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Nodal "ground states" and orbital textures in semiconductor quantum dots[1] JEONGSU LEE, State Univ of NY - Buffalo, KAREL VYBORNY, Institute of Physics ASCR, JONG HAN, IGOR ZUTIC, State Univ of NY - Buffalo — Unlike the common expectation, theoretical calculations in quantum wires and quantum dots have predicted hole ground state wavefunctions with a node [1-2] that are often associated with the formation of dark excitons [3]. The inversion of the energy level ordering between nodeless (S-like) and nodal (P-like) wavefunction states occurs due to various factors, e.g., confinement size and strength, choice of a material, and spin-orbit interaction. However, the existence of the nodal ground states has been debated and even viewed merely as an artifact of a k•p model [4]. Using complementary approaches of both k•p and tight-binding models, further supported by an effective Hamiltonian for a continuum model, we reveal that the nodal ground states in quantum dots are not limited to a specific theoretical model. Remarkably, the emergence of the nodal ground states can be attributed to the formation of the orbital vortex textures that minimizes "divergence". We discuss how our findings and the studies of orbital textures could be also relevant for different materials systems. [1] K. Výborný et al., PRB 85, 155312 (2012) [2] A. Bagga et al., PRB 74, 035341 (2006); P. Horodyská et al., PRB 81, 045301 (2010); J. Xia and J. Li, PRB 60, 11540 (1999); M. P. Persson and H. Q. Xu, PRB 73, 125346 (2006). [3] M. Nirmal, et al., PRL 75, 3728 (1995); Al. L. Efros, et al., PRB 54, 4843 (1996). [4] L. W. Wang et al., APL 76, 339 (2000)

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