}$   $t_{74}$   $t_{75}$   $t_{76}$   $t_{77}$   $t_{78}$   $t_{79}$   $t_{80}$   $t_{81}$   $t_{82}$   $t_{83}$   $t_{84}$   $t_{85}$   $t_{86}$   $t_{87}$   $t_{88}$   $t_{89}$   $t_{90}$   $t_{91}$   $t_{92}$   $t_{93}$   $t_{94}$   $t_{95}$   $t_{96}$   $t_{97}$   $t_{98}$   $t_{99}$   $t_{100}$



Let  $P_{[110]}$  ( ... )  
 $= (P_{[110]} - P_{[110]})$ . ... : ( )  
 $V_{[110]}$  ...  $C_{2v}$  ...  
 ( ) ... 6 ...  
 $[ ( ) ]$  ...  
 $B$  ...  
 $E$  (1) ... ; ( )  
 $[ (B) ]$  ...  
 $E$  (1) ...  
 Fig. 3 ...  
 $A/A$  ...  
 $V_{[110]}$  ...  
 $P_{[110]}$  ...  $[110]$  ...  
 $[ ( = ) ]$  ...  
 2 5

...  
 5. ...  
 Fig. 4 ...  
 $[001]$  ... All ...  
 $A/A$  ... 25 ...  
 5 ...  
 $(r)^2 - (r)^2$  ...  
 $k$  ...  
 $A/A$  ...  
 1.7% to 10.4%, ...  
 $F$  ... 0, 1, ... 2 ...  
 $[001]$  ...  
 $D$  ... 3, 4, ... 5 ...  
 3 ... 5 ...  
 $[110]$  ...

