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Screening of External Electric Field by Photo-Induced Carriers in Multiple Quantum Wells VADIM PULLER, LEV DEYCH, ALEXANDER LISYANSKY, Physics Department, Queens College, City University of New York, Flushing, New York 11367, USA — Multiple quantum well (MQW) structures present a great interest for optoelectronic applications. Their optical characteristics can be controlled by an external electric field. However, ultra-fast applications require an optical control of the spectra. We propose a scheme for ultra-fast optical switching of biased MQW using photo-generated carriers for screening the field in the structure. Using generalized Thomas-Fermi model we obtain the distribution of the electric field in the structure as a function of the applied bias and the excitation conditions. For moderate photo-generated carrier concentrations (10^{15} - 10^{16} cm^{-3}) one can distinguish three screening regimes: (i) quantum well screening; (ii) unsaturated screening with participation of mobile electrons excited from the quantum wells; (iii) saturated screening, when the excess charge induced in the structure is not sufficient to screen the applied potential. For high carrier concentrations (10^{18} - 10^{19} cm^{-3}) the screening regime (i) is not observed, since the carriers cannot completely condense in quantum wells.

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