A one-dimentional model of hydrogen molecular ion for trions in elongated nanorods

Zaal Machavariani [a] *Tamar Tchelidze* [a] *Bachana Beradze* [a]

e-mail: zaal.machavariani@tsu.ge

[a] Physics Department, Faculty of Exact and Natural Sciences, Ivane Javakhishvili Tbilisi State University, 0179 Tbilisi, Georgia

We have investigated theoretically trion states in elongated core-shell quantum rods of cylindrical shape. Type-I and type-II band alignments are considered. Assuming that core-shell cylinder is infinite i.e. the radius of the cylinder is negligible with respect of it's length one can consider trions in such nanorods as an one-dimentional object. Therefore, in the longitudial direction with respect of cylinder's length the coulomb interaction between holes and electron are supressed by the confinement effect. The Coulomb interaction only appears along the cylinder's length. Consequently, the problem naturaly resembels to one-dimentional hydrogen molecular ion's problem. The last problem in turns is solvable by use of quantum mechanical Born-Oppenhaimer approximation and by use of semiclassical WKB approximation [1]. Calcualtions has been curried out in the framework of above mentioned approximation for ZnO heterostucture. Calculations show increase of binding energies with core radius for thin nanorods of type-I.. In type-II structures binding energies sharply drop to zero with increasing core radius.

References

[1] DUAN. Yiwu, YIN. Menya, AN. Weike and HE Chunshan Commun. Theor. Phys., **31** (1999) 27-32.