Ab initio analysis of a quantum dot induced by a local external potential in a semiconducting carbon nanotube

T. Kostyrko[b] and S. Krompiewski[a]

[a]Faculty of Physics, Adam Mickiewicz University, Umultowska 85, 61-614 Poznań, Poland

[b] Institute of Molecular Physics, Polish Academy of Sciences, ul. M. Smoluchowskiego, 17, 60-179 Poznań, Poland

Using the density functional theory[1] we study the influence of external charge probes on the electronic structure of semiconducting carbon nanotubes in vicinity of the Fermi level. We show that the spatially limited potential due to the probe can create localized electronic states in the energy gap and at the edges of the conduction band. By filling these localized states with additional electrons one obtains a quantum dot, which can be tuned by modifying the properties of the external charge probe. We analyze dependence of the electronic structure of the dot on the spatial extension of the potential as well as on the nanotube radius.

9.7 cm

References

[1] J.M. Soler, E. Artacho, J.D. Gale, A. García, J. Junquera, P. Ordejón, and D. Sánchez-Portal J. Phys. Condens. Matter 14, 2745 (2002).

13.4 cm

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Corresponding author :
T. Kostyrko

Address for correspondence :
Faculty of Physics, Adam Mickiewicz University,
Umultowska 85, 61-614 Poznań, Poland

Email address :
tkos@amu.edu.pl