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Excitons and photoluminescence spectra in nanoscale heterostructures AlGaN/GaN/AlGaN[1] E.P. POKATILOV, D.L. NIKA, LPMS, Dept. of Theoretical Physics, State Univ. of Moldova, MD-2009 Kishinev, Moldova, V.M. FOMIN, J.T. DEVREESE, TFVS, Dept. Fysica, Univ. Antwerpen, B-2610 Antwerpen, Belgium — For heterostructures AlGaN/GaN/AlGaN with the GaN quantum wells ranging from 4 to 16 monolayers, we use an exciton model, which includes the interaction of an electron and a hole with deformations of the crystal lattice and with built-in electrostatic fields. It is based on a 6-band hole Hamiltonian, as distinct from the common variational approach. Exciton energy spectra and wave functions for the ground state and some excited states are found after numerical diagonalization of the 6-band matrix hole Hamiltonian with an adaptive grid. The developed theoretical approach has allowed us to interpret the position of the photoluminescence bands in good agreement with experiment. For the first time position and intensity of the phonon sidebands are calculated taking into account phonons specific for the wurtzite heterostructure. We elucidate the transition from the blue shift to the red shift in the photoluminescence spectra with increasing the strength of the built-in electrostatic fields and the quantum-well width. The increase of the exciton radiative lifetime with the quantum- well width is quantitatively explained.

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