

# Pauli blocking versus electrostatic attenuation of optical transition intensities in charged PbSe quantum dots

J. J. A. , A. F. , A. A. g  
 National Renewable Energy Laboratory, Golden, Colorado 80401, USA  
 29 Aug 2007; 26 2007

W localized dot-interior m- f w w  
 localized f f , g  
 W f g m . I , w m m f  
 m. m f g w w g m f  
 - m w gg m g  
 g f m  $S_h-P_e$   $P_h-S_e$  , f  
 f m  $S_h-P_e$   $P_h-S_e$  w I ,  
 g g f - f - I ,  
 g m f w g g f  $P_h-P_e$  .

D I: [10.1103/B.76.161310](#) AC m : 73.21. , 71.15.-m, 78.20.-

f g f m  
 m, g f g  
 f g g g ” g g

\*d m f , \*d  
\*d m f m f g  
\*d m f \*d . I w  
w ff m f g g \*d g  
\*d m \*d  
m w \*d \*d  
g f f Gd m \*d , 16  
f m \*d m \*d

W f m d dg R f 23 d -  
 d d w d g

Results. F g 1 W d -  
 m f N<sub>e</sub> -  
 g d - S<sub>e</sub> . -  
 d d - , W -f g m -  
 d d g - m , CI H m -  
 F g W 1 W g - g -CI m .  
 f f g g g d -  
 d , W d f W g.

Effects of occupying dot-interior, quantum-confined levels by spectator electrons. f m F g. 1

f 1/8 f d S<sub>h</sub>-S<sub>e</sub> -  
 , d f m g. S<sub>e</sub> -  
 m W m f  
 d d P<sub>h</sub><sup>1</sup>-P<sub>e</sub><sup>1</sup> ff d g g S<sub>e</sub> .  
 g m d g  
 W S<sub>h</sub>-S<sub>e</sub> d P<sub>h</sub><sup>1</sup>-P<sub>e</sub><sup>1</sup> d f m f d d  
 f S<sub>h</sub>-P<sub>e</sub> d P<sub>h</sub>-S<sub>e</sub> . -  
 f g g g g , g m W  
 et al.<sup>27</sup> f P<sub>h</sub><sup>1</sup>-P<sub>e</sub><sup>1</sup> -  
 W f S<sub>h</sub>-S<sub>e</sub> , d f  
 m g f P-P d f  
 m f - d P<sub>h</sub><sup>1</sup>-P<sub>e</sub><sup>1</sup> d  
 d - g .<sup>28</sup>

Effects of occupying localized states near the surface of the dot. F g 1 W d -

m f R=30.6 d , W g -  
 g d d f .  
 f S<sub>h</sub>-S<sub>e</sub> d d  
 P<sub>h</sub><sup>1</sup>-P<sub>e</sub><sup>1</sup> d g g f d - S<sub>e</sub> m g-  
 g. , W - g g f d - d  
 F g. 1 [ - d  
 g f d .., S<sub>h</sub>-S<sub>e</sub> P<sub>h</sub>-P<sub>e</sub> , g-  
 f f d F g. 1 [ P<sub>h</sub><sup>1</sup>-P<sub>e</sub><sup>1</sup>  
 d , d g )

$$M_\gamma = \Psi_0 N_h, N_e \mathbf{r} \Psi_\gamma N_h+1, N_e+1, \quad 4$$

W f Ψ<sub>0</sub> N<sub>h</sub>, N<sub>e</sub> g d- , m -  
 f f d W N<sub>h</sub>+N<sub>e</sub> d . F W ,  
 m d

$$I \omega \int_\gamma M_\gamma^2 \delta \hbar \omega E_\gamma + E_0 . \quad 5$$

=30.6 2046 2117 . d m d f d R -  
 a=6.117 , d d -  
 g m d f W ff d d  
 d R d d d g d m W R d-  
 g . F g d , -

d d g m f W m  
 d . d g g d f f  
 m d . d g d ,” d  
 m f f m d d g 1

A<sub>s</sub> d W A<sub>0</sub> d W  
 A<sub>s</sub>/A<sub>0</sub> 0.91 f , d A<sub>s</sub>/A<sub>0</sub> 0.79  
 f d . I f  
 g d f f d , -  
 d g g f W S<sub>h</sub>-S<sub>e</sub> d -  
 P<sub>h</sub><sup>1</sup>-P<sub>e</sub><sup>1</sup> . A f g -  
 g W d W W  
 d - d W S<sub>h</sub>-P<sub>e</sub> d P<sub>h</sub>-S<sub>e</sub> -  
 d , d d 0.9 1.0 - d d , W  
 dipole-forbidden d

g., S

10 m  $\rightarrow$   $S_h-S_e$   $\rightarrow$   $P_h^1-P_e^1$ .  
 f g . Eff f g f m f f  
 m g . H w , ff w f f m  
 C m , ff w f f m  
 f f .  
 , m 4,17 21 g g f m  
 $S_h-S_e$   $P_h-S_e$   $S_h-P_e$  , . w f  
 f m  $P_h-S_e$   $S_h-P_e$  -  
 w k p m .17 H w 23 , m  
 , m  
 w g f m  
 f  $\rightarrow$   $S_h-P_e$   $P_h^1-P_e^1$  . I  $\rightarrow$  w  
 w  $\rightarrow$   $S_h-P_e$   $P_h-S_e$  ,  
 , w  $\rightarrow$   $S_h-S_e$   $P_h^1-P_e^1$  . g -