Abstract Submitted
for the MAR16 Meeting of
The American Physical Society

Configuration space method for calculating binding energies of exciton complexes in quasi-1D/2D semiconductors.[1] IGOR BONDAREV, North Carolina Central University — A configuration space method, pioneered by Landau and Herring in studies of molecular binding and magnetism[1], is developed to obtain universal asymptotic relations for lowest energy exciton complexes (trion, biexciton) in confined semiconductor nanostructures such as nanowires and nanotubes[2], as well as coupled quantum wells. Trions are shown to be more stable (have greater binding energy) than biexcitons in strongly confined quasi-1D structures with small reduced electron-hole masses. Biexcitons are more stable in less confined quasi-1D structures with large reduced electron-hole masses. The theory predicts a crossover behavior, whereby trions become less stable than biexcitons as the transverse size of the quasi-1D nanostructure increases, which might be observed on semiconducting carbon nanotubes of increasing diameters. This method is also efficient in calculating binding energies for trion-type electron-hole complexes formed by indirect excitons in double coupled quantum wells, quasi-2D nanostructures that show new interesting electroabsorption/refraction phenomena. – [1]Landau & Lifshitz, Quantum Mechanics; C.Herring, RMP 34, 631 (1962). [2]I.V.Bondarev, PRB 90, 245430 (2014); PRB 83, 153409 (2011).

[1]Supported by DOE-DE-SC0007117

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Date submitted: 03 Nov 2015 Electronic form version 1.4